

CONSTRUCTIVISM AT THE BIRTH OF THE
SCIENTIFIC REVOLUTION: A STUDY OF THE
FOUNDATIONS OF QUSHJĪ'S FIFTEENTH CENTURY
ASTRONOMY

BY

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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

2014

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A dissertation submitted in fulfilment of the requirement for
the degree of Doctor of Philosophy in Islamic Science

International Institute of Islamic Thought and Civilisation
International Islamic University Malaysia

FEBRUARY 2014

ABSTRACT

The dissertation explores the conceptual structure and the epistemic foundations of the mathematical and religio-philosophical works of ‘Alā’ al-Dīn ‘Alī Qushjī (d. 1474). Current research suggests that one of Qushjī’s treatises is associated with a specific astronomical model that gave an important impulse to the Scientific Revolution in the early sixteenth century. According to recent historiography of science, it was a particular transformation that contained the critical breakthrough for the mathematical foundation of Earth’s motion. Until 2005, it was thought that Regiomontanus’ (d. 1476) *Epitome of Almagest* (1496) had supplied this philosophical impetus to Copernicus’ thesis on the motion of the Earth. But in 2005, it was discovered that ‘Alī Qushjī (d. 1474) [Ali Qushji/Kuşçu; علي قوشجي], mathematician, linguist and *kalām* scholar, had authored an earlier Arabic version of this model. This study unravels the new program of science according to the emerging constructivist project of the Kalām School, which was collated by Qushji and turned into a comprehensive theory of knowledge to serve as a new foundation for astronomy and physical mathematics more generally. This shows how in the fifteenth century, constructivist epistemology had been replacing Aristotelian realism as a foundation for a new mathematical physics. Qushjī’s elucidation on constructive semantics in his linguistic works on ‘*ilm al-waḍ’* (science of language), as well as his epistemic discussions on mental existence (*al-wujūd al-dhinī*) in his *kalām* work, *Sharḥ Tajrīd al-Kalām* (Elucidations on Scientific Abstraction), facilitate this undertaking. The constructive mathematical revolution brought forward by Arabic astronomy emerges as an original scientific breakthrough against Greek geocentrism and its worldview. It also provides the foundation for a contemporary critique of heliocentrism, which is currently also known to be scientifically untenable. The research opens the way for a better understanding of constructivist epistemology and its foundational historical association with modernity. Kant’s ‘Copernican Revolution’ of the late eighteenth century was itself an epistemic quest for constructivism as unearthed from the imbedded structure of the earlier revolution in astronomy. This study helps us answer new critical questions about the historical development of constructivist epistemology, its rise and continuity in time and its early conceptual transmission across cultural boundaries between the Semitic Middle East and early modern Europe.

ملخص البحث

منهجية المعرفة الإنشائية عند بروز الثورة العلمية: دراسة أصول علم الفلك لدى القوشجي في القرن الخامس عشر. تتحرى هذه الدراسة الأصول الفكرية والمنهجية المفاهيمية في أعمال المتكلم والرياضي علاء الدين علي القوشجي (م. 1474) والتي أدت إلى نموذج رياضي فلكي تشير الأبحاث الجديدة إلى أنه أعطى دفعة انطلاقية للثورة العلمية في أوروبا. بناءً على علم تاريخ العلوم، كان هناك نموذج فلكي احتوى على تقدم مفاجئ في المعرفة للأصول الرياضية لحركة الأرض. حتى سنة 2005، كان يُظن أن ملخص الماجست (1496) لريجيومونتانوس (م. 1476) هو الذي وقر الدفع الفكري للثورة الفلكية في القرن السادس عشر (رومي). ولكن في سنة 2005 تم اكتشاف أنّ القوشجي، العالم الأول لدى السلطان العثماني محمد الثاني الفاتح، كان قبل ذلك قد دوّن رسالة رياضية في العربية حول هذا النموذج. يمكننا من خلال هذه الدراسة الكشف عن البرنامج العلمي الجديد المرتبط بتقدم 'مبحث الانشاء الذهني' (أو الوجود الذهني) لدى المدرسة الكلامية المتأخرة والتي أتمها القوشجي وحوّلها إلى منهجية معرفية كاملة كأصول جديدة لعلم الفلك والرياضيات التطبيقية. نرى من خلال ذلك كيف أنّ مبحث الانشاء الذهني تبلور في القرن الخامس عشر حتى استبدل نظرية الواقعية الأرسطية (أو نظرية الشبح) كأساس يُبنى عليه بعلم الفلك الإنشائي الجديد. هناك عنصران أساسيان يساهمان في إتخاذنا هذه المهمة البحثية وهما؛ شرح القوشجي حول الإعتبار الذهني في رسائله اللغوية في علم الوضع، و توضيحاته الكلامية في 'مبحث الوجود الذهني' في كتابه الشهير في علم الكلام، شرح تجريد الكلام. وهكذا فإنّ ثورة المنهجية الإنشائية التي قدمتها الأصول الكلامية لعلم الفلك الإسلامي تبرز كالثورة الأساسية بوجه النظرية الأرضية التي تقول باستحالة حركة الأرض في نفسها. كما أنّها تعطينا الأصول العلمية لتقديم نقض معاصر لنظرية الكون الشمسية لدى كوبرنيكوس والتي يُقرّ اليوم على أنّها ساقطة علمياً. وبما أنّ ثورة كانط الفلسفية في القرن الثامن عشر، والتي تسمى بالثورة الكوبرنيكية، هي استطلاع فلسفي لتحديد معالم الإنشائية الفكرية، هذا يؤدي بنا إلى الاستنتاج بأنّ تأخر تلك الفلسفة عن ثورة كوبرنيكوس سببه أنّ كانط كان يحاول أن يكشف عن الأصول الإنشائية المحتوية في الثورة الفلكية نفسها. تساعدنا هذه الدراسة على الإجابة عن أسئلة هامة حول التطور التاريخي لمنهجية المعرفة الإنشائية وعلاقتها بعلم الكلام الإسلامي، بالإضافة إلى نشأتها واستمرارها ومن ثم انتقالها الفكري إلى أوروبا.

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TRANSLITERATION

ء	'	خ	kh	ش	Sh	غ	Gh	ن	N
ب	B	د	D	ص	ṣ	ف	F	هـ	H
ت	T	ذ	dh	ض	ḍ	ق	Q	و	W
ث	Th	ر	r	ط	ṭ	ك	K	ي	Y
ج	J	ز	z	ظ	ẓ	ل	L		
ح	ḥ	س	s	ع	ʿ	م	M		

Short Vowels	
َ	a
ِ	i
ُ	u

Long Vowels	
ا + َ	ā
ي + ِ	ī
و + ُ	ū

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CHAPTER ONE

QUSHJĪ AND THE COPERNICAN REVOLUTION

1.1 INTRODUCTION: PROBLEM AND SIGNIFICANCE

According to accumulating evidence in recent historiography of science, it was a specific astronomical model, known as *The Eccentric Model for the Second Anomaly of the Lower Planets*, that contained a critical breakthrough for the mathematical foundations of Earth's motion. In 1973, for example, and elaborating on the significance of this model as it appeared in Regiomontanus' *Epitome of Almagest* (Venice, 1496), Swerdlow remarked:

Copernicus's derivation of this theory rests upon the eccentric model of the second anomaly and therefore upon [the] two propositions in the *Epitome* [by Regiomontanus]. In this way Regiomontanus provided the foundations of Copernicus's great discovery. It is even possible that, had Regiomontanus not written his detailed description of the eccentric model, Copernicus would never have developed the heliocentric theory.¹

Swerdlow goes on to claim that “while I do not believe that Regiomontanus ever advocated the heliocentric theory, he was through these two propositions virtually handing it to any taker”². The striking news, however, came in 2005 when Ragep published an Arabic treatise for *the eccentric model of the second anomaly of the lower planets*³ that belonged to the fifteenth century astronomer and foundational scholar, ‘Alā’uddīn ‘Alī Ibn Muḥammad al-Qushjī, who had died in Constantinople in 1474.

¹ Noel Swerdlow, “The Derivation and First Draft of Copernicus's Planetary Theory: A Translation of Translation of the *Commentariolus* with Commentary”, *Proceedings of the American Philosophical Society*, vol. 117 (1973): 472.

² *Ibid.*, 475-6.

³ ‘Alī Qushjī's treatise named *Risālah fī anna aṣl al-khārij yumkin fī al-suflayayn* translated as *A Treatise on the Eccentric Hypothesis Being Possible for the Two Lower Planets* was published in the original Arabic with translations in F. Jamil Ragep, “‘Alī Qushjī and Regiomontanus: Eccentric Transformations and Copernican Revolutions”, *Journal of the History of Astronomy*, vol. 36, no. 4 (2005), 359-371.

Ragep went further by raising in this article the question of transmission, based on pictorial resemblance between the diagram published in his *Alī Qushjī and Regiomontanus*, i.e. the one from an early fifteenth century Suleymaniye Library Manuscript by Qushjī and another from the late fifteenth century text, *Epitome of the Almagest* (Venice, 1496), by Regiomontanus, that Swerdlow had referenced in his 1973 article in relation to Copernicus (Figure 1.1).

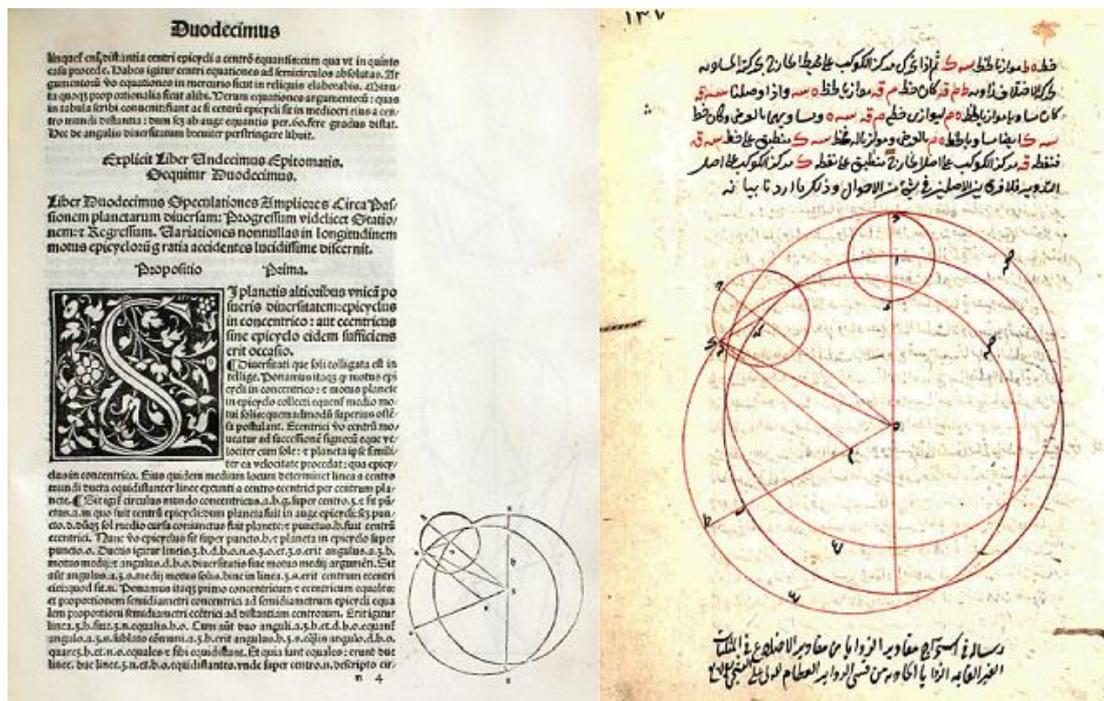


Figure 1.1 The figure shows two diagrams with close configurations: One from an early fifteenth century Suleymaniye Library Manuscript by Qushjī (right), and the other from the late fifteenth century text *Epitome of the Almagest* (Venice, 1496) by Regiomontanus (left).⁴

Despite such resemblance, however, our conceptual study, which traces the development of ideas and their historical rise and continuity in time and across

⁴ The image is taken from a lecture poster titled *Islam at the Crossroads: Reflections on the History and Historiography of Astronomical Transmission* for F. Jamil Ragep's keynote talk at the University of Notre Dame's Eleventh Biennial History of Astronomy Workshop (June, 2013). The author of this dissertation, Mustapha Kara-Ali, presented a paper at this conference which was titled "Constructivism across Islam-European Boundaries in the Fifteenth Century". For more details about the workshop including access to this paper abstract refer to <http://www3.nd.edu/~histast/workshops/2013ndxi/index.shtml>, (Accessed 1 January, 2014).

civilisational boundaries does not rely upon the existence or the absence of a figure resemblance. The conceptual scheme and the intellectual structure of astronomical modeling is more important to the imbedded intellectual meaning and the impetus an astronomical model might give to a scientific revolution. Ragep, however, does make the following preliminary observation, which clears the way perhaps for one of the greatest studies yet to be conducted on the conceptual history and the birth of the Scientific Revolution. He adds:

Since research has just begun into the legacy of ‘Alī Qushjī, in particular into the Istanbul circle of scientists that he helped initiate, we can only speculate [about their exact position]. But it is certainly of considerable interest that Qushjī like Copernicus was open to the possibility of the earth’s rotation based on a new, non-Aristotelian physics.⁵

The interest here, therefore, does not lie solely in pictorial orientation, but should rather transcend such a reading to a conceptual and a philosophical inter-civilisational analysis. Ragep continues:

Clearly there is more to the Copernican Revolution than some clever astronomical models that arose in the context of a criticism of Ptolemy. There also needed to be a new conceptualization of astronomy that could allow for an astronomically-based physics. But there is hardly anything like this in the European tradition before Copernicus. The fact that we can find a long, vigorous discussion in Islam of this issue (Earth’s movement) should indicate that such a conceptual foundation was there for the borrowing.⁶

Moreover, accumulating evidence concerning likely conceptual transmission between Islamic astronomy and the Scientific Revolution in Europe, notwithstanding our later constructivist criticism of heliocentrism, have led Owen Gingerich⁷ to recently make the following submission:

A specific geometrical insight from the Islamic world might have given an indispensable impetus toward the radical heliocentric rearrangement.

⁵ F. Jamil Ragep, “Copernicus and His Islamic Predecessors: Some Historical Remarks”, *Filozofski vestnik*, vol. 25, no. 2 (2004):139 republished in *History of Science*, vol. 45 (2007): 65-81.

⁶ Ibid.

⁷ Emeritus Professor of Astronomy and History of Science at Harvard University.

Around 1430, 'Alī Qushjī, an Islamic astronomer, wrote a small treatise with a parallelogram transformation diagram that reappeared almost identically in Regiomontanus' *Epitome of the Almagest*, a volume finally published in 1496. That book, known to have been used by Copernicus, is most likely the source for an essential step toward heliocentrism. Perhaps a connection between Islamic astronomy and the making of the European scientific Renaissance really does exist.⁸

Despite such commentary, in the last few decades, the growing number of historians of science who have commented on Qushjī's works have done so by focusing mostly on his astronomical and mathematical works. To date, however, no comprehensive study has been conducted on Qushjī's foundations of science and his conceptual scheme that relates to what we later describe as being his revolutionary work with constructive astronomy. Indeed, the aforementioned 1973 study by Swerdlow, which was conducted over 30 years before Qushjī's model was rediscovered and published, points to the great need for a thoroughgoing study of Qushjī's astronomical work from a conceptual perspective; a task that is still to be taken up and which our investigation in this dissertation devotedly undertakes.

It is believed that the current study can contribute towards filling a crucial gap in contemporary historiography of science by studying how the foundations of astronomy from mid to late fifteenth century Islamic world might have influenced Latin Europe via the intellectual crossroad and the scholarly hub of Ottoman Constantinople⁹.

⁸ Owen Gingerich, Review of "Islamic Science and the Making of the European Renaissance", *Journal of Interdisciplinary History*, vol. 39, no. 2 (Autumn 2008): 310-11.

⁹ On this period and during the periods of the two Sultans Mehmed II (1451-1481) and Suleyman the Magnificent (1520-1566) Aydin Sayili writes that the "cultural contact between the Ottomans and Europe had reached its peak and was especially lively in Istanbul. Several Italian painters and men of letters are known to have visited Istanbul and to have stayed there for periods of different lengths. Indeed, Istanbul with its active commercial dealings especially in maritime trade and its thriving Venetian, Genoese, and Ragusan colonies, was a metropolis suited to traffic in ideas and cultural contact between the East and the West. It was itself a foremost representative and repository of Islamic science and culture. The European mathematicians Mordecai Comtino (d. 1478) and Elia Misrahi (1456-1526) - were well familiar with the Ottoman capital, and, in fact, both died there. So it is that the Turkish-Islamic World in general and the city of Istanbul in particular served efficiently as a fountainhead and a vehicle for the transfer of a great deal of knowledge to Europe" (Aydin Sayili, "Turkish Contributions to Scientific Work in Islam", *Foundation for Science Technology and Civilisation*, September, 2004, 15).

Our approach in this research is, thus, to investigate the civilisational influences across European boundaries in the fifteenth century and to do that based on the study of the foundations of Qushjī's astronomical works. Such a study can help us unravel the new conceptual structure of astronomy according to the emerging constructivist way of the *mutakallimūn*. It is specifically believed that Qushjī's elucidation on constructive semantics in his works on '*ilm al-waḍ'*' (science of linguistic positing), as well as his philosophical discussions on mental existence (*al-wujūd al-dhihnī*) in his *kalām* work, could reveal more about the new program of science associated with the developments of the constructivist project of later Ash'arite *kalām*. Qushjī indeed seems to have completed this project and to have turned it into a comprehensive theory of *a priori* knowledge to serve as a new foundation for astronomy and mathematics. Therefore, in tracing this history of the philosophy of *kalām*, a historian of philosophy and science can discover how constructivism in the fifteenth century came to replace Aristotelian realism as a foundation for a new mathematical practice with its associated astronomical and physical sciences.

1.2 'ALĀ' UDDĪN 'ALĪ QUSHJĪ: THE ASTRONOMER AND THE FOUNDATIONAL SCHOLAR

'Alā'uddīn 'Alī Qushjī belonged to the fifteenth century, a very critical period in the history of the formation of Muslim societies in Southeastern Europe, especially the pedagogical development of the higher learning colleges in the city of Constantinople under the Ottomans. According to Ekmeleddin Ihsanoglu¹⁰, "no doubt the most notable scientist of [Sultan Mehmed II's] period is Ali Kuscu [Qushjī]"¹¹. In recent times, both

¹⁰ Ekmeleddin Ihsanoglu et al., *An overview of Ottoman Scientific Activities* (London: Foundation for Science and Technology and Civilisation, no. 629, 2006), 7.

¹¹ Ihsanoglu continues, "He [Ali Kuscu] wrote twelve works on mathematics and astronomy. One of them is his commentary on the *Zīj-i Ulug Bey* in Persian. His two works in Persian, namely *Risālah fil-Hay'a*

Columbia University's Saliba¹² and McGill's Ragep¹³ have each published an astronomical work by Qushjī. But apart from brief coverage on Qushjī's *kalām* in relation to causality¹⁴ and some other non-astronomical references in Arabic on his exposition of mental existence (*al-wujūd al-dhihnī*)¹⁵, his scientific foundations and *kalām* have not been systematically studied in relation to his constructivist theory of *a priori* knowledge¹⁶ and his foundations of science, nor have the two themes of scientific foundations and astronomy been studied as interconnected subjects in the works of Qushjī despite their direct conceptual relevance to one another. It is believed that this gap is mainly due to Qushjī being rediscovered only recently in astronomical and academic circles.

In the last decade, there have been a few brief biographies and various other manuals written predominantly in Turkish¹⁷ indicating a recent rise of interest in Qushjī's persona and works in Turkish culture. But to better understand what is already known about Qushjī as a scholar, we can quote from the few comments that we can find scattered across various biographical and scientific sources. According to Abā Zayd,

(Treatise on Astronomy) and *Risālah fil-Ḥisāb* (Treatise on Mathematics) were taught in the Ottoman Madrasas. He rewrote the two works in Arabic with some additions under new titles, *al-Fathīyah* (Commemoration of Conquest) and *al-Muḥammadiya* (the book dedicated to Sultan Mehmed II), respectively" (Ibid.).

¹² George Saliba, "Al-Qushjī's Reform of the Ptolemaic Model for Mercury", *Arabic Sciences and Philosophy*, vol. 3 (1993): 161-203.

¹³ F. Jamil Ragep, "Alī Qushjī and Regiomontanus: Eccentric Transformations and Copernican Revolutions", *Journal of the History of Astronomy*, vol. 36, no. 4 (2005), 359-371; F. Jamil Ragep, "Copernicus and His Islamic Predecessors: Some Historical Remarks", *History of Science*, vol. 45 (2007): 65-81; F. Jamil Ragep, "Freeing Astronomy from Philosophy: An Aspect of Islamic Influence on Science", *Osiris*, vol. 16 (2001): 49-71.

¹⁴ He translated pages 186 and 187 of *Sharḥ al-Tajrīd* from a Persian lithograph manuscript copy in his article *Freeing Astronomy from Philosophy* (note 12).

¹⁵ For example, Sayyid Kamāl al-Ḥaydarī, *Madkhal ilā manāhij al-ma'rifah 'inda al-Islāmīyīn* (Iran: Dār Faraqīd, 1426), 45; Aḥmad ibn Muṣṭafā Ṭāshkubrīzādah, *al-Shuhūd al-'aynī fī mabāḥiṭh al-wujūd al-dhihnī* (Cologne: Manshūrāt al-Jamal, 2009).

¹⁶ It should be noted that in this study the term constructivism and its variations is used to describe the epistemological justification for *a priori* knowledge.

¹⁷ Yavuz Unat, *Ali Kuscü: cagını asan bilim insane* (Istanbul: Kaynak, 2009); Yavuz Unat, *Mir'atul-'alem, Evrenin aynası: Ali Kuscü'nün Fethiye adli eserinin cevrisi* (Ankara: T.C. Kultur Bakanlıđı, 2001); Musa Yildiz, *Bir dilci olarak Ali Kuscü ve Risale fīl-istiare'si* (Ankara: T.C. Kultur Bakanlıđı, 2002).

for example, in terms of theological orientation, “[Qushjī] is recognised among the highest esteemed Ash‘arite scholars”¹⁸, and he further clarifies that “we can notice his defence of Ash‘arite opinions within the details of his *Sharḥ al-Tajrīd* [*Commentary on Abstracting Kalām*]”. Furthermore, Aḥmad ‘Afīfī in his introduction to the edited version of Qushjī’s *Unqūd al-Zawāhir fī al-Ṣarf* (*The Chain of Radiant Gems in Morphology*) divides Qushjī’s scholarly life into three phases. The first phase is his early life in Samarqand under the Timurid rule. The second is the period he spent among the Turkic kingdoms in Transoxiana (*bilād mā warā’ al-nahr*) due to the political unrest at the time, and the third period being under the Ottoman Sultanate during the rule of Mehmed II al-Fātiḥ¹⁹. Cengiz Aydin also reports that “Muhammad [Mehmed] II took him to the campaign of Bashkent, 878/1473, in the aftermath of which Qushjī was appointed to the Ayasofia Madarasa”²⁰. Qushjī was thus associated first with the Samarqand Observatory and later with the scientific community of Constantinople where, at the invitation of Sultan Mehmed II, he assumed the Professorship Chair in Astronomy and Mathematics at the College of Ayasofia bringing forward synergy to the studies of mathematics and astronomy in Constantinople in the late fifteenth century²¹.

¹⁸ ‘Alī ibn Muḥammad Qūshjī, Ṣābir ‘Abduh Abā Zayd, *Min al-Turāth al-Islāmī: Sharḥ al-Qūshjī ‘alā Tajrīd al-‘aqā’id lil-Ṭūsī "mabḥath al-ilāhīyāt"* (Al-Iskandarīyah: Dār al-Wafā’ li-Dunyā al-Ṭībā ‘ah wa al-Nashr, 2002), 22.

¹⁹ ‘Alī Qushjī, *Unqūd al-Zawāhir fī al-Ṣarf*, ed. Aḥmad ‘Afīfī (Al-Qāhirah: Dār al-Kutob al-Masrīya, 2001), 24-25.

²⁰ Cengiz Aydin, “Ali Kuscü Diyanet Vakfı İslam Ansiklopedisi”, *DIA*, vol. 2 (n.d.): 408-10.

²¹ The influence of ‘Alī Qushjī can be seen in the charter of the *madrasah* colleges of Sultan Mehmed II, which set their framework, and which entailed that the rational sciences are to be taught along with religious studies. It is possible to observe this influence after the period of Mehmed II up until the time of the Suleymaniye *madrasas*. In the Fātiḥ Teskilāt Kanūnnāmesi (legal code), when one examines the organization of Ottoman *madrasas* one observes that the first three are referred to under the names of *Ḥāshiyat al-Tajrīd*, *Miftāḥ* and *Talwīḥ*. These names were taken from the titles of the main textbooks used in these *madrasas*. The *ḥāshiyat al-Tajrīd madrasah* takes its name from the fact that the main textbooks used there were commentaries on Ṭūsī’s *Tajrīd al-Kalām*. These include appendices on the old commentary written by al-Isfahānī’s (d. 1345-46), as well as Qushjī’s own new commentary. (Kātib Celebi, *Kashful Zunūn ‘an Asāmīl-Kūtūbi wa al-Fūnūn*, 2 vols., ed. Serefeddin Yaltkaya and Kilisli Rifat Bilge (Istanbul: n.p., 1941-1943), vol. 2: 1762-1768).

Qushjī was a prolific multidisciplinary writer and a scholar of ‘unity of knowledge’. He authored many works in numerous fields²². Consequently, more than 270 unique manuscripts authored by Qushjī can be found in Turkish Manuscript Libraries²³ alone with 43 different titles; broken down as follows: 7 different works in theology and jurisprudence; 13 in astronomy and mathematics²⁴; and 24 in Arabic grammar, linguistics, and other literary works. His *magnum opus* in Islamic science is known as *al-Sharḥ al-Jadīd (The Novel Commentary)*, which was his commentary on Ṭūsī’s text, *Tajrīd al-Kalām (Abstracting Kalām)*. It is noteworthy that a Latin translation of two of Qushjī’s scientific works, the *Tract on Arithmetic*²⁵ and *Tract on Astronomy*²⁶, were published by John Greaves²⁷ in 1650²⁸ with the noted authorship of ‘Shah Koshgius’.

²² Cengiz, 408-10.

²³ These numbers are based on the author’s search in the listed electronic catalogues of the Turkish Manuscript Libraries.

²⁴ The 13 titles are as follows (in Turkish transliteration): (1) *Risāle fī’l-Fethīye*; (2) *Risālah fī hall ishkal al-mu’addil lil-masir li-’utarid*; (3) *Risālah fī anna aṣl al-khārij yumkin fī al-suflayayn*; (4) *Risāle-i Hey’er*; (5) *Risāle der Hey’er*; (6) *Risāle-i Hey’e ve Hisābı Ehl-i Hind*; (7) *Haṣīye Ala Fethīye*; (8) *Fethīye fī marifeti’l-evkati ve’s-saat*; (9) *Şerh-i Zic-i Uluğ Beg*; (10) *Risāle fī İhtilāfī’l-Metali*; (11) *Mirkātü’s-Semâ*; (12) *Er-Risāletü’l-Muhammediye fī’l-Hisâb*; (13) *Er-Risāletü’l-Fethīye fī’l-A’mâli’l-Ceybiye*.

²⁵ This is a translation of the treatise *al-Risālah al-Muḥammadīyah fī al-Hisâb*.

²⁶ This is a translation of the treatise *al-Risālah al-Fathīyah fī al-Hay’a*. This work was originally in Persian and, given the evidence of the extant manuscripts, quite popular. It was translated by Qushjī himself into Arabic and dedicated to Sultan Mehmed, the Conqueror (al-Fātiḥ) of Constantinople (Ihsanoglu et al in note 2, p27–35).

²⁷ John Greaves (d. 1652) is an English mathematician and astronomer. He was the Savilian Professor of Astronomy at the University of Oxford. He travelled to Constantinople (1638), Rhodes, Egypt, and other parts of the eastern Mediterranean, where he collected a considerable number of Arabic, Persian, and Greek manuscripts (“John Greaves”, *Encyclopædia Britannica*, 2011). Greaves quotes Aly/Koshgy in the fourth part of a work published in 1650 *Ali Kushgi de terrae magnitudine & sphaerarum coelestium a terra distantis*. Greaves quotes from the *Risālah dar ‘ilm al-Hay’a* by drawing from a manuscript in his own collection, containing two works by Qushjī: “Tract on Arithmetic” (*Risālah dar ‘ilm al-Ḥisâb*), ff. 1-31. “Tract on Astronomy” (*Risālah dar ‘ilm al-Hay’a*), ff. 32-65. In his “Elementa Linguae Persae”, Greaves illustrates his Persian language with a quotation from ‘Shah Koshgius’ (Raymond Mercier, “English Orientalists and Mathematical Astronomy” in *The ‘Arabick’ Interest of the Natural Philosophers in Seventeenth-century England*, edited by G. A. Russell (Leiden: Brill, 1994), 162.

²⁸ Ibid.

1.3 QUSHJĪ'S FOUNDATIONS OF SCIENCE: RESEARCH QUESTIONS

The transformation in the scientific foundations of mathematics, from a classical Greek form in which mathematics is less concerned with quantifying natural phenomena, to a more modern form in which mathematics is used to manipulate quantifications of natural objects, is based on the understanding of contingency in nature - away from any assumptions of causal necessity. This transformation to quantification appears within the discourse of *kalām* that had pushed Aristotelian natural philosophy and its affiliated *falsafah* more and more to the fringes, until philosophy itself was freed from Aristotelianism. In fact, the later *mutakallimūn* (i.e. thirteenth century onwards) began speaking of the movement of celestial objects being within the testable or experimental sciences (*al-ʿulūm al-tajrībīyah*) that is classified as part of an involuntary or obligatory knowledge (*al-ḍarūrīyāt*). By devising such a solution to the rejected Aristotelian theory of knowledge that was grounded in the idea of necessary causality, they were in fact extending the common position of the early *mutakallimūn*, including al-Bāqillānī (d. 1013) and al-Ghazālī (d. 1111) who had insisted on an epistemology that secures the possibility of the Prophetic miracle as an extraordinary occurrence (*khariq lil-ʿādah*), and thus paving the way for the contingent modality of the natural world.

This study, therefore, begins by analysing how *kalām* scholars reconciled their *kalām* with their scientific program based on developments in the semantics of the new emerging discipline of *ʿilm al-waḍʿ* as a science of positing expressions for meaning, and which had begun to supplant formal logic in association to the theory of knowledge. On the role of *kalām*, ʿAḍud al-Dīn al-Ījī (d. 1355) and his commentator al-Sayyid al-Sharīf al-Jurjānī (d. 1413), who greatly influenced early Ottoman scholars, had described how *kalām* maintained its position as a general methodological base for other Islamic disciplines by systematising *kalām*'s own epistemology to sufficiently keep it

as the source and framework of these disciplines²⁹. By taking *kalām* as a common foundation for scientific disciplines, the *mutakallimūn* tried to integrate philosophy and science into the empirical contingent world. On this theme, Muḥammad Bāsil al-Ṭāʿī³⁰ asserts that “*daqīq al-kalām*³¹ has much to offer the subjects of natural philosophy and the contemporary philosophy of physics on the conceptual level³².”³³

Indeed something new did happen in *kalām* in the fifteenth century, as a result of such earlier development, and it was represented by what Qushjī himself referred to with his work on *Sharḥ Tajrīd al-Kalām* (*Commentary on Abstracting Kalām*) as being of a new conception, and which he named *The Novel Commentary* (*al-Sharḥ al-Jadīd*) despite there being numerous other supercommentaries by that time that were commentaries on Isfahānī’s (d. 1345-46) earlier commentary including Jurjānī’s gloss *al-Ḥāshiyah ‘alā Sharḥ al-Tajrīd*. Qushjī insisted that his work on the *Tajrīd* was of a new framework and methodology that rendered it a new classification (*taṣnīf jadīd*)³⁴. Saliba emphasised this newness with Qushjī’s work by remarking that “Qushjī ... was in no way connected to the *Tadhkirah* tradition”³⁵ of Ṭūsī’s Maragha Observatory given that he saw himself belonging to a new mathematical school that stems from his new

²⁹ ‘Aḥdud al-Dīn al-Ījī, *Kitāb al-Mawāqif fī ‘Ilm al-Kalām*, ed. ‘Abd al-Raḥmān ‘Umayra (Bayrūt: Dār al-Jīl, 1997), 43-45.

³⁰ He is a professor of physics at Yarmouk University in Jordan (PhD, University of Manchester, UK, 1978). His latest book is entitled ‘*Daqīq al-Kalām: al-ru’yah al-Islāmīyah li-falsafat al-tabī‘ah*’ (Jordan: ‘Ālam al-Kutub al-Ḥadīth, 2010).

³¹ Al-Ash‘arī’s *Maqālāt Islāmīyīn* is divided into two sections “*Jalīl al-Kalām*”, which deals with Attributes of God, meaning of Faith, guidance and misguidance and other related matters, while the second section is on “*Daqīq al-Kalām*” and it deals with the issues that are generally dealt with in natural philosophy, such as atoms and accidents, causality, corporeal bodies, space (*taḥayyuz*), time, etc.

³² Indeed, the *Kalām Cosmological Argument* devised by William Craig is just one contemporary example in a whole field of ideas, concepts and arguments that can be utilized by the modern philosophy of science.

³³ Based on a talk given at the Institute of Arab and Islamic Studies, University of Exeter (UK) on 26 January 2005 entitled *Daqīq al-Kalām: The Islamic Approach to Natural Philosophy*.

³⁴ Qushjī also has *Sharḥ al-zīj al-Jadīd*, which indicates the ‘newness’ of the Samarqand *zīj* as opposed to the Maragha *zīj*, two centuries earlier.

³⁵ George Saliba, “A Sixteenth-century Arabic Critique of Ptolemaic Astronomy”, *Journal of the History of Astronomy*, vol. 25 (1994): 34.

framework for science. This distinction in astronomical tradition in fact supports Qushjī's own classification of his commentary on Ṭūsī's *Tajrīd* being of a new pattern of thought. Indeed, Qushjī continued Ghazālī's volitional criticism of Peripatetic philosophers and their Aristotelian framework by further developing his response to causation (a topic we explore in Chapter Two on *Constructivist Origins*), and by also extending its application onto a new philosophy of science that can be labelled, as we later explain, as being 'subjectivist' or 'conceptualist'.

By modeling the mental process by which individual meanings are assigned to vocal expressions (auditory or visual), conceptual positing or *waḍ'* becomes a representation of how expressions are understood in the mind by way of mentally considering a universal concept. Qushjī, who made significant progress in constructive semantics, brought over his general method of understanding, as we later see in Chapter Three, and in particular his individuation theory from '*ilm al-waḍ'*' into *kalām*'s various investigations on mental existence and its diverse empirical applications, such as the motion of the celestial objects and other astronomical inquiries. Crucially, this breakthrough in conceptualist methodology of knowledge opened the way for a constructive astronomy and a new phase in scientific discovery that today stands as a strong contender for having supplied the trigger for the various events in the history of science since the fifteenth century. A core emerging idea with constructive mathematics as a universal language of symbols is the belief that mathematical statements have validity because they are drawn from linguistically-consistent systems of signification and meaning whose rules are drawn up for common human understanding. At the center of this issue is, therefore, the concern about the justification for mathematising the natural world through the construction of mathematical models.

The implications from constructive semantics on constructive foundations are made clearer in Qushjī's selected work on constructive *kalām*. In this dissertation we, therefore, focus on both the crucial role that Qushjī plays in the development of constructive semantics as well as the role he plays in the development of constructive or universal *kalām*. Our investigation covers three texts; two on constructive semantics studied in Chapter Three and one major text on constructive *kalām* studied in Chapter Four. The two treatises in semantics are: (1) *Sharḥ al-Risālah al-Waḍ'īyah* (*Commentary on the Treatise on Linguistic Positing*) [Manuscript] and (2) *'Unqūd al-Zawāhir fī al-Ṣarf* (*The Chain of Radiant Gems in Morphology*) [Al-Qāhirah: 2001], and the major *kalām* text is (3) *Sharḥ Tajrīd al-Kalām* (*Commentary on Abstracting Kalām*)³⁶ [Manuscript].

On the former two semantics treatises 'Abd al-Malik al-Fatānī (d.1913-4)³⁷, a prominent scholar of Makkah and Madīnah asserts³⁸, "Linguistic topics ... have their principles in the study of *waḍ'* and its texts range in their benefit with the best source as far as I know is *'Unqūd al-Zawāhir* and its commentary as well as *Risālat al-'Aḍud* (i.e. the aforementioned *al-Risālah al-Waḍ'īyah*)"³⁹. On the other hand, *Sharḥ Tajrīd al-Kalām* (*Commentary on Abstracting Kalām*) is a text that contains Qushjī's constructivist philosophy, which is studied here for the foundations of his constructive astronomy. It was written as a commentary on Naṣir al-Dīn al-Ṭūsī's (d. 1274) *Tajrīd*

³⁶ This text which Qushjī dedicated to Timurid Sultan Abū Sa'īd secured him an impressive gift of 50,000 Dinars quickly becoming an object of discussion in the scholarly circles indicating that the intellectuals of the time were aware of its implications. See Bakharzi 'Abd al-Wāsi', *Nizami-yi Maqāmāt-i Jami*, edited by Najīb Māyil Harāwī (Tehran: Nash-i, 1999), 72-74.

³⁷ 'Abd al-Malik al-Fatānī d.1913-4 is a prominent Ḥanafī scholar of Makkah and Madīnah. He was a Qāḍī in Makkah.

³⁸ He states this in *Sharḥ 'Iqd al-La'ālī' fī 'Ilm al-Waḍ'* (Al-Qāhirah: al-Matba'ah al-'Āmirah al-Sharqīyah, 1306) found at Princeton university. This manuscript has been digitised by Google and is available online.

³⁹ *Innal-mawdū'āt al-lughawīyah ... mabādi'uhā mabāḥith al-waḍ' wa kutubihi mutafāwitah fīl-naḡ' wa inna aḥsanahā fimā a'lam 'Unqūd al-Zawāhir wa sharḥihi wa risālat al-'Aḍud wa qad kuntu ibbāna al-taḥṣīl antakhibu minhā* (*Sharḥ 'Iqd al-La'ālī' fī 'Ilm al-Waḍ'*, 2)

al-Kalām, a.k.a. *Tajrīd al-‘aqā’id* or *al-Tajrīd*, which Hossein Nasr says is itself to a large extent influenced by Imam Rāzī’s *al-Masā’il al-Khamsūn*⁴⁰. Indeed to Qushjī, his *Novel Commentary on Abstracting Kalām* was a remarkable achievement, he says in the introductory preface that to compose it he had gone through and studied approximately 70 volumes. Notwithstanding that some mystically leaning philosophers reacted to this work with strong opposition with its mention in certain gatherings even making some walk out⁴¹ - an important axis of its debate was the status of the mathematical devices vis-a-vis *kalām* and scientific methodology as an alternative to what mystics defined as being *al-riyādah*. *Riyādīyat*, which literally translates to *mathesis* as an exercise of the mind, especially mathematical learning, overlaps with the mystical usage of the term to imply an exercise of the spirit.

To date and prior to our current undertaking, neither of Qushjī’s two treatises on constructive semantics nor his *Sharḥ Tajrīd al-Kalām* have been studied from a foundational perspective. This is so despite the great civilisational and scientific significance of these treatises, especially from the perspective of the history and philosophy of the Scientific Revolution that took shape in Europe beginning in the Sixteenth century.

1.4 QUSHJĪ’S ASTRONOMY: RESEARCH QUESTIONS

Our current research takes the approach that “astronomy ... is especially relevant to the question of the relationship between science and religion because of its cosmological

⁴⁰ Hossein Nasr, “Fakhr al-Dīn al-Rāzī” in *A History of Muslim Philosophy* edited by M. M. Sharīf (Pakistan: Pakistan Philosophical Congress, n.d.), 644.

⁴¹ Zayn al-Dīn Mahmūd Waṣifī, *Badāyi’ al-Waqāi’*, ed. Alexander Bolyrev (Tehran: Bunyad-i Farhang-i Iran, 1970), vol. 2, 324.

dimension and the relative ease with which it can be invoked”⁴² in relation to conceptual questions. With that in mind, we focus on the reform tradition that shifted the understanding of astronomy, and physics more generally, from speculative metaphysics to mathematical certainty. This in turn laid the foundation for the demise of Aristotelianism and for the emergence of a new scientific approach that we later describe as being constructivism. In fact, one might contend, that al-Ghazālī’s arguments against Aristotelian natural philosophy were an important factor in giving the impetus to a new cosmology explored by a chain of *kalām* scientists, such as ‘Alī Qushjī (d. 1474), who as we further explain in Chapter Five, seem to have had a decisive impact on early modern Europeans⁴³.

Indeed, it was Qushjī, himself a mathematician *mutakallim*, who completed the attack on Aristotelean cosmology by making his fifteenth century assertion about the possibility of a rotating Earth⁴⁴. Qushjī’s foundational *kalām* orientation has been commented on by Robert Morrison, who remarked, “Qushjī made his comments about astronomy’s epistemological self-sufficiency and astronomy’s value for appreciating God’s majesty in a *kalām* text”⁴⁵, pointing to the scientific foundations of natural

⁴² Ahmad Dallal is the current Provost of the American University of Beirut. This quote is taken from a Sawyer Seminar delivered in 2001 titled *The Interplay of Science and Theology in the Fourteenth-century Kalām, From Medieval to Modern in the Islamic World* at the University of Chicago.

⁴³ There has been extensive new research on the Arabic interest that connected natural philosophers in sixteenth and seventeenth century England to Constantinople under the Ottomans. Texts such as G. A. Russell’s *The ‘Arabick’ Interest of the Natural Philosophers in Seventeenth-Century England* (Brill: 1993) and G. J. Toomer’s *Eastern Wisdom and Learning: The Study of Arabic in Seventeenth-Century England* (Oxford UP, 1996) present us with the historical view that while the medieval concern with Arabic is well established, there was, however, a “second wave” of Arabic interest in sixteenth and seventeenth-century, which in my opinion is much more interesting despite still being less explored in academia. According to these texts, the study of Arabic was pursued by a circle of natural philosophers, philologists and theologians in England in close contact with those on the Continent. The texts make the point that it seems that Arabic interest permeated all levels of English society, encompassing subjects which ranged from science and religion to medicine and even typography, and which, therefore, could add to our knowledge of theology and natural philosophy in the crucial periods of the 16th and 17th century Europe that set the scene for contemporary Western societies.

⁴⁴ ‘Alī Qushjī, *Sharḥ Tajrīd al-Kalām* (Tehran: n.p., 1890), 195.

⁴⁵ Robert G. Morrison, “Review of Ahmad Dallal’s *Islam, Science, and the Challenge of History*”, *Isis*, vol. 102, no. 3 (September 2011): 543-544

science discovery in the works of Qushjī. Perhaps Qushjī’s unique contribution to the development of a new astronomy and its foundations is precluded by an assessment by Ragep, where he states, “In the Islamic world the revolutionary rejection of Aristotelian physics in astronomy was something that took hundreds of years, dozens of scholars and thousands of pages before it bore fruit in the person of ‘Alī Qushjī in Samarqand”⁴⁶.

Historically, the *hay’a* tradition in mathematical astronomy, which was given an early formalisation by Ibn al-Haytham’s treatise *al-Shukūk ‘alā Batlamyūs (Doubts Concerning Ptolemy)* was the beginning of a revolution against the philosophy of an Aristotelian astronomy grounded in his idea of causality as ‘natural necessity’. This constituted the study of the picture of the world (*hay’a*) in terms of its apparent physical mechanism away from the idea of intrinsic necessary causality (*‘illa*). In the fourteenth century, the search for the real *hay’a* of the planets, the Sun and the Moon was taken up at the Samarqand school of Ulugh Beg with a new constructive approach to the foundations of astronomy. With such advancements in the study of the mathematical sciences, Qāḏīzadah⁴⁷ who was Qushjī’s teacher and one of the founders of the Samarkand Observatory, shifted the study of astronomy away from the Maragha tradition of integrating a realist natural philosophy (*al-muqaddamāt al-ṭabī‘īyah*) with mathematics to one that was in-line with the foundational approach of mathematical constructivism. Qushjī, who later headed the Samarkand Observatory after the death of Qāḏīzadah and who published *Zīj Ulugh Beg (Ulugh Beg’s Handy Tables)* after the assassination of the later, succeeded in advancing the mathematical developments that

⁴⁶ Ragep, Copernicus and his ..., 76.

⁴⁷ In Transoxiana, Qāḏīzadah took lessons from al-Sayyid al-Sharīf al-Jurjānī, but due to Qāḏīzadah’s preference for mathematics, they fell into disagreement, and he stopped taking lessons with him. Al-Sayyid al-Sharīf was also a mathematician, but he was known to have said about Qāḏīzāde that “mathematics predominates in his nature” (*ghalaba ‘alā ṭab‘ihi al-riyāḏīyāt*). (Aḥmad ibn Mustafā Tāshkubrīzāda (d. 1561), *al-Shaqā‘ī‘iq al-Nu‘mānīya fī ‘ulamā’ al-Dawlah al-‘Uthmānīyah*, ed. Ahmed Subhi Furat (Istanbul: n.p., 1985).

had taken place to date by articulating the foundations of a constructive methodology that was based on his strong opposition to the interference of Aristotelian realism in astronomy and by extension in his scientific practice⁴⁸. On this, Ihsan Fazlioglu, a biographer of Qushjī, notes that “in *al-Risālah al-Faḥḥīyah*, Qushjī followed the principles he had laid down in his *Sharḥ al-Tajrīd* by excluding an introductory section on Aristotelian physics, which customarily had introduced almost all previous works of this kind.”⁴⁹

Delving deeper into Qushjī’s astronomical models, the two treatises⁵⁰ to be investigated in this study are: (1) *Risālah fī ḥall ishḳāl al-mu‘addil lil-masīr li ‘utārid* (*A Treatise Regarding the Solution of the Equant Problem for Mercury*) which was published with a translation in 1993 by George Saliba⁵¹, and (2) *Risālah fī anna aṣl al-khārij yumkin fī al-suflayayn* (*A Treatise on the Eccentric Hypothesis Being Possible for the Two Lower Planets*) which was published by Ragep in 2005⁵². It is believed that these two treatises can help us better understand the foundations of Qushjī’s astronomical models in relation to the aforementioned pictorial resemblance that later appeared in Regiomontanus’ *Epitome of Almagest* and what that implies for our understanding of the history of the development of the ideas that constituted modern science.

⁴⁸ Through ‘Alī al-Qushjī, the “Istanbul school” formed a composite of Samarqand and Herat, namely Qādīzādah (the mathematician-astronomer) and Taftazānī (the Ḥanafī-Ash‘arite *mutakallim*).

⁴⁹ Ihsan Fazlioglu, “Qushjī” in *Complete Dictionary of Scientific Biography*, edited by Thomas Hockey (NY: Springer/Kluwer, 2008).

⁵⁰ *Al-Faḥḥīyah fī al-hay‘a* was Qushjī’s first book in astronomy published in 1457, and on the occasion of the conquest of Iraq he wrote it in Arabic and renamed it to *al-Faḥḥīyah fī ‘ilm al-hay‘a* as a dedication to the Ottoman Sultan Mehmed II, al-Fātiḥ.

⁵¹ George Saliba, “Al-Qushjī’s Reform of the Ptolemaic Model for Mercury”, *Arabic Sciences and Philosophy*, vol. 3 (1993): 161-203.

⁵² F. Jamil Ragep, “Alī Qushjī and Regiomontanus: Eccentric Transformations and Copernican Revolutions”, *Journal of the History of Astronomy*, vol. 36, no. 4 (2005), 359-371.

Before we proceed to study these five works, as we do in Chapters Three (on semantics), Four (on foundations of science) and Five (on astronomy), we first present in Chapter Two a preliminary study on the origins of constructivist epistemology within the tradition of *kalām*, and which serves as an important foundational examination of the rise of conceptualism within epistemology and theory of knowledge. Such a subjectivist approach appeared in the alternative framework for philosophy that the proponents of *kalām*, the *mutakallimūn*, had put forward in their intellectual battle against the Peripatetic *falāsifah*. Most of the refutations launched by the *mutakallimūn* were in fact over what the *falāsifah* had transmitted into Arabic from the various metaphysical positions that they had adopted from the Greeks – most of which the *mutakallimūn* had argued were in direct conflict with a non-realist comprehensive theory of knowledge that does not rely on upon *a priori* speculation. The fruit of the *mutakallimūn*'s engagement in philosophy was, therefore, the rise of constructivism, which took generations of *kalām* scholars before it emerged in the fifteenth century within the works of ‘Alī Qushjī.

CHAPTER TWO

CONSTRUCTIVIST ORIGINS

2.1 CONTINGENCY, CONCEPTUALISM AND *KALĀM*

Upon the emergence of *kalām* in the 9-10th century, a certain philosophy of *kalām* also emerged that was associated with a worldview strongly hinged on the contingency of the natural world. This non-sceptical philosophy was neither Aristotelian nor Platonic. It was neither a reconfiguration of realism nor an adaptation of idealism. In fact, the origins of this ‘third way’, as expounded in this thesis, came as a result of much intellectual effort that the *mutakallimūn* had exerted in their defence of Prophetic revelation against the system of Peripatetic ideas known in Arabic as *falsafah*. In describing this historical development, A. I. Sabra states:

The historical triumph of Ash‘arism over both mu‘tazilism and falsafa... happened to mark the beginning of new directions and new debates for subsequent centuries of Islamic intellectual history.¹

Running in parallel with these *kalām* polemicists was a group of scholars whose work, rather than being refutational in nature, was an investigation into the foundations for the human understanding of revelation or what is known as *uṣūl al-fiqh*. While *kalām* is a polemic philosophical discipline that develops the mechanisms by which revelation can be defended, *uṣūl al-fiqh* is an internal philosophical discipline that develops the mechanisms by which revelation can be understood. In fact, it is within this latter field of study that the origins of a constructivist formulation began under the study of semantic denotation or *‘ilm al-wad’*². It wasn’t until the works of Qushjī in the fifteenth

¹ A. I. Sabra, “*Kalām* Atomism as an Alternative Philosophy” in *Arabic Theology, Arabic Philosophy*, edited by James Montgomery (Louvain: Peeters Publishers, 2006), 218.

² For more details please refer to section 2.2 below on Language, Conceptualism and Human Understanding.

century, however, that we saw for the first time the emergence of a comprehensive theory of constructivism that is articulated as a general scientific system and a philosophical structure for thought. This gradual development in *kalām* philosophy means that the mainstream school consolidated by al-Ash‘arī (d. 936) was defined in early scholarship, while later generations within the school expanded on philosophic themes that were left pending the resolution of certain philosophical difficulties (*ishkālāt*).

For Aristotle, the world could not not exist; it is an ontological block that cannot conceivably be broken. To the contrary, for the *mutakallimūn*, who believe in the contingency of all creations, the way the contingent world is is not connected by necessity to its actual existence. This leads to the idea of an imagined world that does not exist, but yet could exist, therefore, its conception could be mentally constructed despite its non-existence. The significance of the mind and its role as a medium for positing relationships thus emerges from the *mutakallimūn*’s criticisms of the Peripatetic philosophers as related to their perception of reality and truth. A. I. Sabra says:

It is this constant affirmation of an uncompromisingly contingent view of the world and of everything happening in it that characterized in my view the Ash‘arite [*kalām*] attitude to the science of nature.³

So while realism is based on the idea of necessitarian causality in its quest for the unknown, idealism focuses on the universal and disregards altogether the worldly particular. *Kalām*, on the other hand, brought forward the idea of a constructivist theory of *a priori* knowledge, whereby in contrast to idealism mundane particularity is known, and contrary to realism a contingent natural world is upheld and any necessitarian or

³ A. I. Sabra, “Science and Philosophy in Medieval Islamic Theology: The Evidence of the Fourteenth Century”, *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenschaften*, vol. 9 (1994): 33.

deterministic claims are rejected. In their rejection of realism and its imbedded necessitarianism, the *mutakallimūn*, thus, blazed a constructivist path founded on their doctrine of contingency. *Kalām* scholarship consequently laid the foundation for a natural science that is not based on realist essence but on phenomenal description, therefore, conceptually different from any Greek philosophy; both its sceptical and its non-sceptical versions. Moreover, contingency involved a conceptual shift in the study of nature that abandons the Greek's idea of a single necessitarian universe and exchanges it for the division of the contingent into the actual possible and the non-actual possible (*qismay al-imbkān*). According to Knuuttila, this division of the contingent was the most fundamental change that modern science introduced⁴; a fact that by itself raises various questions about the relation between constructive *kalām* and the development of what became known in European history as modern science.

In any case, with this new theory of meaning in philosophy based on contingency, *a priorism* and its approach to the world, which is assumed within Aristotelian logic, was, thus, overthrown in favour of a contingent worldview and its empirical quest⁵. The reliance in *kalām* on an empirical approach is founded upon the doctrine of divine voluntarism, whereby from the concern to preserve the Will of God followed the idea - contrary to Greek necessitarianism - that God's creative acts are not necessitated; and from the unconstrained activity of God follows the contingency of the

⁴ Taneli Kukkonen, "Plenitude, Possibility, and the Limits of Reason A Medieval Arabic Debate on the Metaphysics", *Journal of the History of Ideas*, vol. 61, no. 4 (Oct., 2000): 539.

⁵ On this relation between *kalām* and empiricism Iqbal had the following to say, "... [of] the purely intellectual results of the Ash'arite mode of thought, and these are mainly two: (1) It led to an independent criticism of Greek Philosophy ... (2) In the beginning of the 10th Century, when the Ash'arite had almost completely demolished the stronghold of Rationalism, we see a tendency towards what may be called Persian Positivism. Al-Birūnī (d. 1048) and Ibn Haitham (d. 1038) who anticipated modern empirical Psychology in recognising what is, called reaction-time, gave up all inquiry concerning the nature of the supersensual ... Such a state of things could have existed, but could not have been logically justified before al-Ash'ari." (Muhammad Iqbal, *The Development of Metaphysics in Persia* (London: London Luzac and Company, 1908), 63-4).

natural order. Finally, from the contingency of the natural world follows the empirical approach for investigating such an order. By finding roots for a similar analysis on *kalām* dating as far back as the 12th century, Goodman states:

Imagination, as Moses Maimonides remarks⁶, is the linchpin of the *kalām*, for what is possible is equated with what is imaginable. If there is no contradiction in an assumption, it is conceivable and therefore possible... contingency ... in the cosmology of the *kalām* seems to aim a sharp riposte at the seeming necessitarianism of Aristotle's naturalism.⁷

To further add to this reflection, in 1903 Duncan B. MacDonald⁸ made a comparison between Kant and the *mutakallimūn* on the issue of subjective positing in the mind, which more than a century later has not been duly explored, despite the few sporadic instances⁹. MacDonald's original comments are as follows:

On the vexed question, 'What is a thing?' he [al-Ash'arī] anticipated Kant. Al-Ash'arī and his followers held that existence was the 'self' ('*ayn*) of the entity and not a quality or state. But in reaching that 'thing in itself' they [Ash'arite *mutakallimūn*] were much more thorough than Kant. Only two of the Aristotelian categories survived their attack, substance and quality. The others, quantity, place, time and the rest, were only conceptual relationships (*i'tibārs*) existing subjectively in the mind of the knower¹⁰, and not things (*ashyā'*)... But a relationship, they argued, if [considered] real, must exist in something, and a quality cannot exist in another quality, only in a substance. Yet it could not exist in either of the two things which it brought together; for example, in the cause or the effect. It must be in a third thing. But to bring this third thing and the first two together, other relationships would be needed and other things for these relationships to exist in. Thus we would be led back in an infinite sequence... Relationships, then, had no real existence but were mere ... subjective nonentities. Further, the Aristotelian view of matter was now

⁶ Maimonides, *Guide to the Perplexed*, ed. M. Friedlander (London: George Routledge & Sons LTD, 1904), 1.73.

⁷ Lenn E. Goodman, "Knowledge and Reality in Islamic Philosophy" in *Companion Encyclopedia of Asian Philosophy*, edited by Carr, Mahalingam (London: Routledge, 1997).

⁸ Duncan B. MacDonald, *Development of Muslim Theology, Jurisprudence and Constitutional Theory* (NY: Charles Scribner's Sons, 1903).

⁹ In a biography of the 11th century *mutakallim* al-Ghazālī M. Sharīf, for example, has the following to say, "Al-Ghazālī points out in Kantian fashion that possibility like impossibility is a purely subjective notion to which nothing need correspond in reality... possibility like impossibility is merely a concept" (Sharīf).

¹⁰ In a similar expression De Lacy O'Leary says, "Of the ten Aristotelian categories they regard only two - existence, i.e., ens, and quality as objectively real; the other eight are merely relative characteristics (*i'tibār*) subjective in the mind of the knower, and having no objective reality" (De Lacy O'Leary, *Arabic Thought and its Place in History* (London: Kegan Paul, Trench, Trubner & Co.; New York: E.P. Dutton & Co., 1922), 214).

impossible for them. All the categories had gone except substance and quality; and among them, passion (*mayl*). Matter, then, could not have the possibility of suffering the impress of form. A possibility is neither an entity nor a non-entity, but a subjectivity purely. But with the suffering matter, the active form and all causes must also go. They, too, are mere subjectivities. Again, qualities, for these thinkers, became mere accidents. The fleeting character of appearances drove them to the conclusion that there was no such thing as a quality planted in the nature of a thing; that the idea 'nature' did not exist. Then this drove them further. Substances exist only with qualities, i.e., accidents. These qualities may be positive or they may be negative; the ascription to things of negative qualities is one of their most fruitful conceptions.¹¹

The ideas raised above were also echoed by Muhammad Iqbal in his *The Development of Metaphysics in Persia*¹² in which he had the following to say about the Ash'arite theory of knowledge:

To answer the question, "What is a thing?" they [the Ash'arites] subjected to a searching criticism the Aristotelian categories of thought, and arrived at the conclusion that bodies have no properties in themselves. They made no distinction of secondary and primary qualities of a body, and reduced all of them to purely subjective relations ... to the knowing subject.¹³

However, unlike the non-realist understanding of categories such as quantity, place and time as being relationships (*i' tibārs*¹⁴) that exist subjectively in the mind of the knower¹⁵, the view that substance and accident or quality are two categories by means of which contingent reality is perceived was not itself a flagship Ash'arite

¹¹ MacDonald, 201-2.

¹² Originally written as his PhD dissertation, he published in London in 1908 under the same title of *The Development of Metaphysics in Persia*.

¹³ *Ibid.*, 56.

¹⁴ Toshihiko Izutsu points out that the term "*i' tibārī*" indicates the subjectivity of the knowledge that a subject holds about a thing. The *i' tibārī* knowledge is that which is conceived subjectively and accepted as the real property of the conceived thing or fact. Toshihiko Izutsu, *The Concept and Reality of Existence* (Malaysia: Islamic Book Trust, 2007), 150.

¹⁵ On this point M. Sa'īd Fūdah, a contemporary Arabic philosopher of science, summarises the position of the *mutakallimūn* by saying, "the *mutakallimūn* have a certain insight regarding some high concepts such time, space and causality and the reality of the relationships between segments of the physical world so that we find that they have been unique in some assertions, such as their saying that time and space are nothing but a mental abstraction for what is observed from sensed bodies and their external changes" (*mazahir al-fikr al-islāmī wa istiqlālīyātihā fī al-ijābah 'an al-as'ilah al-falsafīyah al-taqlīdīyah* (aspects of Islamic thought and its independence in replying to classical philosophical questions) a paper submitted in Arabic to a conference jointly organised by IIIT Jordan and the University of Jordan and the Department of Jordanian Culture, 29-30 October 2008).

doctrine. In fact, this Aristotelian categorisation had seeped into the nomenclature of *kalām* via the Mu‘tazilites and the early *mutakallimūn* assumed it in their refutations given that two of their main opponents, the Mu‘tazilites and the Peripatetic philosophers, had adopted them. Therefore, the seeming dualism adopted by the early *mutakallimūn* regarding the consideration of some categories as subjective, while others as objective was their early attempt at the eventual flight from realism and the subsequent acquisition of the ‘third way’ of constructivism. In fact, this subjective/objective dualism is characteristic of the later debates on the nature of secondary intelligibles (*ma‘qulāt thānawīyah*) as secondary qualities given that generally speaking, it was qualities or accidents which formed the actual predicates of substances. Despite the novel role of the constructive mind in early *kalām*’s conceptual structures (which includes the possible non-existent), its polemic, however, remained mostly within the linguistic framework of its opponents.

Consequently, when the *mutakallimūn* “rejected the Aristotelian view of matter as the possibility of receiving form (*ṣūrah*), their path ... led them straight to the atomists”¹⁶ with the atom, or more precisely the indivisible atomic substance (*al-jawhar al-fard*), considered a *mutaḥayyiz* (place occupier) and its qualities inhering in it (*hal fī al-mutaḥayyiz*). These atomistic substances, according to these *mutakallimūn*, simply have “position, not bulk, and do not touch one another” and between them is “absolute void” (*khalā*). Within this atomic theory, De Boer remarks that “there is no connection between substances ... The world [of essence] is a discontinuous mass...”. As a result, we see that with this outlook on change which is generally central to natural science, the two Aristotelian categories substance (*jawhar*) and accident (*‘araḍ*), when

¹⁶ MacDonald, 202.

scrutinised under the early *mutakallimūn*'s constructivist spirit - as was done with atomism, ended with destroying all false hope for a realist scientific theory of knowledge. This realisation is based on the fact that if constructivism in its final scientific formulation, which is a later *kalām* development, is the genuine theory of *a priori* knowledge, then neither realism nor idealism can occupy this crowned position.

Indeed, to clarify why the early *mutakallimūn* adhered to the atomic minimal part, Sa'd al-Dīn al-Taftāzānī (d. 1390), the 14th century *mutakallim*, explains:

If the question is raised whether there is any benefit resulting from this position [atomic minimal part] which is different (from the Philosophers' views), we reply that there is. In establishing the pure atom we escape many of the obscurities of the Philosophers, such as the positing of primary matter (*hayūlī*) and form (*ṣūrah*) which leads to the eternity of the world, the denial of the resurrection of the body, and many of the fundamental laws of measurement (*al-handasah*), upon which obscurities rests [such as] the continual motion of the heavenly spheres; and also the denial of the rending (*al-kharq*) of them and their being coalesced together again (*al-ilti'ām*).¹⁷

This shows that the only position under the division of a physical object into substance (*jawhar*) and accident (*'araḍ*) that can be maintained within *kalām*, as an Islamic polemic, is that of atomic indivisibility. Consequently, as Aristotelian causality was framed within the language of metaphysical essence, the early *mutakallimūn* responded with a minimal part atomic theory that refutes the claimed necessitarianism within their own purported conceptual framework. On this, Kukkonen remarks that within such a worldview instead of closing the door on discovery, "things can by all account be radically different from one instant to the next"¹⁸, which liberates scientific induction from the restrained imposed upon it by a presupposed universal 'essence' that reduces change into predefined categories that hamper human understanding of change.

¹⁷ Sa'd ad-Dīn al-Taftāzānī, *Sharḥ al-'Aqā'id al-Nasafīyah*, trans. Earl Edgar Elder, *A Commentary on the Creed of Islam* (New York: Columbia University Press, 1950), 32.

¹⁸ Taneli Kukkonen, "Possible Worlds in the Tahāfut al-Falāsifah: Al-Ghazālī on Creation and Contingency", *Journal of the History of Philosophy*, vol. 38, no. 4 (2000), 21.

In fact, this theme, as we later see in Chapter Four, is central to the conceptual shift that the study of astronomy underwent within the works of the scientist ‘Alī Qushjī.

Furthermore, what seems to be significant to the argument on *kalām* and the substance and accident division is how this bifurcation arose in its historical Greek context. The following excerpt is taken from a 2009 University of Texas at Austin PhD dissertation titled *On Fictionalism in Aristotle’s Philosophy of Mathematics*:

Both Plato and Aristotle considered the subject matter of science to be definite properties that don’t change [static], for Plato they were the forms for Aristotle they were the abstractions. Plato argued for the separate existence of objects of sciences on the basis of differences between objects of sciences and sensible particulars. For him while the objects of sciences maintain their identities cross-temporally, sensible particulars did not have such cross-temporal identities since they were in constant change over time. Aristotle avoids this problem of the indefiniteness of sensible particulars by making a distinction between essential and accidental properties: insofar as a sensible individual thing does not undergo its substantial changes, it maintains its identity. Even if its accidental properties change, we have still the same answer to the question of what the thing is. Thus, we can have a definition of a sensible object insofar as its essential properties are not changed. Aristotle argues that the complexity (essence and accidents) of a sensible particular does not imply the separate existence of objects of sciences. It is this complexity problem for which Aristotle introduces abstraction as a solution. For example According to Aristotle, a geometer studies not the triangle itself separated from any sensible triangular thing, but a bronze isosceles triangle *qua* triangle. This aspect of *qua* object of study is the “reductionism of western culture whereby by abstraction certain sensible objects are reduced to selected properties” which hides their true nature in a dynamic world of change whereby it captures in static forms certain space-time aspects of the sensible object.¹⁹

According to the *mutakallimūn* the idea behind a substance (*jawhar*) is that, unlike Platonism, the objects of perception (*a’rād*) inhere (*qā’imah*) in the substance. Also unlike Aristotelians, the *mutakallimūn* held that universals aren’t concrete entities and that qualities are not divided into essential and accidental ones. One downside of the essentialist theory is that it determines in a fixed *a priori* way what constitutes

¹⁹ Young Kee Cho, “On Fictionalism in Aristotle’s Philosophy of Mathematics” (Ph.D. thesis, University of Texas, 2009), 54-5.

substantial change and thus limits the understanding of physical change to a static formula that traps thinking and prevents learning. The early *mutakallimūn* rejected the idea of the existence of universal forms which ends in rejected metaphysics. Thus grouping of particular features into kinds is not done in the physical theory of perception, but is rather a product of intellection (*ta' aqqul*). A significance of this *kalām* development is that knowledge of reality becomes a product of the mind. This also means that essence (*māhīyah*) also becomes a mental product, making it an epistemological entity and not an ontological physical entity as it had been considered by both the neo-Platonic and the Peripatetic philosophers. So for the *mutakallimūn* perception has a physical component and a dynamic mental one. Furthermore, contrary to the claim made by their adversaries they did not close the door on scientific investigation. To the contrary, they shunned the realist theory of correspondence and its physical forms and heralded the coming of a new era of science hinged on a constructivist philosophy of the mind.

Consequently, as *kalām* further developed into the fifteenth century and the fledgling constructivist ideas were turned into a fully-fledged philosophy, the alternative 'third way' of constructivism emerged and with it, as we see in Chapter Four, involuntary knowledge (*al- 'ilm al-ḍarūrī*) and its inferential mental processes become a cornerstone for constructive *a priori* knowledge. Furthermore, increasingly a new more experimental terminology was introduced for philosophical concepts which rely more on psychological concepts of individuation (*tashakhkhuṣ*) and cognition (*mafhūm*) than on ontological ideas of substance (*jawhar*) and accident (*'araḍ*). On the history of the development of *kalām* according to Ibn Khaldūn, A. I. Sabra has the following summation to draw:

The first phase, represented by al-Bāqillānī, Ibn Khaldūn characterizes by a commitment to a form of argument which based the doctrine of God on a system of intellectual premises (*muqaddamāt 'aqlīya*) constituting an atomistic theory of the world, and which tended to raise the employed premises to the status of the religious dogmas themselves. According to Ibn Khaldūn, the argument gained credence only at a time when Aristotelian logic was little known, but the fallacious character of the argument became evident when better understanding of the formal rules of thought prevailed as a result of a wider diffusion of Aristotle's logical works. This happened in the second phase inaugurated by al-Juwaynī (d. 1085) in his book *al-Shāmil* and its shorter version *al-Irshād* which subsequently enjoyed widespread acceptance. Only then was it clearly and generally realized that false premises do not necessarily entail false conclusions, and the connection previously assumed between al-Bāqillānī's brand of atomism and the theological doctrine came to be loosened.... The third phase in Ibn Khaldūn's words resulted in making 'the one discipline ... no longer distinguishable from the other.'²⁰

As a result, we find that while early *mutakallimūn* such as al-Ash'arī (d. 935) and al-Bāqillānī (d. 1013) held atomistic views, al-Juwaynī (d. 1085) and Fakhr ad-Dīn al-Rāzī (d. 1210) preferred to refrain from joining either the atomists or their *falāsifah* opponents²¹.

The third phase as characterised by the above breakdown by Ibn Khaldūn represents the 14-15th centuries during which *kalām* presented a more comprehensive constructivist theory as a philosophical system of thought that acts as an alternative to both neo-Platonic idealism and to Peripatetic realism. In what follows is a discussion of various themes critical to this development of constructivism and which indicate the progress of thought in *kalām* away from realist frames and towards an independent and constructive alternative framework for doing philosophy.

²⁰ Sabra, *Science and Philosophy ...*, 12.

²¹ Sabra, *Kalām Atomism ...*

2.1.1 *A Priori* Knowledge as Involuntary Knowledge

While accepting the division of perceived objects into the two categories of substance (*jawhar*) and quality (*‘araḍ*), the early *mutakallimūn* rejected the Aristotelian division of substance into matter and [universal] form (*ṣūrah*). This meant that knowledge for them was not the attainment of form in the mind (*ḥuṣūl al-ṣūrah fī al-dhihn*), as no such universals existed in the outside. To the contrary, they postulated that the definition of knowledge would have to turn to the subject’s mind for constructing particular associative relations between the knower and the thing known, whereby a change in the thing known would produce a change in the relation. On this MacDonald says that “in ontology the object of the Ash‘arites was to fix the relation of knowledge to the thing in itself. Thus, al-Bāqillānī defined knowledge (*‘ilm*) as cognition (*ma‘rifah*) of a thing as it is in itself^{22,23}. Al-Rāzī elaborated on this position by saying²⁴ that “beyond doubt we know involuntarily by intuition (*na‘lam bi al-ḍarūrah*) that we know a specific thing and that this knowledge according to a great number (*jam‘ ‘adhīm*) of the *mutakallimūn* is a specific connection (*nisbah makhsusah*) or a specific addition (*iḍāfah makḥṣūṣah*) [i.e. knowledge as particular]”. He also rejects²⁵ in his *al-Maṭālib al-‘Āliyah* (*Lofty Requisites*) the Peripatetic definition of knowledge as “the occurrence of the [universal] form of the known in the knower (*ḥuṣūl ṣūrat al-ma‘lūm fī al-‘ālim*)”²⁶. Similarly, in

²² “*Ma‘rifat al-‘ulūm ‘alā mā huwa bihī*” (Muḥammad ibn al-Tayyib al-Bāqillānī, *al-Inṣāf Fīmā Yajib I’tiqāduhu wa la yajūz al-Jahl bihi* (Al-Qāhirah: al-Maktabah al-Azharīyah, 2000), 12).

²³ MacDonald, 201.

²⁴ Fakhr al-Dīn Muḥammad Ibn ‘Umar al-Rāzī, *al-Maṭālib al-‘Āliyah min al-‘Ilm al-Ilāhī*, ed. Aḥmad Hijāzī al-Saqqā (Bayrūt: Dār al-Kutub al-‘Arabīyah, 1987), 103-6.

²⁵ *Ibid.*

²⁶ Moris says: “The definition of knowledge according to the Aristotelian definition [is] an abstraction of forms (*ṣuwar*) from matter and the definition provided by Fakhr al-Rāzī [is] that knowledge is a relation (*iḍāfah*) between the subject who knows and the object that is known” (Zailan Moris, *Revelation, Intellectual Intuition and Reason in the Philosophy of Mulla Sadra* (London: Routledge Curzon, 2003), 100).

al-Mawāqif Ījī states²⁷ that knowledge has to include a relation between the knower and the known, and he calls this relation “*ta’alluq*” (connection) and says that no other definition has been posited with a proof (*wa lam yathbut ghayruhu bi dalīl*). In the commentary al-Jurjānī relates this definition to the community of *mutakallimūn* (*ma’āshir al-mutakallimīn*).

Furthermore, the notion of a relation involving the philosophical category *idāfah* (relation)²⁸ implies that it has been classed under an intelligible category (*maqūlah i’tibārīyah*)²⁹ opening the way for knowledge as a subjective construction, and in a major intellectual breakthrough bringing the subject into the formulation of knowledge. As we discover in the next chapter on the works of Qushjī, this foundational innovation idea ultimately leads to constructivism as a comprehensive philosophy of physical science.

On the other hand, this issue has been a topic of contention amongst a group of realist philosophers known as the school of *al-Ḥikmah al-Muta’ālīyah*, i.e. the followers of Ṣadr al-Dīn al-Shīrāzī (known as Mulla Sadra). Sadra in his response to the *mutakallimūn*’s definition of knowledge as a relation, claims in his *Asfār*³⁰ that Rāzī has “slipped” in making knowledge “amongst the weakest qualities and the least of the existing things”. He then asks from his perspective, which regards knowledge as actually existing in reality as an abstract form, “how can the reality of knowledge be the

²⁷ Al-Sayyid al-Sharīf ‘Alī Ibn Muḥammad al-Jurjānī, *Sharḥ al-Mawāqif* (Al-Qāhirah: n.p.: 1325/1907), 2: 47-8.

²⁸ Rāzī for example defends the association of the philosophical category (relation) with knowledge. In Ḥillī’s *Kashf al-Murād fī Sharḥ Tajrīd al-I’tiqād*, the editor Hasan Zādah al-‘Āmilī states that Rāzī said “*lastu ufī anna al-‘ilm* (knowledge) *min ay maqūlah in lam yakun min maqūlat al-idāfah* (the category of relation)” (Ibn al-Mutahhir al-Ḥillī, *Kashf al-Murād fī Sharḥ Tajrīd al-I’tiqād*, ed. Hasan Zādah al-‘Āmilī (Qum: Mu’assasat al-Nashr al-Islāmi, 1992), 331).

²⁹ In *Sharḥ al-Tajrīd* (325) Qushjī says that the majority (*jumhūr*) of the *mutakallimūn* held that *al-idāfah* is not verified in the outside rather it affirmed in the mind (*thubūtuhā fī al-dhihn*).

³⁰ Ṣadr al-Dīn Muḥammad ibn Ibrahīm ash-Shīrāzī (d. 1641), *al-Ḥikmah al-Muta’ālīyah fī al-Asfār al-‘Aqlīyah al-Arba’ah* (Bayrūt: Dār Ihyā’ al-Turāth al-‘Arabi, 2002), vol 1: 288.

reality of a relationship which has no independent existence ... apart from the existence of its two sides?'. He then raises in a typical fashion the following sceptical doubts about conceptualist knowledge, which have been generally repeated many times over by anti-constructivist realists. Sadra alleges the following:

Pure knowledge and perception (*al-‘ilm wa al-idrāk muṭlaqan*) is not how this skilled scholar (*niḥrīr*) has claimed [i.e. Rāzī] – a mere relationship between the knower and his known thing without a need for the existence of form (*ṣūrah*) – otherwise how could knowledge be divided into conception (*taṣawwur*) and assent (*tasdīq*) or how could it be connected to the non-existent or knowledge of one’s self given that there is no relation with a non-existing matter or between a thing and itself. Rather knowledge is the exact form itself which exists and is an abstraction... a real thing which is dissimilar to a relationship (*amrān haqīqīyān mughayirān li al-idāfah*).³¹

The community of *mutakallimūn* accepted the definition of knowledge as a relation or a connection (between the knower and the known human understanding); a fact that only proves that they had not adopted a realist perspective of knowledge, even though (as we saw earlier) they had attempted to appropriate some of their opponents’ categories and divisions. From a constructivist perspective, a *mutakallim* can easily brush off the above raised doubts by clarifying that conception and assent do not need a universal form to be imported into the mind from the outside, nor do they require the adoption of a dualism between competing external and internal realities in order to achieve knowledge. In fact, if the perceiver constructs meaning and understanding in the mind based on sensory data then both conception and assent can be achieved through an individuation process (the theme of individuation or *tashakhkhuṣ* is covered in more details in Chapter Three). Secondly, on knowing non-existents, it is ironic for a realist to make this assertion when it could be realised by a simple inference that what does not exist does not have form in the first place, and which only adds value to a

³¹ Ibid., vol. 2: 39 (*Faṣl* 4: *Qism* 2 on *jawāhir* and *a‘rāḍ*).

constructivist theory that predicates mental concepts as opposed to having the external object itself or its form act as a subject of predication. Thirdly, on the issue of knowledge of oneself, it is easily conceivable within a constructivist framework that the self can have known concepts about itself given that knowledge is generally a connection between the self and a known understanding or a meaning that the subject constructs in the mind irrespective whether this concept is about the self or about an existing or a non-existing thing. On the other hand, doubts can be easily raised about how a realist can attain his or her own form when the self undergoes change every time it acquires a new form, and which only implies that knowledge of one's self is knowledge of a past state and not of what the self has become after knowing the new form. The exist-strategy from this circular regress³² has generally been for realists to claim a mystical unity between the knower and the known, and which in itself is only a step farther away from any verified theory of perception or knowledge.

Consequently, in seeking the seeds of knowledge that can form a foundation for rational enquiry and scientific understanding, the *mutakallimūn* were inclined to consider the *a priori* knowledge as that knowledge which rests on man's ability to involuntarily attain knowledge of the particulars through his inner and outer sensory faculties³³. We see for example al-Bāqillānī classifying³⁴ as being involuntary knowledge (*al-ʿulūm al-ḍarūrīyah*) the following classes: (1) the produced sensations of the perceiving five senses and all qualities that are subsequently perceived such as color, sound, smell, temperature, where he clearly states that “every knowledge that

³² Taftazānī says, “*Wa thālithuhā anna al-naḥs idhā kānat ʿālimah bi-dhātihā wa ṣifātihā kānat ʿālimah bi-ʿilmihā bi-dhālikā wa halumma jarrā lā ilā nihāyah*” (Saʿd al-Dīn Masʿūd Ibn ʿUmar al-Taftazānī (d. 1389), *Sharḥ al-Maqāṣid fī ʿIlm al-Kalām* (Lahore: Dār al-Maʿārif al-Nuʿmānīyah, 1981), vol. 1: 436).

³³ This contrasts with Plato's saying that the senses cannot be trusted as he holds universals to be permanent and worthy of knowledge while the senses are changing and indeterminate.

³⁴ Al-Bāqillānī, *al-Inṣāf* ..., 13.

occurs with sensory perception from one of these senses is knowledge by obligation, i.e. one that is enforced upon the human self in a way that does not allow for perceptual doubt or hesitation”³⁵; (2) a sixth source which begins with one’s self (*al-mubtadi’ bi al-nafs*), such as the knowledge of one’s existence (*wujūd nafsihī*) and what occurs within it (*yaḥduth fihā*) and what happens to it (*yanṭawī ‘alayhā*) from sensations and emotions; (3) this last type, Bāqillānī asserts, also includes knowledge of facts such as the law of contradiction (*anna al-ḍiddayn lā yajtami ‘ān*), knowledge of what is known by way of rational principles (*awā’il al-‘uqūl*), as well as that which is known by way of habitual occurrence (*muqtadā al-‘ādāt*), for example that fruits are from trees and bovid milk from an udder. In all these cases, Bāqillānī says, knowledge is obligatorily established (*fa al-‘ilm bihi yaqa ‘ḍarūratan*) from the perspective of human choice.

Similarly, Fakhr al-Rāzī defined the epistemological sources of *a priori* knowledge by stating the following in his *al-Maḥṣūl*:

The judgement of the mind (*ḥukum al-dhihn*) upon a matter is either *jāzim* (positive) or not, if it were then it either matches (*muṭābiq*) the judged reality or not, and if it did match reality then that occurs either for an obligatory matter (*yakūn li mūjib*) or not. If it were for an obligatory justification then that is either the sensory (*ḥissī*) or the rational (*‘aqlī*) or that composed of the two (*murakkaban minhumā*) ... such as the intuitive knowledge (*badīhiyāt*) and the rational knowledge (*nazarīyāt*) being by the intellect, the intersubjectively-tested knowledge (*mutawātir*) being by the sense of hearing and the intellect, while experience that is testable (*tajrībī*) and inferential (*ḥadsī*) is by the remaining senses and the intellect. As to that which matches reality but is not regarded as justified obligatorily (*la yakun li mūjib*); it is the belief of an imitator (*i‘tiqād al-muqallid*).³⁶

³⁵ Al-Bāqillānī says, “*kull ‘ilm ḥaṣala ‘inda idrāk ḥāssah min hādhihi al-ḥawās fa huwa ‘ilm ḍarūratan yulzim al-nafs luzūman lā yumkin ma‘ahu al-shakk bi al-idrāk wa al-irtiyāb*” (Muḥammad ibn al-Tayyib al-Bāqillānī (d. 1013), *Kitāb Tamhīd al-Awā’il wa Talkhīṣ al-Dalā’il* (Bayrūt, Mu’assasat Kutub Thaḳāfīyah, 1993), 9).

³⁶ Fakhr al-Dīn Muḥammad Ibn ‘Umar al-Rāzī, *al-Maḥṣūl fī ‘Ilm al-Uṣūl*, ed. Taha Jabir al-‘Alwani (Bayrūt, Mu’assasat *al-Risālah*, 1992), 83. The translation given above is the author’s own.

Crucial to understanding the meaning of *a priori* knowledge according to the *mutakallimūn* is the last statement in the quotation above where Rāzī says that if someone knows something that is true in itself (*muṭābiq*) but does so by imitation (*taqlīd*) then this knowledge is not considered obligatory (*mūjib*). The foundation that Rāzī gives for achieving such *a priorism* in knowledge is, therefore, to resort to the way the psyche or the self knows through constructing a relation between the experiencing subject and its experience. Rāzī refutes the philosophers that claim that knowledge is the occurrence of an outside universal form in the self and finds fault with such a definition due to the circular regress that such a belief would ensue with, as it claims to know about itself and its attributes by including the form of itself in itself's form. Rāzī says in the *Mulakhkhaṣ*:

We know obligatorily (*na'lam bi al-ḍarūrah*) our knowledge of the heavens and the earth and our existence and the existence of our pleasures and pains and we discriminate between such feelings and other psychic states (*aḥwāl naḥsānīyah*) and all this rests on conceptualising knowledge itself ... knowledge is either a real entity or a relation, but the hypothesis that it is real by being the same form as that of the whatness of the perceived (*al-ṣūrah al-musāwīyah li māhīyat al-mudrak*) ends up in a rejected scenario (*bāṭil*) given that the whatness of black occurs in inanimate objects (*ḥāṣilah li al-jamād*) and that cannot be ascribed with knowledge (*wa lā 'ilm hunāk*). On the other hand, there is no difficulty or paradox (*la shubḥah*) in verifying a relation because we know obligatorily (*na'lam bi al-ḍarūrah*) that feelings are not verified except through a specific relation (*idāfah makhsusah*) between the experiencing subject (*al-shā'ir*) and the experience (*al-mash'ūr*)³⁷ ... know that those who say that knowledge is an [acquired] form (*ṣūrah*) that is equal to a [form in the] known thing (*al-ma'lūm*) are engulfed by the difficulty of having knowledge of themselves and their attributes given that the occurrence of a form that is equal to that of the self and its attributes results in the circular regress of combining between the self and itself (*ijtimā' al-mithlayn*).³⁸

³⁷ Rāzī states that this is the position of the majority of the *mutakallimūn*, he says, “*fa hādihā qawl dhahaba ilayhi jam'un 'aẓīm mīnal-ḥukamā' wal-mutakallimīn wa huwa al-mukhtār 'indanā wa huwal-ḥaqq*”. (Rāzī, *al-Maṭālib* ..., 3: 103-6).

³⁸ Quoted in Ījī's *al-Mawāqif* (Al-Jurjānī, *Sharḥ al-Mawāqif* ..., 2: 54).

Another explication of the concept of *a priorism* as used by the *mutakallimūn* in relation to knowledge can be made by clarifying Rāzī's distinction between conceptualising (*taṣawwur*) that which is rationally acquired (*kasbī*) and that which is attained without human volition or choice, i.e. the involuntary (*ḍarūrī*). By focusing on epistemological involuntariness, Rāzī shows in his *al-Tafsīr al-Kabīr* that denying intuitive (*badīhī*) knowledge in favour of only rational (*kasbī*) analysis leads to a circular regress, for if the intuitive knowledge, which occurs in us, is itself rationally acquired, then we end up in the situation where acquired knowledge is composed of other acquired knowledge in a regress that does not logically end. Rāzī's explanation of the solution is as follows:

The truth is that these intuitive *a priori* sciences (*al-ʿulūm al-badīhīyah*) had not occurred to us then they did. So the saying that this implies that they be acquired by analysis (*kasbīyah*) due to their initial occurrence is a rejected presupposition (*muqaddimah*). Rather we say that intuitive knowledge first arises in us through the aid (*iʿānat*) of the two senses; hearing and sight. This account can be explicated by asserting that in their created origins humans were devoid of all knowledge and God created their capacities to hear and see, whereby when an infant sees a thing one time after (*marrah baʿd ukhrā*) another the descriptive whatness (*māhīyāt*) of this object is drawn (*irtasama*) in his imagination (*khayālīhī*). Similarly, when he hears an audible sound one time after another its whatness is drawn in his hearing and imagination, the same applies to the other senses. Consequently, the occurrence of a sensory experience becomes a reason for the occurrence of the description of a sensed matter in the self and the intellection.³⁹

This formulation by Rāzī, therefore, relates the intuitive *a priori* knowledge to the senses; founding them upon a repetitive feedback process similar to a child's learning experience. With this, Rāzī has justified a crucial form of *a priorism* in knowledge; that of testable (*tajrībī*) and inferential (*ḥadsī*) knowledge, and he has opened a door for a non-realist foundation of knowledge that is based on the

³⁹ Fakhr al-Dīn al-Rāzī, *Mafātīḥ al-Ghayb* or *al-Tafsīr al-Kabīr* (Al-Qāhīrah: Dār al-Ghad al-ʿArabī, 1992), 72/20. The translation is the author's own.

individuation of the learnt concepts in the mind. In fact, Rāzī is credited for countering the essentialist *ṣūrah* of the *falāsifah* with a constructive *taṣawwur* as an active verb derived from the same semantic root as *ṣūrah*. In doing so he was only summarising the position adopted in *kalām* against that followed in *falsafah*. Rāzī further asserts in his *Muḥaṣṣal* under the discussion on conception (*taṣawwurāt*) that “for me none of it is acquired by rational analysis (*ghayr muktasab*)”, i.e. it is obtained through intuitive involuntariness. On the other hand, Rāzī considers analytic knowledge to be based on rational verification or assent (*taṣdīq*). For this reason he had the following to say:

A human cannot conceptualise (*yataṣawwar*) except that which he cognizes with his sensory capacity (*adrakahu bi ḥissihī*), or dispositionally finds (*wajadahū bi al-fiṭrah*) such as pain and pleasure, or obtains by the spontaneity of the mind (*badīhat al-‘aql*) such as the conceptualisation of existence, singularity and plurality, or what the mind composes or imagines from these other divisions. Facts outside these categories do not at all (*al-battah*) fall within the realm of mental conception, and alternatively it is induction that ascertains their truth (*wa al-istiqrā’ yuḥaqqiquhu*).⁴⁰

Constructive induction in the above passage or *istiqrā’* is in accordance to the *mutakallimūn*’s notion of involuntary obligation (*ḍarūrah*) and not according to the Greek idea of necessitarian induction that ends with the ‘problem of induction’. In fact, it is for this reason that Ibn Sīnā rejected induction as a tool for *a priori* knowledge saying in his *Ishārāt* that “induction (*al-istiqrā’*) does not necessitate true knowledge (*ghayr mūjib lil ‘ilm al-ṣaḥīḥ*), as what has not been inducted might be contrary (*bi khilāf*) to what has been”⁴¹. On the other hand, the *kalām* perspective on inductive knowledge can be summarised from Ghazālī’s assertion in his *Mi‘yār al-‘Ilm*, where he says, “that which allows one to arrive at assent (*al-mūṣil ilā al-taṣdīq*) is called ‘*hujjah*’

⁴⁰ Fakhr al-Dīn Muḥammad Ibn ‘Umar Al-Rāzī, *Muḥaṣṣal Afkār al-Mutaqaddimīn wa al-Muta’akhhirīn min al-‘Ulamā’ wa al-Ḥukamā’ wa al-mutakallimīn* (Al-Qāhirah: al-Matba‘ah al-Husaynīyah al-Miṣrīyah, 1905), 18.

⁴¹ Avicenna (Ibn Sīnā) (d. 1037), *al-Ishārāt wa al-Tanbīhāt* (Qom: al-Nashar al-Balāghah, 1990), 369.

(proof) and it includes syllogism (*qiyās*) as well as induction (*istiqrā'*) and others". Further on in the same text Ghazālī defines his general meaning of "*al-istiqrā'*" as, "the judgement (*ḥukum*) from many particulars (*juz'iyāt kathīrah*) onto one particular (*juz'ī wāḥid*)". In fact, Ghazālī's definition of induction is based on the *a priorism* of habitual experiential knowledge in both its forms, i.e. *al-tajribī* (intuitively testable) and *al-ḥadsī* (intuitively inferred), which as explained earlier is not a predictive necessitarianism (known as *al-istiqrā' al-nāqis* or incomplete induction), but rather a constructive *a priorism* (*ḍarūrah*) whose epistemological certainty is based on its obligatory nature with regards to human choice and is, therefore, empirical and related to particular knowledge (known as *al-tamthīl* or *qiyās al-ghā'ib 'alā al-shāhid* i.e. analogical syllogism grounded in the habitual occurrence of particular events).

In addition, the theory of knowledge produced by Abū-Mansūr al-Mātūrīdī, a great *mutakallim* himself and the founder of the Mātūrīdī School of *kalām*, had the following two main characteristics in his definition of knowledge:

- 1) Perception for al-Mātūrīdī is a knowledge of the signified sensed particular (*al-'ilm bi al-madhkūr al-juz'ī al-maḥsūs*) based on the perceptual knowledge being involuntarily true (*ṣādiqah bi al-ḍarūrah*). He also holds that the mind is the home of the senses (*al-'aql bayt al-ḥiss*), which means that the senses relay information (*ma'rifah*) to the mind and that there is nothing in the mind that was not present before. This characteristic implies that it is the mind that discriminates the sensory information which is processed in the mind and not statically obtained from an outside form (*ṣūrah*), i.e. a non-realist approach that is constructivist in spirit.
- 2) The mind does not perceive the essence of objects (*la yudrik māhīyāt al-ashyā'*) rather its appearances (*ẓawāhiruhā*) only. This makes the shift for natural science away from the metaphysical description of quiddity (*māhīyah*) and towards a phenomenal definition which is observed by the senses and described in manifest language.⁴²

Furthermore, contrary to the scepticism which might deny all types of *a priori*

⁴² 'Alī 'Abd al-Fattāḥ Maghribī, *Imām al-Sunnah wa al-Jamā'ah Abū Mansur al-Mātūrīdī wa Ārā'ahu al-Kalāmīyah* (Al-Qāhirah: Maktabat Wahbah, 1985), 41-50.

knowledge by way of deconstruction alone, Taftāzānī in *Sharḥ al-‘aqā’id al-Nasafīyah* defends epistemical *a priori* knowledge both through the senses (*ḥiss*) which the sceptics had denied, and by intuition (*badīḥah*) which the rationalists had diverged on. Thus, in providing a foundation for *a priori* knowledge as being involuntary knowledge, Taftāzānī responds to both necessitarian and sceptical Greek theorists. Taftāzānī says:

The error of the senses in some individuals is due to particular reasons (*asbāb juz’īyah*) and this does not falsify affirming the sensory knowledge when those reasons are removed. Further, variation in claims made on the basis of the intuitive type [of knowledge] due to non-acquaintance (*‘adam al-ulf*) or to obscurity of conception (*khafā’ al-taṣawwur*) does not contradict intuition itself. Similarly, differences in theorising do not imply the falsity of all rational knowledge (*naẓarīyāt*) produced.⁴³

The difference between the *kalām* worldview and the peripatetic view of the *falāsifah* on *a priori* knowledge of the natural world could, thus, be expressed by the difference between the *mutakallim*’s assertion ‘I know an *a priori* fact *nonvoluntarily*’ and the latter’s claim ‘I know an *a priori* fact *necessarily*’. This difference is crucial as the first leads to an epistemological investigation, while the second restricts its search to ontological speculation. In epistemology, an object is pragmatically known if it is distinguished from others in appearance, while realism makes the subject matter of knowing a metaphysical essence beyond any appearance. This has an obvious influence on how claims on empirical *a priori* knowledge are justified.

2.1.1.1 The Origins of Empirical A Priori Knowledge

To summarise the *mutakallimūn*’s theory of knowledge, we can repeat a statement by one of the early fathers of *kalām*, who distinctly states, “the *mutakallimūn* in general characterised the first class of acts (such as lifting a book within reach) as will-

⁴³ Mas ‘ūd Ibn ‘Umar At-Taftāzānī (d. 1389), *Sharḥ al-‘aqā’id al-Nasafīyah*, ed. Aḥmad Ḥijāzī al-Saqqā (Al-Qāhirah: Maktabat al-Kullīyah al-Azharīyah, 1987), 14.

dependent (*maqdūr*), [and] the second (such as perceiving a book in front of me in daylight with my eyes open) as involuntary (*ḍarūrī*)⁴⁴. The theme on involuntary knowledge (*al-‘ilm al-ḍarūrī*) as an automatic or an *a priori* knowledge has indeed taken up a central place in philosophical developments within *kalām*. On this Abrahamov, who translates the expression *‘ilm ḍarūrī* as “necessary knowledge”, i.e. as a subjective pre-rational criteria and not as a modality, states, “Discussions of the theory of knowledge occupy a prominent position in Islamic theological manuals, which, as a rule, open by setting out the definition and meaning of knowledge, in its various kinds... A specific kind of knowledge called necessary [i.e. *a priori*] knowledge (*‘ilm ḍarūrī*)⁴⁵ appears to be the basis of most of the theological arguments.”⁴⁶ Abrahamov also makes the comment that “the criterion of the measure of using necessary [i.e. *a priori*] knowledge as proof should be applied in the examination of the ways of argumentation of any Islamic theological school in general as well as in the examination of any theologian in particular.”⁴⁷ This element in fact relates to constructivism as a subjective alternative that was presented by the *mutakallimūn* in response to all forms of realist and idealist theories of knowledge. The basis for the *kalām* inspired involuntary *a priori* knowledge is related to “man’s inability to prevent this knowledge from taking place in his mind”⁴⁸.

⁴⁴ Abī Bakr Muḥammad Ibn al-Hasan Ibn Furāk, *Mujarrad Maqālāt al-Shaykh Abī al-Hasan al-Ash‘arī*, ed. Daniel Gimaret (Bayrūt: Dār al-Mashriq, 1987), 106-8.

⁴⁵ Wensinck in his *The Muslim Creed: Its Genesis and Historical Development* (London: Routledge, 2008), p252, considers this term to mean ‘natural or primary knowledge’ but this does reflect the central theme of *a priorism*, which is perhaps better translated by Hourani (*Islamic Rationalism: The Ethics of Abd al-Jabbar* (London: Oxford, 1985), 20) and adopted by R. M. Frank in *al-Ghazālī and the Ash‘arite School* (Durhan and London: Duke University Press, 1994), where he translates it on p69 as “direct intuition” and on p146 as “immediate knowledge”. Our preferred meaning for *‘ilm ḍarūrī* is, however, ‘involuntary knowledge’ or ‘*a priori* knowledge’ as we continue to clarify in this section.

⁴⁶ Binyamin Abrahamov, “Necessary Knowledge in Islamic Theology”, *British Journal of Middle Eastern Studies*, vol. 20, no. 1 (1993): 20-32.

⁴⁷ Ibid.

⁴⁸ Ibid.

Such a conception of involuntariness, appears in al-Ash‘arī’s theory of individual accountability (or his doctrine on *kasb*) under which that which happens with no conscious control is taken to be unavoidable and non-accountable, while that which happens by human volition is considered to constitute the circle of human answerability. Al-Ash‘arī begins his theory with an explanation of the difference between an involuntary movement (*harakat idtirār*), e.g., shaking from palsy, and appropriated movement (*harakat iktisāb*).⁴⁹ From this perspective, we see that the foundation for the two types of knowledge, i.e. the acquired and accountable (*kasbī*) type and the involuntary and *a priori* (*darūrī*) one, emerges based on their discussions on human subjectivity, accountability and will.

In fact, al-Bāqillānī (d. 1013) is amongst the early *mutakallimūn* who develop the *kalām* framework for involuntary *a priori* knowledge (*al-darūrāt*)⁵⁰. In his *al-Inṣāf*⁵¹ (Equity) he states that “the *a priori* is that which adheres to the human self (*mā lazima anfus al-khalq*) in a manner which one cannot avoid or repudiate through doubt; such as the knowledge of that perceived by the five senses, and that which originates in the psyche (*mā ibtada’a bi al-nafs*) by intuition”⁵². In the next generation, al-Juwaynī further confirms this distinction by saying in his *al-Irshād* (Guidance) that the *a priori* knowledge (*al-‘ulūm al-darūrīyah*) are those that “if one extends his speculative insight to they do not arrive at anything that denies it and its content thus occurs without any human volition or will (*min ghayr taqdīr fard khīrah fīh*)”, and he also adds:

The *a priori* knowledge is that initiated without human choice (*ghayr al-maqdūr li al-‘abd*) by relying on an instrument [such as the senses] while

⁴⁹ Binyamin Abrahamov, “A Re-examination of al-Ash‘arī’s Theory of *kasb* according to *Kitāb al-Luma*”, *JRAS* (1989): 210-221

⁵⁰ The original definitions according to Abrahamov (1993) can be found in al-Bāqillānī, *al-Tamhīd* ..., 7, 8, 9, 11, 13-14. al-Bāqillānī, *al-Inṣāf* ..., 14. Ibn Furāk, 160.

⁵¹ Al-Bāqillānī, *al-Inṣāf* ..., 13.

⁵² Similarly, the Andalusian *mutakallim* al-Bājī amongst others almost repeats the words of al-Bāqillānī on *a priori* knowledge in his *Ihkām al-Fuṣūl* (p. 170-1).

the intuitive *a priori* (*badīhī*) carries the same meaning except it is not contingent on an external means of access ... examples range from the knowledge of sense perception or one's knowledge of one's self or the impossibility in combining between contradictory matters and the like. The acquired knowledge (*kasbī*), on the other hand, is that initiated by human choice (*al-ilm al-ḥādith al-maḥdūr*).⁵³

Towards the end of the thirteenth century, al-Baydawī explicitly states that *a priori* knowledge is that which occurs in the mind without speculation and thought⁵⁴. Furthermore, this approach to *a priori* knowledge founded on the baseline of subjective choice and adopted by the *mutakallimūn* is in clear contradistinction to Greek necessitarianism and deterministic positions that consider that necessity is a modality throughout time and ends in equating *a priori* knowledge with universal generalisations under the supposition that the future resembles the past.

A priori human knowledge means constant and invariable within a specific experience, where such knowledge which encompasses the knowledge of contingent beings cannot be due to any ontological necessity given their contingency. Hence, the foundation for an *a priorism* would have to be a factor of the experiencing subject where no doubt follows the attainment of such knowledge. *A priori* knowledge is, therefore, any actual knowledge whose certainty is psychologically settled in the knowing subject without being impeded by rational doubt. The certainty of such knowledge further implies that no human rational choice is involved in obtaining *a priori* empirical knowledge, as such openness to rational analysis, contrary to being unavoidable, leads knowledge to being discursive. Given that *a priori* knowledge has induction imbedded into its process of attainment, it, therefore, noticeably comprises of an accumulation of

⁵³ 'Abd al-Malik ibn 'Abdullāh al-Juwaynī (d. 1085), *Kitāb al-irshād ilā qawāti 'al-adillah fī uṣūl al-i'tiqād* (*The Guide to the Conclusive Proofs for the Principles of Belief*) (London: Reading Garnet, 2000), 13-4.

⁵⁴ 'Abdullāh ibn 'Umar al-Baydawī (d. ~1286), *Nature, man and God in medieval Islam: 'Abd Allāh Baydawī's text, Ṭawāli 'al-anwār min maṭāli 'al-anzār*, ed. and trans. Edwin E. Calverley and James W. Pollock (Leiden: Brill, 2002), 55.

cognitive moments. Such a momentary nature of human knowledge, in fact, implies that rather than the known relation between the knower and the known concept being permanent in time, it is empirically known to hold at a specific moment in time. With this approach to *a priori* knowledge the ontology of physical objects is replaced with an epistemological consideration restricted to what is known through the inner and outer senses. As a result, empirical *a priori* knowledge is actually inductive, momentary and particular.

Consequently, if our knowledge, that an event in a specific manner, is *a priori* and if all that we've seen of this event is its occurrence in this way, this does not imply that it can be assumed that it has or will always exist in this way. Our *a priori* knowledge which rests on induction does not extend to any unseen cases. Indeterminacy in nature is, therefore, the common scientific order, where one does not inductively know the past in its totality as an *a priorism* and whereby induction as a scientific process is not based on absolute uniformity in nature, but is rather founded upon the individuality and the momentary nature of an inducted report whose existence is known, by subjective *a priorism*, to have occurred. This is what the Aristotelians unjustifiably extend, where they assume that induction gives a universal conclusion that is presumed to be a continuum in time going beyond the particularity of the inducted moments. By being considered necessary, universal forms were thus given by Aristotelian realists an ontology of permanence in being and time. Consequently, it is this modal leap from a momentary subjective involuntariness to a being that is assumed to be permanently necessary in time, which has given rise to ideas such as the uniformity of nature or the laws of nature that constitute an unjustifiable presupposition for deductive logical methods in natural science.

On the other hand, by rejecting any extramental existence of universals the *mutakallimūn* took knowledge to be a subjective relation. This implies that *a priori* human knowledge is based on the actual existence of particulars and not based on the idea of modality across time or in all possible worlds. In other words, involuntary knowledge is particular and not universal, where involuntariness is about being momentarily so and empirically in the actual world. As an example, we know involuntarily that a specific perceived content is actual when the sensorimotor data is cognitively identified with a learnt concept in such a way that the new event becomes an individuation of a mental concept. In this way, perceptual knowledge which is processed by an internal cognitive process that is involuntary to the perceiver is unequivocally known to the subject given that in this case human rational choice does not determine the outcome of the perceptual experience. Involuntary knowledge is, therefore, attained due to the empirical condition of its content being indispensable through an internal mental process that the knower is unaware of. This early theme on the functionality of the mind, as we further discuss in Chapter Three, is a crucial element of Qushjī's comprehensive theory of constructive *a priori* knowledge.

In the end, we can now clearly state that “the foundations of *kalām* included the ‘involuntary’ (*ḍarūrī*) or indispensable propositions”⁵⁵; a fact which constitutes a crucial basis for constructivism as a comprehensive foundation of *a priori* knowledge, which is presented as a normative and a non-sceptical alternative to both realism and idealism.

⁵⁵ Sabra, *Kalām Atomism ...*, 204.

2.1.1.2 Concepts as Universals

As we saw in the first section on contingency, in Greek philosophy, knowledge was considered on the basis of fixed universals under the ontological conviction that particulars are only there because of a causal relation to a universal⁵⁶. For the early *mutakallimūn*, however, the existence of universals was closely tied to their doctrine on contingency which led them to the corollary that “universals in no wise exist in individual things: they are Concepts”.⁵⁷ A substance (*jawhar*) for them was that which resides (*al-qā'im*) in a place (*al-hayyiz*), and on that basis they “rejected the argument of the philosophers who said that natural universals exist outside the mind not as corporeal substances but as incorporeal substances [*jawāhir mujarradah*] placed in sensible substances”⁵⁸. In order to defend their position, Heer states the following about the *mutakallimūn*:

[T]hey [the *mutakallimūn*] maintained that if universals were a part of each particular then it would be impossible to predicate a universal of its particulars because the universal, being a part of each particular, would have to exist prior to the particular and thus would differ from the particular with respect to existence. Since identity of existence is needed for predication, the universal could not be predicated of its particulars, which is absurd... Furthermore, if universals, which are single entities, existed as parts of particulars they could then exist with contradictory qualities and in different places at one and the same time. The theologians therefore concluded that universals existed only in the mind.^{59, 60}

In doing so the *mutakallimūn*, in fact, were rejecting the Aristotelian definition as genus and differentia upon which the entire corpus of Aristotle's logic rests. Al-Rāzī explicitly states that “the falsity (*buṭlān*) of the definition (*al-ḥadd*) composed of genus

⁵⁶ Tom Rockmore, *Kant and Phenomenology* (Chicago: University of Chicago Press, 2011), 7.

⁵⁷ Tjitze J. De Boer, *The History of Philosophy in Islam* (Surrey, Eng.: Curzon Publications, 1994), 59.

⁵⁸ Nicholas Heer, *The Sūfī Position With Respect To The Problem of Universals in Papers on Islamic Philosophy, Theology and Mysticism* (Seattle: Washington: 2009), 81.

⁵⁹ Ibid.

⁶⁰ Qutb ad-Dīn al-Rāzī, *Lawāmi' al-Asrār fī Sharḥ Matāli' al-Anwār* (University of Michigan MS: 1720), 53-56; Qutb ad-Dīn al-Rāzī, *Risālah fī Taḥqīq al-Kullīyāt* (MS Leiden Or. 958 (21)), fols. 68b-69a; al-Taftazānī, *Sharḥ al-Shamsīyah* (MS), fol. 46-47; al-Jurjānī, *Ḥāshiyah 'alā Sharḥ Matāli' al-Anwār* (MS), 134-138.

(*jins*) and differentia (*faṣl*) is known in logic”. Therefore, while with Greek syllogism the path to *a priori* knowledge is claimed to be on knowing the ontological essences that are assumed to be obtained during perception, the *kalām* worldview rejects the idea of essence as universals of perceived objects and focuses rather on distinguishing one particular from another as they appear to us leading to a descriptive or an empirical rather than an ontological or a speculative definition (*ḥadd*) of objects. As Nashshar summarises, the *mutakallimūn*’s objective (*ghāyatuhum*) from the *ḥadd* is to discriminate the defined thing from others (*tamyīz baynahu wa bayn ghayrihi*)⁶¹. Comparatively, while the *kalām* definition refers to *tamyīz* as a mental activity, the Aristotelian definition only focuses on the reception of universal forms; therefore reducing human perception to being a passive receptacle of outside forms. Here again we see the place of subjectivism and its constructivist origins in the mental activity that the *mutakallim* places within his theory of perception.

On that basis if universals are in fact subjective mental concepts, then they are in accordance with one’s conceptualisation and not according to a realist theory of correspondence that considers them as physical forms imported into the mind from the outside. Furthermore, such conceptual activity varies in degrees of rationality and coherence leading to the concepts themselves being considered as changeable constructs. The direct implication of this idea is that whatness (*māhīyah*) would be that which is judged in the mind and not that which is in itself imported from the outside. Blake Dutton elaborates on this aspect of *kalām* by making the following observation on Ghazālī:

Ghazālī argues rather curiously that the objects of the concepts of the sciences do not exist in reality. But he does not dismiss them as being

⁶¹ ‘Alī Sāmī Nashshār, *Manāhij al-Baḥth ‘inda Mufakkirī al-Islām wa-Iktishāf al-Manhaj al-‘Ilmī fī al-‘Ālam al-Islāmī* (Al-Qāhirah: Dār al-Salām, 1984), 103-7. The original dissertation was written in 1952.

completely nonexistent. The implication is that these objects have some sort of mental existence.⁶²

In a similar way to Ghazālī, the commentator on *al-Mawāqif*, al-Jurjānī, says that “universality (*al-kullīyah*) is a verifiable attribution (*ṣifah thubūtīyah*) which implies that the attributed is an existent and if this is not in the outside (as all that is in the outside is an individual) then in the mind”⁶³.

Prior to this position, however, when the *mutakallimūn* first rejected the existence of universals, they resorted to a linguistic theory of nominalism whereby when humans use words they are considered individually posited with an intended meaning that is determined by the speaker’s intent. Under this semantic scheme commonality between individuals is determined analytically in the mind and not posited by language usage. In fact, the same way the indivisible atom was the initial response by the *mutakallimūn* to the Aristotelian definition of substance as form and matter, we also see here that the idea in linguistic commonality or homonymy (*ishtirāk lafzī*) came as an initial response to the Greek theory of common meaning under analogical semantic categories (*ishtirāk ma‘nawī mushakkak*) that implied an analogy between God’s necessary existence and that of contingent beings. The early *mutakallimūn* with their doctrine of contingency, thus, rejected a positing (*wad‘*) theory based on common meaning and chose the method of positing common expressions or homonyms instead.

This early *kalām* position on denotation, however, was gradually developed in parallel with other developments in *kalām* based on a more elaborate study of the mind and its process of individuation (*tashakhkhuṣ*) of the perceived objects and their relation to learnt mental concepts. In fact, by the time of Taftāzānī in the 14th century the

⁶² Blake D. Dutton, “Al-Ghazālī on Possibility and The Critique of Causality”, *Medieval Philosophy and Theology*, vol. 10 (2001), 23-46.

⁶³ Aḥmad ibn Mustafa Tāshkubrīzāda (d. 1561), *al-Shuhūd al-‘Aynī fī Mabāḥith al-Wujūd al-Dhihnī* (Cologne: Manshūrāt al-Jamal, 2009), 81.

majority of the *mutakallimūn*, as he notes held that existence is semantically common as a single univocal (*muṭawāṭi'*) notion that is considered a single reality in the mind, as such Taftāzānī says that the existence of the Necessary Being refers to the meaning of 'extramental beingness as an entity' and when the 'beingness' of man is thought of, this mental concept is also considered, however, the disparity between the Necessary Being and man concerns their quiddity.⁶⁴ In fact, it was al-Rāzī who first introduced the view that "pure existence is merely a concept"⁶⁵, which is at variance with the position of Ibn Sīnā and his followers. Shams al-Dīn al-Samarqandī⁶⁶ in his *Ṣaḥā'if* related to the verifying scholars (*muḥaqqiqīn*) the saying that existence is semantically common and superadded to the concept in the mind⁶⁷. This clearly leads to a position of 'conceptualism', which explains universality of particulars as grouped particulars within a conceptualising framework posited in the mind. Extending nominalism and still in opposition to realism, the conceptualist position, thus, approaches the concept of universals from the view that rejects the idea of their existence as particular entities outside the mind. One can see that even as early as Ghazālī's *Tahāfut al-falāsifah* (*The Incoherence of the Falāsifah*), one can find roots for such a conceptualist view. Ghazālī summarises below what it means for a *mutakallim* to accept universal concepts:

Nothing inheres (*yaḥill*) in the mind except that which inheres in the senses, however, in the senses it is congregated (*majmū'an*) and unspecified and the mind can indeed specify (*tafṣīl*) the various components ... in the mind the relation (*al-nisbah*) to all particulars (*mufradāt*) is one, hence it would be said that it is a universal (*kullī*) in that sense ... the relation of the mental image to all the particulars of its genus (*jins*) is the same relation so that for example if one sees a human and then sees another human no new form (*hay'ah*) occurs to the seer.⁶⁸

⁶⁴ Tafatazānī said, "inna wujūd al-wājib huwa kawnuhu fī al-'ayān 'alā mā yu'qal min kawna al-insān wa innamā al-ikhtilāf fī al-māhīyah" (Taftāzānī, *Sharḥ al-Maqāsid*, 1:307)

⁶⁵ John Cooper, "Al-Rāzī, Fakhr al-Dīn (1149-1209)", *Islamic Philosophy* (London: Routledge, 1998).

⁶⁶ Muḥammad Ibn Sharīf As-Samarqandī, *al-Ṣaḥā'if al-Ilāhīyah* (Kuwait: Maktabat al-Falāḥ, 1985), 78-81.

⁶⁷ Sa'd al-Dīn Mas'ūd Ibn 'Umar al-Taftāzānī (d. 1389), *Tahdhīb al-Kalām* (MS), fols. 37-39.

⁶⁸ Abū Ḥāmid al-Ghazālī, *Tahāfut al-falāsifah* (Bayrūt: al-Maktabah al-'Aṣrīyah, 2001), *mas'alah* 18, *dalīl* 9.

This clearly indicates that for Ghazālī the universal is determined by having a genus-based concept that relates in a similar manner to all the particular individual meanings that the mind fits them under. Such a mentally active schema, therefore, relies on the mental capability of the subject giving rise to what can be called a subjective universal that is different from the Peripatetic definition of universal as an independent entity that exists extramentally. By making the known universal a mental concept and not a universal form that exists in the physical object itself, Ghazālī was also representing the *mutakallimūn*'s non-essentialist pragmatic theory of denotation which although separates between a physical object of *knowledge* (*'ilm*) and the mentally *known* (*ma'lūm*) concept, it, nevertheless, uses those mental concepts to signify their objects of perception without the need for a heuristic program to match between physical objects and their mental conceptions. In a recent article, Kukkonen notes that for Ghazālī words refer to things primarily by means of concepts despite language being used as a communication tool about reality. Kukkonen says, "these concepts are what al-Ghazālī refers to as the meanings (*ma'ānī*) of names, and the overwhelming impression is that what are meant thereby are universals"⁶⁹. One can, therefore, find in Ghazālī's subjective concepts an epitome of the constructivist origins that the early *mutakallimūn* incorporated into their philosophical *kalām* scheme.

The next section delves into Ghazālī's well known position on causality as it was expressed in the seventeenth discussion of the *Tahāfut*. Once we understand Ghazālī's position from a constructivist perspective, we actually edge closer to resolving a hermeneutic controversy that has stood in Ghazālīan studies for almost one hundred years. Furthermore, in constructivism we seem to find a general framework for

⁶⁹ Taneli Kukkonen, "Al-Ghazālī on Accidental Identity and attributes", *The Muslim World*, vol. 101 (2011): 662.

interpreting much of the philosophical output of the *mutakallimūn*, which puts us in a stronger position to relate its arguments and positions directly into contemporary philosophical debates.

2.1.2 Ghazālī and Conceptual Causality

In the face of an Aristotelian ontological conviction that there are particulars only because of a necessary causal relation to a universal,⁷⁰ the *mutakallimūn* responded that such a realist necessitarian claim would imply that the contingent beings have a necessary existence, which of course the *mutakallimūn* did not accept. It is within this worldview that Ghazālī famously “cuts the bond of causality with the edge of his dialectic and proclaims that we can know simply that one thing follows another.”⁷¹ However, as we later see, by following in the footsteps of earlier *mutakallimūn* (such as Bāqillānī) Ghazālī does not deny the *a priorism* (*ḍarūrah*) of some knowledge, he rather attacks Greek realism and its necessitarianism as being the root source to what our minds understand as being *a priori* to our everyday rational experience. Kelley Ross comments on this aspect of *kalām* studies by saying, “actually, Ghazzali did believe in causality; he just did not believe that it was where we thought it was”⁷². Historically, in order to maintain an *a priori* category associated with contingencies, the *mutakallimūn* ultimately arrived at the position that constructive *a priori* connections are the result of subjective associations of ideas constructed by the mind itself. This subjectivism which is better explicated in later *kalām* texts, such as Qushjī’s fifteenth century *kalām*, certainly finds its constructivist origins, as we demonstrate below, in the general position of the early *mutakallimūn*, such as Ghazālī.

⁷⁰ Rockmore, 7.

⁷¹ MacDonald, 229.

⁷² Kelley L. Ross, *Substance and Essence*, 2006, <<http://www.friesian.com/essence.htm>>.

According to Aristotelians the natural place of falling objects is Earth, and they held that this relation is a necessary causal one. For example, their statement that ‘a body falls because it has weight’ was considered to give a presumed effective cause of the fall, and their other argument that ‘it seeks its natural place’ refers to what they considered to be a final cause. The early *mutakallimūn*, on the other hand, objected to such qualitative causality saying that there is no logical necessity neither about causality nor about nature itself, and the Prophetic miracle (*muʿjizah*), which many had witnessed earlier with Prophets of God, is an empirical proof for their contingency. With the Prophetic miracle, an epistemological conception was put forward beyond the idea of necessary causality. This impetus gave rise to a modality of existence that focuses on empirical evidence as drawn from the idea of contingency in scientific practice.

In an opening statement in the seventeenth discussion (*masʿalah*) of the *Incoherence of the Falāsifah* Ghazālī famously argued the following assertion, which along with the next quote from *Miʿyār al-ʿIlm* (*Standard of Knowledge*), I quote extensively from, due to the relevance of such passages to our later discussions in Chapter Four on constructive *kalām*, in which Qushjī further extends the *Tahāfut* discussions on causality and scientific knowledge:

[Passage A]: We differ from them [the *falāsifah*] in their judgement that the observed concomitance that exists between causes (*asbāb*) and effects (*musabbabāt*) is a necessary concomitant connection ... The first case (*masʿalah*) is to exclusively prove the truth of Prophetic miracles where differences in this case arise over the reality of miracles that occur as a rending of natural habits (*al-khariqah li al-ʿādah*) such as the turning (*qalb*) of a staff into a serpent, the revival of the dead and the splitting of the moon. Those that pretend that the running of habits (*majarī al-ʿādāt*) happens by a necessary connection (*lāzimah luzūman ʿdarūrīyan*) have in effect asserted the impossibility of that mentioned [the miracles] by necessity (*aḥāla jamīʿ dhālika ʿdarūrīyan*). The connection (*al-iqtirān*) between what is habitually (*ʿādatan*) believed to be a cause or an effect is not considered by us modally necessary (*darūrī*) ... such as those found in ... natural and medical concurrences and in sense perception (*mithil ... al-mushāhadāt wa al-muqtaranāt al-ṭibbīyah wa al-ṭabīʿīyah*) rather

any concomitance between the two is in accordance to God's Will (*taqdīrillāh*) Who creates them being congruous (*'alā tasāwuq*) with no essential necessity in itself (*lā li kawnihi ḍarūrīyan bi nafsīhi*) ... Let's take one analogical example (*mithāl*): That of the burning that occurs in cotton when, for example, it comes in contact with fire, whereby we can foresee the scenario where the two come in contact with no burning occurring ... The opponent claims that the actor in burning is the fire (*fā 'il al-ihtirāq huwa al-nār*) which is an agent that acts by its very own nature without volition (*fā 'il bi al-ṭab ' lā bi al-ikhtiyār*)... However, the inanimate (*jamād*) fire does not have any power to act in itself (*lā fi 'l lahā*) and consequently the burning happens with (*'indahū*) the fire and not through it (*bihi*). Further, they [the *falāsifah*] have no evidence to the contrary ... It has been established that the existence with a thing (*al-wujūd 'inda al-shay'*) does not indicate the existence through or in that thing (*al-wujūd bihi*)... Our response therefore is the following: God acts and God has a Will (*Allāh yaf'al bi al-irādah*). With the confirmation that God creates the burning in accordance to His will (*bi irādatihi*) when the cotton touches (*mulāqāt*) the fire, it is mentally conceivable (*amkana fī al-'aql*) also that He does not create [the burning] despite the existence of the contact.⁷³

By stating that no essential necessity exists between presumed causal relations, Ghazālī, like his *mutakallimūn* predecessors, was denying the existence of essential properties that are defined by speculative presuppositions and alternatively basing his judgement on empirical features that are ascertained by the mind. This alternative approach is founded on *kalām*'s contingency doctrine, which in this case Ghazālī expresses by stating that God “creates them [i.e. observed concurrences] being congruous”, which implies their contingent (*mumkin*) modality.

Perhaps the following statement epitomizes Ghazālī's conceptualist epistemology, where conceptual knowledge of a patterned occurrence is granted to humans as a result of their direct experience. Al-Ghazālī remarks:

[Passage B]: When a Prophetic miracle has not occurred we say that God created in us the knowledge (*khalaqa lanā 'ilman*) that He will not do all these possible [non-habitual] things (*mumkināt*), and that we only profess that these things are not necessary (*wājibah*), rather that they are possible and may or may not happen. Protracted habit (*istimrār al-'ādah*) time

⁷³ Al-Ghazālī (2001), *Tahāfut ... , mas'alah 17, maqām 1.*

after time actually fixes their occurrence in our minds (*yurassikh fī adhhāninā*) according to a past habit in a fixed impression.⁷⁴

In another place in the *Tahāfut*, Ghazālī continues:

[Passage C]: When God disrupts (*kharaqa*) the habitual [course of events] by making [the Prophetic miracle] occur at a time when a disruption of the habitual events takes place, we know that these cognitions [about the habitual course of events] have slipped away (*insālat hadhihi al-‘ulūm*) from people’s minds⁷⁵. Therefore, there is nothing to prevent (*falā māni*) us from considering that some specific matter is possible for God to create (*mumkinan fī maqdūrātillāh*), but that God eternally knows that He does not do so (*la yaf’aluhu*) despite his power to do so at particular times (*fī ba‘d al-awqāt*), and He creates for us the knowledge that He does not create such a thing at that time (*fī dhālika al-waqt*).⁷⁶

Recent academic research endeavours to better understand the early *mutakallimūn*’s approach to contingent science based on an epistemological procedure that grants the knower ‘*a priori* knowledge’ about contingent world events. On this theme Ragep points out⁷⁷ what seems to be a leap in this epistemological direction, by quoting Griffel’s 2009 book *Al-Ghazālī’s Philosophical Theology*, in which the latter problematically uses the expression “in our knowledge, the connection ... is necessary”⁷⁸, and he also adds, “although causal connections between events in the outside are not necessary, our knowledge of them is necessary”⁷⁹. By citing such problematic psychologism that misses constructivism for some form of epistemic necessitarianism, Ragep, however, notes that the early *mutakallimūn* “may have had a far more significant effect” and that “Ghazālī may well have opened up new avenues

⁷⁴ Modified from Richard N. Bosley and Martin Tweedale, Eds., *Basic Issues in Medieval Philosophy: Selected Readings Presenting the Interactive Discourses Among the Major Figures* (Broadview Press, 2006), 31.

⁷⁵ Abū Hāmid al-Ghazālī, *Tahāfut al-falāsifah = The Incoherence of the Philosophers*, A parallel English-Arabic text, ed. and trans. Michael E. Marmura, 2nd edn. (Provo, Utah: Brigham Young Univ. Press, 2000), 286, 171.

⁷⁶ Al-Ghazālī (2001), *Tahāfut ... , mas’alah 17, maqām 2*.

⁷⁷ F. Jamil Ragep, “Review of Frank Griffel’s *al-Ghazālī’s Philosophical Theology*”, *Isis*, vol. 101, no. 4 (December 2010): 867-868.

⁷⁸ Frank Griffel, *Al-Ghazālī’s Philosophical Theology* (USA: Oxford University Press, 2009), 203.

⁷⁹ Griffel, *Al-Ghazālī’s Philosophical Theology ...*, 279.

(such as alternatives to Aristotelian natural philosophy and the possibility of the earth's motion)" - a notion that we take up in Chapter Four on constructive *kalām* where we analyse this theme based on the idea of constructive *a priori* knowledge as involuntary rather than necessary knowledge. Griffel further adds:

In human judgments, there is a "hidden syllogistic force" (*quwwah qiyāsīyah khafīyah*) that connects what we identify as the cause with what we identify as its effect. In human judgments, the connection is permanent, and there is no synchronic alternative. Thus in our judgments, the connection between the cause and its effect is necessary [i.e. subjectively obligatory]. This line of thinking is echoed in the view that the modalities only exist in human judgments, not in the outside world.⁸⁰

Away from such misreading of contingent modality as being some form necessitarian subjectivism, Ghazālī himself, as a *mutakallim*, and in a groundbreaking manner, lays out in his *Mi'yār al-'Ilm* a non-realist and non-sceptical method for achieving experiential *a priori* knowledge, which he founds on the subject's inner syllogistic power⁸¹ to perceive from the information provided by the senses. Ghazālī introduces this hidden syllogistic power as a core element of his epistemological initiative and associates it with an emerging subjectivist spirit that traces back to the early *mutakallimūn* from whom he inherited this pattern of thought. In fact, Ghazālī lays down the original seeds for a scientific subjectivism that continues to remain foundational for later constructivist developments in *kalām*. The two passages below (D, E) not only provide an epistemological direction but by insisting that the non-sceptical assenter does not need to present the reasoning process by which they arrived

⁸⁰ Ibid.

⁸¹ The concept of a *qiyās khafī* was raised earlier by Avicenna in his *Ishārāt* however the purpose to which Avicenna uses this hidden syllogism is contrary to how al-Ghazālī appropriates this concept within his own *kalām* metaphysical outlook. On this Marmura says, "He [Avicenna] argues that along with observation, there is a hidden rational argument, a hidden syllogism, to the effect that if the regularity in the past had been coincidental or accidental it would not have continued the way it has. From this he concludes that regularities are essential and derived from the inherent causal properties in natural things" (Michael E. Marmura, *Ghazālī's Attitude ...*, 106). al-Ghazālī obviously rejects the idea of essential causal powers derived from inherent natures as a form of animation for what is an inanimate body and he introduces instead the idea of human agency to provide a subjectivist basis for certain knowledge.

at their positive experiential judgements, Ghazālī was also ontologically arguing that we can directly access perceptual representations in our consciousness without any matching heuristic that realists often get entangled in. Consequently, the pedagogy for acquiring such experiential *a priori* knowledge is not by instructional education but rather by constructive learning where the adept student is given the tools to personally construct and arrive at the desired cognitive outcome (*yudall al-ṭālib ‘alā al-ṭarīq alladhī salakahu wa istanhajahu*)⁸². Ghazālī’s subjectivist approach, therefore, sees a crucial role for the individual, concluding that experiential knowledge is acquired through a subjective mental exercise. Ghazālī explains:

[Passage D]: The introductory premises (*muqaddamāt*) are divided into those that are certain (*yaqīnīyāt*), veridical (*ṣādiqah*) and necessitating assent (*wājibat al-qabūl*) and to others ... The third category [of the certain ones] is the time-tested type of *a priori* knowledge (*al-mujarrabāt*) which is that involving matters that have been assented to empirically by way of the senses (*waqa‘a al-taṣdīq bihā min al-ḥiss*) utilising the aid of a hidden syllogism (*qiyās khafī*) ... and that have been repeated until a strong belief is produced in which there is no doubt (*‘uqd qawī lā yushakk fīh*) and for which the subject does not need to present the reasoning process by which he arrived at such a positive outcome (*laysa ‘alaynā dhikr al-sabab fī ḥuṣūl al-yaqīn*) ... crucial to this conclusion is the hidden syllogistic force (*quwwah qiyāsīyah khafīyah*) which mixes with the sensory data (*tukhālīṭ al-mushāhadāt*) to allow the subject to reach experiential knowledge as had this matter being incidental (*ittifāqī*) or accidental (*‘araḍī*) and conceptually non-binding (*ghayr lāzīm*) then it would not have continued in the majority with no variation.⁸³

In light of this subjectivist analysis, causality, according to Ghazālī, is a mentally drawn concomitance (*iqtirān*) defined in the mind. Hence, it is not a necessary connection in itself as an essential feature that does not change. Rather, it is a contingent habit (*‘ādah*) that occurs in nature and which is subject to being rended (*kharq*). Further, with this contingent sense of causation, “a deeply entrenched human custom of knowing

⁸² Abū Ḥāmid al-Ghazālī (d. 1111), *Mi‘yār al-‘Ilm fī Fann al-Mantiq* (Bayrūt: Dār al-Andalus, 1964), 1:92.

⁸³ Ibid.

natural phenomena”⁸⁴ corresponds through repeatedly observing concurrent natural events. For Ghazālī, knowledge about habitually concomitant events is *a priori* because such a knowledge is framed within experimental experience (*tajrubah*) where a pattern of occurrence has been observed and learnt. Our knowledge of habits (*‘ādāt*) is, thus, founded upon repeated events that have been verified to exist and that fact is known obligatorily as it is established by the knower beyond doubt⁸⁵. However, as it has been alluded to before, habitual concurrence does not relate our *a priori* knowledge to any assumptions about the future necessarily resembling the past; neither in the mind nor in the events themselves. In the last passage to be presented from *al-Mi‘yār*, Ghazālī continues:

[Passage E]: If a questioner asks: How do you believe this to be certain (*yaqīnī*) when the *mutakallimūn* have doubted this relation and they’ve said: Decapitation is not the cause of death, nor eating is the cause of satiation, nor burning is that of burning, rather God creates burning, death and satiation being in sequence with their concomitant events (*‘inda jarayān hadhihi al-umūr*) and not through them (*lā bihā*). It is sufficient here to say that if the *mutakallim* was informed that his son has been decapitated he does not doubt his death, and no sane person would doubt this, as he recognises (*mu‘tarif*) the occurrence of death and seeks to unveil the concomitance (*bāḥith ‘an wajh al-iqtirān*)... As to the thought of whether such matters are due to a necessary connection between the two concomitants (*luzūm darūrī*), this thought is engaged in the modality of concurrence (*wajh al-iqtirān*) and does not deal with the concurrence in itself (*nafs al-iqtirān*). It should thus be made clear that skepticism about the death of the decapitated [under habitual circumstances] is sheer hypochondria (*waswās mujarrad*) rather the belief in the death of the decapitated is a certainty (*yaqīn*) [the knowledge of] which cannot be doubted (*la yustarāb fīh*).⁸⁶

⁸⁴ Nader El-Bizri, “Some Phenomenological and Classical Corollaries on Time” in *Timing and Temporality in Islamic Philosophy and Phenomenology of Life*, ed. Anna-Teresa Tymieniecka (NY: Springer, 2007), 146.

⁸⁵ In his encyclopedia *al-Kashshāf*, Tahānawī describes the foundation for the knowledge by habitual occurrences (*‘ādah*) by saying that “what is obligatorily known by habit is that which settles in the conceiving mind from repeated occurrences” (p. 1156). This description is, therefore, related to time-testing and experience through repeated events (*al-umūr al-mutakarrirah*) and which forms the basis for a learning theory to construct contingently empirical and *a priori* knowledge in the mind.

⁸⁶ Al-Ghazālī, *al-Mi‘yār*..., 190-1.

In this passage, Ghazālī appropriates the word *yaqīn* (verified certitude) from an Avicenna logical context. But unlike Avicenna, Ghazālī speaks of *yaqīn* (certitude) in a way that implies a particular meaning and not a universal one. This, therefore, leads us into a form of *yaqīn* that is now subjectively determined rather than being objective in any realist manner. Consequently, Ghazālī gives with his case study about decapitation an example from the language of everyday communication, through which he attempts to ground the new subjective meaning he grants to the appropriated philosophical term *yaqīn*. Further, Ghazālī does so from within his *kalām* approach that considers language to operate within the epistemic realm of *'ādah* and not within that of a necessitarian ontology. The foundational discrepancy between the two linguistic applications is that while the *'ādah* (habitual occurrence) established through *al-mujarrabāt* (time-tested knowledge) gives one a psychological anticipation that forms a shared linguistic foundation for constructing particular empirical meaning amongst human interlocutors, the peripatetic logicians argue that knowledge of a universal causal relation is the only appropriate basis for inferring certainty from expressions that involve causal connections. Certainty is, thus, achieved in language usage and not through logical inference, as we further discuss on constructive semantics in Chapter Three. Induction in this way is not about inducting universal presuppositions, but rather about inducting empirical particulars that are neither incidental (*ittifāqī*) nor accidental (*'araḍi*). Therefore, when such inducted particulars conglomerate into habitual norms in the mind, they then serve as a conceptual foundation for establishing the certainty of new particular knowledge in a way that avoids the fallacies of Aristotelian syllogism. This, in fact, brings us back to what was earlier raised about what is known in *uṣūl al-fiqh* (foundations of jurisprudence) as *al-tamthīl* or *qiyās al-ghā'ib 'alā al-shāhid*, i.e. analogical syllogism, as an alternative to Aristotelian deductivism.

With everyday modes of communication, an established habit (‘*ādah*’) in nature gives a way of drawing connections between concomitant events so that human interlocutors can make references between events based on the *a priori* knowledge that one can empirically attain about actual occurrences at a particular point in time. In the example raised by Ghazālī in Passage E, the reported incident is the decapitation in accordance to the habit of death being a concomitant of severing the head. Thus, it would be understood with no doubt that according to standard rules of parlance death is implied here. *A priorism* in the usage of language is, therefore, not reduced to logical necessity, rather induction (*istiqrā’*) in this case takes a learnt concept into consideration as a mental tool for understanding. Remarking on this alternative *kalām* based inductive process, Marmura says that when it comes to the philosophical justification of induction Ghazālī makes the important departure from Avicenna for it is here that the theory of causality is involved. He states that when the premises of a demonstration “are presented to the mind in a certain order, the soul becomes prepared for the creation in it of the conclusion from God the Exalted [i.e. as involuntary *a priori* knowledge]”⁸⁷.

The learnt conceptual habit in itself allows for its use as a signifier (*dalālah*) in language; facilitating with an external indicator (*qarīnah*) the denotation of either a habitual or a non-habitual occurrence. On the occasion of a non-habitual event, Ghazālī says that God does not create in us knowledge of the habit (‘*ādah*’) occurring, which clearly indicates that for Ghazālī knowledge is inducted non-synchronously on a case by case basis in time, as we see with his reference “*fī dhālika al-waqt*” (at that time). As a result, the logic of syllogism that Ghazālī alternatively develops becomes subsumed within a mental process of perception that hides the syllogism and hence the

⁸⁷ Al-Ghazālī, *al-Mi’yār* ..., 183-4, and Michael E. Marmura, “Ghazālī and Demonstrative Science”, *Journal of the History of Philosophy*, vol. 3 (1965): 183-204.

name *qiyās khafī* (hidden syllogism). This, therefore, can be called momentary or contingent logic as a naturalised form of the syllogism within the *kalām* tradition.

In his scientific approach, Ghazālī had made the critical assumption that logic is derived from language and not vice versa. He recognized the boundaries of logic and the utility of natural language, and accordingly began to modify the foundations of Avicennan logic. Ghazālī understood that Aristotelian syllogistic logic imposes limitations on the forms involved in a judgement. As it were, it was based on *a priori* rational presuppositions claimed on inductive intuition. But given the identified ‘problem of induction’ within the Aristotelian framework, this meant that the whole Aristotelian enterprise was nothing more than mere speculation. In fact, such analysis opened up a doorway for independent exploration of linguistic elements from the divergent fields of semantics, semiotics and philology as was later the rationale behind Ījī’s development of the new scientific discipline of ‘*ilm al-waḍʿ*’ as a science of positing meanings for expressions. As a matter of fact, the appeal to language usage in philosophy and theory of knowledge, as we see in section 2.2, was what led to the development of ‘*ilm al-waḍʿ*’ as a study of denotation. This new semantic science, as was referred to earlier, is the topic of Chapter Three, in which we explore Qushjī’s constructivism as it first appears in his commentary on Ījī’s treatise on *waḍʿ*.

In fact, Ghazālī’s appropriated logic as founded on his scientific distinction between modality and actuality, appears to differentiate, in a way unknown to the Peripatetic logicians, between analytic predication and a new form of inferential *a priori* predication. While analytic or verbal predication dealt with concepts considered to be defined *a priori*, this new inferential *a priori* predication was now dealing with the actual properties of perceived objects; inducted and tested in experience (*tajrubah*). Ultimately, by being predicated on particulars, it was this novel inductive inference that

mostly formed the foundation of everyday linguistic usage. This philosophic milestone has been discerningly noted by Kukkonen who observed that “once any metaphysical ties between language usage and ontology are severed, there is no assumption that the names with which we denote things refer to essences. This leads to an inapplicability of logic to achieve nomic certainty as logic is *a priori* (ontological essence) based. This opens up new lanes of investigation and, in the final analysis, the viability of an inductive scientific methodology”⁸⁸.

In conclusion, Ghazālī’s alternative logic relies on human understanding, which is of a dynamic inductive nature, to replace an *a priori* universality that is assumed to be necessary prior to experience. This means that Ghazālī overcomes the limitations of Aristotelian logic and alternatively involves the subject in the process of constructing meaning. With such a constructivist reading, the subject becomes part of the process of understanding and not just a static user of language who relies on speculative universal claims for obtaining semantic certainty. We, consequently, see here that Ghazālī’s subjectivist attempt at appropriating Avicennan logic is in some way driven by the same motive behind the aforementioned Ash‘arite attempt at appropriating the two categories; *jawhar* (substance) and *‘araḍ* (accident). In many ways, this is also similar to what Qushjī later successfully develops with his constructive appropriation of geometric mathematics (*handasah*), which, as we later see, was a result of continued developments with Rāzī’s conceptualist theme of *al-wujūd al-dhihnī* (mental existence) and Ījī’s new discipline of *‘ilm al-waḍ‘* as constructive semantics; both of which culminated in Qushjī’s constructivism and its subsequent civilisational influence through constructive astronomical modeling.

⁸⁸ Kukkonen, Plenitude ..., 555.

2.1.2.1 On Actual and Possible Worlds

In *Tahāfut al-Falāsifah* Ghazālī argues:

The impossible consists in affirming a thing conjointly with denying it, affirming the more specific while denying the more general, or affirming two things while negating one. What does not fall within these categories is not impossible ... [an example of] the impossible is to combine between black and white or for a person to be in two places at the same time, etc ... The reason behind the impossibility of a person in being in two places at once is because we understand from him being inside the house, for instance, is his non-being outside the house, hence it cannot be estimated that a person is outside the house when he is inside the house with an understanding that negates him being elsewhere ... By these sciences which God creates we can ascertain the running of natural habits (*majāri al-‘ādāt*) and we can know the existence of either of the two divisions of possibility (*qismay al-‘imkān*). The mere existence of either of the two classes does not render impossible the other.⁸⁹

On the important subject of modality and in line with his *kalām* heritage, Ghazālī states that only self-contradictory events are impossible, while non-self-contradictory events are possible for a human’s judgement and thus cannot be ruled out as impossible. However, admitting that something is possible involves no commitment to it being actually true. This last idea relates to the rationale of induction (*istiqrā’*) within the scientific framework of contingency. Induction, as a scientific process, begins with *qismay al-‘imkān* (the two divisions of possibility), i.e. the actual and the non-actual, and it proceeds forward to determine the actual class by way of empirical sense perception. In this case, the pool of possible meanings or models would be the class of all analytic possibilities that can be determined by rational judgement to be possible states - known collectively as synchronic alternatives - a view Griffel says had already been developed in Ash‘arite *kalām*⁹⁰. On the other hand, the inferential *a priori* model is the outcome of an empirical process that represents what is actually perceived, and which can be used to describe the existing state of affairs. Furthermore, this description can be in a

⁸⁹ Al-Ghazālī (2001), *Tahāfut ...*, *mas’alah* 17, *maqām* 2.

⁹⁰ Griffel, *Al-Ghazālī’s Philosophical ...*, 167.

natural language or in any other semiotic way, which includes mathematical notations or geometric symbols.

Deniers of the Prophetic miracle, Ghazālī tells us, had said that it was impossible for the miracle to take place. But the impossible, as he establishes, does not apply to the Prophetic miracle, as it does not contain self-contradictory assertions. Further, by the very definition of induction, a non-habitual state can be inducted by the same process that allows us to induct habitual concomitance.

Further, in the *Tahāfut* al-Ghazālī denies the Avicennan premise that possibility exists in the objects themselves⁹¹; rather, in human knowledge possibility and impossibility are rational judgements in the mind⁹² that act as a function of conceptual coherence. This, thus, positions Ghazālī's critique within a more fundamental doctrine of modality, where he asserts:

The possibility which they mention reverts to a judgment of the mind (*qaḍā' al-'aql*). Anything whose existence the mind supposes, [nothing] preventing its supposing it possible, we call *possible*, and if it is prevented we call it *impossible*. If [the mind] is unable to suppose its nonexistence, we name it *necessary*. For these are rational propositions (*qaḍāyā 'aqlīyah*) that do not require an [extramental] existent so as to be rendered a description thereof ... [this] shows that the mind, in judging possibility, does not need to posit [something] having existence to which it would relate possibility.⁹³

The implications of all of this are enormous says Blake D. Dutton who lists at least two examples. First, he says “it allows Ghazalé to bring a much broader range of phenomena within the domain of the possible”, and second “it allows Ghazalé to subvert Aristotle's entire account of change”. Consequently, Aristotle's limitations on change in terms of potentialities of matter is not significant when considering the possibility of

⁹¹ This is Avicenna's position where he teaches that the mental existence of modalities derives from their existence in reality. (Back, “Avicenna's Conception of the Modalities,” 217–18, 229–31.)

⁹² Griffel, *Al-Ghazālī's Philosophical ...*, 204.

⁹³ Al-Ghazālī (2000), *Tahāfut ...*, 70.10–71.1 / 42.2–5.

things, whether substance or accident.⁹⁴ These matters are of crucial importance to Qushjī's development of constructivism, as we see in the following two chapters, both in the sense of an inductive methodology and a general theory of human knowledge and understanding.

2.1.2.2 Recent Controversy in Ghazālīan Studies

A key to understanding the *kalām* perspective on the *darūrīyāt* (*a priori* knowledge), is not to regard it as being the same idea of the *a priori* as that in the Avicennan schema, which given the Aristotelian 'problem of induction' claims to base the same idea instead on a psychological mental judgement. Alternatively, the definition of knowledge according to the *mutakallimūn* has to be based on particularity and not universality. *Darūrah* in this case is thus not universal necessity predicated onto a future event, but a constructive *a priorism* judged on acquiring empirical knowledge based on learnt habitual concepts, where a pattern of particular occurrence has been repeatedly observed, even if in the majority (*fi al-akthar*) with some unexplored exceptions. This implies that rather than being a universal, an established habit is an accumulation of particulars that are used directly in individuating a new particular event. The resultant conception (*taṣawwur*) is, therefore, one that is subjectively held within the human domain of knowledge and is to be found within the objects. Contrast this to a deterministic worldview that only considers universality based on complete induction in which inanimate objects are given powers and potentialities in themselves to act, and which they are assumed to do by a static logical necessity that is not allowed to vary or change. Consequently, the Aristotelian way claims to predict outcomes as deductions from *a priori* inducted principles considered as arguments of syllogism. However, while

⁹⁴ Dutton, 23-46.

the later approach attempts to prove its prediction analytically in advance, the *mutakallimūn*'s system would ask how a current conceptual model could be constructed and tested going forward. In fact, this is what is indicated by al-Suyūfī in his *Ṣawn*⁹⁵, where he says that the *mutakallimūn* and most of the *uṣūliyyīn* (scholars of foundations of knowledge) before Ghazālī regarded the inductive (*istiqrā'*) inference known as *al-qiyaṣ al-uṣūli* or *qiyaṣ al-ghā'ib 'alā al-shāhid* as resulting in certitude (*yaqīn*), while applying its idea within the Aristotelian frame only results in speculation (*ẓann*).

This situation has led to a hermeneutic problem in understanding Ghazālī's position, when an interpreter assumes that Ghazālī with his conceptual causality has merely given an alternative justification for Aristotelian logic. So much so that these critics assume that the same universal laws are kept by Ghazālī as universal principles for syllogistic prediction of future consequences. This, however, would run in the face of a conceptual causality that Ghazālī staunchly defended at the beginning of his seventeenth discussion of the *Tahāfut*. The evidence does run contrary to such interpretations, as there is no proof that Ghazālī was in the business of abandoning his *kalām* understanding of contingency to appropriate Avicennan logic. He was rather naturalising logic by giving it an alternative scientific foundation in opposition to the necessitarianism that the *falāsifah* had willingly inherited from Aristotle. Ghazālī does say that *al-istiqrā' al-nāqis* (incomplete induction) which is an Aristotelian division gives uncertain (*ẓannī*) conclusions, but he also says that the *tajrubah* (time-tested experimentation) does yield *yaqīn*. Therefore, interpreters that associate Ghazālī's appropriation of logic with the Aristotelian syllogistic prediction are only doing so based on an Aristotelian - and not a Ghazālīan - philosophical framework.

⁹⁵ Nashshār, 225; Jalal al-Dīn aṣ-Suyūfī, *Ṣawn al-Manṭiq wa al-Kalām 'an Fann al-Mantiq wa al-Kalām* (Bayrūt: Dār al-Kutub al-Ilmīyah 1947), 232.

As a result, Ghazālī's distinction in causality is a temporal one between what has been psychologically established as a habit from past occurrences and what is claimed according to the *falāsifah* to be established by necessity across time. While Ghazālī holds onto the first as a description of what actually exists, he berates the second as unjustified prediction. This thus elucidates his definition of scientific knowledge as that which describes what exists, to one held by the Peripatetic philosophers that scientific knowledge is a deduced body of causal universal statements.

In support of an alternative Ghazālīan logic, Julian Obermann suggested in his 1915 article *Der philosophische und religiöse subjektivismus Ghazālīs* that for al-Ghazālī humans perceptively identify objects by means of their will. Consequently, the senses do not observe any agency between cause and effect, rather causality is the result of human mental activity and choice. Indeed, Ghazālī had argued that it is “solely due to the continuity of a habitual action that our memory and our imagination are imprinted with the validity of an action according to its repeated observation.”⁹⁶ Obermann called this position “philosophical subjectivism”⁹⁷ and regarded it as a refutation of realism as represented by Avicenna's epistemology. In a similar vein to Duncan B. MacDonald's assessment of al-Ash'arī, Obermann declared that al-Ghazālī anticipates Immanuel Kant. According to Obermann, al-Ghazālī rejects what he regards as the naive empiricism of the *falāsifah* and believes that possibility and impossibility do not actually exist in the things themselves, but are rather judgements of the human mind.

Moreover, in what is crucial to the origins of constructivism, Obermann noticed a feature in Ghazālī's *Tahāfut* which stood out in his criticism of causality. Although Obermann's view was from the viewpoint of the post-Kantian debate about

⁹⁶ Al-Ghazālī (2000), *Tahāfut ...*, 285.11–12 / 170.20–22.

⁹⁷ Refer to Bakar, *Tawhīd and Science* (p. 55) on Obermann being against subjectivism also refer to Giuseppe Furlani.

“subjectivism”, it, nevertheless, identifies a telling prelude of constructivism in its *kalām* origins. As Griffel notes in his translation of Obermann’s opinion, Obermann relied on Ghazālī’s first discussion in the *Incoherence* in his rejection of the eternity of the world, where “al-Ghazālī argues that ‘will’ (*irādah*) is something that is not determined by the things we find in this world. For al-Ghazālī, will is the capacity to distinguish one thing from another that is exactly similar to it.”⁹⁸ Obermann extracted from this his distinctive position on al-Ghazālī’s subjectivism and made him in his words a “predecessor” of Immanuel Kant. This Obermann thesis, however, despite its incisiveness and relevance to understanding early *kalām* did not seem to become the mainstream opinion, either because it was obscurely written in German, or because the whole topic of subjectivism was skewed to a Kantian reading that did not fit into a Ghazālīan mould - and so it was it ignored.

In 1965, a new commentator on Ghazālī, Michael E. Marmura, trivially stated that Ghazālī’s use of the term “certainty” (*yaqīn*) in connection with the empirical premise (*al-ḥadsīyāt* or the inferential *a priori* knowledge) is “somewhat ambiguous”, and he adds “we can infer from the argument he uses to justify this belief that the certainty is not only psychological but is also epistemological”⁹⁹. In fact, such a position as explained earlier had been generally accepted into *kalām* as an epistemological categorization of certain knowledge in accordance with its constructivist origins, hence, its psychological and cognitive dimension. An ambiguity might indeed arise in case such a classification is perused with Aristotelian ontological spectacles, in which case epistemological certainty would only be granted where a claim is made in an Aristotelian spirit for the “existence of permanent natures inherent in things” or an

⁹⁸ Obermann, *Der philosophische und religiöse Subjektivismus Ghazālīs*, 73, quoting al-Ghazālī (2000), *Tahāfut*, 37.9–38.2 / 22.1–9. Cited in Griffel, *Al-Ghazālī’s Philosophical ...*, 160.

⁹⁹ Marmura, *Ghazālī and Demonstrative Science ...*, 13.

allegation proposed for “necessary causal connections [actually existing] between things”¹⁰⁰. Furthermore, the “paradox”¹⁰¹ that Marmura raises about Ghazālī’s “insistence despite his acceptance of Prophetic miracles that scientific knowledge is certain”¹⁰² is solely based on the equation of ‘certainty’ of knowledge with realist claims to knowledge, the latter of which commonly involves the very same causal theory that was clearly rejected in Ghazālī’s conceptualist theory of knowledge.

Consequently, opinions on Ghazālī have generally diverged between two extreme ends. On one end is Fakhry’s assessment that Ghazālī has rejected causality and has adhered to what he defines to be an Ash‘arite thesis (Fakhry 1946), on which he says, “for Ghazālī the alleged certainty of cause-effect relationship is an illusion; it is reducible to habit (‘*ādah*)”¹⁰³. On the other hand, there are others such as Frank who argue, in a similar vein to Abrahamov (1988) and Nakamura, that there are distinctive divergences between Ghazālī’s works and Ash‘arism, so much so that Frank calls for a reassessment of Ghazālī’s philosophical thought as a whole (Frank 1992). Frank remarks:

The question has been raised as to how al-Ghazālī can claim adherence to the Aristotelian logic and how he can hold that the experience of the consistent sequential relationships between entities and events can be said to constitute a valid basis for justified premises in demonstrative syllogisms if he follows the Ash‘arite doctrine according to which efficient causality is not attributed to things in virtue of their natures as such.¹⁰⁴

He then asks, “does he follow the tradition of the Ash‘arite school regarding natures and causation?”, and continues by saying:

¹⁰⁰ Ibid.

¹⁰¹ Ibid., p6.

¹⁰² Ibid., p19.

¹⁰³ Majid Fakhry, *Reason and Philosophy*.

¹⁰⁴ R. M. Frank, *Al-Ghazālī and the Ash‘arite School* (Durham and London: Duke University Press, 1994), 17.

The matter is discussed in *Mi'yār* in a passage (pp 109f) which may be taken as an example of the rhetorical maneuvers al-Ghazālī sometimes performs when for one reason or another he feels obliged to address this issue explicitly. To illustrate the kind of certain knowledge which may be gained by experience al-Ghazālī like Avicenna often offers the example of medicine (p17-18)... When however the question is raised in *Mi'yār al-'Ilm* concerning the denial of efficient causality by the *mutakallimūn* ... he limits himself to noting that the relation between decapitation and death is an instance of an event in which the invariant relationship between the antecedent and the consequent is universally known through experience.¹⁰⁵

Furthermore, those, like Griffel, who represent Ghazālī's position with expressions like, “*in our knowledge*, the connection between what we identify as a cause and what we identify as an effect is necessary,”¹⁰⁶ while accepting that Ghazālī denies any necessary causal relations, are in fact accusing Ghazālī of psychologism or solipsism where psychic knowledge of a thing (what Griffel calls ‘necessary connection’) is different from the reality of the thing known (Ghazālī's view on concomitance or *iqtirān*). Further, this idealism clearly clashes with Ghazālī's apodeictic position on scientific knowledge as demonstrated in the second introduction at the beginning of the *Tahāfut*, in which al-Ghazālī defends certain knowledge by which we know that solar eclipses result from the moon coming between the observer and the sun “for these matters rest on demonstrations, geometrical and arithmetical, that leave no room for doubt (*barāhīn handasīyah ḥisabīya lā yabqā ma'ahā rībah*)”¹⁰⁷. As explained earlier, for Ghazālī this habitual analysis does not imply certainty in predicting the moon's behaviour in a future point in time, as habitual sciences are not based on ideas of future particularisations in which deterministic claims are imbedded with the unjustified assumption that the only possible world is the actual world. In other

¹⁰⁵ Ibid., 17-8.

¹⁰⁶ Griffel, *Al-Ghazālī's Philosophical Theology* ..., 203.

¹⁰⁷ Al-Ghazālī (2000), *Tahāfut* ..., 11.8f, cited in Frank Griffel, “Taqlīd of the Philosophers: Al-Ghazālī's Initial Accusation in his *Tahāfut*” in *Ideas, Images, and Methods of Portrayal*, edited by Sebastian Gunther (Leiden, Boston: Brill, 2005), 289.

words, for Ghazālī *a priorism* in the contingent world is a predicate of human knowledge about past experiences and not a predicate with a universal modality about possible future events.

In conclusion, with early *kalām*'s recourse to epistemological certainty based on the subject's rational judgement, one can understand that demonstrative science under the *mutakallimūn*'s worldview is a descriptive non-essentialist enterprise that upholds a contingent natural order. Ghazālī's position, therefore, does not end in the paradox alluded to by Marmura¹⁰⁸. In contrast, it indicates an early subjectivist epistemology that in itself adds to our growing understanding of the nature of the development of constructivism that, as we see in Chapter Four, took a further four centuries of dialectic interaction before it reached its maturity with Qushjī's constructive *kalām* and philosophy of science. However, as a result of the above subjectivist reading of Ghazālī's position on causality, we seem to have provided a solid basis for resolving an ongoing controversy in Ghazālīan studies.

2.2 LANGUAGE, CONCEPTUALISM AND HUMAN UNDERSTANDING

What primarily concerns us here is the conceptual shift described above¹⁰⁹ as an "epistemological turn" from an ontological to an epistemological priority. In fact, this philosophical turn in the human enterprise of understanding is more about how to do

¹⁰⁸ Marmura brings into the discussion Averroes' *Tahāfut al-Tahāfut* (p. 531) to reach the conclusion that "if we accept Averroes' interpretation ... the orderly course of nature (according to al-Ghazālī) holds in the intervals between miracles. It is though we are permitted to derive scientific certain knowledge on the basis of such an order." Further, in defense of causation, Ibn Rushd argued in *Tahāfut al-Tahāfut* that the refutation of the causal principle entailed an outright rejection of reason and a denial of knowledge. Averroes held that demonstrative science rested on the idea of efficient causality, so without it he claimed demonstrative science would be impossible. He attacks the position of al-Ghazālī as mere "sophistry" and says: "Logic implies the existence of causes and effects and the knowledge of these effects can only be rendered perfect through knowledge of their causes" (1:318-319). The Shī'ite al-Ḥillī (d. 1325) the first commentator on Ṭūsī's *Tajrīd al-kalām* argues that denial of causation renders intellectual inquiry futile. Knowledge for the two is based on *a priori* axioms and causation is one of these (Ḥillī, 121).

¹⁰⁹ Refer to the section in Chapter Two on the involuntariness of *a priori* knowledge.

philosophy itself where theories of language and meaning represent the different approaches to this enterprise. Consequently, the approach taken here is that a productive philosophy of language deals with two main themes. First, it deals with the study of how our language engages and interacts with our understanding. Second, it tackles the specific semantic task of achieving *a priori* knowledge through the verbal medium of communication.

In particular, *uṣūl al-fiqh* or the principles of understanding is a philosophical approach to knowledge unique to Islamic scholarship. In addition to legal sources, it can be used as an epistemological approach for understanding the world around us and a specific methodology to be applied in both the natural sciences as well as the humanities¹¹⁰. *Uṣūl al-fiqh* is amongst the sciences that were developed by the Muslim mind with no analogical case study, from any other nation, that they emulated in this regard. In *al-Maḥṣūl*¹¹¹, Rāzī defines it as epistemological principles for a scientific methodology of knowledge (*arkān al-manhaj al-`ilmī*). He also says that *uṣūl al-fiqh* is a general methodology for understanding based on an evidential criteria for evaluating the signified meanings (*majmū` turuq al-fiqh `alā sabīl al-ijmāl wa kayfīyāt al-istidlāl bihā wa kayfīyat ḥāl al-mustadill bihā*). The relation between *uṣūl al-fiqh* and *kalām*, hence, follows under the consideration that this methodology for knowledge is itself a philosophical framework from which certain meanings emerge¹¹². It can also be utilised as a philosophical standard for other disciplines by abstracting from it a foundational

¹¹⁰ Stated in the Preface to Ali Gomaa, *Juristic Methodology and its Connection to Islamic Philosophy* (Al-Qāhirah: Dār al-Risālah, 2002) [Arabic], <<http://www.aligomaa.net/books.html>>

¹¹¹ Rāzī, *al-Maḥṣūl* ..., 1:94.

¹¹² *Ibid.*, 11.

theory of knowledge that can be employed¹¹³, making it, therefore, “[a] paradigm whereby its processes represent a method of intellectual investigation”¹¹⁴.

‘Ilm al-waḍ’ (science of denotation) as an extended unit of *uṣūl al-fiqh*; described by Weiss as “a science which grew out of the science of the principles of jurisprudence (*uṣūl al-fiqh*)”¹¹⁵; replaces the core element of Greek logic which was claimed on assumptions from Greek language and certain other metaphysical presuppositions. With such an alternative theory of *waḍ’* (denotation), matter was no longer taken to constitute individuation as in the Aristotelian theory of matter and form. Instead we see a new conceptual theory of meaning, in line with a non-essentialist *kalām* worldview, which provides an alternative basis for constructive individuation of particular meanings in the mind.

Ibn Khaldūn¹¹⁶ describes the *uṣūlīyīn*, i.e. the practitioners of *uṣūl al-fiqh*, as being one of two groups; the *mutakallimūn* (Shāfi‘ites) and the *fuqahā’* (Ḥanafites)¹¹⁷. Reflective of their philosophical underpinnings, the Ḥanafites wished to put forward a theoretical framework for the established practice of their school where neither abū-Ḥanīfah, abū-Yūsuf or al-Shaybānī had laid down their epistemological principles like al-Shāfi‘ī had done. Ibn Khaldūn says:

The corpus of the *fuqahā’* is closer to inductive understanding and more correlative of subdivisoning due to the large number of particular cases that they document as evidential precedents. On the other hand, the *mutakallimūn* tend to abstract the forms of these cases favoring rational deduction wherever feasible given that it is incorporated in most of their disciplines and serves as an indicator of their way.¹¹⁸

¹¹³ Ibid., 28.

¹¹⁴ Ali Goma, *The Moral Ceiling of Intellectual Investigation*, Rose El-Yousef Journal (n.p.).

¹¹⁵ Bernard George Weiss, “Language in Orthodox Muslim Thought: A Study of *Waḍ’ al-Lughah* and its Development” (Ph.D thesis, Princeton University, 1966).

¹¹⁶ Ibn Khaldūn (d. 1406), *Kitāb al-‘Ibar wa Dīwan al-Mubtada’ wa al-Khabar* (Bayrūt: Mu’assasat Jamal, 1969).

¹¹⁷ This naming scheme does not coincide with that used in *kalām*, where Ḥanafīs are known to have been also *mutakallimūn*, such as the school of Mātūrīdī *mutakallimūn*.

¹¹⁸ Ibid.

The school of Shāfi‘ites in *uṣūl al-fiqh* are also generally known as the school of extracting particular cases (*furū‘*) from fundamental principles (*uṣūl*), i.e. deduction, while the Ḥanafite school is known for its extrapolation of new particulars from other known particulars (i.e. induction). This broad distinction has been described as resulting in two different scientific worldviews, with the former school of the Shāfi‘ites resorting to logical verification of their principles. Farīda S. Zūzū¹¹⁹ identifies this school with the prolegomena one finds in the preliminary discussions inserted at the beginning of their *uṣūl* books alongside other exordiums, such as the one on logic, language, etc.

Consequently, in philosophy of language while the Shāfi‘ites considered *al-mawdū‘* (the linguistically posited) as a main point of reference, the Ḥanafites with their deference to precedent responded and the term *wad‘* made its way into their terminology as it appears in Bazdawī’s (d. 1089) works. Further, unlike the Shāfi‘ites the Ḥanafites did not develop “linguistic premises” as an introduction to their legal principles, alternatively, in their *uṣūl* texts they covered language matters within the first Book on *al-Qur’ān al-Karīm* under the chapter on *al-lughah* (language) and specifically within the sections on positing expressions (*wad‘*), the divisions of expressions (*taqsīm al-alfāz*), and others. This, therefore, indicates that *‘ilm al-wad‘* or the science of *wad‘*¹²⁰ finds its intellectual roots in the inductive method of the Ḥanafites.

Ali who delves into the foundations of the two early models in *uṣūl*, i.e. the Shāfi‘ites and the Ḥanafites, identifies the former, i.e. the “logician model” of the Shāfi‘ites with “foundationalism” or “the doctrine that meanings are predetermined and

¹¹⁹ Faridah Zuzu, “Dalālat al-Alfāz”, <<http://fiqh.islammessage.com/NewsDetails.aspx?id=5097>> (Accessed 19 July, 2012).

¹²⁰ The scholar acknowledged for initiating the semantic discipline of *‘ilm al-wad‘* is the fourteenth century *mutakallim* ‘Aḍud al-Dīn al-Ījī (d. 757/1355) whose short treatise was entitled *al-Risālah al-Wad‘īyah* and upon which Qushjī has written a popular commentary.

a priori ‘established’”¹²¹. On the other hand, we can identify the origins of the counter movement in ‘ilm al-waḍ‘ with what Ali calls the “empirical” school of the Ḥanafites who seem to provide the roots for the aforementioned constructivist ideas, albeit in an early form.

In describing the Ḥanafite classification of signification, two types stand out as leading to a hearer’s construction of meaning from the mere utterance; signification from the textual expression (*‘ibārat al-naṣṣ*) or from a textual reference (*ishārat al-naṣṣ*). These two signifiers which satisfy the same purpose can be found in the *uṣūl* works of Ḥanafite classical scholars such as al-Bazdawī and Badr al-Dīn al-‘Aynī (d. 1451). In fact, this category of signification seem to provide an important key for later developments in constructive waḍ‘ and can thus be seen as ‘constructivist foundations’ for an emerging movement in ‘ilm al-waḍ‘. In explaining the meaning of the referential signifier (*al-ishārah*), al-Bazdawī states:

It is a signification (*dalālah*) from the linguistic construction (*naẓm al-kalām lughatan*) for an unintended meaning (*ma ‘nā ghayr maqsud*), and they are, i.e. the expression based signifier (*‘ibārat al-naṣṣ*) and the reference based one (*ishārat al-naṣṣ*), equivalent in affirming a judgement regarding the meaning, because the verification of each signified meaning is done through the linguistic construction itself (*thābit bi nafs al-naẓm*).¹²²

Similarly, Badr al-Dīn al-‘Aynī describes these two types of signification by indicating that they refer to “that which is affirmed by the very linguistic construction and composition (*ma thabata bi naẓm al-kalām wa tarkībihi*), however, the only difference between the two is that with the reference (*al-ishārah*) the meaning is not intended by the expressed statement (*ghayr maqṣūd min al-kalām*), nor is it reported by

¹²¹ Mohamed Yunis Ali, 88.

¹²² ‘Abd al-‘Azīz al-Bukhārī, *Kashf al-Asrār ‘an Uṣūl Fakhr al-Islām al-Bazdawī* (Bayrūt: Dār al-Kutub al-‘Ilmīyah, 1997), 2:314. The translation given here is the author’s own.

it (*wa lā sīqa al-kalām lahu*).¹²³ Further, al-Jurjānī has defined the word *nazm* (linguistic construction) as “the composition of words and sentences such that their meanings are semantically systemised and their significations are arranged in accordance with the requirements of reason”¹²⁴. Ali elaborates on this from a technical sense without any reference to any constructivist philosophical connotations:

That is to say to put words and sentences in a coherent and cohesive way. Thus in order for the hearer to ‘deconstruct’ the speaker’s message, he has not only to decode the conventional meaning but also to reason about the rational way in which the utterance is constructed. This may involve a consideration of the shared background knowledge and the communication principles governing the linguistic construction of the text.¹²⁵

In constructing meaning from the *nazm* itself by purely relying on a syntactical process of coherence, which is what these Ḥanafite scholars are suggesting, we seem to have identified a great opening that is later deployed for the development of a constructive theory that achieves the positing of *a priori* knowledge. Signification (*dalālah*) in human understanding is based on an inductive approach, i.e. it depends on ideas and concepts that have been learnt from experience. In addition, these inductively learnt concepts also constitute the basis for the intersubjective appeal of human understanding. As an example, we find that verbal signification (*dalālat al-laḥẓ*), i.e. acquiring the mental concept from the expression, is based on the learnt semiotic relations of the various linguistic expressions. Similarly, the signification of concomitance (*dalālat al-iltizām*) is based on another form of involuntary (*ḍarūrī*) knowledge, which is the testable (*tajrībī*) knowledge that is acquired through learning from the habitual concomitance (*‘ādah*) of contingent events. It is for this reason that

¹²³ Badr al-Dīn Mahmud Ibn Aḥmad al-‘Aynī (d. 1451), *Umdat al-Qārī Sharḥ Ṣaḥīḥ al-Bukhārī* (Bayrūt: Dār al-Fikr, 2002), 132.

¹²⁴ See the definition of “*nazm*” in al-Sayyid al-Sharīf ‘Alī ibn Muḥammad al-Jurjānī, *Kitāb al-Ta’rifāt* (Bayrūt: Maktabat Lubnān, 1990), 126; Mohamed Yunis Ali, 164.

¹²⁵ Mohamed Yunis Ali, 164.

we find that when Rāzī defines the relationship between the concomitance (*al-luzūm*) and the signification of concomitance, he states that the occurrence of the concomitant event is not necessitating (*mūjib*) for the *dalālah*, but rather only an empirical condition for it (*shart*)¹²⁶, which ties us back to a *kalām* based inductive understanding that is outside the fold of the *falāsifah*'s necessitarianism. From this we can also note that the *dalālah* of linguistic expressions defines a foundational basis for subjectively acquiring *a priori* knowledge through the human construction of meaning that we find in everyday language usage. In fact, the classification of signification (*dalālah*) into its three popular categories already appears in Ghazālī's *Mi'yār* where he related linguistic expressions to meanings in the following manner:

Expressions signify meanings in three different way: The first is the signification of congruence (*al-mutābaqah*) like in a name posited for an object, such as the signification of the word 'wall' for the [actual] wall. The second is through inclusion (*al-taḍammun*) such as the signification of the word 'house' for its walls ... The third is the signification by way of concomitance (*al-iltizām*) or succession (*al-istitbā'*) such as the signification of the word 'ceiling' for the wall; the two concur with one acting as an accompanying concomitant that is external to the other (*al-raftīq al-lāzim al-khārij 'an dhātihī*).¹²⁷

Indeed, such empirical signification was found in the linguistic practice of the Arabs, and it was consequently adopted by the *uṣūlīyīn* in their own classifications. The relationship between the signifier and the signified meaning in the mind¹²⁸ is, thus, descriptively drawn from reality without any reliance upon essentialist definitions that were taken to be central to the Aristotelian theory of logic. Consequently, this non-essentialist empirical approach to signification¹²⁹ constituted a foundational building

¹²⁶ Mohamed Yunis Ali, 152.

¹²⁷ Al-Ghazālī, *al-Mi'yār* ..., 42-3.

¹²⁸ The argument for the conceptualist view according to Rāzī, who also subscribed to this opinion (Jalāl al-Dīn as-Suyūfī (d. 1505), *al-Muzhir fī 'Ulūm al-Lughah wa Anwā'ihā* (Al-Qāhirah: Dār al-Ḥadīth, 2010), 1/42), is that as the mental image might change in perceiving an approaching physical object the expression itself tended to correspondingly change as well.

¹²⁹ This constructive approach to signification also overcomes the problem of defining vs non-defining features which confused many including the likes of al-Qarāfī (d. 1285) who says that he did not believe

block for subsequent *kalām* constructivism, and as we see in the next chapter, with the development of '*ilm al-waḍ'*', it brings forward an inductive approach to human semantics and understanding.

that a clear distinction between the two can be reached by reason alone (Shihāb al-Dīn Abū al-‘Abbās al-Qarāfī, *Sharḥ Tanqīh al-Fuṣūl fī Ikhtisār al-Maḥṣūl fī al-Uṣūl* (Al-Qāhirah: Dār al-Fikr, 1973), 12-13).

CHAPTER THREE

QUSHJĪ AND THE DEVELOPMENT OF CONSTRUCTIVE SEMANTICS

3.1 'ILM AL-WAḌ' AND CONSTRUCTIVE SEMANTICS

The *mutakallimūn* held that a human is an accountable actor who is endowed with a capacity to think. In methodological terms this implies that man's active experience is both subjective and rational. At the same time, they held, that man's empirical knowledge including knowledge of one's self and its states was intuitive and *a priori* - meaning that the process by which this knowledge is attained is not reliant on human volition or discursive ability. In other words, empirical knowledge is considered by the *mutakallimūn* to be given, prior to any rational experience, as building blocks for thought. The subjective, i.e. conscious, experience thus involves a foundational empirical process that acts prior to any rational mental analysis.

For the early *mutakallimūn* the above position translated into a theory of semantics that can be summarised as beginning with the theory of homonyms (*mushtarak lafẓī*), whereby knowledge related to a posited expression is taken to be a non-universal referent in line with their general rejection of the *falāsifah's* universal forms (*ṣuwar kullīyah*). For them the external indicator (*qarīnah*) was a precondition to a multiple *waḍ'*; one for each specific referent in the case of pre-defined names and for a categorical meaning in the case of homonyms, i.e. in this case a particular meaning was not achieved rather only a general meaning.

Further, under this theory a distinct subjective process is assigned to the positing of each of the homonyms that shares the same expression but has a different meaning. This is significant on many counts, including its unique approach to having the positing

of meanings subjectively carried out in stark contrast to the *falāsifah* who in following of Aristotle had assumed a static theory of perception, where the knowledge of particulars is established when the mind receives a universal form (*ṣūrah*) that resides in the outside object. While the latter approach held this to be constitutive of the essence or quiddity of an object that is (statically) received *a priori* to the experience of understanding, the former *kalām* approach relied instead on mental ideas and concepts that are socially learnt in order to form an understanding of the perceived object.

Later generations of *kalām* scholars, however, realized that the early theory of homonyms despite its subjectivity does not achieve a particular posited meaning. Consequently, they began seeking a solution through their research on mental existence (*al-wujūd al-dhihnī*). For some, such as Taftāzānī, the *qarīnah* (indicator) was now instead taken to be a post-condition of a *wadʿ* that covers a *kullī* mental concept. Yet for others such as Ījī they took the denotative *qarīnah* to be inside the experience of *wadʿ* and the *kullī* concept itself was considered to be a precondition of the *wadʿ* process. Qushjī's constructive solution, however, as we see in our study of his two treatises below, came as a general scientific solution that combined both the *wadʿ* and the individuation (*tashakhkhuṣ*) of the *mawdūʿ lahu* (posited for) meaning within the same constructive positing experience. Qushjī's posited meaning, therefore, achieves being a particular, i.e. non-generalist, meaning given his conceptualist individuation process (more on this is given in our detailed study in the next section).

Kukkonen, in a recent work, is perhaps one of the first academics to identify the core *kalām* theme of conceptualism. In fact, he explains the origins of conceptual content in relation to the theory of *wadʿ* as found in “Ashʿarite textbooks”, and he does so in the following manner:

If and only if two crucial conditions are met, then it becomes possible to say that the name is one and the same as the ... thing named. This is when (1) 'the name' is taken to denote the meaning of the name and when (2) by the thing named one understands its essence in the special sense of its quiddity (*māhīyah*), i.e. that which makes a thing what it is. With this shift from linguistic to conceptual existence, on the left-hand side of the equation, and from any chance universal characteristic to a designation of a thing's one and only true essence on the right, a formal unity of the required strength is attained to allow one to posit a true identity relation between the name and the thing named ... commonality and indeed formal identity between quiddity and conceptual content.¹

It is a requirement, therefore, for any conceptualist theory to be structured on particular designated meanings; a theme that we consistently find, as indicated above, in the subjectivist approach to knowledge exhibited by the *mutakallimūn* and which posits that universals do not exist as extramental entities like the Platonist and the Aristotelian philosophers had speculated. Human knowledge does not carry the status of a universal, as human understanding is founded upon the specifics obtained through the particular external and internal senses in a particular human experience.

Despite such epistemological advancement, the development of constructivism and its final maturation as we next see in the works of Qushjī was not strictly a subjectivist or conceptualist exercise in philosophy although conceptualism itself stood at the origins of constructivism as crucial infrastructure for its early rise. In fact, a constructivist theory that explains how *a priori* human knowledge is attained has to be comprehensive to remain normative and at the same time overcome any psychological difficulty or challenge posed against it. This scientific quest, therefore, goes well beyond (although it resolves) the conceptualist challenge that Kukkonen describes under the theme of "establishing an identity relation between the name, the named, and the act of naming".

¹ Kukkonen, *al-Ghazālī ...*, 664.

As already mentioned above, with *kalām* developments on the important theme of mental existence (*al-wujūd al-dhihnī*), the later *mutakallimūn* began conceiving the possibility of the subjective mind acting as a substratum for universal concepts. Their purpose was to achieve the particular posited meaning as the end result of the process of denotation, but to also open a dynamic subjectivist window within this process, for the activity of the mind in relation to an external indicator. Once a constructivist opening has begun, however, as we see with Ījī's *al-Risālah al-Waḍ'īyah* on '*ilm al-waḍ'*', a constructive scientific process does not immediately follow. The two scenarios that can unfold are either that of the failure of dualism² or the promise of a normative epistemology. "Dualism," as Ali notes, "can be seen as the human mind's intellectualisation of the external realities which may or may not conform to those realities, i.e. realities always being specific and particular and the universals are the intellectualised in the mind"³. In fact, it was this challenge that the developers of the science of constructive semantics, under the new discipline of '*ilm al-waḍ'*', wished to meet in order to fall on the side of the certainty of science and not on that of the scepticism of a dualism that attempts with difficulty to correlate the relation between universal concepts and particular objects of perception.

Furthermore, the scientists of '*ilm al-waḍ'*' attempted to resolve a standing difficulty raised against their earlier *kalām* associates, who had denied the existence of universals and had held to the empirical belief that the posited knowledge is always achieved as particular knowledge. To the contrary, the non-subjectivist argument raised by their opponents, the *falāsifah*, said that if *waḍ'* existed for the extramental referents proper we would need a special expression for each particular entity to serve as a

² We come back to this theme in Chapter 5 when discussing European dualism under the rubric of primary and secondary qualities or the mind-body problem.

³ Mohamed Yunis Ali, 87.

designation for it⁴. In response, the early *mutakallimūn* had invoked the notion of analogy (*qiyās*)⁵ as the basis for drawing relations of signification (*dalālah*) between the signifier and the signified⁶. However, with the development of a conceptualist methodology in *kalām*, the later *kalām* scholars were of the position that the signified meaning is actively constructed instead. They considered this to be based on subjective intervention with the aid of a universal mental tool (*ālah dhihnīyah*) that specifies the posited meaning through either an external external indicator (*qarīnah*) or through the context itself including the syntactic system of language. On this al-Jurjānī, who lived a generation before Qushjī, says, “when we put a given subject that has never been heard before in the nominative case, what is being done in effect is not an application of an analogy (the logician model) but the realisation of a universal concept”⁷. Consequently, with the development of the new discipline of ‘*ilm al-waḍ*’ a new semantic approach was born, which further developed the foundational roots of the aforementioned subjectivist approach of the *mutakallimūn* towards constructivism as a scientific theory of knowledge.

To put things in their historical perspective, ‘*ilm al-waḍ*’ as a scientific technical discipline was initiated when providing a solution to how humans understand the denotation of the demonstrative pronoun ‘*hādhā*’ (this) given that its particular and specific meaning is determined by an external indicator (*qarīnah*) only after the pronoun has already been posited. In other words, the word ‘*hādhā*’ is understood implicitly in

⁴ Mohamed Yunis Ali, 19.

⁵ Qarāfī, *Sharḥ Tanqīh ...*, 413; Abū Ishāq Ibrāhīm Ibn ‘Alī Ash-Shīrāzī (d. 1083), *Sharḥ al-Luma* (Bayrūt: Dār al-Gharb al-Islāmī, 1988), 1/186.

⁶ As-Subkī says, “*dalālat al-laḥẓ ‘alā tamām musammāh muṭābaqah wa ‘alā juz’ihī taḍammun wa ‘alā lāzimihī al-dhihnī iltizām wal-dalālah ma ‘nā ya ‘ruḍ lil-shay’ bil-qiyās ilā ghayrihī wa ma ‘nāh kawn al-shay’ yalzam min fihmihi fahm shay’ ākhar*” (‘Alī bin ‘Abd al-Kāfī as-Subkī, *al-Ibhāj fī Sharḥ al-Minhāj lil-Baydawī*, faṣl 2, via <<http://www.islamicbook.ws/asol/alibhaj-002.html>>). This view assumes that each produced utterance is based by way of analogy on a similar utterance used by the establisher.

⁷ Al-Sayyid al-Sharīf ‘Alī ibn Muḥammad al-Jurjānī, *Hāshiyah ‘alā Sharḥ al-‘Aḍud* (MS), fol. 183.

its context or explicitly through an indicator but not at the first instance of consciously noting it in a linguistic statement. The solution to this issue known under its semantic category of *general positing for a posited particular* (*wadʿ ʿām li mawdūʿ lahu khāṣ*), as we explain in the following section, begins by noticing that a general concept associated with the pronoun actually exists in the mind, and this concept serves as a mental tool for the construction of the specific meaning during the mental process of constructive understanding. Such constructive semantics is actually feasible given that the subjective experience despite its ‘obligatory’⁸ or *a priori* (*darūrī*) mechanism is controlled by a conscious human actor. The new theory of *wadʿ*, therefore, describes a cognitive process that has the following components or features:

- (1) A *signification* relation that is learnt and retained in the mind. This happens between sensory signifiers (e.g. verbal, symbolic, etc.) and mental universal concepts as signifieds.
- (2) A universal *concept* that is learnt through experience and is retained in the mind across experience. It is universal given that it’s known prior to possible future experiences and it acts as a mental tool for a constructive individuation process that produces particular meanings.
- (3) A particular meaning that is individuated in the mind during an experience of human understanding and is thus posited within a human mind. In case the concept relates to more than one particular meaning then an implicit or an explicit external indicator (*qarīnah*) is used to direct the constructive process.

The literature in *ʿilm al-wadʿ*, consequently, “classifies the positing of vocables with reference to two things: (1) a *concept* which exists in the mind of the positor at the time of the positing of a vocable, and (2) the *meaning* which the vocable has in actual speech situations that is to say the meaning which it acquires as a result of the positing”⁹.

On the technicalities of the new positing type, *general positing for a posited particular* (*wadʿ ʿām li mawdūʿ lahu khāṣ*), Weiss explains:

⁸ ‘Obligatory’ here is from a subjective view point meaning pre-rational or empirical given that the conscious experience is subjective and thus rational.

⁹ Such classification is presented by Weiss without much elaboration on its constructivist significance or its relation to the early subjectivist theory of semantics presented by the early *mutakallimūn*.

[It] was developed by Ījī¹⁰ as a means of accounting for the positing of certain vocables the meanings of which could not have been known at the time of their positing. We may take the pronoun *he* (*huwa*) as an example. If we understand the meaning of a vocable to be that to which the vocable refers in an actual speech situation then the meaning of *he* can only be a particular male individual whom the speaker has in mind when using the pronoun. Unlike vocables such as man (*insān*) which have the same meaning in all speech situations *he* will have a different meaning in different speech situations since the speaker or speakers will not necessarily be referring in every speech situation to the same male individual. How then can he be said to have been posited as the designation of a meaning? If its meaning can be known only in concrete speech situations, then to what could it have been assigned in the moment of its original positing, which took place prior to all speech situations?¹¹

As far the solution to this semantic dilemma, some early thinkers had advocated the positing of general ideas or even lexical definitions to linguistic elements such as pronouns. However, as we know from the development of ‘ilm al-waḍ‘, Ījī was displeased with positing a general definition for a pronoun in an actual speech situation because it did not provide its specific particular meaning. On the initiation of a new solution for this pronoun, Weiss comments:

Ījī advanced the theory that *he* and its likes are assigned to their meanings not directly but through the medium of general concepts. To state the matter more precisely the positor in positing *he* contemplates the general concept ... but instead [of] assign[ing] *he* to this concept as such he assigns it indeterminately for each and every particular subsumed under the concept. The phrase “each and every particular” is crucial; it is meant to be a translation of *kull wāḥid min al-mushakhkhaṣāt bi-khuṣūṣih* a key phrase formulated by Ījī himself in his *Risālah*. The positor does not assign *he* to a class viz the class of all those particulars subsumed under the general concept. In an actual speech situation *he* obviously does not refer to such a class it refers rather to a single particular. Consequently, it must be stressed that he is posited in such a way that when it is used one and only one particular is to be understood... It is the context in which the vocable is used not the vocable itself that enables the hearer to identify the actual individual objects referred to. With this the positing itself is classified as general (*al-waḍ‘ al-‘ām*) to which the further qualification *li mawḍū‘ lahu khāṣ* is added to stress the assigned meaning being of a particular.¹²

¹⁰ It was initiated by Ījī in his *al-Risālah al-Waḍ‘īyah* which Qushjī wrote a popular commentary on.

¹¹ Bernard George Weiss, “‘Ilm al-Waḍ‘: An Introductory Account of a Later Muslim Philological Science”, *Arabica*, vol 34 (1987): 339.

¹² Ibid.

As we further explore in Qushjī's two treatises on *'ilm al-waḍ'*, conceptualism opens up a door for the *mawḍū'* and the *mawḍū' lahu* to be different under mental consideration where the *mawḍū'* concept becomes a mental tool (*ālah dhihnīyah*) rather than being itself a posited meaning. Constructive *waḍ'*, therefore, gives rise to a cognitive 'concept' that is learnt from experience and that acts as a foundation for *a priori* knowledge when expressing our particular meanings in perception.

In summary, we're now in a position to state that the rationale for the first part of Chapter Three on constructive semantics is to sum up the wider philosophical challenge in presenting a semantic framework for human understanding, which the foundational scholars (*uṣūlīyīn*) were faced with when trying to explain how specific meanings are denoted in using common pronouns. The implication from constructive semantics upon a constructivist philosophy becomes clearer when we discuss in the next chapter Qushjī's important work on constructive *kalām*, *Sharḥ Tajrīd al-Kalām* (*Commentary on Abstracting Kalām*), and its development of constructivism as a general scientific approach that extends a constructive mental process from linguistics to mathematics and to the rise of constructive astronomical modeling. In support of the crucial place that Qushjī plays in the development of *'ilm al-waḍ'*, the 19th century scholar al-Fatānī asserts, "Linguistic topics ... have their principles in the study of *waḍ'* and its texts range in their benefit with the best source as far as I know is [Qushjī's] *'Unqūd al-Zawāhir fī al-Ṣarf* (*The Chain of Radiant Gems in Morphology*) and its commentary as well as *Risālat al-'Aḍud* [al-Ījī]"¹³.

Below we present an abridgement and translation of Qushjī's popular treatise *Sharḥ al-Risālah al-Waḍ'īyah* in which Qushjī's first exposition of *waḍ'* appears,

¹³ Al-Fatānī, 2.

followed by his more elaborate text titled *‘Unqūd al-Zawāhir* in which he presents his complete philosophy of language forming a basis for his general constructivist theory of *a priori* knowledge.

3.2 [TEXT] *SHARḤ AL-RISĀLAH AL-WAḌ‘ĪYAH* (COMMENTARY ON THE TREATISE ON LINGUISTIC POSITING)

The treatise, *Sharḥ al-Risālah al-WaḌ‘īyah*¹⁴, under study in this section was written by Qushjī due to the importance, he says, of the original treatise authored by ‘Aḍud al-Dīn al-Ījī, and which he describes as “containing delicate issues (*masā’il daqīqah*) and in-depth discussions (*tahqīqāt ‘amīqah*), while being very condensed and abbreviated”. Therefore, Qushjī says that he found the need to write a commentary on this treatise in order to “consolidate its finer points and details” and to “reach its intended purpose of composition”. Qushjī dedicates his treatise as a *tuhfah* (gift) to whom he calls “the great prince of abundance and graciousness” and one who has been “granted with the dual wisdoms of knowledge and practice”; a “leader of the religious and secular affairs” al-Amir ‘Abd al-Karīm.

This treatise epitomises Qushjī’s first exposition of constructive *waḌ‘*. Judging by the extent of the manuscript, we can see that it was a popular pedagogical text, and by its content, we can see that it was a significant development in the history of the philosophy of language. The manuscripts that we have been able to find include the following:

- 1) Al-Sayyid Ḥāfiẓ’s *al-Ḥāshiyah al-jadīdah ‘alā ‘Alī Qushi* [i.e. *Qushjī*], which contains *Sharḥ al-Risālah al-WaḌ‘īyah* by ‘Alī Ibn Muḥammad Qushjī. (Istanbul: Dār al-Ṭibā‘ah al-‘Āmirah,

¹⁴ ‘Alī Ibn Muḥammad Qushjī, *Sharḥ al-Risālah al-WaḌ‘īyah*. In Sayyid Ḥāfiẓ, *al-Ḥāshiyah al-jadīdah ‘alā ‘Alī Qushi* [i.e. *Qushjī*] (Istanbul: Dār al-Ṭibā‘ah al-‘Āmirah, 1851/1261). [Princeton University Library (2271-502-897) MS Microform]. The MS has been digitised by Google and made available online at <<http://hdl.handle.net/2027/njp.32101076411956>> (Accessed January, 2013).

- 1851/1261). The text is a gloss on Qushjī's commentary on al-Ījī's *al-Risālah al-waḍ'īyah*, available at Princeton University Library¹⁵.
- 2) Commentary on *al-Risālah al-wadiyah* by 'Alī ibn Muḥammad Qushjī. British Museum, London, No. 61 "Two commentaries on *al-Risālah al-'īyah*", copied in 1702.
 - 3) *Hawāshī 'alā sharḥ al-Risālah al-waḍ'īyah al-'Aḍudīyah* by 'Ajlūnī, Ismā'īl ibn Muḥammad¹⁶; 'Alī ibn Muḥaad Qushjī. A supercommentary on Qushjī's commentary on *al-Risālah al-waḍ'īyah*. (Harvard University - Houghton Library, MS Arab 218).
 - 4) *Sharḥ 'Alī al-Qushjī 'alā al-'Aḍudīyah* by 'Alī al-Qushjī, (Al-Qāhirah: 1920), available at King Saud University (MS:7540).
 - 5) *Hāshiyah jadīdah 'alā 'Alī Qushi* [sic] by al-Sayyid Ḥāfiẓ (Anqarah: 'Uthmān Nūr, 1305 [1888]).
 - 6) *Hāshiyah 'alā sharḥ Risālat al-'Aḍudīyah fī al-waḍ'* by Ḥāfiẓ Sayyid; 'Alī ibn Muḥammad Qushjī; 'Aḍud al-Dīn 'Abd al-Raḥmān ibn Aḥmad Ījī, (Siirt: Aşan kitabevi, [19--]).
 - 7) *Al-Hāshiyah al-jadīdah 'alā 'Alī Qushi li-Sayyid Ḥāfiẓ*, by 'Alī ibn Muḥammad Qushjī; 'Aḍud al-Dīn 'Abd al-Raḥmān ibn Aḥmad Ījī; Sayyid Ḥāfiẓ, (Istanbul: [s.n., 1895 or 96]).
 - 8) *Hāshiyah 'alā ta'liq 'Alī al-Qushjī 'alā al-Risālah al-'Aḍudīyah* by Abū al-Baqā'¹⁷, (Umm al-Qurā University (MS:12-1960)¹⁸.
 - 9) *Hāshiyah 'alā sharḥ al-Qushjī 'alā al-Risālah al-waḍ'īyah* by Abū al-Baqā', (Maktabat Jam'iyat Şalāḥ al-Dīn (MS:2/13), 1825).
 - 10) *Hāshiyah 'alā sharḥ al-Qushjī 'alā al-Risālah al-waḍ'īyah* by Ismā'īl bin Ibrāhīm bin Ḥaydar al-Kurdī, (Maktabat Jam'iyat Şalāḥ al-Dīn, MS: 1/136), 1825.
 - 11) *Hāshiyah 'alā sharḥ al-Qushjī 'alā al-Risālah al-waḍ'īyah* by Sayyid 'Alī (Maktabat Jam'iyat Şalāḥ al-Dīn, MS:3/123), 1825.

In our presentation we keep the same four divisions that appear in Ījī's original treatise and which Qushjī's commentary maintains, i.e. Introduction (*Muqaddimah*), Remark (*Tanbīh*), Classification (*Taqṣīm*) and Conclusion (*Khātimah*). The transliteration of the abridged Arabic selections is added in Latin letters as footnotes to the English translation, which is displayed in the body of the pages with each numbered passage preceded by the word 'Text' within square brackets. Comments on the

¹⁵ The Princeton University Library MS (2271-502-897) is the version that forms the basis of our study and the one that all subsequent numerical references refer to.

¹⁶ Ismā'īl al-'Ajlūnī was born and died in Damascus (d. 1749). He was Shāfi'ite scholar, a linguistic, a *Muhaddith* (scholar of Prophetic tradition), a scholar of *kalām* and Tafsir and a mathematician.

¹⁷ Abū al-Baqā' al-Ḥanafī (d. 1683), according to *al-A'lām* by al-Zarkalī was a *Ḥanafīte* Qāḍī (judge) in Kafah (Turkey), Jerusalem and Baghdad. He returned to Istanbul and died there.

¹⁸ Available online at <http://uqu.edu.sa/lib/digital_library/search> (Accessed January, 2013)

translations are then presented as separately numbered paragraphs preceded by the word ‘Comment’ within square brackets. The manuscript folio numbers follow the Princeton University Library MS copy, which is described above in point 1 of the list of MS versions.

3.2.1 Translated Anthology with Annotations

I. Introduction¹⁹

1.0 [Ījī] *<An expression could be posited for an individual in itself.>*²⁰

1.1 [Qushjī] The classification of the posited expression from the view of the individuation of the meaning and its generality and the specificity of the positing and its generality is divided according to mental possibilities into four divisions given that the meaning is either particular or not and in either case the positing is either specific or not. So the first class is that which is posited for a particular meaning by way of its specific mental consideration and this is named *specific positing for the posited specific ...* The second class is that which has been posited for an individual by way of its mental consideration, not as a specific but as a general concept, and this division is called *general positing for the posited particular*. The third is that which is posited for a universal concept by way of its mental consideration and it’s called *general positing for the posited general ...* The fourth is that which is posited for a universal by way of the mental consideration of some of its particulars, but this part is non-existent, rather, it has been judged as being impossible, because the particulars cannot be conceived to act as a mirror

¹⁹ A complete presentation of Ījī’s text is given for *al-Muqaddimah* section.

²⁰ Qushjī, *Sharḥ al-Risālah al-Waḍ’īyah...*, folio 111. See Appendix I, Figure I.1, for original Arabic.

for perceiving universal features, contrary to the reverse situation ... The genuine purpose behind this treatise is to verify the meaning of the *ḥarf* (preposition), the *ḍamīr* (personal pronoun), *ism al-ishārah* (demonstrative pronoun) and *al-mawṣūl* (conjunctive pronoun).²¹

[Comment] A crucial difference between Ījī and Qushjī’s expositions seems to be based on the first class, i.e. *specific positing for the posited specific*, where Qushjī’s constructive *wadʿ* is given in contrast to Ījī’s positing of an expression for an “individual in itself”. Ījī’s expression seems to be based on a passive theory of positing that holds, as we see in the next section, that a mental consideration (*bi iʿtibār taʿaqqul*) is only a feature of the universal meaning in the mind. For Ījī, *wadʿ shakhṣī* involves *wadʿ* (positing) for the *shakhs bi ʿaynihi* (the individual in itself), thus, it involves *al-mawjūd al-khārijī* (the extramental existent) from which the perceiver obtains the *ṣūrah* that Ījī links to the expression through the *wadʿ*. Qushjī, on the other hand, introduces the mental concept as an intermediary between the expression and the particular entity. So in contrast to Ījī, Qushjī focuses on the *mawdūʿ lahu* (posited-for particular) being posited through a mental process (*mawdūʿan li mushakhkhaṣ bi iʿtibār taʿaqqulihi bi khuṣūṣihi*) and not through a direct one-to-one relation. For Qushjī, the *mawdūʿ lahu* also implies a particular meaning and not a particular entity (*shakhs*), as Ījī states, because *iʿtibār* in Qushjī’s expression means that mental consideration is involved as a constructive mental process. So while an “individual in itself”, as it appears in Ījī’s theory, is an extramental existent or an object of the senses, Qushjī’s “individuated by way of mental consideration” (*mushakhkhaṣ bi iʿtibār taʿaqqulihi*) refers to an extramental existent, but is itself an occurrence in the mind (*qāʿim fī al-dhihn*).

²¹ Ibid. See Appendix I, Figure I.2.

Therefore, in Qushjī’s exposition we see him connecting a mental concept to a particular sensory entity in a constructive connection between the actual and the mental worlds, with no recourse to theories of abstraction (*tajrīd*) or formal (*ṣuwarī*) verification that commonly give rise to dualistic theories of knowledge. In fact, as we see in his later treatise on *wadʿ*, ‘*Unqūd al-Zawāhir*, Qushjī develops a general theory of *wadʿ* that subsumes all the possible divisions that he presents here, and he does so through his theory of individuation (*tashakhkhuṣ*).

Another feature of Qushjī’s commentary is that he eliminates the universal *mawdūʿ lahu* (posited-for meaning) by rejecting the fourth category of *particular positing for the posited general* and alternatively holds that a universal functions in a subjective intermediate stage between the *wadʿ* of an expression and the particular *mawdūʿ lahu* meaning. Sayyid Ḥāfiẓ in a supercommentary on Qushjī’s commentary says that the fourth type does not exist based on *istiqrāʾ* (induction) given that particulars with their rootedness and their being rationalised based on the five apparent senses are not related to the universals, which, by being in the mind, are not connected directly to the senses. This is in contrast to the universals themselves, which, due to them not being rooted in the senses, can be applied to the particulars and to that which is in the mind. Hence, the mental individuation (*tashakhkhuṣ dhihnī*) of the particulars follows under this reading but not the other way around of identifying universals (*kullīyāt*) by their particulars²². As is later presented in more details, this analysis resolves the “problem of induction” as a universal is not taken to be achievable through some of its particulars, as an objective universal. Rather, as Qushjī elaborates, the

²² Sayyid Ḥāfiẓ said “*wa hādihā al-qism (al-rābiʿ) mimmā lā wujūd lahu ya nī bi dalīl al-istiqrāʾ... wa bayān ʿadam al-imbkān bi anna al-juzʿiyāt li taʿaṣṣulihā wa taʿaqqulihā bi al-ḥawās al-khams al-zāhirah la tartābit bi al-kullīyāt al-mutaʿalliqah bi ghayr al-ḥawās bi khilāf al-kullīyāt li annahā li ʿadam taʿaṣṣulihā tartābit bi al-juzʿiyāt wa ghayrihā*” (Ḥāfiẓ, *Hāshiyah ʿalā ʿAlī Qushjī*).

universal is a subjective entity that serves as a mental tool within the process of constructing particular meanings.

On the other hand, with the third category, i.e. the *general positing for the posited general*, the general meaning is itself a particular description and not one that is universally common (*mushtarak ma' nawī*) as Ījī's theory holds (refer to the next passage). Therefore, the 'posited general' here is just a particular general meaning that is not itself universally applicable to particulars. It is, rather, only a specific description with a general extent or scope.

2.0 [Ījī] <And it could also be posited for it [the individual] by way of considering a general concept, and this happens by mentally considering a general concept that is common between the individuals and then it is said that this expression is posited for everyone from among these individuals in itself and not for any common concept between them>²³

2.1 [Qushjī] This general concept is conceived by way of considering it as a mirror for perceiving these individuals that are the referents, which the expression is individually posited for.²⁴

[Comment] Ījī in this case involves the mental consideration of a general concept which he, contrary to Qushjī, considers to be a common overlapping concept (*mushtarak ma' nawī*) among the particulars. This new exposition, consequently, avoids the difficulties associated with the idea that the specifying of a particular posited meaning in human understanding happens prior to the *wad'* experience itself, as this would render it an *a priori* process for passively receiving the intension (*qasd*) of an external

²³ Ibid., 112. See Appendix I, Figure I.3.

²⁴ Ibid. See Appendix I, Figure I.4.

human speaker. On the other hand, Qushjī does not hold the mental concept to be a common meaning (*mushtarak ma' nawī*) between the particulars. In fact, it is this idea that the *mawdū' lahu* is a particular despite a universal concept applying to it, which gives rise to a constructivist process that individuates particular meanings in the mind, as opposed to a theory correspondence that conditions the *wad'* to the reception of a specifying intension from a human speaker. In fact, this leaves the *wad'* itself being a predefined structure, as opposed to it being a dynamic mental process.

3.0 [Ījī] <Whereby what is understood and benefited from it is only one particular in itself and not a shared proportionality amongst all the particulars.>²⁵

3.1 [Qushjī] This is so in order for one not to be deceived into thinking that what the expression has been posited for is the occurrence of the common concept in each of the particulars, so that it be used for the understanding of such particularity, as this is a false analysis. Rather, what is intended is for the posited to be each and every one of the particulars on their own without any common quantities with that positing, as such [commonality] is not considered here nor is it the posited for ... Hence 'hādhā' (this), for example, which is the understanding of that which is referred to and which in perception is singular and masculine, cannot be mentioned to imply a general concept.²⁶

[Comment] A significant point about the demonstrative pronoun 'hādhā' is that it is used in everyday language to refer to a particularity and not used as a general concept. As we further elaborate below, this example forms a cornerstone for the development of the new discipline of 'ilm al-wad'. Consequently, we also see this example as a

²⁵ Ibid. See Appendix I, Figure I.5.

²⁶ Ibid., 112-3. See Appendix I, Figure I.6.

crucial case study for expatiating a constructive theory of perception with its relation to a general constructivist process and its consequent application in the physical sciences.

4.0 [Ījī/Qushjī] <The mental consideration> by the positor <of that common concept is a tool for positing> and a means for achieving it <not that it is> i.e. the commonality <the posited for. The positing is therefore universal and the posited for is a particular, such as we have with the demonstrative pronoun.>²⁷

4.1 [Qushjī] It is in this manner that the universal concept has been established for the referred to specifics so that a comprehensive specification can be achieved by way of a true external indicator. So it is in this way that the posited [universal] concept is used for the individuals.²⁸

[Comment] Individuation is summed up by a universal being established for a particular in the mind and for that to take place based on a true report or indicator by which the particularity could be specified. In this way the universal is taken to be a mental concept that does not exist in the outside with the individuals, but rather only acts as a tool for understanding aiding the mind in constructing a particular meaning. So the universal does not apply to the individuals as a common meaning (*mushtarak ma'nawī*), rather, what is held to be extramental is the expression as a sound or visual symbol and the actual existent, while the universal concept and the particular meaning remain strictly in the mind.

Moreover, a 'tool for positing' as we find in Ījī's words does allude to a constructivist theory as a process in the mind, which then refers to a subject or a positor (*wāḍi*). In Qushjī's theory, this leads us to the idea of a *wad'* as a construction in the

²⁷ Ibid., 113. See Appendix I, Figure I.7.

²⁸ Ibid. See Appendix I, Figure I.8.

mind, while being verified through an intersubjective process that is grounded in an empirical approach to language usage. This also implies that through this theory of constructivism a universal or a conceptual descriptor can be a true account of a specified individual, whereby dualist matching theories fail to draw demonstrable relations between universal ideas and particular referents. Therefore, in the way of constructivism, human understanding becomes a mental process that involves known concepts in the mind, rather than passively obtaining universal forms (*suwar*) through sense perception.

5.0 [Ījī/Qushjī] <For example ‘hādhā’ (this) is posited and used as the referent> i.e. the meaning of <or the referred to individual>²⁹

5.1 [Qushjī] This means each and every one of the individuals of the concept is being referred to. Further, the word individual here applies as a description to each and every one, whereby it is the meaning of the referred to here, rather than being a general descriptor with the concept itself being the referred to.³⁰

5.2 [Ījī] <whereby it [the pronoun] is not accepted as being a common concept.>³¹

5.3 [Qushjī] This confirms what is understood from the individual. In other words, the meaning obtained from the usage of the pronoun ‘hādhā’ is that individual which is referred to and which is not itself a shared entity and not a common concept. As a result, the meaning of ‘hādhā’ in perception is every singular masculine individual that is perceived by way of a general concept and that is what is understood by the referred to singular masculine entity, which is true for this

²⁹ Ibid. See Appendix I, Figure I.9.

³⁰ Ibid. See Appendix I, Figure I.10.

³¹ Ibid. See Appendix I, Figure I.11.

referred to individual and for that other. A case study is given where it is judged upon every Roman that they are white, and under this category one perceives all the particular Romans from the person named Zayd to that named ‘Amr and others by way of a general concept, which is ‘the Roman’ and which is judged as being white.³²

[Comment] The relation between the pronoun ‘*hādhā*’ and its referent (*musammā*) is contingent on an external indicator (*qarīnah*), thus, it is not a fixed relation that is known prior to the *waḍ*’ process. Here, we also find that the universal concept does not contain or define the particular; it merely allows the mind to draw specific meanings and relations. The meaning (*mafḥūm*) of the demonstrative pronoun (*ism al-ishārah*) is, therefore, one of the singular individuals that the pronoun applies to by way of being conceived through the mental consideration of a general concept. The universals in this way do not carry overlapping meanings, but rather act as constructive tools, whereby the existence of overlapping universals is denied and the mind’s ability to draw constructive relations and associations is affirmed. In constructive *waḍ*’, two matters are involved: the posited (*al-mawḍū*’) as a universal concept which serves as a positing tool (*ālah lil-waḍ*’) and the posited-for meaning (*al-mawḍū*’ *lahu*) as a particular. Here, we find that there are no one-to-one relations between the *waḍ*’ and the *mawḍū*’ *lahu* as in earlier theories of *waḍ*’ that were based on correspondence.

The expression “*al-rūmī abyāḍ*” (the Roman is white) for realists faces the ‘problem of induction’ as it is treated as a universal within a necessitarian frame that takes the universal to mean necessarily true in the same way that we find in the rejected fourth class of *particular positing for the posited general*. On the other hand, with

³² Ibid., 113-4. See Appendix I, Figure I.12.

constructivism the expression is considered to be based on a cognitive concept and so its universality as a mental concept stems from being known through learning. Further, its application is conducted within individuation, which is a constructive mental process that associates the universal relation “*al-rūmī abyad*” to a particular new case after it has received corresponding sensory data that allows the mind to construct such a particular meaning from the known universal. With this scenario the learnt concept acts as a way of identifying the sensory data based on an involuntary mental process that gives it its *a priori* status. The idea of human volition and its relation to *a priori* human knowledge - whereby mental activity is divided into intentional rationalism and unconscious mental processing that is universally shared by humans - has been preliminarily introduced in the previous chapter and is further expanded on in the next chapter.

II. Remark³³

6.0 [Ījī/Qushjī] <What is taken from this perspective>³⁴ that is that which is true for the particulars that the expression is posited for by way of it being subsumed under the general concept³⁵ <does not lead to individuation except through a specifying indicator (*qarīnah*) due to the interchangeability of the positing of the individuals.>³⁶

6.1 [Qushjī] This implies that due to the sharing of all individual meanings with their association [to the concept], there has to be a specifying indicator which joins a particular and by which way the specification of its meaning occurs. This is what is meant by the external indicator (*qarīnah*) ... The need for the indicator thus

³³ A complete presentation of Ījī’s text is given for *al-Tanbīh* section.

³⁴ Ibid., 114. See Appendix I, Figure I.13.

³⁵ Ibid. See Appendix I, Figure I.14.

³⁶ Ibid. See Appendix I, Figure I.15.

arises in our case with the shared concept in order to dispel the contention of true meanings and to drive their proper understanding - and not for their [preconditioned] usage.³⁷

[Comment] Preconditioned usage here means an extra-experiential condition outside the process of *wad*⁶, as is the case with the alternative perspective on real/metaphorical (*haqīqī/majāz*) meanings where the real meaning is considered to be posited without an indicator and the metaphorical one is taken to be based on a specifying indicator in usage. Qushjī states that the universal concept applies to all possible and true individuations, but the actual individuation is based on a specifying external indicator. With this analysis, we find a foundation for a science of positing that is understood through a constructive process, as opposed to being reliant on a theory of correspondence.

III. Classification³⁸

7.0 [Ījī/Qushjī] The division of [the positing of] expressions according to their indicated meanings is into two groups; that which indicates a universal and that which indicates an individual <The expression;> i.e. the posited <its indicated meaning> that is the meaning that the expression is posited for; that which occurs in the mind merely by way of its occurrence in the mind is described with this expression; and by way of its absolute comprehension is called an *understanding*, and by way its comprehension with the reliance on another is called *the indicated*; and by way of positing an expression for it is called the *posited for*; and by way of intending it to outflow from the expression is called *meaning* <is either a universal

³⁷ Ibid. See Appendix I, Figure I.16.

³⁸ *Al-Taqsīm* section.

or an individual> this is because that which is indicated [by the expression] is either prevented from being truly applicable to many, in which case it would be an individual and a true particular, or it is not prevented from that, and in which case it would be a universal.³⁹

[Comment] The *mushtarak ma'nawī mutawāfi'* (theory of overlapping semantic commonality), which is Ījī's position⁴⁰, accepts a *wad'* for a universal concept that could be true upon many particulars (*ma'nā kullī yaşduq 'alā muta'addid*). Its proponents consider this theory to be a mental approach that is combined with a post-*wad'* process for individuation (*tashkhīş*). This theory is, therefore, not constructive but rather passive, although it is subjective as the two processes of *wad'* and its post-condition are taken to occur in the mind. Further, this theory is obviously not constructive, although it forms a basis for later constructive developments. The *mushtarak lafzī* (theory of linguistic commonality), on the other hand, holds one *wad'* for each meaning, which makes the specifying of the *wad'* in this case a pre-condition, and it makes the *wad'* itself a rational process. To the contrary, constructivism involves the same *wad'* for many particular meanings (*ma'āni mushakhkhaşah*), where the expression allows for the mental consideration (*ta'aqqul*) of a universal concept that acts as a constructive mental tool (*ālah dhihnīyah*) for the conception of the particular meaning itself.

7.2 [Ījī/Qushjī] <The *wad'* is either an individuated particular> where that which the expression is posited for is an individual which is conceived in itself, i.e. by way of that which specifies it <or a universal> which means it's general, whereby what the expression is posited for is each and every individual that is generally

³⁹ Ibid. See Appendix I, Figure I.17.

⁴⁰ This position can be found in his *al-Mawāqif fī 'Ilm al-Kalām* (al-Jurjānī, *Sharḥ al-Mawāqif* ..., 1:233-9).

conceived, i.e. by way of a general universal concept that applies to all particular meanings as a true descriptor.⁴¹

[Comment] Qushjī uses the words “*lūhiza bi khuṣūshihi*” (conceived in itself) here and says that this means “*ma yu ‘ayyīnuhu*” (that which specifies it), i.e. an indicator (*qarīnah*) that specifies, and which for Qushjī happens during the mental constructive process of individuation (*tashakkhuṣ*). In the case of a posited universal, Qushjī does not speak of semantic commonality (*ishtirāk ma ‘nawī*), rather, he speaks of a general concept that applies to all individuated meanings (*amr ‘ām kullī ya ‘umm ṣidqan al-mushakkhaṣāt*) that have been conceived in this general manner (*lūhizat ijmālan*). The difference between semantic commonality and a mental concept for conceiving meanings relates to the foundation of constructivism, where the first is a static form of meaning that is assumed to overlap between individuals, while the second is a specific mental process by which the meaning is individually constructed with no assumption of overlap. The generality of the concept that acts as a mental tool is, thus, a subjective generality which allows the subject to conceive individuality and to construct unique meanings for each empirical new case.

7.4 [*Ījī*/Qushjī] <The first> i.e. the expression that is posited for the individual particular positing <is the personal name> i.e. the actual individual. As to the genus; it is outside this division for having a universal meaning <and the second...> i.e. the expression that is posited for an individual with general positing; it is divided into four categories: The preposition (*al-ḥarf*); the personal pronoun (*al-ḍamīr*); the demonstrative pronoun (*ism al-ishārah*); and the conjunctive pronoun (*al-mawṣūl*).⁴²

⁴¹ Ibid., 117. See Appendix I, Figure I.18.

⁴² Ibid. See Appendix I, Figure I.19.

[Comment] Indeed, it is the second positing class, which includes the positing of a pronoun, that forms the basis for the development of a constructive *wad'* beyond the static theories that either pre-condition or post-condition the *wad'* as a non-subjective element, which hampers a mental constructive process from forming. As we see in the next chapter, constructive *wad'* forms the basis for a constructive scientific methodology that goes beyond the difficulties that are associated with the usage of Aristotelian logic in natural philosophy, especially the “problem of induction” and the “problem of dualism”.

IV. Conclusion⁴³

8.0 [Ījī/Qushjī] <The conclusion includes some notes ... The second: a mental demonstration does not lead to individuation> this alludes to the difference between the conjunctive pronoun, the personal pronoun and the demonstrative pronoun whereby the conjunctive pronoun with its indicator, which is an association, does not lead to any individuation <because the conditioning of a universal on another universal does not lead to particularity; in contrast to the contextual and the sensory indicators> each of these two indicators does in fact lead to individuation, whereby the hearer comprehends from both of them that which is not a shared feature <it is for this reason that they are> i.e. the personal pronoun and the demonstrative pronoun <particular and the other> i.e. the conjunctive pronoun <universal>. It is said that the conjunctive pronoun is counted as a universal with regards to the understanding of the hearer from the mere associative indicator or from a mental

⁴³ *Al-Khātimah.*

demonstration without any reference to the outside, but not that the conjunctive pronoun is truly a universal.⁴⁴

[Comment] Individuation is seen as a product of a constructive process with an external indicator, whereby a mental demonstration on its own, i.e. through rationalism alone, does not achieve it. Individuation or *tashakkhush* is a core process in a general constructive theory of human understanding that is related to constructing particular meanings in perception. Constructivism, thus, needs to be empirical in order for it to retrieve the sensory or the contextual indicator and to achieve the particularity of its meanings. On the other hand, rational tools on their own do not achieve individuality of meaning as they are universal tools. In this way, universals only play a part within a constructive process and are not themselves what the expressions are posited for.

8.1 [Ījī] <The fourth: It has been made clear from the above that the saying of the grammarians that the preposition is that which points to a meaning in another linguistic element actually means that it does not independently convey a complete meaning>⁴⁵

8.2 [Qushjī] Meanings could be conceived of intentionally and in themselves [i.e. independently conveying a complete understanding] and they could be conceived of by association without them being intended in themselves, rather only acting as a tool for conceiving other linguistic elements and a mirror for sighting others ... This can be made clear through the two sayings ‘Zayd stood’ and ‘relating standing to Zayd’ whereby in both cases one realises the act of standing in association with him ... This is also similar to what is seen being sighted in itself,

⁴⁴ Ibid., 119-20. See Appendix I, Figure I.20.

⁴⁵ Ibid., 120. See Appendix I, Figure I.21.

by intentionally directing the eyesight to it, and being seen by association to the seeing of another acting as a mirror. The relation of the vision to the conceived is similar to the relation of the sight to its sensory objects ... It has therefore become clear that the reference to that which is associated with a preposition is needed in order for its meaning to occur in the mind given that it cannot be conceived of except through this reference. This, consequently, makes the preposition a tool for conceiving meanings and not one that points to the meaning because the positor has presupposed a correspondence between its usage and the meaning ... As to the exposition of the positing of the word ‘from’, the positing occurs when the positor conceives of the absolute meaning of ‘beginning’, which is a common concept among all the particular beginnings that are conceived of by way of mentally considering the word ‘from’ that is taken to be posited for each of the particulars. The analogy follows for all the other prepositions.⁴⁶

[Comment] Qushjī here explains the positing of the preposition ‘from’ by applying his constructive method to it. He introduces the idea of sighting without a direct intention in order to show how a sighted object can in fact act as a medium for the transmission of a form from another source, such as what happens with a mirror reflection. As a result, Qushjī says that one cannot judge the mirror the way one judges what it carries from form (*la-yumkin laka an taḥkum ‘alayhā aw bihā kamā yumkin lil-ṣūrah*). Qushjī then uses this analogy to compare between a mirror and a preposition, by shifting the focus from the eye’s vision to the vision of the mind and its conceptualising of meanings. The crucial expression “*li-yataḥaṣṣal ma ‘nā fī al-dhihn*” indicates that the meaning is actually constructed in the mind and not just transported from the outside

⁴⁶ Ibid., 121-2. See Appendix I, Figure I.22.

given that the preposition acts as a tool for constructing a new meaning from an external indicator. This means that the preposition does not on its own convey the meaning in full; its meaning is only conveyed through being constructed by those two components, i.e. the conceptual tool and the external indicator. The above passage also alluded to Qushjī's comprehensive theory of constructivism, whereby the meaning is actually constructed in the mind (*huṣūl ma'nā fī al-dhihn*) rather than being imported from an object of perception.

10.0 [Ījī] <The ninth: The verb has a universal indicated meaning>⁴⁷

10.1 [Qushjī] One should know that the verb with regards to part of its meaning, which is the event, is universal, but with regards to its complete meaning, which is the event and its association in a specific time to a specific event; its universality is subject to further conjecture. In consideration of its full meaning, it is rather like the preposition. The same way that the expression 'from' is posited in a general way for each specific beginning in itself, the expression 'hit' is posited in a general way for each relation of the event to an actor in its particularity. Therefore, his referral [Ījī's] to the verb as belonging to the category of expressions posited for universal meanings is not true.⁴⁸

3.3 [TEXT] 'UNQŪD AL-ZAWĀHIR FĪ AL-ŞARF (THE CHAIN OF RADIANT GEMS IN MORPHOLOGY)

The study below is based on an edited version of Qushjī's text '*Unqūd al-Zawāhir fī al-Şarf*' carried out by Aḥmad 'Afīfī from the Department of Dar al-'Ulūm, Cairo University. The edition was published in 2001 by *Maṭba'at Dār al-Kutub al-Masrīyah*

⁴⁷ Ibid., 127. See Appendix I, Figure I.23.

⁴⁸ Ibid. See Appendix I, Figure I.24.

bil-Qāhira and it was based on four manuscript copies as described on pages 143-151 of the book. Below we present an abridged translation of Qushjī's treatment of 'ilm al-waḍ', which is covered on pages 169-224 of the edited book. The transliteration of some Arabic quotations in Latin letters is added as footnotes to the English translation, which is displayed in the body of the pages with each numbered passage preceded by the word 'Text' within square brackets. Comments on the translations are then presented as separately numbered paragraphs preceded by the word 'Comment' within square brackets. *Unqūd al-Zawāhir* is divided into three *Unqūd* (gem knots) with the analogy being carried from the name of the text which means *The Chain of Radiant Gems*. The first of these 'knots' and which is on the foundations of language (*mabādi' 'ilm al-lughah*) is the section that we cover here.

In the preface to the treatise (*khuṭbat al-kitāb*), Qushjī points to the reason behind authoring this work and says that it was done at the request of Sultan Mehmed al-Fātiḥ ibn Murād Khān, whom he praises extensively in this preface. It should be pointed out that Qushjī's patronage by Sultan Mehmed in his final days after he relocated to Istanbul, i.e. 3 or 4 years prior to his death in 1474, gives us a good indication of the book's authorship date, as well as it being one of the last works authored by Qushjī.

3.3.1 Translated Anthology with Annotations

1.0 Waḍ' (semantic positing) in common language usage means to posit an object in a specific location, and in linguistic terminology it means to specify a thing in order for it to signify, in itself, a specific meaning ... What is meant by signification in itself (*dalālah bi nafsihi*) is for the knowledge of the signification to be sufficient

for determining the meaning without the need for an external indicator (*qarīnah*). Accordingly and under this account, the expression is not considered to be posited for its metaphorical meaning.⁴⁹

[Comment] By establishing a foundation for the positing of expressions in the signification of the expression in itself, without the need for an external indicator external to the expression, Qushjī is laying a foundation for human understanding in linguistic usage that is real and sufficient in itself without being metaphoric. Qushjī's fundamental assertion here is crucial on two counts: (1) The first presents a theory of human understanding that emphasises the certainty of linguistic positing, whereby the potential meaning of an expression in usage is determined prior to the external indicator. This, therefore, implies an *a priori* element in Qushjī's constructive theory of *a priori* knowledge. (2) The second relates to the status of constructive *a priori* knowledge (*ilm ḍarūrī*) in Qushjī's constructive semantics, whereby, by focussing on a real foundation for initial positing, Qushjī is making a distinction between foundational knowledge and rational knowledge that man has control over. Within this view, metaphors would become a rational choice in linguistic usage as opposed to constituting any foundational semantic principle. Consequently, Qushjī's positing of expressions fits a constructive knowledge framework which we see him further develop, especially in his third classification for *wadʿ* in passage 4.0 below. Furthermore, Qushjī further explores the relation between real and metaphoric language usage in passages 3.1-3.4 below, where this relation is put within its semantic context in order to aid the development of a constructive theory of human communication and understanding.

⁴⁹ Qushjī, *Unqūd ...*, 170. See Appendix II, Figure II.1 for the original Arabic.

1.2 We, hereby, methodically chose to reduce any discursive reasoning in our analysis, because the majority of the proofs in the Arabic linguistic sciences ... are established upon purely inductive methods and strict investigation.⁵⁰

[Comment] Qushjī's inductive modeling with semantic analysis, such as how he understood the pronoun 'hādhā' to be used in practice, actually relates the Arabic language and its usage to the rise of constructivism as a philosophical framework for human understanding (this observation is further taken up in our concluding remarks).

I. Divisions of Linguistic Denotation (*Waq'*)

2.0 *Al-waq'* is either individual (*shakhṣī*) or categorical (*naw'ī*). What is meant by the individual *waq'* is for the positor to conceive of a specific expression (*lafz khāṣ*) and to conceptualise a specified meaning (*ma'nā mu'ayyan*) for it whether particular (*juz'ī*) or universal (*kullī*). The positor then specifies the expression for the meaning itself, as in the example of the name Zayd, 'man' or 'hit' or for each and every one that the meaning applies to as we see in the implicit pronouns (*muḍmarāt*), the demonstrative pronouns or the conjunctive ones. What follows from such a *waq'* is the understanding of that meaning from the expression or an individual of that meaning after knowing the meaning itself. What also follows is the permissibility of usage of that expression for that specific meaning or one of its individuals and nothing else.⁵¹

[Comment] By including the word 'man', Qushjī is not advocating the positing of an expression for a universal, but rather he maintains the specificity of the meaning of an individual man as related to the concept 'man'. The concept in itself is, therefore, not

⁵⁰ “*Wa āthartu al-taqlīl min al-ta'līl li-anna 'ammāt adillat al-'ulūm al-'arabīyah ... mabnāhā 'alā al-istiqrā' al-mahḍ wa al-tatabbu' al-baḥt*” (Ibid., 115).

⁵¹ Ibid., 171. See Appendix II, Figure II.2.

the true meaning of any one individual that the concept applies to. Importantly, Qushjī does not put forward that a universal shared meaning (*mushtarak ma' nawī*) is posited to apply to all particular individuals with the same meaning, as this would lead to knowledge itself being universal, which is an idea the *mutakallimūn* rejected. This classification, therefore, lays the foundations for a general theory of positing, which opens up the way for the universal mental concept to be introduced as a mental tool that aids the constructive individuation process by which way a particular meaning is related to a known universal concept.

3.0 A second classification of *waḍ'*: This section needs a preface/introduction to raise the query as to what the implicit pronouns (*mudmarat*), the demonstrative pronouns (*asmā' al-ishārah*) and the explicitly defined names (*al-mu' arrafah bi lām al- 'ahd*) have been posited for? It has appeared in the words of the grammarians (*al-nuḥḥāt*) that they have been posited for universal meanings. However, the purpose in positing such pronouns is their use for the particulars of those meanings and not for the pronouns in themselves, whereby the positor conditions its usage upon it being used for one of its particulars and not for a universal concept. In other words, the positor has not allowed its usage for itself.⁵²

3.1 For example the positing of the pronoun '*hādhā*' (this), the concept of the referred to singular masculine, is conditioned in its usage on being used for a particular that this concept applies to, and it's prevented from being used for the concept as being the posited-for meaning. The same applies to other pronouns. Accordingly, some have interpreted the meaning of the knowledge of that which is posited for a specific matter as being that which is posited in order to be used for

⁵² Ibid., 172. See Appendix II, Figure II.3.

that specific matter. However, this is distant from the truth given that it implies that one who knows the positing of ‘*hādhā*’, for example, understands from it the universal concept at a time that no one who knows the meaning from the positing process understands from it, when he hears it being used, anything except for its particular individual⁵³. This [mistaken] interpretation also entails that such expressions with common everyday usage are always used as metaphors, whereby no real meaning follows from such usage⁵⁴.

3.2 On the other hand, some verifying scholars (*muḥaqqiqīn*) have found a more agreeable solution [for the usage of the pronoun ‘*hādhā*’], which states that common expressions are posited for each and every individual meaning subsumed under the universal mental concept that the positor considers in his or her mind when positing the expression. In this way, the individuals become considered in a general way by these concepts, which act as tools for conceiving the individual posited meanings and not themselves as posited meanings. Also in this way, the aforementioned definition of knowledge as that which has been posited for a particular meaning now applies apparently as it appears without any farfetched interpretations. Accordingly, these pronoun expressions become similar to the homonymous expressions (*al-mushtarak al-lafzī*) or the common names (*al-a lām al-mushtarakah*), with the only difference being that the homonyms are posited for the various meanings with various separate positing, while the new constructive solution only involves one positing, which relies on an external indicator (*qarīnah*).⁵⁵

⁵³ Daḥlān says this is Taftazānī (*Mukhtaṣar*, fol. 6B).

⁵⁴ Qushjī, ‘*Unqūd ...*, 173. See Appendix II, Figure II.4.

⁵⁵ *Ibid.*, 173. See Appendix II, Figure II.5.

3.3 If it were said: ‘You have inserted into the definition of *wad*’ [passage 1.0] the condition of ‘in itself’, and you have interpreted that as being independent of an external indicator (*qarīnah*). But if this positing is reliant on an indicator then no positing is established in the first place’. We say: ‘In our exposition is a appraisal that the intended by ‘independence of any indicator’ is its independence from the indicator itself. The understanding of its meaning and its reliance upon it here is only to specify the intended meaning from a pool of possibilities’. The difference between the two is vast. To validate this, we clarify the meaning we intend with the indicator in our saying: ‘To specify the expression by the signifier in itself or by the indicator carrying the same meaning, we emphasise that what is intended from it is more than it’s mere occurrence in the mind [as it aids in constructing the particular meaning]’. This is the recognised external indicator by experts in the field. This also explains how a *wad*’ is understood, whereby if the knower of the positing of ‘*hādhā*’, for example, hears the expression without being informed of the signification of the speaker to a particular individual that could be implied, he or she would understand either this individual or that from it without either being selected ahead of the other(s). With this each of the possibilities is understood as being intended from the expression, however, only dubiously so with the concept being interchangeably applicable to the meanings. Only after the indicator is conveyed is the congestion of meanings allayed and the true one specified. This is contrary to the metaphor where if the hearer hears the expression without an external indicator, he or she do not understand a metaphoric meaning being intended, neither as a specified meaning nor as being interchangeably posited with another, rather in this case the specified meaning would be the “real” meaning,

and with an indicator this is eliminated and the metaphoric meaning alternatively takes place.⁵⁶

[Comment] One can see how with Qushjī's semantic theory the process of obtaining the particular meaning is a constructive process that relies on a mental tool to direct the subjective construction, as opposed to a static accumulation of external meanings in the mind, as is the case with a correspondence theory of semantics.

3.5 With this introduction presented, we say⁵⁷: 'The *waḍ'* and the posited-for meaning could be both particular, such as in the case of mentally considering an individuated meaning and positing an expression for it as in the case of proper names, or they could be both general by considering a universal concept and positing an expression for it such as 'man' or 'hit'. Further, the *waḍ'* could be general and the posited-for particular such as is the case with the implicit pronouns (*muḍmarāt*) and its like. On the other hand, the case of having the *waḍ'* a particular and the posited-for meaning general is denied (*muta'adhdhir*), because based on the universals the particulars are conceived of in a general way (*ijmālan*), and this is enough to use the expression for the individuals. The same does not follow for the particulars in comparison to the universal, as is well know. One should also be aware that what is designated with a general or particular positing is that the positor mentally conceive a general or a particular concept making the positing general with this meaning. This, however, does not conflict with it being an

⁵⁶ Ibid., 174-5. See Appendix II, Figure II.6.

⁵⁷ Here, Qushjī gives his second type of classification for denotation based on the four combinations of pairings between general (*'ām*) and specific (*khāṣ*) conceptual positing (*waḍ'*) and particular (*juz'i*) and universal (*kullī*) posited-for meaning (*mawḍū' lahu*).

individual positing with the aforementioned meaning [i.e. individual positing (*wadʿ shakhṣī*)].⁵⁸

[Comment] The third category which can be seen as expounding the general constructive case for positing and which is a central theme with the new discipline of *ʿilm al-waḍʿ* is the *general positing for a posited particular* (meaning). This category is seen applied in the case of the pronouns, where a concept is mentally considered during the construction of the particular meaning or what is known as the process of individuation (*tashakhkhuṣ*).

The last type of *particular positing for a posited general* (meaning) is denied in line with the general *kalām* rejection of the existence of universal forms in the outside (*fī al-khārij*). Qushjī's justification for this is that the universal concepts are used to subjectively conceive particular meanings, in a general way, and he considers this sufficient to assign the expression to the individuals. At the same time, he denies the reverse situation, i.e. deducing a universal from particulars.

With Qushjī's expression "*mutaʿaqqal al-wāḍiʿ ʿinda al-waḍʿ mafhūman kullīyan aw shakhṣīyan*" (at the time of *wadʿ* the positor mentally conceives of a general or a particular concept), we find the roots for a general constructivist process for establishing meanings in the mind, whereby a human positor mentally conceives of a concept in order to construct the posited particular meaning. Such a constructive theory of *wadʿ* is, therefore, both a subjectivist and a conceptualist theory that relies on an active mind.

4.0 A third classification for *wadʿ*: This was enunciated by our skilled scholar (*shaykhunā al-nihrīr*)⁵⁹ and which is that the *wadʿ* is either intentional (*qaṣḍī*), as

⁵⁸ Ibid., 175. See Appendix II, Figure II.7.

⁵⁹ In a footnote: Saʿd al-Taftazānī.

has been previously mentioned with its divisions, or unintentional (*ghayr qaṣdī*) and which is the positing of every expression that has been posited for a meaning, whether it is a name (*ism*) [and pronouns] or a verb (*fi'l*) or a preposition (*ḥarf*), for itself (*li nafsihi*) ... However, this is an unintentional *wadʿ* by which the expression does not become shared and the meaning of its referent is not known through it. Sharif al-Jurjānī, however, denied this assertion from him.⁶⁰

[Comment] Qushjī speaks of a second type of *wadʿ* other than the usual positing that is driven by human volition and which is an unintentional *wadʿ* that overlaps with the intentional type, as it is additionally evident in every intentional case of *wadʿ*. This type is also not specific to the meaning of the referent, which makes it independent of the empirical context of the *wadʿ*. In fact, this *wadʿ* forms a foundational basis for constructive *wadʿ* as it constitutes the establishment of linguistic elements without a subjective dependence serving as a counter-base to the realist theory of correspondence. “*Wadʿ al-lafz li-nafsihi*” or “*dalālat al-lafz ‘alā nafsihi*” as we find in Qushjī’s expression, implies an unintentional *wadʿ* that relates back to the basic theory of constructivism, and which is that the basic meaning obtained by the *wadʿ* is *darūrī*, i.e. immediate and unintended, and it constitutes empirical *a priori* or constructive knowledge. This understanding, in fact, establishes the basis upon which the common intentional *wadʿ* is composed in the mind.

It is also noteworthy, to point out that Qushjī’s classifications especially the third on intentional/unintentional positing is itself grounded in Arabic language usage, where we see on numerous occasions Qushjī defend his position with references to linguistic proof. As an example, we cite Qushjī’s following examples, where he says: (1) “there

⁶⁰ Ibid., 176. See Appendix II, Figure II.8.

is no disagreement among the expert linguists of the Arabic language (*arbāb al-‘arabīyah*); (2) “based on this we see that its proof is not a matter which cannot be aided by rational or transmitted sources of evidence [as Jurjānī claims], rather its proof is based on the syntax rules of the Arabic language (*qawā‘id al-‘arabīyah*); and (3) “it has become popular among the lingual specialists (*ahl al-lisān*) to use the posited in this way”, etc.

II. Need for a Positor⁶¹

5.0 To prove the need for a positor: Any discussion about the specification of a positor is an intellectual matter. The signification of an expression to one thing over another, despite the interchangeability of its usage for these different cases, is disallowed. Therefore, a discriminating factor (*ikhtīṣāṣ*) is needed to make a distinction (*takhṣīṣ*) between the two and such a discrimination entails that it be an act by a discriminator (*mukhaṣṣiṣ*). Further, by way of mental classification this discriminator is either the expression itself or another, and the other is either the Creator or the created ... Many verifying scholars (*muḥaqqiqīn*) have said that the signification of the universal is by the specification (*ta‘yīn*) and the pre-establishment (*tawqīf*) that God gives to one or many ... what is apparent is that this means that the signification is known as *a priori* knowledge (*‘ilm ḍarūrī*).⁶²

5.1 Another group has said that the universal is in fact specified by the act of a community of people (*tā‘ifah min al-bashar*) and their intercommunicating this to others through reiteration (*tardīd*), repetition (*takrīr*) and designation (*ishārah*), the same way that children are taught languages. This school is called

⁶¹ *Ithbāt al-hājah ilā wāḍi‘* (Proving the need for a positor).

⁶² *Ibid.*, 180. See Appendix II, Figure II.9.

conventionalism (*al-iṣṭilāḥ*) ... Still others suspended any decision (*tawaqqafa al-ba'd*) ... One of the verifying scholars (*muḥaqqiqīn*) has said,⁶³ after refuting that the expressions are essentially associated with the meanings or that the meanings are a feature of the expression itself (*ba'd ibtāl kawn ikhtiṣāṣ al-alfāz bi al-ma'ānī min dhawātihā*), and in order to precisely define the various schools when it was confirmed that the signification of expressions is through *waq'*, [said] that the *wāḍi'* is God or the creation (*al-khalq*) or by distribution (*bi al-tawzī'*), then to either confirm one of the three or not. The schools presented are thus four with each being held by some. The scholar then related these schools to their proponents. Consequently, it becomes clear after assessing the schools that the third alternative, i.e. confirmation by distribution, has not been associated with anyasserter.⁶⁴

5.2 In addition, the fourth group maintained that if the specific part for running a conventionalist theory (*iṣṭilāḥ*) was not based on pre-establishment (*tawqīf*) then a circular argument (*dawr*) follows because the *iṣṭilāḥ* would rely on itself or else a non-finite regress (*tasalsul*) would result. The reason for this they argued was because if this part is not known by *tawqīf* then it is by *iṣṭilāḥ* and then this *iṣṭilāḥ* would rely on another *iṣṭilāḥ* etc. ... The answer [however] is that we don't submit to the idea that if it [the basic part] were not by *tawqīf* then it would be by *iṣṭilāḥ*, due to the permissibility of it being by repetition (*tardīd*) and external indicators (*qarā'in*), as it happens with children [i.e. by learning]^{65,66}

⁶³ In the editor's footnote it's Ījī in his *Sharḥ al-Mukhtaṣar al-Uṣūlī*, 1/194.

⁶⁴ Qushjī, *Unqūd* ..., 181-182. See Appendix II, Figure II.10.

⁶⁵ As we find in the two texts: (1) Bayḍāwī's *Minhāj al-Wuṣūl fī 'ilm al-Uṣūl*; and (2) the *Mukhtaṣar* of Ibn al-Ḥājjib.

⁶⁶ Qushjī, *Unqūd* ..., 191. See Appendix II, Figure II.11.

[Comment] Earlier in the argument, Qushjī had maintained that *tawqīf*, which is not by rational acquisition, but rather obtained *a priori*, does not need to be considered exclusively based on revelation (*waḥī*) as some have claimed, because it is permissible for such *a priori* knowledge to be by the creation of empirical constructive knowledge⁶⁷. What is significant here, therefore, is the way Qushjī raises the idea of *a priori* knowledge as implying that the knowledge of the *waḍʿ* is outside the domain of human volition. As it was made clear in Qushjī’s third classification, i.e. the intention-based classification, the idea of an unintentional *waḍʿ* was also related to it being outside of rational human experience. Consequently, we note here how Qushjī’s constructive theory relates the foundation of *waḍʿ* to empirical knowledge and to it being known prior to any rational volition. This is crucial as it relates to Qushjī’s general constructivism as a theory of semantics, as well as a theory of perception.

In a relevant and important comment stated in his own text on *waḍʿ*, *al-Mukhtaṣar ‘alā al-Risālah al-Waḍʿīyah*, the well known scholar Aḥmad bin Zayni Daḥlān⁶⁸ (d. 1886) states, “If it is said that the *waḍʿ* as the placement of an expression in relation to a meaning is actually an act by a positor, this implies that it can only be particular given that it is an external individuated action for which generality [universality] cannot be conceived. Therefore, the question follows about how such a *waḍʿ* can be made general and particular? The answer to this lies in the fact that the usage of the general and the specific for this positing occasionally happens with regards to the situation of the mental tool by which the posited-for meaning is presented for the

⁶⁷ *Qawluhum al-tawqīf lā yakūn illā bi al-waḥī mamnūʿ li jawāz an yakūn bi khalq ʿilm ḍarūrī* (Ibid., 191).

⁶⁸ In *Mukhtaṣar ‘alā al-Risālah al-Waḍʿīyah* (Manuscript 1578 at Maktabat Jamʿiyat al-Riyād, copied in 1862), Aḥmad bin Zayni Daḥlān (d. 1886) says, “These are qualifications which I have gathered for clarifying the positing of proper names (*al-ʿalam*), personal pronouns (*al-ḍamīr*), demonstrative pronouns (*ism al-ishārah*) and conjunctive pronouns (*al-mawsūl*), as well as prepositions (*al-ḥurūf*) ... I summarised from what the verifying scholars (*al-muhaqqiqin*) have written in commentary on *al-Risālah al-Waḍʿīyah*” (Daḥlān, fol. 4B).

expression and also by considering the meaning that has been posited by the expression. This does not contradict the fact that in itself it is always particular. The conceptual tool for *waḍ'* might be its mental consideration in its particularity or its mental consideration by way of a universal concept that is applicable to the particulars that have been posited as individuals”⁶⁹.

III. Establishment of Language⁷⁰

6.0 It [the establishment of language] is by way of transmission and nothing else; either through a tested report (*tawātur*) as the words ‘heaven’ and ‘earth’ and its like are conveyed, or by way of singular reports (*āḥād*) as in other words. Further, they [the linguists] have agreed on denying that language is confirmed by way of syllogism (*al-qiyās al-fiqhī*), which relies on extending a judgement on something - onto something else, because it assumes that it shares with it a common connection related to the judgement.⁷¹

IV. Dividing the Posited⁷²

7.0 The expression is either posited for each and every one of two or more meanings as an initial positing (*waḍ' ibtidā'i*); and this is the shared (*al-mushtarak*), or else it

⁶⁹ *Fa-inn qīla al-waḍ' ja' l al-lafz bi-izā' al-ma'nā fa-huwa fi' l al-wāḍi' wa ḥīnahā lā yakūn illā khāṣṣan li-annahū min al-af'āl al-khārijīyah al-mushakkhāṣah falā yutaṣawwar fīhi al-'umūm famā wajh ja' luhu 'āmmān wa khāṣṣan fal-jawāb anna itlāq al-khuṣūṣ wal-'umūm 'alayhi tārratan yakūnu bi-i'tibār khuṣūṣ al-ālah al-latī yustahdar bihā al-ma'nā al-mawḍū' lahu al-lafz wa 'umūmahā wa tārratan bi-i'tibār al-ma'nā al-ladhī wuḍi'a lahu al-lafz wa hādihā lā yunāfi'annahū fī ḥadd dhātihī dā'iman khāṣṣan... ālat al-waḍ' (qad takūnu) al-ta'aqqul bil-khuṣūṣ (aw) ta'aqqul bi-amr kullī sādiq 'alā al-juz'iyāt al-mawḍū' lahu al-muta'aqqal al-mushakkhāṣ ... ta'aqqul al-mushakkhāṣ dhihnī wa khārijī... 'alam al-shakḥ ... ta'aqqulahu dhihnī la khārijī wa 'alam al-shakḥ madlūlahu mushakkhāṣ tashakkhūṣan khārijīyan wa dhihnīyan (Daḥlān, fol. 4B).*

⁷⁰ *Bayān ṭarīq thubūtihā [al-lughah]* (Presenting the way language is established).

⁷¹ Qushjī, *Unqūd* ..., 192. See Appendix II, Figure II.12.

⁷² *Ṭaqṣīm al-mawḍū' ilā mushtarak wa ghayrihi* (Dividing the posited into common concepts and other divisions).

is not shared. What is implied by initial positing is that it does not rely for the posited-for (*mawdū` lahu*) meaning on a relation with anything else.⁷³

[Comment] Qushjī speaks of the initial positing as a mental concept that does not rely in its relation to the posited-for meaning on any external relations, i.e. one can view the initial positing as an *a priori* positing, which constitutes constructive knowledge. In either case, the external indicator only serves to specify the intentional meaning from a pool of possibilities.

8.0 The first class [of *wad`*] being the categorical (*naw`ī*) is not inclusive of the posited concept (*al-mawdū`*) in order for it to give an exposition for it under this class; this is the theory of linguistic commonality or homonyms (*al-mushtarak al-lafzī*). On the other hand, the theory of semantic commonality (*al-mushtarak al-ma`nawī*) is that which is posited for a universal concept that subsumes many, whether it is interchangeable for all and that is called the overlapping commonality (*mutawāfi`*) [or else it is called] the graded (*al-mushakkak*).⁷⁴

[Comment] The *mushtarak lafzī* (theory of linguistic commonality) has no *mawdū`* as a mental concept, rather the *mawdū` lahu*, in the case of the general positing (*wad` `ām*), is a categorical meaning as opposed to a particular one. On this theme Daḥlān says, “The homonymous expressions do not always specify the posited meaning, whereby in some cases the specifying happens for the posited meaning as in the case with the proper name Zayd ... it is specified by the indicator. Other times, however, the specification of the meaning does not take place, as in the example of the word *`ayn* [which in Arabic has many meanings including spring, human eye, gold etc.], whereby if there was an indicator that points to the meaning gold, for example, the meaning, nevertheless, has

⁷³ Ibid., 195. See Appendix II, Figure II.13.

⁷⁴ Ibid., 196. See Appendix II, Figure II.14.

not been specified as a specific particular, rather the expression is still true for all individuals of the type gold. Another difference [between the *general positing for the posited particular* and the theory of homonymous expressions] is the unity of positing for the expression with the general positing, while it's plural with the theory linguistic commonality. Moreover, a difference between it and the theory of semantic commonality is that with the latter the positing is for a universal concept, while with the former [i.e. the constructive type] it is for a particular"⁷⁵.

When the *mutakallimūn* rejected the existence of the universal in the outside, they held to the theory of the *mushtarak lafẓī* (theory of linguistic commonality) which posited meanings as categorical meanings and not as particular ones. The *waḍ'* process was thus considered as a way of positing this collective meaning. In relation to the universal meaning Daḥlān further adds, "The universal does not exist in the outside [of the mind], because it is a mental concept, and if it did exist in the outside it would have been a particular, because it cannot be conceived for an animal specified as an individual to be a universal for the acknowledged prevention of the specified individual from being a shared entity, rather it [the universal] exists in the mind only."⁷⁶

Furthermore, in their quest for positing particularity of meaning and with the development of the theme of mental existence (*al-wujūd al-dhihnī*), some pre-Qushjān *mutakallimūn* proposed a theory of *waḍ'* for a mental universal concept which applies to particulars through a mental consideration. They called this theory the theory of

⁷⁵ 'Adam luzūm ta'yīn al-ma'nā fī al-mushtarak al-lafẓī bal tārratan yahṣul al-ta'yīn li ma'nā mawdū' lahu kamā fī al-a'lām ka-zayd ... fa bi al-qarīnah yatamayyaz wa tārratan lā yahṣul ta'yīn ka-'ayn fa-innahū idhā wujīdat qarīnah dāllah 'alā anna al-murād al-dhahab mathalan lam yata'ayyan fī dhālika fard mukhaṣṣaṣ bal mā zāla al-lafẓ ṣādiqan 'alā kull fard min afrād al-dhahab wa al-farq ayḍan baynahu wa bayna al-mushtarak al-lafẓī bi-wiḥdat al-waḍ' fī-mā huwa min hādhā al-qabīl wa ta'adduduhu fī al-mushtarak wa baynahu wa bayn al-mushtarak al-mā'nāwi bi-anna al-mushtarak al-waḍ' fīhi li al-mafhūm al-kullī wa hādhā li al-juz'īyāt (Daḥlān, fol. 7A).

⁷⁶ Al-kullī lā wujūd lahu fī al-khārij li-annahū mafhūm 'aqlī wa law wujīda fī al-khārij lakāna juz'īyan idh lā yu'qal kawna al-ḥayawān al-muta'ayyan bi al-shakhṣ kullīyan li al-qat' bi imtinā' qabul al-muta'ayyin bi-shakhṣihi li al-sharikah wa innamā yūjad fī al-dhihn (Daḥlān, fol. 8B).

mushtarak ma 'nawī mutawāfi' (common overlapping meaning). Given the role that the mental universal concept plays within the *wad'* as expounded by the constructive solution of the *general positing for particular meanings*, we note the similarity from that perspective between it and the theory of commonality (*ishtirāk*), while also noting the apparent differences.

9.0 The proponent of *al-mushtarak al-lafzī* (theory of linguistic commonality) might adhere to his position based on his defence that if *wad'* was not based on this theory then the use of the word '*wujūd*' (existence) for the *wājib* (necessary existent) and *mumkin* (contingent existent) would be by *ishtirāk ma 'nawī* (semantic commonality) or by real/metaphoric usage; both of which are rejected.⁷⁷

9.1 The reply is that commonality (*ishtirāk*) only means that there is one meaning that humans take as befitting the *wājib* (necessary existent) and another that fits the contingent, while the mental concept of *wujūd* (existence) is considered in the mind to be true for each. Further, *ishtirāk* with this meaning does not imply the unity of necessity (*al-wujūb*) and contingency (*al-imbkān*) of existence ... As an example, it might be [falsely] stated that 'if the concept of 'man' was common (*mushtarakan*) between the individuals, it would have been unified among them otherwise it is not in common'. But with this scenario if the concept of 'man' is concomitant with 'knowledge' then this would entail the knowledge of the ignorant, otherwise the ignorance of the knowledgeable would follow.⁷⁸

⁷⁷ Ibid., 200. See Appendix II, Figure II.15.

⁷⁸ Ibid., 201. See Appendix II, Figure II.16.

3.4 CONCLUSION

'*Ilm al-waḍ'* is the science of constructing particular meanings, which lays down the principle that the meaning of words is to be found in the minds of speakers, rather than in the domain of objects themselves. This thus relates mental existence (*al-wujūd al-dhihnī*) to a particular meaning and not to the existent itself. Another corollary is the idea that the meaning attributed to a word is subjective, eliminating the philosophical 'theory of reference' that is based on the notion that words refer in a one-to-one relation to things in themselves.

Conceptualism is, consequently, a basis for the new constructive *waḍ'* of a general concept to a particular meaning. The idea of many possibilities and one actuality is a *kalām* contingency idea that is used in '*ilm al-waḍ'* in place of a direct one-to-one connection between the signifier and the signified as a specific *a priori* relation (as seen in Aristotelian logic). Alternatively, the new *waḍ'* solution associates a universal concept in the mind to the signifier expression from which the particular signified meaning is constructed. Constructive *waḍ'*, therefore, allows for a universal to be simultaneously exemplified or individuated by many particulars.

Crucial to the discovery of constructive *waḍ'* was the demonstrative pronoun (*ism al-ishārah*) '*hādhā*' (this) which was considered before this development to be preconditioned by a signification (*dalālah*). However, the *ḍamīr* (personal pronoun), *ism al-ishārah* (demonstrative pronoun) and *ism al-mawṣūl* (conjunctive pronoun) are the same in that their signified meanings are not meanings in others but in themselves, so their *waḍ'* should not be preconditioned, as it is the case for the *ḥarf* (preposition). The preposition is different in that it is only specifically known with an indicator (*qarīnah*) that is obtained from others (*tatahaṣṣal bi al-ghayr*). Like the early *mutakallimūn* the later ones regarded the demonstrative pronoun as being posited for

each and every potential particular in itself (*wuḍi‘a li kull fard bi ‘aynihi*); thus dealing with particulars. Consequently, when Qushjī spoke of general positing (*wad‘ ‘ām*), he implied that a universal concept now acts as a mental tool (*ālah dhihnīyah*) that deals with particular posited-for meanings. This way the real meaning (*al-ma‘nā al-haqīqī*) is also established in the *wad‘*. Further, because ‘*hādhā*’ is posited for a particular (*mawḍū‘ li khāṣ*), the specification (*ta‘yīn*) involved was taken to be an important step. In summary, with the development of a universal under contingent existence, the general *wad‘* was now considered to imply that a particular meaning is constructed through a three-tier process of understanding that begins with perceiving the possible meanings (albeit in a general way), then progresses to interpreting the external indicator as a specifier of meaning, and ends with individuating the particular meaning from among the possible ones. With this new constructive *wad‘* the demonstrative pronoun was, therefore, now neither regarded as a universal meaning as *ism jins* (genus name), nor preconditioned by the indicator, nor used by substitution (*badal*) or metaphor (*majaz*), rather it was a distinct and constructive fourth way.

Qushjī’s constructive *wad‘* includes the mental tool, which stems from the *wad‘* itself being a mental process rather than a static structure. The *ālah dhihnīyah* or mental tool is a root concept that is acquired by *darūrah* (*a priori* involuntariness) and which gives dynamism to the relation between the signifier and the signified beyond the two being considered “intimately linked” in the mind “by an associative link” where “each triggers the other” as is generally considered within the structure of passive signification. In addition, the mental existent (i.e. the mental concept) serves as an aid that allows the subject to determine the possible meanings, which the sign could have based on linguistic structure, and to then have the external indicator specify one of these meanings as being the actual meaning (*ma‘nā*) the expression was posited for. The *ālah*

dhihnīyah is in fact an acquired concept that is attained by learning and thus acts as a basis for the *a priori* or involuntary particular knowledge.

Constructive *wadʿ*, therefore, turns the signifier into a mental tool (*ālah dhihnīyah*) or a mental existent (*mawjūd dhihnī*) that is itself associated with the expression as a sign, as opposed to the two things being treated as one. Furthermore, in between the signifier as a mental tool and the signified as a particular meaning there is now a constructivist window for individuating the meaning, rather than a direct one-to-one signification between the signifier and the signified. The signifier is what the mind utilises in combination with an external indicator (*qarīnah*) in order to construct the specific meaning. In fact, the division of general or specific positing (*wadʿ ʿām* or *khāṣ*) for a general or particular meaning (*mawdūʿ lahu ʿām* or *mushakkhāṣ*) is only analysable due to the opening of a constructivist window within the process of *wadʿ*. Prior to this development, the *wadʿ* was considered to either be that of a universal (*kullī*) or a particular (*juzʿī*) positing without the hybridisation of the two categories that the constructivist process produces.

Moreover, with regards to passive signification, i.e. where the signifier is connected to the signified in a one-to-one non-constructive relation, we can state that the ‘problem of universals’ is a result of holding that the universals are features (e.g. redness or tallness) shared by many individuals, each of which is said to instantiate or exemplify the universal. The metaphysical issue that has arisen from this is whether or not these features exist independently of the particular things that contain them (i.e. the relation between the universals and the particulars): realists hold that they do; nominalists hold that they do not; conceptualists as constructive positors extend the nominalist position by holding that they do so only mentally. While the *mutakallimūn*

were mostly the conceptualists with some early nominalists, the *falāsifah* were strictly the realists with some later dualists.

A basic underlying assumption with a realist usage of logic is that the terms are understood by the hearer the same way that the speaker intended them. So propositions are then formed based on the idea of two separate terms being linked together by affirmation or denial. To have a judgement, their argument goes, syllogism as an inference holds that one proposition (the "conclusion") follows of necessity from two others (the "premises"). In this way, a judgement about a particular can follow, where an instantiation premise would be included as a universal judgement for a common universal term. A problem with this is that it assumes that the first premise is a complete proposition, which in many cases faces the 'problem of induction' to arrive at in the first place. So while the syllogism itself yields certainty, however, it is the *a priori* universal presuppositions, which are held as premises to the inference, that are problematic, as they reflect a sterile necessitarian worldview and approach to knowledge. Fleeing pure realism, dualists influenced by Ibn Sīnā's mixing of neo-Platonism and Aristotelianism with subjective elements from *kalām* gave universals a mental substratum that his followers considered an abstract form of weaker or shadowy existence in the mind. Dualists were, thus, left with both a mental and an extramental substratum for universals.

On the other hand, the early *mutakallimūn* in rejecting altogether a mental substratum were comprehensively rejecting dualism as a viable scientific theory of knowledge. By following the tracks of the early *mutakallimūn*, Qushjī also rejected dualism, however, he did so while accepting the mental existence of universal concepts. Synthesising between the need for a universal concept in natural science and the *kalām* rejection of dualism's independent existence of universals, Qushjī developed an

understanding of mental existence (*al-wujūd al-dhihnī*) that went beyond the mind acting as a substratum for objects with a shadowy existence and towards the idea of the mind serving as a receptacle for learnt universal concepts. In this way, particularity of meaning is achieved based on a mental individuation process, as opposed to being statically obtained through matter, as dualists held. In fact from this perspective, dualism is seen as being based on an unresolved distinction between percepts and concepts, i.e. between objects of the acts of perception and the acts of conception, whereby a form (*ṣūrah*) is assumed to provide the basis for a matching theory between the two domains. In this case, identity (*huwwīyah*) was taken to be a composite of individuation (matter) and universal form. Dualists, therefore, attempted to make form the subject matter of perception by having it inhere in the mind and the outside. On the other hand, Qushjī's non-dualist constructivism is not based on matching forms between two competing substrata, but is rather a mental process for constructing individuated particular meanings that in perception act as mental referents for the extramental objects of perception.

By focusing on the relationship between philosophy and language, Qushjī was able to develop a constructivist theory of *a priori* knowledge. With constructivism, we have particular meanings constructed by way of universal concepts that are learnt from experience. Within Qushjī's theory of *wad'*, linguistic expressions correspond to entities in the 'real' world, for example, 'that particular horse (*hādhā al-ḥiṣān*)' corresponds to the particular individuated meaning of horse in the mind through the universal concept 'the idea of horsehood' which is also in the mind. This, therefore, allows Qushjī to overcome the difficulties that dualists face when associating a universal entity with a particular one. In fact, language fills the gap between our

understanding of the actual (*'aynī*) and the mental (*dhihnī*), and it provides us with the empirical basis for the science of constructive *wad'*.

With constructive *wad'* as a philosophy of language, the new philosophical method of constructivism emerges. Further, while rising within the discussions of *uṣūl al-fiqh* (foundations for understanding), constructivism, as we see in part two, becomes a foundational analytic method in *kalām*. Philosophy itself within the framework of *kalām*, thus, becomes a constructivist enterprise, with the Ḥanafites, importantly, being the first to have dealt with the process of *wad'* within the purview of *al-wujūd al-dhihnī* (mental existence)⁷⁹. Constructivism as a thoroughgoing scientific methodology, thus, arises in *kalām* as an alternative to the Aristotelian ways and ideas of universality and meaning. Logic as a general method concerns the application of universals to particulars or vice versa, i.e. it is about how universals relate to particulars. Alternatively, constructivism models the mental process of constructive *wad'* by which individual meanings are assigned to vocal expressions. This means that expressions whether they are audible or visual are understood in the mind by way of mentally considering a universal concept and by relying on an external indicator which could include perceptual or implicit signification or socially accepted standards of usage.

The similarities between the theory of *wad'* and the theory of perception are high, whereby within a perceptual process the linguistic elements are replaced by visual elements with both elements now considered as conceptual signs. A constructivist process thus emerges as a general theory of understanding based on the same constructive mental process that is followed for both perceptual and linguistic signs. In fact, perception could be represented by the same constructive process used for

⁷⁹ Fatānī says, “*ikhtulīfa fī wad' al-alfaz hal huwa lil-ṣuwar al-dhihnīyah aw lil-umūr al-khārijīyah ... fa-dhahaba al-ḥanafīyah ilā al-awwal wa al-shāfi'īyah ilā al-thānī*” (Sharḥ 'Iqd al-La'ālī', 91).

obtaining the meaning of the pronoun ‘*hādhā*’ (this) in linguistics, and which acts as a general theory for obtaining particular empirical meaning as *a priori* constructive knowledge.

In the end, Qushjī, who made significant progress by advancing the aforementioned constructivist ideas, brought over his general method of understanding and in particular his individuation theory in constructive semantics, into *kalām*’s various investigations on mental existence and its diverse empirical applications, such as the motion of the celestial bodies and other astronomical inquiries. Crucially, this breakthrough in constructivist methodology of knowledge opened the way for constructive mathematics and the new phase in scientific discovery that triggered the various events in the history of science. Specifically, by studying the constructive process by which semantics deals with the meaning of words in a particular natural human language, constructive mathematics as a language of symbols for mental conceptions emerged. Hence, a core idea with constructive mathematics is the belief that mathematical statements have validity because they are drawn from linguistically-consistent systems of signification and meaning whose rules were drawn up for common human understanding. Consequently, at the center of the issue of constructive mathematics, to be tackled in more details in Chapter Five on astronomy, is the concern about the justification for mathematising the natural world through the construction of mathematical models for physical science.

In the following part, part two of the current chapter, we tackle the theme of a constructive philosophy of science through our primary study of Qushjī’s main *kalām* text, *Sharḥ Tajrīd al-Kalām (Commentary on Abstracting Kalām)* or what is popularly known in scholarly circles as *al-Sharḥ al-Jadīd (The Novel Commentary)*.

CHAPTER FOUR

QUSHJĪ'S CONSTRUCTIVE *KALĀM*

4.1 INTRODUCTION: THE RISE OF CONSTRUCTIVE *KALĀM*

The history of the development of the foundations of human understanding in Islamic societies, or what is known in Arabic as *Uṣūl al-Fiqh*, was initially devised as a scheme for interpreting Revealed truth, but with the rise of constructivism it became a universal mechanism to be deployed across all human endeavours that investigate reality including inquiries into the human psyche and the physical cosmos. The development of constructivism in Islamic foundational scholarship, however, is in many ways still an unwritten chronicle let alone an active research program in recent times. In my view, the biggest contributor to this predicament is an entrenchment attitude towards scholarship, which oversees the growth of rigid teaching structures and de-emphasises the comprehensiveness of a unified program for the foundations of understanding across all human intellectual pursuits. The rise of constructive *kalām* as described in this section, therefore, attempts to investigate this history from its origins until the synthesis that Qushjī achieved between two main streams; one favouring a deductive methodology under the Shāfi'ites and another advancing induction under the Ḥanafītes.

Ibn Khaldūn, the renowned historian and sociologists, described the initial stages of the rise of a universal methodology in *Uṣūl al-Fiqh* in his book *al-'Ibar* by stating that initially the school of the *mutakallimūn* authored texts on this discipline with the most famous of the Shāfi'ite texts being Juwaynī's *al-Burhān* and Ghazālī's *al-Mustaṣfā*. He then stated that in a later period the books of the *mutakallimūn* were summarised by two; (1) al-Rāzī in *al-Maḥṣūl*, which he reworked as an epitome in *al-*

Muntakhab, and (2) Sayf al-Dīn al-Āmidī in *al-Iḥkām*. Their methods, however, varied as Ibn Khaldūn asserts with al-Rāzī tending to the way of textual consolidation and the increasing of the number of empirical proofs¹, while Āmidī was partial to the method of verifying opinions, categorising their cases and classifying their themes for deductive purposes. Moreover, Ibn al-Ḥājjib, later wrote a compendium on the latter book by Āmidī known as *al-Mukhtaṣar al-Kabīr* on which he himself authored a summary that became a popular manual for students and a target for numerous commentaries and other compendiums. Ibn Khaldūn says that the “cream (*zubdat*) of the methodology of the *mutakallimūn*, in this discipline, was to be found in these compendiums”. On the other hand, the second school or approach to this discipline according to Ibn Khaldūn can be found in the way of the Ḥanafītes who wrote numerous texts in this field with the best being written by Abī Zayd al-Dabbūsī from the earlier scholars and Sayf al-Dīn al-Bazdawī from the later ones.

Arguably, a new stage, however, began with Rāzī and followed by other foundational scholars of *Uṣūl*, who began developing a universal methodology that involved combining the two methodologies of the *mutakallimūn* and the Ḥanafītes, so as to produce books that unified the *Uṣūl* of the two schools. In this way, Ṣadr al-Sharī‘ah² (d. 747) wrote *Tanqīḥ al-Uṣūl (Refining the Foundations)*, in which he summarized *al-Maḥṣūl* of Rāzī, *al-Uṣūl* of al-Bazdawī and *al-Mukhtaṣar* of Ibn al-Ḥājjib. He then wrote a commentary on his own book entitled *al-Tawdīḥ (The Clarification)*, to which Taftāzānī (d. 792) added a marginal commentary entitled *al-*

¹ Rāzī’s approach was more inductive than other Shāfi‘ites. Perhaps his known travels to the Ḥanafite lands beyond the Amu Darya River (*bilād mā warā’ al-nahr*) and his debates with famous Ḥanafites thereof played an influence on his methodology of knowledge and his foundational approach.

² Ṣadr al-Sharī‘ah is the same scholar studied by Ahmad Dallal for his PhD dissertation at Columbia University. Ṣadr al-Sharī‘ah signaled the beginnings of a new approach to science with his text *Ta’dīl al-Ulūm (Regulating the Sciences)* based on an *Uṣūl* merger project of *Uṣūl* and he himself was engaged in modifying astronomy towards a more constructive approach.

Talwīh fī Kashf Ḥaqā'iq al-Tanqīh. In fact, Taftāzānī himself was an active proponent of merging the two schools by addressing the reconcilable elements and the foundational components, as he arguably did in *Sharḥ al-'Aqīdah al-Nasafīyah* and to a clearer extent in *al-Talwīh*³. These elucidations have invited many commentaries that could be classified under this universal project. Moreover, having himself authored a commentary on Taftāzānī's *al-Talwīh*⁴, Qushjī was well versed within this universal project that, within the pages of his semantics treatises of '*ilm al-waḍ'*' and his *kalām* works, reached, as we argue in this dissertation, a new level of completeness that his astronomical models stand as a strong testimonial for.

Under the influence of this foundational universalism, which took a constructive form with the *mutakallimūn*, philosophy itself adopted a post-Greek framework that emerged from *kalām*'s discussions on the theme of *al-wujūd al-dhihnī* (mental existence). It is for this reason that the likes of Ṭūsī, who was more an Avicennan philosopher than a *mutakallim*, adopted a quasi-constructivist framework in his philosophic text *Tajrīd al-Kalām (Abstracting Kalām)*. For example, we note in this text that Ṭūsī abandons Avicenna's theory of emanation and other core Peripatetic themes in favour of the *mutakallimūn*'s arguments on the issue of the empiricism of constructive knowledge. The general pattern of the approach that Ṭūsī elaborates in his *Tajrīd* is clearly traceable to the *mutakallim* Fakhr al-Dīn al-Rāzī, in his *al-Muḥaṣṣal* and *al-Maṭālib al-'Āliyah* (especially the elaborations thereof on mental existence).

³ Taftāzānī said the following in its introductory section:

ما أودعت هذا الكتاب الذي لا يستكشف القناع عن حقائقه إلا الماهر من علماء الفريقين، ولا يستسهل الاطلاع على دقائقه غلا البارع في أصول المذهبين (الحنفية يسمون طريقة المتكلمة في الاصول أو طريقة الجمهور طريقة الشافعية) وأول من بدأ بمناقشة الطريقتين فيما يظهر السمعي في القواطع ثم تتالت المصنفات على هذه الطريقة في ذكر المذهبين والتوسط بينهم.

⁴ Taftāzānī, *Ḥāshiyah 'alā at-Talwīh* (Turkey: n.p.).

Historically, in the *mutakallimūn*'s efforts to challenge the *falāsifah* a unique philosophy of science emerged as being both subjective and conceptualist. With Qushjī this stage was completed with the development of constructivism as a comprehensive theory of *a priori* knowledge in which the mind constructs the particular *a priori* knowledge that is founded on mental universal concepts that are learnt from experience. Qushjī, therefore, can be said to have completed or finalised the universal project that evolved within the study of the foundations of understanding by turning the research program of *kalām* into a foundational philosophy of science. The overhaul of *falsafah*'s philosophic framework was carried out by Qushjī and his predecessors under the themes of existence and of quiddity in order to refute the *falāsifah*'s necessitarianism and to set in motion a scientific foundational alternative for understanding reality. The *mutakallimūn* placed an emphasis on the place of human subjectivism within their scientific methodology leading them to the process of individuation from learnt mental concepts by which way human knowledge is constructed in the mind.

It would be fitting at this stage to refer to Sabra's perspective on the subject of later *kalām*, where he argues that it should not be seen as apologetics, as is often claimed, but rather as a rational enquiry into the human understanding of Revealed truth. As such, *kalām* would be a science parallel to *falsafah*, indeed a quest "to offer an alternative philosophy to *falsafah*"⁵. On this Qushjī, himself, elaborates in an introductory section in *Sharḥ al-Tajrīd*, where he defines the foundational place that *kalām* occupies within the pursuit of reality and truth. Qushjī says:

‘Ilm al-kalām or the science of *kalām* is the foundational knowledge (*asās*) of the religious laws (*al-sharā‘i‘ wa al-aḥkām*) and the balance by which the doctrinal rules of Islam are known (*miqyās qawā‘id ‘aqā‘id al-Islām*), the most dignified of the sciences (*ajall al-‘ulūm*) ... whose evidential support is the strongest of proofs (*aqwāhā hujjatan wa dalīl*) ... and with it any veil that hides

⁵ Sabra, *Science and Philosophy ...*, 23.

the reality of the quiddity of things is removed (*wa bihi yukshaf 'an wujūh haqā'iq al-māhīyāt astārihā*) ... It is a prioritised discipline that efforts should be exerted towards acquiring (*fa huwa awlā bi an yuṣraf 'anān al-himmah nahū taḥṣīlihī*) and great intellectual vigour should be dedicated towards the pursuit of its completion (*wa yuḍrab adhyāl al-ṭalab 'alā minṭaqat al-ijtihād fī takmīlihī*).⁶

Indeed, it is this “completion” that we seek to identify and investigate the features of in the following section of our study on Qushjī’s *Sharḥ al-Tajrīd*.

4.2 [TEXT] *SHARḤ TAJRĪD AL-KALĀM* (COMMENTARY ON ABSTRACTING *KALĀM*)

4.2.1 Introducing the Text

It was in Herat Afghanistan, the new capital of the Timurides, that Qushjī is said to have put the final touches on his *Sharḥ Tajrīd al-Kalām* (*Commentary on Abstracting Kalām*⁷) after having begun his first draft in Kirman⁸; a center he visited as a student early in his scholarly career. Qushjī dedicated this work to his new patron, the Timurid Sultan Abū Sa’īd (r. 1451–69), the grandson of Timur’s son Miran Shah, who after a short period of political turbulence succeeded Ulugh Beg (d. 1449); Qushjī’s first and more famous patron in Samarkand. In his commentary Qushjī “spells out the philosophical principles underlying his concept of existence, nature, knowledge, and language”⁹. Hossein Nasr acknowledges the far extent that Qushjī’s work reaches by asserting that it was a “very popular commentary [on the *Tajrīd* of Ṭūsī] of the 9th/15th

⁶ Qushjī, *Sharḥ al-Tajrīd*, fol. 2.

⁷ Ragep translates it as being a commentary on *The Epitome of Belief*. It has also been called *Abstract of Theology* and *Summation of Belief*. In Arabic *al-Tajrīd* is often listed as *Tajrīd al-Kalām fī Tahrīr ‘aqā’id al-Islam* (in short *Tajrīd al-‘aqā’id*). The *Tasdīd* of Shams ad-Dīn al-Isfahānī was called *al-Sharḥ al-Qāḍīm* (old commentary) and Qushjī’s text *al-Sharḥ al-Jadīd* (new commentary). (Arabic Theology, Arabic Philosophy, 418).

⁸ Chalabi, Katib (d. 1657 or 9), *Kashf al-Únūn ‘an Asāmī al-Kutub wa al-Funūn* (Bayrūt: Dār al-Fikr, 1994), 455-59.

⁹ Ihsan Fazlioglu, “Ali Kuscü” in *Encyclopedia of the Ottoman Empire*, edited by Gabor Agoston, Bruce Masters (NY: Facts On File, 2009), 35.

century scientist, philosopher and theologian ‘Alā’uddīn Qushchi which is famous throughout the Islamic world and upon which over four hundred scholars have written glosses, including Dawānī and Khafīrī.”¹⁰

As a scientist, Qushjī describes in the preface to his *Sharḥ al-Tajrīd* the program that he has undertaken with this text. Indeed, he says that he has carried out an extensive review of all material that he can obtain as written works of *kalām*. In analysing such works, Qushjī was endeavouring to extract what could be uniquely attributed to the emergence of *kalām* as a philosophical discipline. This then allows him to define the parameters of the philosophy of science that he ultimately presents, and which could be seen as the first explication of a constructivist theory of *a priori* knowledge that was written in a post-Aristotelian context. Qushjī describes his program as follows:

After spending years of my life unveiling truths within this science and examining its finer details to the extent that there wasn’t a book in this field that I did not examine, whether it was of quality or not, and there was no scripted paper on this theme that I did not explore whether cheap or valuable. I refused to keep such splendour concealed under any cloak of obscurity, or for these [intellectual] deposits to be enshrouded from understanding. I, consequently, saw that I should explicate it in such a way that makes its problems comprehensible and its lineaments and features plain so that I can thereof reveal its pleasant secrets and mysteries and further append to it [other] benefits that I have collected from various texts and notebooks as well as supplements that I’ve inferred with my own scant mentation and limited imagination. The end product, praise be to God, came like I had intended.¹¹

Jalal al-Dīn al-Dawānī (d. 907) has indeed written a gloss on Qushjī’s commentary which he wrote initially prefaced with the name of Sultan Ya‘qūb Bayandari Aq Quyunlū (r. 883-896) but dedicated it in the end to Sultan Bāyazīd. Similarly, Mir Ṣadr al-Dīn Muḥammad al-Dashtakī al-Shīrāzī (d. 903) also wrote a gloss dedicated to Sultan Bāyazīd and in which he included various objections against

¹⁰ Seyyed Hossein Nasr, *Traditional Islam in the Modern World* (London: Kegan Paul International, 1987), 174.

¹¹ Qushjī, *Sharḥ al-Tajrīd*, fol. 3.

Dawānī's gloss. In response Dawānī wrote another gloss in which he responded to the difficulties raised against his views by Shīrāzī, and which was called the "new Jalālī gloss" (*al-Ḥāshiyah al-jadīdah al-jalālīyah*) as opposed to his earlier "old gloss" (*al-Ḥāshiyah al-Qaḍīmah*). To counter this new gloss, Ṣadr wrote another gloss of his own in which he responded to Dawānī's counter-arguments and expositions, and which he later followed with yet again another gloss as an attempt to further verify its arguments, as a result, it seems, of a backlash from a certain student readership of this debate. In this last gloss Ṣadr added some opinions by his own son Mir Ghiyāth al-Dīn Mansūr al-Husaynī (d. 949) - specifically on the topic of substance (*al-jawāhir*) - and again he dedicated it to Sultan Bāyazīd. This, however, was not the last of the exchanges, as Dawānī wrote a third gloss in response to Ṣadr's last work which was known as the "newer Jalālī gloss" (*al-Ḥāshiyah al-ajadd al-jalālīyah*). These glosses combined are known as the "Ṣadrī-Jalālī ranks" (*al-ṭabaqāt al-ṣadrīyah wa al-jalālīyah*). When Ṣadr al-Dīn died before writing back a response to Dawānī, his own son Mansūr wrote the final gloss. Although I have not been able to verify the following comment made by John Cooper on this exchange especially that made on Dashtakī being an idealist who denies reality, I still list it here as it was mentioned in his article published in the Routledge Encyclopedia of Philosophy. Cooper remarks:

Of particular interest to subsequent philosophers were his [Dawānī's]¹² ... series of glosses on the commentary by 'Ala' al-Dīn al-Qushjī (d. AH 879/AD 1474) on al-Ṭūsī's *Tajrīd al-Kalām* (Abstract of Theology). In this work "he engaged with his contemporary Ṣadr al-Dīn al-Dashtakī (and subsequently the latter's son Ghiyāth al-Dīn). All three were greatly influenced by al-Suhrawardī, although the Dashtakīs perhaps more than al-Dawānī. Ṣadr al-Dīn denied any reality to existence, either mental or extramental ... Al-Dawānī, on the other hand, held the view that existence in the outside world is a single necessary

¹² Endress says, "Dawānī, who from al-Abhari, al-Shahrazuri and Qutb al-Dīn al-Shīrāzī took the mixing of Ibn Sīnā's rational and al-Suhrawardī's mystical philosophy into the Sunni madrasa". (Gerhard Endress, "Reading Avicenna in the Madrasa. Intellectual Genealogies and Chains of Transmission of Philosophy and the Sciences in the Islamic East" in Montgomery James (ed.), *Arabic Theology, Arabic Philosophy* (Louvain: Peeters Publishers, 2006), 418).

reality, absolutely devoid of multiplicity. Everything else is contingent: 'entities' whose existence is not real but only various 'portions of existence' (*ḥiṣaṣ*) conceived by the mind. The reality of the external world is established solely through quiddities (in the mind). Al-Dawānī's illuminationism was followed by Mir Damad and initially by the latter's pupil Mulla Sadra before he turned to his radical existentialism.¹³

Others who have cited Qushjī's commentary on *Tajrīd*, include Tashkubrīzāda (d. 962) who in the introductory sections of his *al-'Aqd al-Mandhum* mentions his gloss on Jurjānī's gloss on *al-Tajrīd* and says that it covers all sections until the topic on quiddity (*mabāḥith al-māhīyah*). He also says that in it he collected the interpretations of Mulla 'Alī Qushjī, Dawānī, Mir Ṣadr al-Dīn al-Shīrāzī, as well as Ibn al-Khatīb's, and that he followed this with his own elucidations.

As far as the manuscripts of *Sharḥ al-Tajrīd* are concerned, we have been able to find 28 manuscripts in Turkish Manuscript Libraries, with 14 of them digitised on the Turkish Ministry of Culture's online Manuscript Catalogue¹⁴. We have obtained samples of all 14 and selected the most readable and most complete manuscript to download¹⁵. We were also able to locate 12 different super-commentaries and glosses

¹³ John Cooper, "al-Dawānī, Jalal al-Dīn", in *Islamic Philosophy* from the Routledge Encyclopedia of Philosophy, ed. Oliver Leaman (Routledge, 1998), 2: 806 – 807.

¹⁴ <<https://www.yazmalar.gov.tr/>>

¹⁵ On the other hand there are two known prints:

1. شرح المواقف، للشريف الجرجاني، طبعة دار الطباعة العامرة، وهي طبعة عثمانية قديمة، في ثلاثة أجزاء ضخمة، وعلى هامشها طبع "مطالع الأنظار" للإمام الأصفهاني شرح "طوالع الأنوار" للإمام البيضاوي، وشرح التجريد للقوشجي.

2. منشورات الرضي . بيدار . عزيزي . قم . ايران شرح تجريد العمائد، علاء الدين علي بن محمد القوشجي (ت: 879هـ) طبعة حجرية.

on the *Sharḥ*¹⁶. Consequently, the manuscripts used¹⁷ in this study are three: (1) an Istanbul copy¹⁸; (2) a Lahore copy¹⁹; and (3) a Harvard copy²⁰.

The text of *Sharḥ al-Tajrīd* is divided, like *al-Tajrīd*, into six *maqāṣid* (parts) with each subdivided into a *faṣl* (chapter), *maqālah* (discourse), *mabḥath* (inquiry) and *maqtaʿ* (section). The two *maqāṣid* that are to be studied in this dissertation are the first two, i.e. Universal Matters (*al-umūr al-ʿāmmah*) [Folios 4-151] which includes the three chapters on existence, quiddity and causality, as well as the second *maqṣad* on Substance and Accidents (*al-jawāhir wa al-aʿrāḍ*) [Folios 152-347]. Specifically, these two parts deal with the foundational elements that relate to empirical *a priori* knowledge and thus they are directly associated with the philosophy of astronomy and more generally with the physical sciences. In other words, the first two parts are those that deal with constructivism as a theory of *a priori* knowledge and as a new scientific methodology that covers the subject matter of natural science; including themes in the second part on mathematical philosophy, mechanics, astronomy, optics, acoustics and

¹⁶ These include works by: (1) Jalāl ad-Dīn Muḥammad b. Asʿad Ad-Dawānī (d. 1512) (2) Kamāl ad-Dīn Huseyin b. Sharaf ad-Dīn Abd al-Ḥaqq al-Irdibīlī (d. 1543) (3) Sadr ad-Dīn Muhammed b. Ibrahim ash-Shīrāzī (d. 1649) and (4) Ibrahim Karamani Āmidī (d. 1659). There are also over 15 other commentaries and glosses on *al-Sharḥ al-Qāḍīm* (Old Commentary) of Shams ad-Dīn Mahmud b. Abd ar-Raḥmān al-Isfahānī (d. 1349). These include works by as-Sayyid ash-Sharīf Ali b. Muhammed b. Ali al-Jurjānī (d. 1413), Khatibzada Mehmed b. Ibrahim Kastamoni (d. 1495) and Fenari-zade Muhyi ad-Dīn Mehmed b. Ali b. Yusuf (d. 1547).

¹⁷ A doctoral dissertation completed at the University of London (SOAS) in 1977 on the original monograph of Ṭūsī's *al-Tajrīd*, has also been obtained. It is titled *Naṣir al-Dīn al-Ṭūsī and his Tajrīd al-Ṭīqād – an edition and study*. This was written by Hassan Mahmud ʿAbdel-Latif who later became the rector of the International Islamic University Pakistan.

¹⁸ As it appears in the Turkish catalogue: Alī Kuşçu Alâ ed-dîn Alī b. Muhammed, *Eş-Şerhül-Cedid Alâ Tecrīdül-Akâid*, [Milli Kütüphane-Ankara Collection (03 Gedik 17867)], 179 folios. The cost associated with downloading manuscript pages from the Turkish ministry website <https://www.yazmalar.gov.tr/> is equivalent to RM1.6 per page (Dec, 2011). So a typical *Sharḥ al-Tajrīd* manuscript (375 pages) would cost around RM600.

¹⁹ Qūshjī ʿAlī ibn Muḥammad, *Sharḥ Tajrīd al-iṭīqād*, [Tehran: s.n., 1890]: Lithograph. Hardcopy obtained in person from LUMS University, Lahore, Pakistan.

²⁰ Qūshjī ʿAlī ibn Muḥammad, *Sharḥ Tajrīd al-ʿaqāʿid* a.k.a *al-kalām* (Tabriz: Asʿad Kitābfurush, 1301 [1883 or 84]); 218 folios; lithograph; obtained from the Middle Eastern Division of the Widener Library at Harvard University.

biology. The other four *maqāṣid* concentrate on the *kalāmīc* subjects; namely God (Part III), Prophethood (Part IV), Imamate (Part V) and Eschatology (Part VI).

In the following section, we, therefore, follow the various themes and topics on existence, quiddity, causality (Part I), as well as substance, bodies and accidents (Part II), in order for us to extrapolate Qushjī's constructivist theory of *a priori* knowledge. It is believed that this task can help us dissect Qushjī's philosophy of science and more specifically his philosophy of astronomy, for the intellectual purpose of understanding the scientific foundations of his historically significant astronomical models.

The study below is not a stocktake of Qushjī's general opinions as found in his *Sharḥ al-Tajrīd*, rather, it is an anthology of selected passages that has been collected in order to analyse the specific positions that allow us to extrapolate Qushjī's constructivist foundations of science. My analysis is presented as annotations and comments on the translated anthology. The first two parts of *al-Sharḥ al-Jadīd* are, subsequently, organised into our three topics: (1) Epistemology, (2) Empirical Knowledge, and (3) Foundations of Astronomy.

The folio images for the translations that have been selected for this study have been appended to this document as a separate Appendix. The images are based on the MS found at the Widener Library at the Middle Eastern Division, Harvard University²¹.

²¹ The electronic reproduction note associated with the manuscript library record is: Cambridge, Mass.: Harvard College Library Digital Imaging Group, 2009. (Open Collections Program at Harvard University. Islamic Heritage Project). Copy digitized: Widener Library: OL 22800.10.5.

4.2.2 Translated Anthology with Annotations

I. EPISTEMOLOGY

I.1 EXISTENCE AND NON-EXISTENCE

I.1.1 Commonality of Existence

In Fol. 7²² Ṭūsī gives three reasons as proofs for his claim that existence is common (*mushtarak*) to all existents. He says, “The wavering of the mind when confirmation of absolute existence is established, the unity of its opposite concept and its acceptability of being divided [all] indicate the commonality [of existence].” On the other hand, Qushjī does not hold that existence is *mushtarak* and his reasons for that, as we shortly see, clarify an important aspect of his constructive conceptualism. On the second reason given by Ṭūsī, i.e. “the unity of its opposite concept” (*ittiḥād mafhūm naqīdahū*), Qushjī maintains that the existence (*wujūd*) or non-existence (*‘adam*) of a contingent object is due to a specific (*khāṣ*) existence and not to any ideas of an absolute (*muṭlaq*) existence. Qushjī says that no intellectually closed relation (*ḥaṣr ‘aqlī*) is established between a specific non-existence (*‘adam khāṣ*) and a specific existence (*wujūd khāṣ*) as they are not the opposites of one another, and this is because when a contingent object is not existent with its specific existence it could exist with another possible specific existence. The main issue of relevance to us here is that for Qushjī the theory of knowledge takes into consideration the contingency of perceivable objects, which implies that their possibilities of being or existence are numerous and need not be restrained to a deterministic approach that encloses such possibilities to only one shared (*mushtarak*) and absolute existence. By doing so, however, Ṭūsī seems to be assuming *a priori* what

²² See Appendix III, Figure III.1 for the original Arabic excerpt.

he claims to be an empirical evidence about the closure between existence and non-existence.

[Folio 8] I say intellectual enclosure [of the possibilities] is achieved whenever reasoning attends to it and the intellect affirms it. [On the other hand] there [i.e. with Ṭūsī's saying], the intellect made its affirmation by means of an extraneous presupposition which is that the thing does not exist with another [possibility of] existence nor is it non-existent with some other non-existence. This is [only considered to be so] if this presupposition was not put under study, [but] our saying that Zayd is non-existent (*ma 'dūm*) with his specific non-existence (*'adamihi al-khāṣ*) is not of the same meaning as saying that he does not exist with his specific existence, as the former is more specific than the latter ... The intellect affirms the enclosure of the case whereby a thing is either existing with its specific existence or not existing (*laysa mawjūd*) with its specific existence but does not affirm the intellectual closure of the case when the thing is either existing with its specific existence or non-existent with its specific non-existence except after considering that extraneous presupposition. Consequently, the closure does not stand.²³

[Comment] Qushjī also denies Ṭūsī's third reason, on existence being divisible (*wa qabūlihi al-qismah*). Qushjī gives the alternative to Ṭūsī's idea of *ishtirāk ma 'nawī* (semantic commonality) of existence with his conceptualist position beyond the semantic meanings of specific languages.

[Folio 8] We say this [the alternative] could be achieved if one were to consider the expression 'existence' and its application to the various particular meanings that

²³ See Appendix III, Figure III.2.

the expression is posited for and one finds this in itself irrespective of the language and its establishment.²⁴

[Comment] This implies that the concept of existence is a mental concept of understanding and not one that is expressed on the level of the semantic meanings that are defined within a specific language. With this analysis the concept existence can be seen as being a mental universal concept that allows one to construct the particular subjective meanings without it being a semantically common in itself as a universal meaning, like it is considered under a realist theory of knowledge. Qushjī, therefore, rejects Ṭūsī's position that existence is a shared meaning (*mushtarak ma'nawī*) by further raising difficulties (*ishkālāt*) against his view. In this way, Qushjī achieves both the particularity of meaning and the commonality of mental concepts without the subjective meanings or human knowledge itself being universal or common. It is noteworthy that Qushjī does so in line with his constructive semantics as expressed in his two treatises on '*ilm al-waḍ'*', and which were the topic of our last chapter.

I.1.2 Superaddedness of Existence to Quiddity

[Folio 10] [Existence is distinct from quiddity because] they are intellectually separable from one another. For we may intellectually exist while we are unmindful of the specificity of the quiddity, and this is apparent, and we may rationalise the quiddity while we are oblivious to its existence either in the outside, which is clear, or in the mind. This is achieved given that we do not admit that to rationalise equates with the existence in the mind ... I say, it is not hidden that this judgement [raised by Ṭūsī] is valid, however it does not apply to the text [as Ṭūsī intended, i.e. as a proof for the superaddedness of existence to quiddity (*ziyādat al-*

²⁴ Ibid.

wujūd 'alā al-māhīyah)]. This is so because the meaning of intellectually separated applies when one side is intellectualised without the other, while the doubt in the existence [of a thing, to the contrary,] is the opposite of the assent in it and not its intellectual consideration, as that [i.e. the doubt] requires it [i.e. requires intellectualising the thing whose existence is doubted]. [In other words,] if we were to rationalise a quiddity while doubting its existence, then both would be rationalised by us, in which case, where is the separation [that Ṭūsī claims]?²⁵

[Comment] The idea that doubt and assent are rational processes implies a crucial distinction between empirical knowledge, which is based on intuition, and acquired knowledge, which is the result of a rational undertaking. Qushjī holds that quiddity and existence are both present in our rational consideration as concepts even when existence is itself denied in the outside, while Ṭūsī holds that to perceive a quiddity as existent and to doubt its existence are themselves rational processes. Therefore, for Ṭūsī if any doubt in existence is experienced then this would imply that rationalising the quiddity has not taken place. The difference between the two positions relates to a core issue on the subjectivity of perception as held by the two theories of knowledge, namely realism and constructivism. According to Ṭūsī's realism, perception is a mere passive process of obtaining the form of an extramental object in the mind. This means that for Ṭūsī the empirical experience is in fact a rational operation that involves the abstraction of a mental form. In contrast, under Qushjī's constructivism empirical perception, as we later discuss in more detail, involves an *a priori* process that is established based on the subjective mental existence of concepts of human understanding. This is, therefore, a separate process from rationalism, which becomes an *a posteriori* process that has

²⁵ See Appendix III, Figure III.3.

empirical knowledge as an *a priori* foundation for thought. The distinction between the empirical and the rational is, therefore, made much clearer under constructivism, than under realism which passively conflates the two together.

Consequently, according to the theme of superaddedness of existence on quiddity, rationalised quiddities are considered in the mind as being independent of existence. This, therefore, leads to the idea that existence itself is not a mental concept but an attribution based on extramental reality. The division of knowledge into *taṣawwur* (conceptualisation) first and *taṣdīq* (assent) second in this manner is, therefore, a dualist approach, which Qushjī reverses by ordering empirical knowledge, as being *a priori*, and rational (*kasbī*) knowledge as being *a posteriori*. Therefore, while the former assumes verification happens after conceptualisation, i.e. typical of hypothetico-deductive methods that attempt to affirm what is first taken as a hypothesis, the latter establishes foundations accessible to the process of rational composition.

To consider rationalism as mental existence implies a non-subjective theory of knowledge as the role for the subject between rationalisation and mental existence would be accordingly eliminated. In fact, under such equation the two would be conflated leading to a passive theory of the mind, where to exist in the mind would be taken to mean to be consciously held in the mind; eliminating in this way the process by which the subject unconsciously retains the learnt concepts that aid in the individuation of particulars. To deny that mental existence is equated with rationalism, as the early *mutakallimūn* did, follows from a subjective approach to knowledge, which maintains man's capacity to attain particular *a priori* knowledge as obligatory or pre-rational knowledge. Furthermore, to say that any mental existence equates with rationalism also implies that all particular knowledge is rational, consequently, leading to *a priori* or intuitive knowledge being universal knowledge; another proposition that

the *mutakallimūn* rejected, as they maintained that human knowledge associated with a particular contingent psyche can only be particular.

[Folio 10] Contingency is a matter of the quiddity having an equal probability to existence and to non-existence.²⁶

[Comment] Considering the issue of contingency (*imkān*) as the equivalence of the probability of being to existence and non-existence, indicates a closing of the door on obtaining empirical *a priori* knowledge under a realist theory of abstraction and opening of another for the acquisition of empirical *a priori* knowledge by way of subjective construction or individuation from mental concepts. The constructive approach to *a priori* knowledge relates to the idea that to know something exists by *a priori* knowledge stems from the subjective way by which one knows that the thing exists, i.e. by it being an involuntary process that gives no rational choice to the knower. This is contrasted to the realist's approach of assuming that *a priorism* of knowledge relates to a permanence of existence based on deterministic causal relations. We, therefore, see the contrast between two methodologies of knowledge and even more so between two worldviews; with contingency of being implying that empirical *a priori* knowledge is subjectively or epistemologically achieved, while an assumed necessitarianism is closely tied to a realist focus on ontological necessity. We, therefore, note how a contingent modality in the natural world does not eliminate the possibility of *a priori* knowledge, as the *falāsifah* had claimed in their attacks against the *mutakallimūn*.

On the other hand, contingency of physical being led its proponents to the subjective consideration of the natural phenomena accompanied by an epistemological verification of *a priorism* that drove them to the study of nature as a foundational

²⁶ Ibid.

science, as opposed to the speculative philosophy program of the *falāsifah* and its determinism. In relation to the theme of this section, although the idea of predicating existence on quiddity (*ḥaml al-wujūd ‘alā al-māhīyah*) arose out of an attempt to devise a contingency response against necessitarianism. Such an idea, however, is indicative of a persistent realism that speculates on extramental existence being superadded to a mental quiddity. Dualists considered existence (*al-wujūd*) to be not existent (*mawjūd*) rather only a conceptual matter, while most *mutakallimūn* said that it does exist, which means that they were considering it as such by mental derivation (*ishtiḳāqan*) and not like the Greeks who in their anti-conceptualism had considered existence to be an independent universal. Furthermore, such dualism resulted in numerous difficulties and problems that were only resolved, as we later show in this section, under a constructivist approach that demonstrated that the foundations of a science are not met by a realist philosophy but are rather found within the normative methodology of constructivist science.

[Folio 10] [In stating Ṭūsī’s argument, Qushjī says that] it means that had existence not been superadded, it would have either been identical to the quiddity, in which case the predication of existence upon it would be [analytic] with no [empirical] benefit ... This further means that its predication upon the quiddity would not be conditional upon any empirical proof, because an analytic predication [in Ṭūsī’s view] is non-conditional upon an external proof. However, we require an empirical proof when we predicate existence upon quiddity [due to the two being non-overlapping]. [Consequently] the response to this argument and the [previous] one on the rational separatedness [of existence and quiddity], and which is applicable to both, is that the arguments would follow had the quiddity been rationalisable in

itself by way of its essence. However, if it were rationalised not in itself by way of its essence, [then] in this case it would be permitted for its essence to be unknown let alone for it to be associated with it [i.e. the quiddity] ... As a result, [Ṭūsī's argument is refuted] by way of a quiddity that is known to us; whereby it is foreseeable for some quiddity which has not been [initially] conceptualised for it to have its conceptualisation unseparated from rationalising its existence, in which case further proof would not be required if existence were predicated upon this quiddity [known by this way].²⁷

[Comment] To rationalise a quiddity, which is a conscious act, is not achieved, according to Qushjī, by acquiring its essence (*kanh*), as this could be unknown. This is contrary to an essentialist realism that holds that to rationalise a quiddity is to know its essence as causal nature and to then have that exist in the mind. Constructive *a priori* knowledge, according to Qushjī's method, are, thus, based on actual empirical existence rather than on essentialist causal explanations, therefore, following instead a different approach to knowledge, i.e. one that is existential and descriptive.

Qushjī, therefore, in reforming Ṭūsī's advances towards a contingency theory of science was supporting the *kalām* program of contingency against necessitarian *falsafah*. Qushjī says that one can rationalise the essence of a thing by rationalising its analytic parts. On the other hand, if the quiddity is already known, then to conceptualise its existence would effectively mean that one becomes consciously aware of its quiddity as well, without the need for constructive *a priori* evidence. This implies that the existence of a quiddity is not superadded to the quiddity, but rather joined to it. For Qushjī, to be in *ta' aqqul* (intellection) is to be known first, otherwise, one does not

²⁷ Ibid.

conceptualise what he does not have the concepts for. In addition, one can obtain the concepts by learning, as Qushjī's comment indicates, which means that if a quiddity is rationalised then its concepts would have already existed *a priori* in the mind. Qushjī's revolution, therefore, is that a reversal of the process of abstraction is considered with the conceptualisation of a quiddity only taking place as a result of learnt concepts that are already existing in the mind. In other words, as we later explore, individuation based on universal concepts and empirical input produces particular knowledge that is rationalised by the psyche (*nafs*) as being inferential *a priori* knowledge.

[Folio 11] I say it could be responded to [i.e. the superaddedness thesis] ... [by establishing] the difference between describing a thing with something and predicating it upon it [essentially] by co-occurrence (*muwāṭa'atan*) and between describing and predicating by derivation (*ishtiqāqan*) [from sense perception] ... We say contingency means that it is not mandatory upon the quiddity to be described with existence by derivation [from reality], nor the description with non-existence in the same way, and this is what is implied by having the probability that a quiddity relates to existence being equal to the probability that it relates to non-existence. His [i.e. Ṭūsī's] saying that had existence been identical with quiddity, no relation [between quiddity and existence] would have been conceived let alone its equality [to its non-existence] is rejected. This is so because a relation between a thing and itself by derivation [i.e. between it and its derived real features] could be conceived of. Furthermore, it could become a theme that is investigated by intellectual beings who disagree about it in denial and approval. For example, the relation between existence and itself by derivation is a battle amongst ferocious competitors, whereby, the majority of the *mutakallimūn* are of

the opinion that existence exists, while some others and a group among the philosophers such as Farabi and Ibn Sīnā say that it does not exist rather is among the secondary intelligibles ... Consequently, if you were to say existence exists then you would be relating to existence the concept of ‘that which has existence’ (*dhī wujūd*) and the two are dissimilar.²⁸

[Comment] *Al-ittiṣāf ishtiḳāqan* means to be described by derivation from reality, i.e. done so constructively and not analytically in which case the subject and the predicated statement are assumed to have overlapping meanings. On the other hand, Qushjī’s constructive *a priori* approach is not based on essentialism but is rather grounded in existential features that are used to conceive a quiddity by way of deriving its features from sense perception. Qushjī confirms that contrary to a realist theory the relation between a thing and itself by way of derivation is conceivable, therefore, existence is not superadded to quiddity and there is no need to maintain this thesis in order to defend physical contingency in the face of Aristotelian necessitarianism, as Ṭūsī claims. In fact, quiddity and its existence are tied together in a similar position to that of the early *mutakallimūn* except that now under mental existence a subjective approach is more explicit allowing for a quiddity as a mental universal concept to be existent prior to the construction of *a priori* empirical knowledge, whose *a priorism* is itself subjective. This leads to an overcoming of Aristotelian necessitarianism by maintaining the prior universality of subjective concepts in the lead up to the acquisition of empirical knowledge. We, therefore, see that, in contrast to dualism which had conflated mental existence with external existence²⁹, the subjectivism of *kalām* helps achieve the priority

²⁸ See Appendix III, Figure III.4.

²⁹ Jurjānī’s definition in his *Ta’rifāt* is dualistic. He says:

حمل المواظمة عبارة عن أن يكون الشيء محمولا على الموضوع بالحقيقة بلا واسطة كقولنا الإنسان حيوان ناطق بخلاف حمل الاشتقاق إذ لا يتحقق في أن يكون المحمول كليا للموضوع كما يقال الإنسان ذو بياض والبيت ذو سقف.

of universals and its applicability without the need to claim the eternity of universals or to claim that the *a priorism* of knowledge is due to the assumption of determinism. On the other hand, subjectivism helps achieve both universal concepts and *a priori* constructive knowledge, while maintaining the contingency of the physical world and the need to subjectively construct its constructive and descriptive meanings.

[Folio 11] As to the Ash‘arites, perhaps what they wanted by their saying ‘the existence of everything is identical to its quiddity and not superadded to it’ that there is no distinction between it in the outside, i.e. there is no such thing in the outside which is the quiddity and another which is existence established upon it externally as the perusal of their proofs indicates. There is no disagreement with them on that.³⁰

[Comment] The fact that Qushjī finds no disagreement with the Ash‘arite position on their ‘no addedness of existence to quiddity in the outside’, indicates that Qushjī defends their position from within his own constructivist framework that accepts the argument for mental existence. In doing so, Qushjī shows that his theory of knowledge despite its conceptualism is still non-dualistic, unlike the proponents of the superaddedness of existence to quiddity, who as we saw earlier, end up with various difficulties and problems that are unresolvable under a realist theory of knowledge.

[Folio 12] I say ... it should not be said that the quiddity as it is in itself exists in the outside. Some relation could be established for it with the outside and it does not negate from that the fact that such a feature is only affirmed for it in the intellect ... For example, whiteness is not established in the white body nor is it established

³⁰ Ibid.

in the non-white body, rather it is established in the body as it is and this feature is only affirmed for it in the intellect.³¹

[Comment] Qushjī's argument, on the quiddity being affirmed in the intellect, shows how with a non-dualist subjectivist theory of knowledge an empirical feature which is intellectually affirmed is also considered to be affirmed in the outside without the need for a matching heuristic (*muṭābaqah*) between the two existences. In this way, for example, the two concepts of whiteness and body are considered separately in the mind and their combination is only mentally added during the process of individuation, which allows us to perceive the whiteness established in the body. So, here, as we further elaborate later, we find that contrary to dualistic attempts at *a priori* knowledge, the only resolution to it is the one that is founded on a constructive semantic theory of human understanding.

Jurjānī says, “The author [Ījī] said that the disagreement over whether existence is superadded [to quiddity] or not, reduces to another disagreement on mental existence. Those that did not affirm it [mental existence] such as the Shaykh [al-Ash‘arī] said that external existence is absolutely identical to the quiddity, and those that did affirm it said that the external existence is added to the quiddity in the mind. [On the other hand] those amongst the later authors who said that the existence is added while denying mental existence show no insight with these claims”³². In what follows we, therefore, further explore the central theme of mental existence³³.

³¹ See Appendix III, Figure III.5.

³² Jurjānī, *Sharḥ al-Mawāqif*, 1:252:

قال المصنف فإن النزاع في أن الوجود زائد أو ليس بزائد راجع إلى النزاع في الوجود الذهني فمن لم يثبت كالشيخ قال إن الوجود الخارجي عين الماهية مطلقاً ومن أثبت قال الوجود الخارجي زائد على الماهية في الذهن فمن ادعى من المتأخرين في أن الوجود زائد مع أنه ناف للوجود الذهني لم يكن على بصيرة في دعواه هذه .

³³ Tahānawī defines mental existence as that which is learnt, i.e. by way of the construction of the mind and its imposition (*al-mawjūd al-dhihnī al-ladhī yakun bi-ta‘allumihī ay bi-ikhtirā‘ al-dhihn wa farāḍihī*) (Tahānawī, *Kashshāf*..., 1769).

I.1.3 Division of Existence into Mental and Extramental

[Folio 12] What could be provided as evidence for mental existence, is the fact that we reason about matters that are non-existent in the outside. Further, it is a requirement in that to understand a thing, to rationalise it and to discriminate it in the intellect that there be a relation between the rational being (*al-‘āqil*) and the rationalised (*al-ma‘qūl*). Further, a relation between the rational being and absolute non-existence is impossible by necessity, therefore, the rationalised, in general, has to be established [in a substratum], whereby if that is not in the outside then it would have to be in the mind.³⁴

[Comment] Perhaps for the first time, a similar demonstration for mental existence appears in Fakhr al-Dīn al-Rāzī’s *al-Mabāḥith al-Mashriqīyah fī ‘Ilm al-Ilāhīyāt wa al-Ṭabī‘īyāt* (in brief *The Oriental Investigations*)³⁵. This demonstration is based on the mind’s ability to predicate a true judgement upon entities that are non-existent in the outside (*ma‘dūmāt*), and would, therefore, only be considered as entities that are mentally existent. In fact, the theme of the non-existent plays a crucial part in uncovering the intricacies of *kalām*’s constructivist theory of *a priori* knowledge. We cover this theme more extensively in our discussions on Folio 13.

[Folio 13] This [i.e. Ṭūsī’s saying, “That which exists in the mind is the form which varies [from the object] in many of its concomitant attachments”] is a response to the argumentation of the deniers [of mental existence, who say] that had things had an existence in the mind, then it would have followed for the mind to be hot and cold whenever heat or coldness occurs in it, as well as straight and crooked

³⁴ Ibid.

³⁵ Fakhr al-Dīn Rāzī, *al-Mabāḥith al-Mashriqīyah : fī ‘ilm al-Ilāhīyāt wa al-Ṭabī‘īyāt* (Bayrūt: Dār al-Kitāb al-‘Arabī, 1990), i, 130-131.

whenever straightness and crookedness occurs in it, and other examples from attributive opposites that are denied being in the mind. This is so given that the existence of these attributive things in a substratum requires that the substratum be described accordingly. In addition, the occurrence of the reality of the mountain and the sky with its enormity in our mind is inconceivable. An account of the answer [according to Ṭūsī] is that the occurrence of the essence of these matters in a place requires the attribution of the place with it, however, the occurrence of its forms and its phantasma in it does not necessitate that. [As a result, according to Ṭūsī] that which exists in the mind are the forms of these things and their phantasma and not the things themselves. The attribution of the place in this case, therefore, does not follow. Further, the forms and the phantasma are not equivalent in concomitant effect to that which has the forms, rather it differs in many of it [i.e. the concomitant effects].

A problem was raised [against this position] in that the form that occurs in the mind from heat [for example] is either the quiddity of heat or not. On the account of the second, there is no existence for heat in the mind, rather what is in the mind is a matter that differs in quiddity from heat, but [the consequence of this is rejected as] it is invalid for things to have two existences; one in the outside and one in the mind. One cannot say, there is no meaning for the existence of things in the mind except the existence of their form in it even if it were different in reality, because we say that what they [i.e. the proponents of mental existence] adhered to, if it were thoroughgoing, would indicate the existence of things in themselves in the mind. [For example] a judgement upon the triangle, in what has been reported, implies its establishment in it [i.e. the mind] and not the establishment of something that differs from it in reality. Further, on the account of the first, it would follow

that the mind is hot and cold, because there is no meaning for hot and cold except that which has the quiddity of heat and coldness in it.

In response, it was said that existence in the mind is the quiddity of heat and coldness as well as the quiddity of the mountain and the sky, but it exists with a shadowy existence. The fact of having the substratum of heat described accordingly [i.e. as being hot] is among the judgements that are associated with its essential existence and the same applies to its antonym coldness as it [i.e. the effect] accompanies its essential existence and not its shadowy one. In general, mental forms, whether they are universal as in the forms of the intelligibles or particular as for the sensory ones, differ from the extramental ones in those concomitant effects that relate to the specifics of the existence, even if it shared with it the concomitance of the quiddity as it is in itself. [Therefore] what you [i.e. the deniers of mental existence] have mentioned from its denied actuality is in fact related to its extramental features, because the origin of those is in the outside existence. Consequently, the essence of heat is denied any occurrence in the mind and the same for its opposite, i.e. the essence of coldness, as well as the essence of the mountain; they are [all] denied an occurrence in the mind, hence, why did you state that [i.e. your rejection] in relation to the mental [occurrence].

I say, this issue hinges on [further] analysis, because this answer relates to the opponent, who attributes to the mind the descriptions that exist in the outside such as heat, coldness and its like and it does not [altogether] overcome the difficulty [raised], if he were to cling to the concomitant effects of quiddities, such as evenness and oddness, for example, or to the descriptions of the non-existent, such as what is existentially denied or its like. He might, for instance, say that had evenness or oddness occurred in the mind, then it would follow for the mind to be

even or odd given that there is no meaning for even and odd except that in which evenness and oddness occurs. Similarly, [the same follows] for the case of the occurrence of that whose existence is denied; if it were to occur in the mind, then it would follow that the mind is denied any existence given there is no meaning for being existentially denied except that in which such denial occurs. In this case, it would not have been sufficiently responded to [the opponent] with this [aforementioned] response, because it is not viable to say that the place of evenness is attributed with it by way of the features that relate to its essential existence in the outside and the same for its antonym oddness, i.e. that it is associated with the essential existence and not the shadowy one. The reason for this is that its like [i.e. the likes of evenness, oddness] do not exhibit any essential existence in the outside, since they are among the features of the quiddity [as a mental existent]. In a similar way, one can speak of that which is denied any existence in the outside, and its like, as it could not be [validly] said that the place of existential denial is ascribed with a feature that is associated with an essential existence in the outside, because an essential existence is inconceivable for it [i.e. the existentially denied].

The response that definitely overcomes the difficulty [raised by the opponent] is [founded on] the difference between the occurrence of non-attributive existence (*ḥuṣūl*) in the mind and the establishment or attributive existence (*qiyām*) in it. For, the occurrence of a thing [i.e. the non-attributive existence] in the mind does not require the description of the mind with the features of the occurrent, in the same way that the occurrence of a thing in space does not require the attribution of space itself with its features. Similarly, the occurrence in time does not require the description of time [itself] with [the features of] that which occurs in it. Rather, what requires the description of a thing with another thing, is the

establishment (*qiyām*) of that thing [i.e. the attributive existence] in it, and these things, i.e. heat, coldness, evenness, oddness, existential denial and its like occur (*hiya ḥāṣilah*) in the mind and are not established in it. Consequently, it does not require the attribution of the mind with it. On the other hand, it would have been attributive of the mind had it been established (*qā'imah*) in it, but [as indicated] it is not.

With this verified study a strong problem is eliminated, which is raised against those who say that the things themselves are in the mind and not their forms or phantasma. This study asserts that the cognitive concept of the animal, for example, if it were to exist in the mind, then we know with certitude that there are two matters [that take place]. One of which exists in the mind and it's known, a substance and a universal, i.e. the concept of the animal, given that what is meant by substance is a quiddity, which if it exists in the outside, it would not be [accidentally] in any subject. The second matter is an existent in the outside that is the knowledge, which is particular and an accident. In the theory of those who assert the phantasma and apparition [of the quiddity], that which exists in the mind is the concept of the animal whose phantasma is established in the mind given that in this way the existence of a matter [i.e. a concept] in the mind is the establishment of its phantasma and its apparition thereof and which is [i.e. the concept] a universal substance that is known, while that which exists in the outside is the phantasma, which is established in the particular mind that exists in the outside. This means that it [i.e. the phantasma] is particular and an accident among the psychic qualities, and it is the knowledge, therefore, no problem [follows]. As to the theory of those who assert that the things themselves are in the mind, a problem ensues, which relates to the existent in the outside, which is a

particular knowledge and an accident among the psychic qualities, as to what its place is [in this theory], given that in this way there is only the concept of the animal which is existent in the mind and established in it and known. [However] according to our verified way, as hereby expounded, we say that the cognitive concept of the animal, for example, if it were to occur in the mind, then a psychic quality is established in the mind (*yaqūm bi al-dhihn*), which is knowledge of that concept and it is accidental and particular for being established in an individuated psyche and individuated with mental individuations or characteristics (*mutashakhkhiṣ bi tashakhkhuṣāt dhihnīyah*). It also exists in the outside. As to that which exists in the mind, it is the concept of the animal, which occurs in it, and it is a universal, a particular, and it constitutes that which is know.³⁶

[Comments] After affirming the proofs for mental existence, especially the one that rests on the need for the existence of the substratum of a true judgement that is passed on a non-existent entity, Qushjī continues in this passage to describe the history of the rise of constructivism, as a methodology of knowledge, over a period that extends from the early Greek influenced *falāsifah* to his predecessor *mutakallimūn*. Qushjī's method for doing so is based on stating the difficulties that failed theories of knowledge resulted in and how they were attempted to be overcome. In particular, he focuses on the approach of the Avicennan *falāsifah*, which includes Ṭūsī, and also on the way the preceding post-Rāzīan *mutakallimūn* responded to their difficulties, albeit, without clearly stating the constructivist solution that *kalām*'s worldview introduced as the only theoretical guarantee to the empirical attainment of *a priori* knowledge. Qushjī's place in history as the first scientist to have completed the theory of constructivism is,

³⁶ See Appendix III, Figure III.6-8.

therefore, cemented by the preceding passage in which he represents the *kalām* program by resolving all outstanding difficulties associated with his predecessors. His solution, as we shortly explain, was in line with the subjective spirit of the *mutakallimūn*, who defined human knowledge as a qualitative relation (*idāfah*) held by the knower, and which had led them to make the existence of the universal concept in the mind a central issue for the attainment of such relational human knowledge and understanding.

Below we describe the main historical currents and events that led to such a significant breakthrough in the theory of knowledge and that contributed to the scientific developments that outflowed from that event and that all began with Qushjī's constructive mathematical models, which is the topic of our next chapter on astronomy.

I.1.3.1 *From Realism to Constructivism*

Historically, the Socratic school that produced Plato and Aristotle set out to achieve a *a priori* knowledge by favouring demonstrative certitude, but in their quest to do so they incorporated determinism into their philosophy, as well as a necessitarian methodology that constituted an emerging realism. In aiming for the certitude of knowledge, realists, therefore, sought an objective foundation for knowledge which they associated with permanence or what they took to be an ontological necessity. Otherwise, they opined, a contingency of being would only lead to incertitude in knowledge. So as a way of seeking permanence, realist philosophers asserted that abstract universal concepts constitute necessary knowledge. Furthermore, they maintained that perceptual knowledge is only achieved by attaining an abstracted image or a form in the mind, and which means that quiddity as a universal was considered to be an extramental entity that is duplicated in the mind by way of passive correspondence.

On the other hand, realists in the mould of Avicenna, such as Ṭūsī, claimed that human knowledge involves the inscription (*intibāʿ*) of a phantasm (*shabaḥ*) or an apparition (*mithāl*) from the known (*al-maʿlūm*) in the mind³⁷. Given that they held that the quiddity exists in the object, they further asserted that if the quiddity itself was transported to the mind then the mind would take on the attributes of the quiddity, because they held onto a necessitarian outlook that states that causal quiddity is always associated with its effects, otherwise the existence of the cause would not mean the existence of the effect, and this for them resulted in a breakdown of the relations that yield certitude of knowledge. Hence, these philosophers associated themselves with the belief that the phantasma or the apparition of the quiddity is what exists in the mind with different effective concomitants to that of the quiddity. The phantasma approach, however, was not satisfactory to those that insisted on the existence of the quiddity in the mind, for they argued that if the proofs of mental existence hold then this implies that the things themselves, i.e. their quiddities, are in the mind and not their apparition. The phantasma way of the empirical realists, and which is promoted by Ṭūsī, was, therefore, generally rejected for its quiddity dualism as a result of the distinction it made between the objects and their mental representation.

Furthermore, realist philosophers, such as Ṭūsī, maintained a theory of abstraction for the acquisition of universals from the particulars that held that knowledge as an accident of the human psyche is an abstract mental form. Therefore, they argued that the human psyche, being a receptacle of an abstraction, is also itself an abstract entity. This, consequently, opened up a doorway for mystical idealists, who although continued the idea of knowledge as the casting of an outside form,

³⁷ Qushjī, *Sharḥ al-Tajrīd*, fol. 281.

nevertheless, they attempted to overcome the dualism associated with Avicennan philosophers by holding that the abstract psyche accesses the abstract form from another place other than the mind. Consequently, mystical idealists, and realists more generally, held that *naḥs al-amr* (actual fact) was in accordance with an outside parallel existence that is known through a matching heuristic (*muṭābaqah*), contrary to any subjective process that would be founded in mental consideration (*i'tibār mu'tabir*) or subjective imposition (*farḍ fāriḍ*)³⁸. In fact, the rise of the philosophy known as *al-ḥikmah al-muta'āliyah* or Transcendental Theosophy in later periods is in many ways an extension of such a mystical idealist position on knowledge. But the theory of mystical idealism that knowledge or mental forms match that which is known in the outside (*al-'ilm mutābiq li al-ma'lūm*), actually eliminates the subject as the third element in the formulation of knowledge, i.e. rather than being a subjective connection between the knower and his known concepts, knowledge is rather considered to be identical to the known. Ṭabaṭabā'ī describes this position as being common to all those whom he calls *ḥukamā'*, i.e. mystical idealists of the aforementioned philosophy, also known as being followers of Suhrawardi.

But despite their rejection of dualism, mystical idealists, consequently, claimed that what exists in the mind are the things themselves, and so they held that the only way knowledge of the object could be acquired is if the known was itself united with the knower, in such a way that the quiddity of the object would exist in the mind of the knower without any reliance on the senses. They claimed that the knowledge produced by such nonsensory mysticism is called *ḥudūrī* (presentational) in relation to an immediacy of presence. This group, therefore, tried to overcome the difficulty of the

³⁸ Tahānawī supports such a realists approach to *naḥs al-amr* (actual fact), whereby he says, “*laysa muta'alliqan bi farḍ fāriḍ aw i'tibār mu'tabir siwā'an kāna faraḍan ikhtirā'īyan aw intizā'īyan*” (Tahānawī, *Kashshāf* ..., 1769).

phantasm by holding that there exists only one quiddity, which is both in the outside object and in the mind. So while overcoming quiddity dualism, they, however, fell into the trap of existence dualism by holding that empirical knowledge is divided into the two categories of *ḥuṣūli* (representational) and *ḥudūrī* (presentational). They, consequently, used extramental (*khārijī*) and mental (*dhihnī*) categories as a duplication of the quiddity's existence.

In addition, realists whatever their persuasion, i.e. whether empirical or mystical, Greek or Persian, considered that *a priori* knowledge was universal knowledge, and so they ultimately overlooked the immediacy of the contingent particular and the subjectivity of the human knower. On this William James, the 19th century American pragmatist, commented in his *The Principles of Psychology* by saying:

From every point of view, the overwhelming and portentous character ascribed to universal conceptions is surprising. Why, from Plato and Aristotle, philosophers should have vied with each other in scorn of the knowledge of the particular and in adoration of that of the general, is hard to understand, seeing that the more adorable knowledge ought to be that of the more adorable things and that the [material] things of worth are all concretes and singulars. The only value of universal characters is that they help us, by reasoning, to know new truths about individual things.³⁹

On the contrary to the realists, under the worldview of *kalām*, as a philosophy of science, the necessitarian assumptions of realism were abandoned when al-Ash'arī overhauled the standing realist theory of knowledge that was advocated by the *falāsifah* and the Mu'tazilites of his time. Al-Ash'arī did so by introducing two major philosophical breakthrough themes:

(1) Subjectivism was given its rightful place within a theory of knowledge when al-Ash'arī asserted that knowledge is not a form (*ṣūrah*) from the known object, but is rather a contingent relation (*idāfah*) that is established between the knower and the known.

³⁹ William James, *The Principles of Psychology* (NY: Cosimo, 2007), vol. 1, 479-480.

(2) *A priori* knowledge was subjectively defined to imply ‘involuntary’ knowledge (*ilm ḍarūrī*) or one that a human attains empirically from the senses (both external and internal), involuntarily and without any wilful choice. This, therefore, gave empirical intuition its place within a theory of *a priori* knowledge that focuses on the particular (*juz’ī*) and the contingent (*mumkin*).

Consequently, we hereby find an alternative worldview to a realism that had made the unscientific assumptions of necessitarianism, determinism and objectivism, which only resulted in a speculative methodology. On the other hand, constructivism, which makes no such assumptions, is founded upon physical contingency and subjectivism and consequently arrives at *a priori* knowledge as a constructed endeavour without the need for a fallibilist scheme by which one - to no avail - sets out to verify what had been hypothesised to be a parallel copy of reality.

Ṣadr al-Sharī‘ah, the aforementioned universalist, for example, in his *Kitāb Ta‘dīl al-‘ulūm* says that *nafs al-amr* (actual fact) are *al-umūr al-khārijīyah* (outside matters), whereby all the *māhīyāt al-dhihnīya* (mental quiddities) are *muntaza‘ah* (empirically derived) from it. He, thus, confirms in the same empirical spirit as Qushjī that quiddities are *dhihnīya* (mental) and he gives them an extramental foundation to which *al-aḥkām al-ṣādiqah* (true judgements) conform. In fact, he clearly states in a constructivist spirit that the meaning of ‘truth’ (*ṣidq*) in relation to ‘actuality’ (*fī al-nisbah al-thubūtīyah*) is:

That a thing in the outside is conceived as occurring whenever a predicative relation [between concepts] is established in the mind, and this thing could be with no mediation as when both of the two sides are primary intelligible like we have with the saying “Zayd is a writer”. The thing could also be through mediation, as we have when either of the sides or both of them are constructed intelligibles taken from the primary intelligibles that are based on the extramental existents, as in the saying “human is universal”.^{40, 41}

⁴⁰ Ṣadr al-Sharī‘ah, *Kitāb Ta‘dīl al-‘Ulūm*, MS (Istanbul: Suleymaniye Kutuphanesi, H. Husnu Pasa Col.).

⁴¹ Ibid. *An yaḥṣul fī al-a‘yān shay’ ‘inda al-nisbah fī al-dhihn wa huwa qad yakūnu bilā wāṣiṭah kamā idhā kāna kull min al-ṭarafayn min al-ma‘qulāt al-uwal ka qawlika zayd kātib wa qad yakun bi wāṣiṭah*

Therefore, comments such as those that appear in Qazwinī's *Ḥikmat al-ʿAyn* on his discourse on mental existence⁴² while are right in identifying that the dispute over the issue stems from the different understandings of what knowledge is, however, they fall short in restricting the dispute to two groups namely the *falāsifah* as advocates of mental existence and the *mutakallimūn* as deniers. Arguably, in their subjective approach to knowledge the *mutakallimūn* were the first proponents of mental existence as they opened up the way for the retaining of concepts and ideas which do not appear in the outside in contrast to the Greek realist philosophy, which treated universal forms as independently existing entities. In its basic form the realist theory of “the obtainment of the form of the known in the mind” (*ḥuṣūl ṣūrat al-maʿlūm fī al-dhihn*)⁴³ does not require any subjective involvement that would justify being considered as a form of subjective existence in the mind as the driving philosophy behind such as theory relates to a passive mind that acts merely as a mirror upon which outside images are cast. Therefore, what the early *mutakallimūn* were opposing in denying mental existence was in fact the *falāsifah*'s dualism, which says that objects have a duality of existence. In fact, later *mutakallimūn* after Rāzī, who accepted mental existence while denying dualism, were in fact giving rise to a theory of mental existence that is at once subjective, conceptual and empirically constructive.

kama idhā kāna aḥad al-ṭarafayn aw kilāhumā min al-maʿqulāt al-nāshīʿah ʿan al-maʿqulāt al-uwal al-nāshīʿah ʿan al-mawjudāt al-khārijīyah ka qawlika al-insān kullī.

⁴² Qazwini (*Ḥikmat al-ʿAyn*, 49) as discussed in Mohd Zaidi Ibn Ismail's, “Existence (al-Wujūd) and Its Relation to Quiddity (al-Māhīyah) in the Later Ashʿarite *Kalām*” (Ph.D thesis, International Islamic University Malaysia: International Institute of Islamic Thought and Civilisation, 2005).

⁴³ Ibid.

I.1.3.2 Rāzī's Shadowy Existence

Of the *mutakallimūn*, who reform the phantasma theory, Rāzī puts the first comprehensive alternative methodology of knowledge by shifting the quiddity to the subject to exist in the mind not as a replication (*muṭābaqah*) with the outside but rather as being unique to the mind. He, consequently, presented his solution by way of distinguishing between essential (*‘aynī*) existence and shadowy (*zillī*) existence as a comprehensive distinction between the outside and that in the mind. He did so without dividing the mental into primary and secondary qualities as commonly happens under philosophic dualism. In other words, this now meant that the *ṣūrah* (cognitive form) is considered to be in the mind as a quiddity existing with a shadowy existence (*wujūd zillī*). Further, this also implied that the effective concomitants (*lawāzim*) such as heat and coldness are not shared with the essential existence (*wujūd ‘aynī*) in the outside.

To clarify the point of subjectivity further, we observe that Rāzī makes a distinction between the *ṣūrah* that is an accident inhering in the mind and that which is universal and occurring in it. In fact, this subjective approach to mental existence closely resembles that of Qushjī's constructivist elaborations, as we see in point (iv) below, and the distinction he makes between *al-ḥuṣūl* (occurrence) and *al-qiyaṃ* (establishment) in the mind. In *Risālat Taḥqīq al-Kullīyāt*, Rāzī says that the *ṣūrah* applies to two meanings:

The first is a quality (*kayf*) that takes place in the mind as a tool or a mirror to observe that represented by the *ṣūrah* (cognitive form) ... There is no doubt that the form with this first meaning is individual; in an individual psyche ... [The second meaning Rāzī speaks of is] the known that is made distinct by way of this [the first] form in the mind ... Further, universality does not apply to the form of the animal [for example] that is an accident that inheres in the intellect rather [it applies] to the animal that is distinguished in the mind ... The form that occurs in the intellect is identical to various matters ... Therefore, the two mentioned meanings for the form are different in quiddity.⁴⁴

⁴⁴ Tāshkubrīzāda, *al-Shuhūd ...*, 105. *Kayfīyah taḥṣul fī al-‘aql ka al-ālah li mushāhadat dhī al-ṣūrah ... wa lā shakk anna al-ṣūrah bi al-ma‘nā al-awwal ṣūrah shakhṣīyah; fī nafs shakhṣīyah ... ma‘lūm al-*

Rāzī's position on mental existence is relayed in Tashkubrīzada's *Risālat al-Shuhūd al-ʿAyni fī Mabāḥith al-Wujūd al-Dhihnī*⁴⁵, under the chapter on the defence of *al-wujūd al-dhihnī*, he states Rāzī's opinions as they appear in the *Mulakhkhaṣ* and follows them by Qushjī's objection and solution from *Sharḥ al-Tajrīd* under the heading “*wa i ʿaraḍa ʿalayh ba ʿd al-ʿulamā*” (some scholars objected to his [Rāzī's] views) and in a gloss on the *Risālah* the words “*mawlānā ʿAlī al-Qushjī*” appear. Rāzī refers to the idea of *al-wujūd al-zillī* for the *māhīyāt* in the mind in contrast to its essential (ʿaynī) existence to which the effects, such as heat, are ascribed (*mawṣūf*). The essence or core of the heat (*māhīyāt al-hararah* with *wujūd ʿaynī*) is not allowed to occur in the mind and the same is for the rest of the examples raised.⁴⁶ Rāzī considers that the place of heating is due to the *lawāzim* (concomitant effects) of the extramental existence (*al-wujūd al-khārijī*). He presents his theory of *al-wujūd al-aṣīl* (genuine existence) and *al-zillī* (shadowy) in his attempt to defend both *a priori* knowledge as well as the subjectivity of universals being in the mind given that the *mutakallimūn* did not believe in the extramentality of universals. Contrary to the realists on mental existence, the *mutakallimūn* rejected the theory of *al-ʿaql al-faʿāl* (Active Intellect) or that of *al-mabādiʿ al-ʿāliyah* (Transcendental Principles) or any other form of mystical idealism⁴⁷, therefore, mental existence for them became associated with a pure subjectivism. In this way, the theme of *al-wujūd al-dhihnī* (mental existence) was raised by the *mutakallimūn*, in contradistinction to the *falāsifah*, in order to present a theory of

mutamayyiz bi wāsiyat tilka al-ṣūrah fī al-dhihn ... fa inna al-kullīyah laysat taʿruḍ li ṣūrat al-ḥayawān al-latī hiya ʿaraḍ ḥāl fī al-ʿaql bal li al-ḥayawān al-mutamayyiz ʿinda al-ʿaql ... al-ṣūrah al-ḥāṣilah fī al-ʿaql muṭābiqah li umūr kathīrah ... fal al-maʿnāyayn al-madhkūrān li al-ṣūrah mukhtalifan bi al-māhīyah.

⁴⁵ Ibid.

⁴⁶ Tāshkubrīzada relates this opinion to al-Imam al-Rāzī in *al-Mulakhkhaṣ* (Tāshkubrīzada, *al-Shuhūd ...*, 90).

⁴⁷ Ibid., 82.

knowledge that conforms to their outright rejection of all nonsensory ideas of forms, or what was known as *'ālam al-mujarradāt* (world of abstractions), which the Neo-Platonic philosophers promoted.

In this way, mystical idealists, who stood as opponents of empiricists, i.e. proponents of the particularity of knowledge, believed that the things (*al-ashyā'*) are themselves in the mind, while their lack of effective concomitants (*lawāzīm*), such as heat and coldness, was due to a weaker gradation or degree of existence and not one that was distinctively different as was the case with the *mutakallimūn*'s subjective approach to the *zillī/ 'aynī* distinction. Arguably, however, by adopting this distinction Rāzī's theory maintained that reality was itself defined in the outside and was only interpreted subjectively by the mind, which is a step that did not go the full constructive way, and which was undermined by Qushjī's example of the quiddity of the extramentally non-existing evenness and oddness. Rāzī's position is, therefore, contrasted to Qushjī's elaborations, which indicate that the quiddity or the concept of understanding is by way of *ittiṣāf ishtiḳāqī* (derivational attribution) and not by *ḥaml tawāṭu'ī* (co-occurring predication). The significance of this is that Qushjī is now free to define reality from the subjective foundation of human understanding as opposed to the ontologically speculative basis of realism. Therefore, Rāzī's reversal of the essentialist dualism of the phantasma into an existentialism opens up a subjective doorway in the theory of knowledge that ultimately results, after some elaborations, in Qushjī's final development of the normative theory of constructivism.

I.1.3.3 Post-Rāzīan Deliberations

In the post-Rāzīan era, i.e. the thirteenth and fourteenth centuries, we see a continuation in the *mutakallimūn*'s attempts to better clarify the distinction between non-mental

existence and mental existence along subjective lines and without adopting the mystical idealist position of having things themselves in the mind, i.e. they did so by maintaining the associational approach to knowledge as the relation between the knower and the known.

I.1.3.3.1 Empiricism vs. mysticism: Ījī and his commentator Jurjānī

Within the pre-Qushjān era we witness an amendment to the wording of the Rāzīan position, which now considers essential existence (*al-wujūd al-‘aynī*) as the ipseity or the identity (*huwwīyah*) and the shadowy existence (*al-wujūd al-ẓillī*) as the universal quiddity (*māhīyah*) in the mind. In fact, it was Ījī who considers in *al-Mawāqif* the occurrent (*al-hāṣil*) in the mind as the universal form (*ṣūrah kullīyah*), whereby the quiddity of the ipseity (*māhīyāt al-huwwīyah*) is not equivalent to the ipseity itself, because the quiddity is universal while the ipseity is particular (*juz ‘īyah*)⁴⁸. Ījī, thus, made the distinction between, “A form and a quiddity that exist with a shadowy existence and an extramental core ipseity that exists with a real existence”⁴⁹.

Similarly, in his own commentary on Ṭūsī’s *Tajrīd*, Jurjānī says⁵⁰ that if that pictured in the mind was the ipseity then this would lead to that which doesn’t have an existence in the outside (*al-mumtani‘*) having an ipseity which is mere sophism (*safsaṭah*). On the other hand, if it were the quiddity then this is what is meant by mental existence, as it confirms a type of discrimination for the intelligibles that is different to discrimination by ipseity and which we call external existence. Furthermore, the quiddities, i.e. the mental existents, are either considered to be empirically constructed

⁴⁸ Mohd Zaidi Ibn Ismail, “Existence (al-Wujūd) and Its Relation to Quiddity (al-Māhīyah) in the Later Ash‘arite *Kalām*” (Ph.D thesis, International Islamic University Malaysia: International Institute of Islamic Thought and Civilisation, 2005), 97.

⁴⁹ (al-Jurjānī, *Sharḥ al-Mawāqif* ..., 1: 263):

صورة وماهية موجودة بوجود ظلي وهوية عينية خارجية موجودة بوجود أصيل.

⁵⁰ Mohd Zaidi Ibn Ismail, Existence (*al-Wujūd*) ..., 79.

by the mind (*ikhtara 'ahā al-dhihn*) as held by the *mutakallimūn* or viewed from another place, as we saw earlier, and which is held by the opposing mystical idealists, such as Ījī's commentator; Jurjānī⁵¹. In a rather more mystical than empirical approach, Jurjānī states in his same *Sharḥ al-Tajrīd*, as relayed by Tashkubrīzada⁵², that *al-dhihn* (the mind) could mean transcendental principles (*al-mabādi' al-'āliyah*) on its own whereby epistemic unveiling (*al-inkishāf al-'ilmī*) happens by way of the casting of forms of the intelligibles (*irtisām ṣuwar al-malūmāt*) in a substance (*fī jawāhir*) other than the psyche (*al-nafs*) and from where it is observed (*yalḥāzuhā min hunāk*).

Consequently, in relation to Rāzī's distinction, given above, on the two meanings of form, Jurjānī disagrees with Rāzī's empiricism in his gloss on *Sharḥ al-Maṭāli*⁵³, whereby, after quoting Rāzī's position, he states that this would imply that “the casting in the mind from the thing is not its quiddity but its image and its corresponding form, which are in reality different to the quiddity ... This [position] is therefore nothing [i.e. of no validity], as it requires that things do not have a mental existence except by way of metaphoric interpretation”⁵⁴. He, therefore, rejects Rāzī's subjective position after misconstruing it as an empirical realist stance inline with the phantasma approach of the Avicennan philosophers. Jurjānī further adds that the proofs given for mental existence imply that what is established in the mind is the quiddity itself and not its like. Jurjānī, thus, in a realist fashion retains the idea that the quiddity is obtained from the outside where it exists with an essential (*'aynī*) existence and which is then mystically attained in the mind where it resides with a shadowy (*zillī*) existence.

⁵¹ Tashkubrīzada, *al-Shuhūd al-'Aynī*, 78-87.

⁵² Ibid.

⁵³ *Maṭāli' al-Anwār fī al-Ḥikmah wa al-Mantiq* is by Maḥmūd Sirāj al-Dīn al-'Armāwī (d. 1283). He was a Shāfi'ite scholar of *uṣūl* and logic. He died in Konya.

⁵⁴ *Al-murtasim fī al-'aql min al-ashyā' laysa māhīyātiha bal ṣuwarīhā wa ashbāhīhā al-mukhālifah fī al-ḥaqīqah li māhīyātihā ... wa laysa bi shay'in idhan yalzamuhu an lā yakūn li al-ashyā' ḥīna-idhin wujūd dhihnī illā bi ta'wīl majāzī.*

Typical of other mystical idealists, he, therefore, considers that the *ṣūrah* in the mind is both a universal (*kullī*), i.e. the known, and one that it inheres (*hāll*) in the mind, i.e. knowledge. He remarks, “The form that occurs in the mind - if stripped from the specifications that follow its inhering in a specific psyche - matches many others. As to the saying that the animalistic form is an accident, that is invalid, because the form is the [universal] quiddity of the animal”⁵⁵. Tashkubrīzāda comments on this by saying, “what he wanted from this is that the form and that represented by the form are identical in quiddity”⁵⁶, thus confirming Jurjānī’s mystical streak, which eliminates the particular subject from epistemic formulation by regarding knowledge, an attributive quality of the psyche, as being universal.

Pushing in the opposite direction, however, i.e. towards empiricism, was Ījī, who asserted, as we saw earlier with his elaboration on constructive semantics under ‘*ilm al-waḍ’*, that that which is known in the mind is a universal. He bases that on the idea that the human knower constructs his universals in the mind. Otherwise, he maintained, had the universals been transported from the outside as Plato and Aristotle and the proponents of the phantasma held then the known in the mind would be a particular and not a universal. In this way, Ījī avoids the realist path that leads to dualism and further clarifies the position of the *mutakallimūn*, which holds mental existence as a distinct realm of concepts and ideas and not one that runs a duplicated parallel to an outside existence. We see this with Ījī’s following clarification:

The mental image constitutes what is knowledge and what is the known, and if you need further elucidation then listen [to this]; is it not [the case] that if the known was some matter behind what is in the mind, then its occurrence would be in the outside, and so it would be a particular, therefore, negating [its] universality? This is so except if the conceptualised matters were considered to

⁵⁵ *Inna al-ṣūrah al-hāsilah fī al-‘aqilah idhā ukhidhat mu‘arrāt ‘an al-tashakkhuṣāt al-‘aridah bi sabab ḥulūlihā bi nafs shakhṣīyah kanat mutabiqah li al-kathīrīn. wa ammā al-qawl bi anna al-ṣūrah al-ḥayawānīyah ‘araḍ fa bāṣil li anna tilka al-ṣūrah māhīyāt al-ḥayawān.*

⁵⁶ *Wa arāda bi dhālika kawn al-ṣūrah wa dhī al-ṣūrah multaḥiqayn bi al-māhīyah.*

be [mystically] cast in [something] other than the intellect, but this negates [it having] mental existence [in the first place].⁵⁷

A clear difference between Ījī and Jurjānī, as it appears in his commentary below on the above passage, is that while Ījī says that the mental form (*al-ṣūrah al-dhihniyah*) constitutes knowledge and the known and mentions nothing about the same form being both the knowledge and the known, Jurjānī holds to a more mystical idealist position by claiming that the two are identical in essence (*mutasāwiyyayn bi al-dhāt*), which means that for him knowledge takes place when that known inheres in the knower. In this way, therefore, the universal in the mind is no longer a mental aid (*ālah*) for individuation of particular knowledge, as Ījī held with his theory of semantics, but rather is taken to problematically claim the universality of knowledge itself. In commentary on Ījī's above passage, Jurjānī says:

The mental image constitutes knowledge and the known and this is so because we rationalize what is merely negative and what is purely non-existent in the outside, and there is no doubt that if we knew such a matter then there would be between us and it an association and a specific relation. Further, it is not conceivably achievable for a relation to be except between two distinct matters and there is no distinction generally except with the affirmation of each of the two distinct matter. Consequently, if that known is not in the outside [as being non-existent] then it would be in the mind. Therefore, the mental image is the quiddity of the known and accordingly knowledge and the known is united in essence, in which case it is required that that which is described with universality is the rational image. In addition, what has been said in that the described with universality is not the image but rather what is known by way of it is [also] invalidated ... [In fact] those that affirmed the mental image are two groups. One group [which Jurjānī supports] claims that the image is identical in quiddity to the known matter, where the images are the quiddities of the known facts, due to them occurring in the psyche, whereby the knowledge and the known are united in essence, while being different by way of mental consideration as has been said. According to the saying of these people, things would [therefore] have dual existence; an existence in the outside and an existence in the mind ... Another group [which he accuses the empirical *mutakallimūn* of] alleges that the rational images are [only] likes and phantasmas to the matters known by it

⁵⁷ Jurjānī, *Sharḥ al-Mawāqif*, 2:69:

الصورة الذهنية هي العلم والمعلوم وإن كنت تحتاج إلى زيادة بيان فاستمع أليس إذا كان المعلوم أمرا وراء ما في الذهن كان حصوله في الخارج فيكون شخصا وهو يناهي الكلية اللهم إلا أن يصار إلى أن الأمور المتصورة لها ارتسام في غير العقل وهو يناهي الوجود الذهني.

and which are different to it by quiddity. By their saying, things do not have a mental existence in reality rather only metaphorically and by way of interpretation. For example, it might be said that fire exists in the mind to mean that a phantasma of it exists in it, which has a specific association with the quiddity of the fire, so that the phantasma constitutes knowledge of the fire and not any other quiddity.⁵⁸

As problematic as a confession of dualism is, in Jurjānī's comments, we, however, find that the issue of the conceivability of the non-existent (*'adam ṣarf*) is raised as proof for the mental existence of the known in order to also subjectively hold what by definition does not exist in the outside. In this proof, which as mentioned above is said to have been first raised by Rāzī, we note clearly that the conceptual object of the mind is in no way a replication of an outside object as the theory of forms (*ṣuwar*) holds, but rather the mind conceives of ideas and concepts that do not in themselves exist in the outside despite being derived from actuality to serve as descriptors (*ittiṣāf ishtiḳāqī*) and not as co-occurring predicators (*ḥaml tawāṭu 'ī*)⁵⁹. In fact, the theme of the non-existent (*al-ma 'dūm*) and its place within a constructivist theory of *a priori* knowledge plays a crucial part in uncovering the real position that mathematical objects as non-existents occupy within a constructive physical theory. As we later discuss, such a development in *kalām* comes to full fruition under Qushjī's foundations of science and his constructive astronomical modeling.

⁵⁸ Jurjānī, *Sharḥ al-Mawāqif*, 2:73-4:

الصورة الذهنية هي العلم والمعلوم وذلك لأننا نعقل ما هو نفي محض وعدم صرف في الخارج ولا شك أنا إذا علمناه حصل بيننا وبينه تعلق وإضافة مخصوصة ولا يتصور تحقق النسبة إلا بين شيئين متميزين ولا تمايز إلا مع ثبوت كل من المتمايزين في الجملة وإذ ليس المعلوم ههنا في الخارج فهو في الذهن فالصورة الذهنية هي ماهية المعلوم فقد اتحد العلم والمعلوم بالذات ووجب أن يكون المتصف بالكلية هي الصورة العقلية وبطل ما قيل من أن المتصف بالكلية ليس هو الصورة بل المعلوم بما ... فلا يصح نفي الكلية عن الصور وإثباتها للمعلوم بما ... قيل القائلين بالصور فرقتان فرقة تدعي أن تلك الصور مساوية في الماهية للأمور المعلوم بما بل الصور هي ماهيات المعلومات من حيث أنها حاصلة في النفس فيكون العلم والمعلوم متحدين بالذات مختلفين بالاعتبار كما مر وعلى قول هؤلاء يكون للأشياء وجودان وجود خارجي ووجود ذهني وتكون الكلية عارضة للصور العقلية حقيقة لأنها ماهيات المعلومات المحمولة على أفرادها وفرقة تزعم أن الصور العقلية مثل وأشباح للأمور المعلوم بما مخالفة لها في الماهية وعلى قولهم لا يكون للأشياء وجود ذهني بحسب الحقيقة بل بحسب المجاز والتأويل كأن يقال مثلا النار موجودة في الذهن ويراد أنه يوجد فيه شبح له نسبة مخصوصة إلى ماهية النار بسببها كان ذلك الشبح علما بالنار لا بغيرها من الماهيات.

⁵⁹ For clarification on the difference between the *al-ḥaml al-tawāṭu 'ī* and *al-ittiṣāf al-ishtiḳāqī* please refer to our previous discussion on fol. 11, where Qushjī compares between the two concepts.

Furthermore, Ījī's crucial distinction between knowledge, itself a quality, and that which is known of universal mental concepts, which clarifies Rāzī's earlier subjective position in the lead up to Qushjī's great synthesis, is perhaps made more explicit with Ījī's following comment:

The particulars are singulars whose forms are not cast in the psyche itself but rather in its tools ... This is in contrast to the genera forms and its like for they are universal matters that occur as varying quiddities which are cast in the intellect and the particulars [of a shared quiddity] occur as ipseities that are drawn in the senses while their quiddity is one.⁶⁰

Ījī asserts that the intellect does not compete with the senses as part of the physical world, and, therefore, the forms of the mind are universal, while the particular (*mushakkhkhashah*) forms occur in the senses. In claiming to offer intuitive or *a priori* knowledge, mystical idealists use the cover of the intellect in order to compete against empiricism and in particular against constructivism as a process for pure empiricism. Consequently, our discussion above contributes to settling the debate on whether Ījī was an empiricist *mutakallim* in line with Ash'arī's and Rāzī's schools, or a mystical idealist philosopher, as Jurjānī's position indicates.

I.1.3.3.2 The way to constructivism: Taftāzānī's elaborations

Taftāzānī's constructivist spirit emerges in a clearer form than that of his post-Rāzīan predecessors. The following comment demonstrates this point. Taftāzānī says:

The form [occurring in the mind] could be taken to imply the occurrence itself and in this way it would be an accident that inheres in the psyche and occurs in it with a genuine and descriptive occurrence that exists with an essential existence like the rest of its [psychic] attributes. Alternatively, it could be taken to imply something other than the occurrence and in that case it would be a the form and quiddity of the actual existent which could be an independent substance that is not attributive of the psyche, nor does it occur to it in any genuine way. In this regard, the form would be a concept that is only verifiably established in the

⁶⁰ Jurjānī, *Sharḥ al-Mawāqif*, 1:317:

المشخصات أمور جزئية لا ترسم صورها في ذات النفس بل في آلاتها ... بخلاف صور الفصول وما فإنها أمور كلية تحصل ماهيات متخالفة تنطبع في العقول والمشخصات تحصل هويات ترسم في الحواس مع كون الماهية واحدة.

mind and to be termed as that which is known (*al-ma'lūm*) is allowed, because commonly the known is used for that which is implied by the mental form and not the form itself ... The known ... which is that which has an actual existence is not described with universality except to imply that which occurs from it in the mind is a universal.⁶¹

Taftāzānī, for the first time in the tradition of *kalām*, speaks explicitly of the form as a subjective concept (*mafḥūm*) that exists only in the mind without any correspondence to a parallel existence in the outside. Nevertheless, certain difficulties are raised against his incomplete position despite its individuation theory, as he continues to assert that the known is itself the object in the outside. In this way, the issue of the non-existent (*al-ma'dūm*) with its crucial mathematical dimension remains unresolved within Taftāzānī's theory of knowledge. To clarify this further, we quote a passage from Taftāzānī's *Sharḥ al-Maqāṣid* in which he states:

(The *mutakallimūn*) meaning that those who did not assert mental existence and the occurrence of the form in the mind, posited that knowledge is either a relation or an association between the knower and the known or a description which has such a relation ... A difficulty was raised against them on the knowledge of one's self whereby an association is only conceivable between two things. The response was that the mental differentiation is enough, as has been relayed, for the occurrence of one thing for another. It is true, that a difficulty [also] arises against them on the knowledge of the non-existents (*al-ma'dūmāt*) among the contingent matters, such as the many geometric figures and those matters that are intellectually incoherence (*al-mumtana'āt*), as these matters do not exist in the outside, and so if it were not verifiably established in the mind as well then no relation would be conceived between these matters and the knower. Further, what is said of the possibility of its verification as independently existing entities, as it is held in Plato's view or as some other form of non-empirical body, then that is invalidated by way of empirical *a priori* knowledge. We do not submit to the saying that this issue is resolved by [merely] affirming a mental form in the case of the non-existents. We say [to that] that cognition has one meaning that only varies in its relation to the cognitive content (*al-mudrak*), and if this *mudrak* is known to be other than the relation in one case then that is known absolutely [for all cognitive cases] ... So we say there is nothing in the mind except one thing, which is the cognitive form, and the

⁶¹ Taftāzānī, *Sharḥ al-Maqāṣid*, 1: 441:

الصورة قد تؤخذ من حيث أن الحصول نفسها فتكون عرضا قائما بالنفس حاصلا لها حصولا متأصلا اتصافيا فيكون موجودا عينيا كسائر صفاتها وقد تؤخذ من حيث أن الحصول غيرها فيكون صورة وماهية للموجود العيني الذي ربما يكون من الجواهر فلا تتصف النفس بما ولا هي تحصل للنفس حصولا متأصلا وهي بهذا الاعتبار مفهوم لا تحقق له إلا في الذهن وإطلاق المعلوم عليها تجوز لأن المعلوم ما له صورة في العقل لا نفس الصورة ... المعلوم ... أعني الموجود العيني فلا يتصف بالكلية إلا بمعنى أن الحاصل منه في العقل كلي.

meaning that it is a form for the non-existent is that had it [i.e. the form] been verifiable in the outside along with its non-existent object, then that form would have been its form. In addition, by way of its establishment in the mind and its occurrence in it, it is knowledge that the psyche is described with, and by way of its essence and its mental existence, I mean other than the consideration of its inherence in the mind, it is the known which has no essential existence [in the outside]. Consequently, this is contrasted to the existent [in the outside] as that has knowledge existing in the mind and the known associated with it existing in the outside, as has been reported.⁶²

On the crucial issue of the non-existent (*ma' dūmāt*) in relation to mathematical objects, Taftāzānī defends the subjective case for it by saying that had the cognitive form been verifiable in the outside along with the non-existent then the two would have been the same. However, this explanation hardly provides a solution to mathematical physics, as it treats mathematics as non-descriptive of reality by not having a genuine existence contrary to the physical objects which he considers to be verifiably real in the outside. Perhaps this approach explains why Taftāzānī did not have any known mathematical or astronomical works. This implies that ambiguities over an apparent duality of existence remained in Taftāzānī's theory of knowledge. Further, this seems to leave aspects of the epistemic question of reality open, despite him resolving many other difficulties that were left over by the Avicennan proponents of the phantasma. Similarly, we find that earlier Ījī had stated that given that non-existents are non-empirical, therefore, they would not be drawn in the sensory peripherals of the psyche and as such they are only mere imaginings (*mawhūmāt*). But in describing mathematics

⁶² Taftāzānī, *Sharḥ al-Maqāṣid*, 1: 441-2:

(قال والمتكلمون) يعني أن من لم يقل بالوجود الذهني وحصول الصورة جعل العلم إما مجرد إضافة وتعلق بين العالم و المعلوم وإما صفة لها تلك الإضافة ... فإن أورد عليهم علم الشيء بنفس ذاته فإن التعلق لا يتصور إلا بين شيئين أجيب بأن التغاير الاعتباري كاف على ما مر في حصول الشيء للشيء نعم يرد عليهم العلم بالمعدومات من الممكنات ككثير من الأشكال الهندسية والممتنعات ... فإنه لا تحقق لها في الخارج وإذا لم تتحقق في الذهن أيضا لم تتصور الإضافة بينهما وبين العالم وما يقال من إمكان تحققها قائمة بأنفسها على ما هو رأي أفلاطون أو غيرها من الأجرام الغائبة عنا فضروري البطلان في الممتنعات لا يقال غاية ما في الباب إثبات الصورة الذهنية في العلم بالمعدومات قلنا الإدراك معنى واحد لا يختلف إلا بالإضافة إلى المدرك والمدرك فإن علم أنه غير نفس الإضافة في موضع علم كونه كذلك مطلقا ... قلنا ليس في الذهن إلا أمر واحد هو الصورة ومعنى كونها صورة للمعدوم أنها بحيث لو أمكن في الخارج تحققها وتحقق ذلك المعدوم لكانت إياه ثم أنها من حيث قيامها بالذهن وحصولها فيه علم تتصف به النفس ومن حيث ذاتها وماهيتها العقلية أعني مع قطع النظر عن قيامها بالذهن معلوم له وجود غير متأصل وهذا بخلاف الموجود فإن العلم ما في الذهن و المعلوم ما في الخارج كما مر .

with expressions such as “*law amkana fī al-khārij taḥaqquqahā*” (had it been verifiably existent in the outside), Taftāzānī is indicating that he is extending the ‘known’ to cover the existent thing itself; widening by that the epistemic framework beyond what is empirically verifiable in itself. On the other hand, by reducing the framework of the ‘known’ to the cognitive concept alone, which are in fact empirical, Qushjī normalises the advances that Taftāzānī makes in order to structure *kalām*’s constructivist spirit within a comprehensive theory of knowledge.

It is ironic that while Taftāzānī asserts that cognition happens according to one process for all cognitive cases, he ends the above passage with the claim that the known in the case of the non-existent is the cognitive form as a mental concept, while in the case of the existent it is the existent itself, which he considers to be the known. In the next section, we see that in fact this last step is advanced by Qushjī who in doing so holds that the known is the cognitive concept (*al-mafhūm*) and he absolutely holds that to be the case for all cognitive experience. Qushjī, therefore, replaces the idea of forms (*ṣuwar*) in the mind with the cognitive concept (*mafhūm*) existing instead in the mind with no realist correspondence, turning by that the *mutakallimūn*’s constructivist origins into a normative constructivist theory of *a priori* knowledge that becomes a hinge for all future scientific advancement.

In summary, the challenge facing Ījī was how to obtain the universals from the particulars that are drawn in the sensory resources of the mind, and the solution was his learning theory as described in his earlier semantic discussions on ‘*ilm al-waḍ*’. On the other hand, the challenge for Taftāzānī was how to have a particular conceptual representation of the known thing in the mind that is considered to have an actual existence (*wujūd ‘aynī*). His answer was a theory for individuating (*tashkīṣ*) particulars from learnt universals. The way forward for Qushjī, which we now explore in detail,

was to merge the two streams in a philosophical synthesis that bridged the gap to scientific universalism by uniting the intellectual work of the deductionist Shāfi'ites of Shiraz with that of the inductionist Ḥanafites of Transoxiana.

I.1.3.4 Qushjī's Great Synthesis

Epistemological subjectivism means that knowledge is a relation (*ta'alluq* or *idāfah*) established between the knower and the known, therefore, implying that *kalām* as advocated by al-Ash'arī asserted a subjective theory of knowledge that is distinct from both empirical and mystical idealism. Mental existence is therefore extended subjectivism, and thus it could only be defended in its empirical constructivist form.

In what proceeds we focus on three issues that relate to Qushjī's breakthrough in the scientific foundations of knowledge. The first is the failure of the theory of his immediate predecessor *mutakallimūn*, who beginning with Rāzī, categorised knowledge into *'aynī* (essential) and *ẓillī* (shadowy) divisions. The second is a discussion on the semantics of existence and on that which exists in time or space not being attributive of time or space itself and its relation to the emergence of a non-attributive mental category of existence. The third and final issue relates to the place of the non-existent in the methodology of knowledge as the concept that only exists in the mind forms the foundation for our attribution and individuation of empirical existents.

(1) In pointing out the failure of the theory of his immediate predecessor *mutakallimūn*, which divides existence into essential (*'aynī*) and shadowy (*ẓillī*) types, Qushjī relies on the example of evenness and oddness as being concomitant effects of the quiddity (*lawāzim al-māhīyah*), while at the same time not having any essential existence (*wujūd 'aynī*), i.e. they are non-existent in the outside. What follows is that evenness does not fit into the formulation of *al-wujūd al-ẓillī* or shadowy existence, which was presented

as a general solution to overcome the problem of the phantasma in the face of those that consequently denied mental existence on the basis that had the quiddity existed in the mind, the mind would be attributed with its effects. In response, Qushjī states that evenness only exists in the mind, which implies its existence is not a *zillī* existence, but is rather one can only be described as being non-attributive (*ghayr ittiṣāfi*) to its substratum.

(2) With that point established, Qushjī uses the common semantic usage of the word *ḥuṣūl* (existence) in time and space to give the meaning of being a non-attributive existence. Qushjī argued that that which exists in time, for example, does not characterise time itself, and similarly that which exists in space. With this empirical evidence from language usage, Qushjī presents a solution to what mental existence could be without the need to be founded on a *‘aynī/zillī* (essential/shadowy) division. Qushjī, therefore, relies on the fact that mental existence is not descriptive of its substratum to base his answer on the linguistically accepted division of existence into that which is attributive (i.e. *qiyām*) and that which is non-attributive (i.e. *ḥuṣūl*). As a result, Qushjī defends the *ḥuṣūl* of the concepts (*maḥāhīm*) or the quiddities in the mind and not their *qiyām* in it. In doing so, he reverses the foundational order in the relation between the mind and the outside away from the realist assumption that the mental quiddities correspond to ones with essential existence in the outside to an alternative position that holds that mental concepts are the foundation for our individuated empirical knowledge. Further, with constructivism both the identification in time and the identification in space are achieved by a general process of individuation in the mind whereby both time and space are themselves considered as mental concepts that are learnt from experience. In this way, objects of sense perception are perceived by way of their mental characteristics (*tashakhkhusāt dhihnīyah*) based on our learnt concepts.

which leads to the idea that our empirical knowledge is subjectively constructed with a learning feedback mechanism that allows it to be progressive.

(3) Following on from the semantic division of contingent existence into that which ascribes the substratum (i.e. *qiyām*) and that which doesn't (*ḥuṣūl*), we note the place of the non-existent within this constructivist process as the mental concepts, which are themselves non-existent in the outside, form the foundation for the mental process of individuation (*tashakhkhuṣ dhihnī*) by which way we identify empirical existents. This understanding, thus, forms the basis for Qushjī's *ittiṣāf ishtiḳāqī* (derivational attribution), where such attribution is grounded in mental existents (i.e. concepts) as it applies to extramental contingent existents. Consequently, we further note that mathematical entities, as non-existents in the outside, also emerge with a foundational role within constructivism as being a specific type of relational concept that is learnt in the mind. *Qiyām* for empirical objects is used when the *qā'im bihi* (substratum) exists extramentally, but from the perspective of human understanding the *qiyām* attribution is founded upon the *ḥuṣūl* of the concepts in the mind to give us our empirical knowledge. Consequently, the breakthrough in scientific theory follows as a corollary when we realise that the foundationalism of the learnt mental concept also implies that from our perspective, reality as human understanding is itself based on the *ḥuṣūl* (existence) in the mind. Otherwise, under a correspondence theory of knowledge non-existents, such evenness, would not be considered real, nor would mathematical description of the empirical world be considered as such.

As we saw in the previous section, the path from Rāzī's *zillī/ʿaynī* division of existence to Qushjī's *tashakhkhusāt dhihnīyah* (mental individuation) or his *ḥuṣūl/ʿaynī* division of existence has been contributed to by many scholars from various schools and traditions. Qushjī, however, was the first *kalām* scientist to explicitly declare the

quiddity a mental concept (*mafḥūm*) that has no correspondence to a parallel quiddity, which is assumed to exist in the outside. This development has major effects on human understanding and on how we define scientific reality. Like in the case of his predecessor *mutakallimūn*, we again note with Qushjī that the issue of the *ma'dūmāt* (non-existents) was central to further unravelling the intricacies of *kalām*'s constructivist theory of *a priori* knowledge. The concepts of evenness and oddness not only serves as Qushjī's main case study for demonstrating the weaknesses of his post-Rāzīan predecessors, but it also serves as a crucial example to show how a cognitive quiddity can only be fulfilled within a subjective methodology that holds mental concepts to be without any correspondence with a parallel quiddity in the outside world. Consequently, Qushjī not only rejects the realist's process of abstraction of universals from particulars, but he also reverses their order by maintaining that universals are in fact learnt concepts that serve as *a priori* mental quiddities for the individuation of empirical *a priori* and other forms of constructive *a priori* knowledge.

I.1.3.4.1 *Dynamic Concepts vs. Static Forms*

Qushjī transforms the language prevalent in discussions on the theory of knowledge from that of *ṣuwar* (forms or images) to one that focuses on the *mafḥūm* (cognitive concept) instead. Mental existence, hence, becomes a matter of *ḥuṣūl al-mafḥūm* (conceptual occurrence) in the mind, as opposed to the realist's theory of correspondence that held that the *ṣuwar* existed within the physical realm, where the existence or *qiyām* of the quiddity in a thing means its attributive inherence in that thing. In fact, Qushjī altogether denies a place for forms (*ṣuwar*) within a constructivist methodology of knowledge, as neither knowledge, which is a specific relational quality nor the known mental concepts are forms that correspond to a parallel existence in the

outside. Qushjī is in line with Rāzī's definition of knowledge, which states that knowledge "is synonymous with a pure relation between the knower and that which is known to the knower without the need for the existence of a form"⁶³. Rāzī differentiates his definition from that of the *falāsifah* who say that "knowledge is an expression for the occurrence of the form of the known in the knower"⁶⁴. Consequently, the mind for Qushjī is part of an active construction of human knowledge as opposed to a passive place for duplicating forms from the outside.

Furthermore, mental existence (*al-wujūd al-dhihnī*) is not a substratum for *suwar*, human understanding instead is based on learnt concepts that exist in the mind. Mental existence is, therefore, a cognitive platform for dealing with the outside objects. Under this platform *'awāriḍ al-wujūd al-dhihnī* are the individuated features of the mind that are used to describe a particular existent, while the concepts themselves are considered to be *bi i 'tibār al-dhihn* (by the consideration of the mind) and not passively imported to the mind as duplicates. In other words, mental existence is not based on bifurcating existence into mental and outside existences in such a way that what is in the mind is a duplicate of the outside or even partly so, as such a division is the basis for dualism. Constructivism as an individuation process involves constructing a relation (i.e. knowledge) between a particular knower (*'ālim*) and the known universal concept (*al-ma'lūm*). Further, given that the psyche (*nafs*) is itself existent in the outside (*mawjūd fī al-khārij*), therefore, knowledge (*'ilm*) as a specific relational quality of the *nafs* (*kayfīyah nafsānīyah*), that inheres in it and is descriptive of it, is also an extramental existent (*mawjūd fī al-khārij*).

⁶³ العلم والإدراك عبارة عن إضافة محضة بين العالم ومعلومه من غير حاجة إلى وجود صورة

⁶⁴ قول جمهور الفلاسفة فإنهم يقولون: العلم عبارة عن حصول صورة المعلوم في العالم

I.1.3.4.2 Individuation vs. Abstraction

When *a priori* knowledge is constructed in the mind of a human knower, Qushjī asserts, two simultaneous matters could be ascertained in association with the mind; (1) a mental existent (*mawjūd fī al-dhihn*) as a known concept that conceptually occurs in the mind, and (2) an outside existent (*mawjūd fī al-khārij*) as a relational quality that descriptively inheres in the psyche - momentarily connecting the knower and the known concept as long as it is intentionally retained in consciousness. In saying two things occur at once, i.e. one in the mind (*al-ma'lūm*) and the other in the outside (*al-'ilm*), we are indicating that the universal concepts of the mind are accessed by way of individuating particular knowledge from these concepts, and which, therefore, acts as the window to these concepts, given that all human knowledge is in fact particular knowledge. This then links knowledge and the already known in a feedback cycle that updates the repertoire of concepts every time new constructive knowledge is experienced and which is itself founded upon the existing concepts at the time of construction.

As a consequence, the aim of having rational thought founded upon *a priori* knowledge is not satisfied by a realist philosophy that is based on abstracting the universals from the particulars, as this reduces rationalism to the acquisition of universal knowledge, while under constructivism the learnt universal concepts are themselves foundational to the individuation of empirical knowledge that then forms a foundation for rational acquired knowledge. Rationalism is, therefore, no longer considered to be a passive theory of logical deduction, but is rather one that encompasses the whole sphere of human accountability. In this way, we see the reverse of the abstraction process take place under individuation and what accompanies that from other reversals such as the universal being prior to the particular and the basic empirical knowledge being a building block for the rational process. In this way also, we note that the constructed

particular knowledge is not assumed to duplicate an outside existence in the mind, but it rather derives an attribution from the outside that fits into a human semantic scheme for understanding.

Therefore, rather than being the subject matter of rational knowledge, universal concepts under a constructivist philosophy are considered as mental concepts that have been learnt and that are retained in the mind. Further, with no necessitarian assumptions we find that contingency is a foundation for constructivism, therefore, automatically overcoming the ‘problem of induction’. Equally, we also find that the other problem of dualism, known as the ‘mind/body problem’, has also been resolved with the reversal of the process of abstraction into a process of subjective individuation by way of learnt mental concepts that define the boundaries of human understanding without the need for any correspondence theories of reality.

In the end, Qushjī’s universal concept is not a deterministic one, and it does not serve as a predictive tool. Rather, it serves as a mental aid in constructing particular *a priori* knowledge, whereby sensory data (internal and external) is individuated based on these known universal concepts. So instead of being a static form that is transported to the mind from the outside, with Qushjī the universals are subjectively learnt from repeat habitual occurrence. Consequently, Qushjī has no theory of abstraction of universal knowledge from particulars in the outside rather one of individuation of particular knowledge from universal concepts in the mind. In this way, there is no problem of correspondence as an actual object triggers the senses that trigger a mentally existing concept to act as an aid for instantiating or individuating particular knowledge. As we saw earlier, Qushjī’s reversal of the realist process into constructivism or abstraction into individuation was founded upon his subjectivist approach to knowledge as a relation (*idāfah*). In fact, Qushjī is the first known *mutakallim* to have described

kalām's theory of knowledge based on the idea of *tashakkhkhuṣāt dhihnīyah* (mental individuation), whereby learnt universal concepts serve as a foundation for the construction of knowledge about particulars, which are then conceived through the mental characteristics that form the basic units of human understanding.

[Folio 17] If it were said that it has been reported that there is no attribution between the quiddity and existence with regards to the outside, for example between whiteness and the body, rather this is only by way of the mind, how then do you make the quiddity attributed with existence in the outside? I say the effect of human ability is that it makes it so, whereby [in the process of perception] if a realiser were to realise it [in the mind], then he consequently finds it described with an external existence.⁶⁵

[Comment] Qushjī clarifies here his earlier position about the reversal of the order in the relation between the mind and the outside during the process of perception, whereby the mind uses the learnt mental concepts in order to characterise the perceived object. In this way, the concept whiteness, as the example given, and the concept body are considered separately in the mind and their combination is then added in the mind before we perceive the whiteness as being established in the body. Qushjī also speaks of human ability as covering the constructivist process that allows the human knower to realise concepts in the mind as a result of sensory data that allows the knower to individuate the object of perception with the conceptual characteristics of the mind.

[Folio 56] When it was truly the case that the receptiveness of the quiddity to existence and its attribution with it was in accordance with the intellect, and it was also sufficient for the occurrence of the receptive cause that its advancement

⁶⁵ See Appendix III, Figure III.9.

(*taqaddum*) is realised by intellectual existence, accordingly, we assert that its efficacy for existence is also by intellectual existence. Furthermore, we similarly state that the sufficiency of the occurrence of the efficient cause is also taken to be the case through the promotion of the quiddity by way of its intellectual existence, without having any advancement in accordance with outside existence. For example, the quiddity of four is an efficient cause for its evenness and there is no occurrence for it by way of an extramental existence.⁶⁶

[Comment] Qushjī follows the example of evenness not being existent in the outside to draw conclusions beyond mental concepts, to what is known as an efficient cause. He says that the quiddity of four is an efficient cause for its evenness and concludes that the occurrence of an efficient cause is conceived by way of the intellectual existence of its quiddity without an advancement in accordance with the outside existence. The implications, therefore, of constructivism upon our understanding of causality is very significant. We see in part III on the foundations of science, how such a new understanding of causality influences the methodology of science and the way we establish *a priori* knowledge as being involuntary knowledge without the reliance upon ideas of determinism or necessitarianism, which are assumed by the realists to be established in the outside world.

[Folio 59] Existence in the outside characterises the quiddity in itself as has been expressed and not the quiddity that exists in the mind. That which exists in the outside is not the quiddity that is existent in the mind. Further, existence is not only conceived as a characteristic for another intelligible in order for it to be a secondary intelligible. Perhaps the origin of this confusion emerges from when

⁶⁶ See Appendix III, Figure III.10.

they saw that the description of the quiddity with existence is not an extramental description, such as the attribution of a body with whiteness, but rather they judged that its description [i.e. the quiddity's] with it [i.e. existence] is an intellectual matter and that the quiddity is only receptive of existence upon its existence in the intellect only, as we see in the words of the author in the way that we have reported from his commentary on [Ibn Sīnā's] *al-Ishārāt*. Consequently, they considered that what follows from that is the idea that what is described with existence is the mental quiddity and that existence is a secondary intelligible. However, the truth of the matter is not like that, as the description of the quiddity with existence is in accordance with things as they are, as has been reported in summarising the proof given by the philosophers, and so what is described with existence is the quiddity as it is in itself and not the quiddity as it exists in the mind.⁶⁷

[Comment] Qushjī completes the issue of mental existence by tightening another argument that relates to the misconstrual of conceptualism in the direction of idealism, as he says Ṭūsī has done. Here, Qushjī denies that existence is a secondary intelligible that is accidental to the quiddity as a primary intelligible. Qushjī believes that such a confusion is only due to the realist philosophy that held that the quiddity in the mind is a duplication of that in the outside. Qushjī makes that point very clear by stating, “that which exists in the outside is not the quiddity that is existent in the mind”. He also adds that existence is not “conceived as a characteristic for another intelligible.” On the other hand, the attribution of existence to the quiddity is according to the way it is in actuality, where by way of constructive derivation (*ishtiqāq*) man acquires the knowledge of such

⁶⁷ See Appendix III, Figure III.11.

a quiddity and not by way of correspondence and co-occurrence (*tawāṭu'*). The implication of this explication is that the existence of a quiddity in reality, contrary to the doctrine of idealism, is not pending man's conceptualism of the quiddity in order for existence to be attributive of the actual existent. Rather, the identity of a perceived object, for example, can be said to have existed prior to man constructing his cognitive concepts to derive such an identity. Contrary, to this constructive approach, the result is, therefore, an idealist theory that assumes that the identity of an object as a quiddity only comes into existence when it is conceived in the mind, limiting, therefore, the scope of reality to that which is in the mind, rather than distinguishing between the coming of objects into being and our human understanding and knowledge of such a being. Consequently, Qushjī contrasts idealism, as a dualist philosophy, to constructivism, as a normative approach to reality.

I.2 QUIDDITY AND ITS APPENDAGES

[Folio 82] Essence and reality are often used as terms for it, i.e. for the quiddity ... These three terms are sometimes used without considering any difference between them ... [Specifically] essence could be used to mean what the quiddity applies to from particulars, while the particular reality is called ipseity, and it could be used to imply individuation (or characterisation), while it could also be intended for the outside existence.⁶⁸

[Folio 87] The intellectual image for the cognitive concept, the animal, is not ascribed with being a universal, because the image is particular in a particular psyche ... The concept of the animal is other than its intellectual image, because it

⁶⁸ See Appendix III, Figure III.12.

is the known not the knowledge and the intellectual form is the knowledge and not the known, which is what is described with universality.⁶⁹

I.3 CAUSE AND EFFECT

[Folio 125] [Ṭūsī says,] “Everything that has some matter emanating from it, either by emergence or convergence, is a cause for that matter, and the matter is an effect of it”.⁷⁰

[Comment] Ṭūsī’s definition of cause is based on the idea of emanation (*iṣḍār*), which analytically begins with the hypothetical cause rather than the verified effect, as emanation itself is not empirically verified rather only mystically hypothesised. On the other hand, Qushjī corrects this definition in accordance with his empirical philosophy by stating, “The truth [instead] is to say cause is what a matter needs for its existence”⁷¹. We note that Qushjī’s definition is existentially drawn from the perspective of the existence of the effect, which can be empirically verified, and which in determining how it relates to a cause, allows for a subjectively defined causality to emerge from the learnt concepts of the mind. In contrast to Ṭūsī’s *a priori* speculation about an emanational causality, Qushjī deals empirically with the existent that is attributed with relations that are acquired by involuntary knowledge through a constructive process that individuates a specific conceptual relation as evidence-based causal knowledge.

Qushjī’s attitude to scientific causality is inclusive of the idea of contingency in science as opposed to Ṭūsī’s necessitarian attitude, which relates a cause to an effect by way of a necessitarian relation that is presumed to exist in the outside. To demonstrate his causal methodology, Qushjī gives the example of the form of the sword (*ṣūrat al-*

⁶⁹ See Appendix III, Figure III.13.

⁷⁰ See Appendix III, Figure III.14.

⁷¹ *Fa al-ṣawāb an yuqāl al-‘illah mā yaḥtāj ilayh amr fī wujūdihī.*

sayf) and its relation to the sword itself. He says, “We do not tend towards [the idea] that the form of the sword occurs in the wood”⁷². This indicates his existential approach, whereby the form of the sword is a mental derivation (or quiddity) from the sword itself, as it exists and appears and not from the wood as a retainer of the form, because in this case the form would be uncogently considered as an independent entity that exists apart from the sword itself. On that Qushjī adds, “When it has been ascertained here that an individual of the kind of the form of the sword exists, it would be required that an individual of the kind of the sword also exist, however, when an individual sword was not verified in actual fact, we, consequently, knew that the existence of the form of the sword was also not verified hither”⁷³. Accordingly, Qushjī rejects that anything emanates from the form of the sword and only establishes the cause after the sword is itself empirically witnessed to exist. He explicitly makes that point, by stating that his approach begins with the effect as a contingent matter (*mumkin*) and then proceeds to seek the cause. On that he says, “We, therefore, take a certain contingent matter, then we seek for it a cause”⁷⁴.

In fact, Qushjī’s constructive approach to causality firmly resolves a standing issue in relation to the study of change (calculus) and which was prevented by an Aristotelian necessitarianism that related cause and effect in such a way that the termination of the cause also determined the termination of the effect. Qushjī, introduces the idea of a momentary changing causality, which indicates that the effect could persist under a changing causality. We see this approach in the following passage.

⁷² *Lā namīl ilā anna šūrat al-sayf taḥṣul fī al-khashab.*

⁷³ *Lammā taḥaqqaqā hayhunā fard min naw‘ šūrat al-sayf wajaba an yataḥaqqaq fard min naw‘ al-sayf wa lammā lam yataḥaqqaq fard al-sayf bi al-fi‘l ‘alimnā anna šūrat al-sayf lam tataḥaqqaq hayhunā.*

⁷⁴ *Fa innā na’kudh shay’an mumkinan thumma natlub lahu ‘illah (fol. 126).*

[Folio 129] The effect does not become non-existent with the termination of the first cause, rather with the termination of the first cause a second cause emerges and the continued existence of the effect is due to this reason ... The existence of the effect during the moment of existence of the second cause, and which is the consequence of the second cause is different to the existence in the previous moment and which was the consequence of the first cause. It could not be [validly] said based on this, that the upshot of the second cause is the existence of the effect in the second moment, rather it is its continued existence. Further, there is no meaning for persistent existence except this, whereby the second cause results in the continued existence of the effect, which occurs by way of the first cause without being independent, because we say that the second cause results in the same existence without conditioning this existence to the first or to the second moment. Therefore, when the second cause emerged at the same time as the termination of the first cause in such a way that there are no interspersing periods between the existence of the two causes, in this way, the continued existence of the effect followed as it persisted in time, and this is not contradicted by the independence of the [momentary] causality.⁷⁵

[Comment] The above position, therefore, gives the study of change or calculus an existential causal frame, which is grounded in the contingency of physical change, and which is not based on necessitarian realist conditions that impede scientific discovery and knowledge.

[Folio 134] Natures have no existence in the outside, rather what exists thereof are the individuals ... I say, there is no doubt that the two [i.e. the cause and the effect]

⁷⁵ See Appendix III, Figure III.15.

are among the cognitively conceived matters, otherwise an infinite regress would ensue.⁷⁶

II. EMPIRICAL KNOWLEDGE

II.1 SUBSTANCE

[Folio 154] There is nothing in the body, which is empirically verified as being added to the essence, and which is called the substance (*jawharīyah*), nor is there in blackness, for example, a verified matter, which is added to its essence and that is called the accident (*‘araḍīyah*). I say, and you [i.e. the reader] are an expert [by now], that what is affirmed with this is that rather they [i.e. the substance and the accident] are two cognitively considered matters, which are not genuinely found in [extramental] existence. They are also not secondary intelligibles, as this, as you have been repeatedly informed, is an expression for the characteristics of mental existence; and what is apparent is that they are not among it.⁷⁷

[Folio 158] Speed and slowness are associated with the essence and not with the accidental qualities. They are among the cognitive constructs connected to motion in accordance with a specific relation to another motion and based on the covering of a particular distance in more or less time. For this reason, they vary based on the relation; whereby the fast [for example] becomes slow in relation to the faster. In general, there is no such thing as an accident, which is the motion and another that is speed and slowness.⁷⁸

⁷⁶ See Appendix III, Figure III.16.

⁷⁷ See Appendix III, Figure III.17.

⁷⁸ See Appendix III, Figure III.18.

[Comment] This is a brief presentation of the relativity theory of motion that is in accordance with constructive *kalām*, and which realism misses by stressing that speed and slowness are absolute features of an objective existence.

[Folio 159] [On] the reality of the mathematical body [or a 3-dimensional figure]: They have defined it as the substance which is receptive to the three dimensions, and they intended by the three dimensions three lines that cross at three perpendicular angles. They also intended by the receptivity the possibility, i.e. the possibility that lines could run through it.⁷⁹

[Comment] We also see here a brief presentation of what is known as the Cartesian coordinate system of having three dimensional axes meeting at perpendicular angles to model a mathematical body along those three quantifiable axes.

[Folio 170] I say, it is valid for a sayer to say that that which is receptive to the three dimensions is the mathematical body, i.e. the quantity that extends in the three dimensions. As to the natural body, it is described with receptivity [only] accidentally and by association to being the outward display of the mathematical body. A body which undergoes division loses its accident that ceases to exist, but not its essence, i.e. the mathematical body which was before the division [is lost], while two [new] accidents originate, i.e. the two new mathematical bodies that arise after the division. Consequently, the receptivity to the dimensions is required for the natural body, and it does not separate from it due to the lack of separation of some mathematical body [from it]. With the one mathematical body it is a connected one, and with the plurality of the mathematical bodies [it is] plural [and] connected ... Further, we say that the mathematical body is the one which is

⁷⁹ See Appendix III, Figure III.19.

connected in itself, and it is the body which ceases to exist, and which originates anew, while the natural body is neither connected in itself nor is it divided [in itself], rather it is existent and lasting in both cases. As a result, there is no need to prove [the reality of] the hyle, rather we say that we do not support that if the body was subject to division then it would not be receptive for the three dimensions. All that there is to it is that, before the division, it was one receptive entity to the dimensions, and, after the division, it became two parts each of which is receptive to the three dimensions. In reality, unity is ceased from the body when it underwent plurality, while [at the same time] during the state of unity the body was exactly the same as it was during the division. The extent of the matter is that we do not say [in that case] that the body is one individual rather [we say] it is many individuals.⁸⁰

[Comment] Mathematics is conceptually used to perceive momentary change in a natural body, whose essence does not change when it undergoes division, for example, but what changes are the mathematical models that are the *a priori* concepts in the mind and by which way the outside bodies are individuated as being many when the mathematical bodies are themselves many and as one when the mathematical body is one. This allows us to study change through mathematical models that are mental existents, and which do not exist in the outside in themselves, in other words calculus. On the other hand, the body that the mathematical models describe is in the outside and so the mathematical or the conceptual relation with the outside is established by way of this natural body, which acts as the outward display of the cognitive models that

⁸⁰ See Appendix III, Figure III.20.

constitute human scientific understanding and which consequently determines how we define reality.

[Folio 173] The natural shape for the simple body is the sphere, because nature in the simple body is one and the singular actor in the one receptive entity does not do except for one act. Further, every figure except for the sphere contains multiple actions. [For example] the polygon as a figure could have one of its sides as a line, another could have a surface and another a point.⁸¹

[Comments] On this basis the circular figure is used as a basic unit for modeling compounded motion, as we see later with astronomical modeling. This usage, however, does not imply that the apparent trace of a planet's motion, for example, has to be circular because planetary motion, as observed from Earth, is actually a compounding of uniform circular motion. Similarly, we note that earlier in folio 9 Qushjī had said, "The compounded must end with the basic, as the basic is the foundation for that which is compounded"⁸². This comment also explains why *kalām* constructive astronomers clung to uniform circular motion as the basic unit of uniform (i.e. cyclic) compounded motion but not essentially as the phenomenal or apparent celestial motion. In other words, such a concept is the foundation for constructive mathematical practice.

[Folio 176] That extent [of a body], which is the location, could be seen as an imagined matter that is occupied by the body that fills it by way of imagination, as the school of the *mutakallim* is.⁸³

[Comments] This approach to location relates to constructive mathematics and its relation to the individuated body. Thereby, the mathematical body becomes a

⁸¹ See Appendix III, Figure III.21.

⁸² *Al-murakkab lā budd lahū min al-intihā' ilā al-basīṭ li-anna al-basīṭ mabda' al-murakkab.*

⁸³ See Appendix III, Figure III.22.

description of the location occupied by the body. In this way, also, space becomes mathematised, as both of the entities are conceptually conceived.

II.2 BODIES⁸⁴

[Discussions on the two themes, *Researching Celestial Bodies* and *Researching Basic Elements*, are delayed here until part III, where we discuss them under foundations of science]

[Folio 206] They [i.e. the *mutakallimūn* and the *falāsifah*] differed on whether the bodies are seen in their individuality and essence (*dhūt*) or not. The Peripatetic philosophers said that it is not seen in its essence rather what is seen primarily or in essence are the colors and the lights that inhere in the surface of the bodies, otherwise, one would see the air which is not seen, because it is void of such [features]. Then after that the intellect with the aid of the senses judges accordingly that what is between the surfaces is an essence that is spread in the [six] directions, i.e. they hold that the bodies are secondary observables or seen accidentally. On the contrary, the *mutakallimūn* asserted that it [i.e. a body] is seen in its essence.⁸⁵

[Comment] This is another indication of the *mutakallimūn*'s subjective theory in which *a priori* knowledge is constructed in the mind, and which means that one attains the empirical knowledge of perception when an individual body or its essence is ascertained by way of it being individuated in the mind through the known mental concepts. This process is known as empirical constructivism or empirical intuition, i.e. a pre-rational process of acquiring *a priori* knowledge that is founded on the empirically learnt concepts of the mind. On the other hand, the *falāsifah* as proponents of a realist theory

⁸⁴ *Ajsām*.

⁸⁵ See Appendix III, Figure III.29.

of correspondence claim that knowledge of perception is limited to the forms that are obtained from the object, i.e. forms such as color and that are directly visible, while the actual realisation of the object is treated as a secondary intelligible, i.e. non-existent in the outside. The problems arising from such a theory are obvious and they relate mostly to what constitutes the subject matter of a physical theory, as well as to what defines our notions of reality and truth.

[Folio 212] We do not believe that time exists [in the outside] for it to be a created [external] being or to be eternal [as the *falāsifah* claimed], rather it is a constructed matter that exists in the mind (*mawhūm*) as it is held in our school.⁸⁶

[Folio 224] I say ... that mental existence in the manner that we have verified does not involve the casting of an image inside the mind and its inhering in it.⁸⁷

[Comment] Qushjī relays Ṭūsī's theory of abstraction, which says that the accident of the human self is a mental image that is printed in the mind, and it is itself considered an abstract form, therefore, the human psyche as a receptacle of an abstraction was also considered an abstraction within this theory. This position was protested by those who held that knowledge is not by way of casting an image in the psyche, given that they saw that it is permissible for knowledge to be the unveiling of things when their forms are cast in another non-subjective abstraction to which the abstract self has access. A third theory was the consideration that knowledge could be the unveiling of an image without its casting anywhere. However, a response to this was that a difficulty arises whereby the image would not be equivalent in quiddity to the known, rather it would be like the figure of a horse on the wall. In the passage above Qushjī responds to the

⁸⁶ See Appendix III, Figure III.30.

⁸⁷ See Appendix III, Figure III.31.

first two realist theories, i.e. to both the empirical realist and the mystical idealist theories. While the mystical idealists were in line with the constructivists in regarding that *a priori* knowledge is pre-rational, that did not mean, however, that intuition equates with mysticism, and so this is where the two depart. While they both rejected the dualism of the first theory, where Qushjī, with his *kalām* constructivism, came down on the side of empiricism, the mystics, who had earlier devised their approach, fell on the side of mysticism; with all the scientific and the political implications that such a variation involves.

II.3 ACCIDENTS⁸⁸

[Folio 251] The line, the surface, and the mathematical body could be considered [pure] mathematics; meaning that each is considered without any [extraneous] conditions, and this leads to visualising the quantity in itself without taking note of anything of matter or its states. Therefore, if we imagine (*takhayalnā*) the thickness, I mean the quantity that extends in the three directions without taking note of anything related to matter and its states, then the imagined would be a mathematical body.⁸⁹

[Folio 252] The mathematical body might vary, while the essence or the truth of the individuated body remains in itself.⁹⁰

[Comment] This last passage, i.e. on Folio 252, is maintained because the mathematical body is affirmed by way of mental consideration, and it does not in itself exist in the physical structure of the perceived objects and their makeup. This, consequently, opens

⁸⁸ A *rād*.

⁸⁹ See Appendix III, Figure III.32.

⁹⁰ See Appendix III, Figure III.33.

up the study of change or calculus to mathematical bodies as mental concepts. Further, the theory of knowledge presented by Qushjī clears up a conceptual window for the tracking of a mathematical body that is mentally established as a description of change over time. This, therefore, allows for mathematical bodies to be tools for modeling change in the mind, and to also act as conceptual aids to empirical intuition during the process of constructing *a priori* knowledge.

[Folio 263] Tendency [for motion] (*al-mayl*) in an absolute way is what the *mutakallimūn* call motional dependency (*i 'timād*), and it is a quality by way of which the body resists that which opposes it.⁹¹

[Comment] The crucial point with this passage is the contrast between the Peripatetic approach of the tendency (*al-mayl*) by way of presupposing a specific nature as a cause, and the descriptive way of the *mutakallimūn*, which defines the origin of motion based on the counter resistance to an empirical force; making by that the moving body dependent upon other than itself for motion.

[Folio 266] For the *mutakallimūn*, it [i.e. the tendency for motion] is a genus, which varies in accordance with the variation in direction, whereby each body has many directions and for each direction it has a motional dependency (*i 'timad*).⁹²

[Comment] While the Aristotelian philosophers held that one body has one specific *mayl* or tendency for motion due its one nature, the *mutakallimūn* held that each body has multiple directional forces; one for each direction. This position stems from their subjective approach that allows them to mentally conceive a specific dependency force (*i 'timād*) for each direction that the body has.

⁹¹ See Appendix III, Figure III.34.

⁹² See Appendix III, Figure III.35.

II.3.1 Divisions of Knowledge: Constructive *A Priori* and Rational *A Posteriori*

[Folio 284] Knowledge (*al- ʿilm*) is divided into that which is *a priori* or involuntary (*ḍarūrī*), and its divisions are six; and that which is acquired or rational (*kasbī*). This means that knowledge is divided into that whose occurrence requires thinking (*fīkr*) for its acquisition [i.e. rational] and it is the acquired, and to that whose occurrence does not require any thought [i.e. pre-rational or constructive] and which is the *a priori*. Its subdivisions [i.e. that of the *a priori* knowledge] are six: [1] *badhīyāt* (intuitive *a priori* knowledge), [2] *mushāhadāt* (empirical *a priori* knowledge), [3] *fīṭrīyāt* (dispositional *a priori* knowledge), [4] *mujarrabāt* (time-tested *a priori* knowledge), [5] *ḥadsīyāt* (inferential *a priori* knowledge⁹³) and [6] *mutawātīrāt* (intersubjectively-tested knowledge). [In clarifying these subdivisions, Qushjī says] I say: The manner by which we can organise these divisions is based on whether the conceptualising of its terms - on condition of its intentionality (*al-iltifāt*) and soundness of instruments (*salāmat al-ālāt*) - is sufficient for mental judgement or not. The former is the intuitive knowledge (*badhīyāt*) [i.e. conceptualising its terms is sufficient], and the latter is either extrasensory or not. The latter [i.e. the sensory] is the empirical *a priori* knowledge (*mushāhadāt*), and the former [i.e. the extrasensory], if the non-sensory mediation is binding (*lāzimah*) - which means that it does not leave the mind while the terms are conceptualised - then it is the dispositional *a priori* knowledge (*fīṭrīyāt*), and if it was non-lasting

⁹³ The word *constructive* is used for *ḥads* instead of the commonly used word *intuition*, because without a constructive theory of *a priori* knowledge intuition was used as the term to explain the pre-rational acquisition of empirical knowledge as being self-evident or immediate. But with constructivism as a comprehensive theory of *a priori* knowledge, as developed by Qushjī, we find that the idea of constructivism better explains the manner by which the empirical type of knowledge is attained through the various involuntary inferential processes of the mind. This interpretation is also supported by the two other categories of knowledge which are sometimes subsumed under the *ḥadsīyāt*, i.e. the *mujarrabāt* and the *mutawātīrāt*.

then it either relies on inferential intuition (*ḥads*) or not. The former are the inferential *a priori* knowledge (*ḥadsīyāt*) and the latter, if its judgements rely on auditory reporting (*al-ikhbār*), then it is the intersubjectively-tested knowledge (*mutawātirāt*), or else it is the time-tested knowledge (*al-tajribīyāt*). As to the conceptual knowledge, which is also called primary knowledge (*awwalīyāt*), it involves premises that the intellect judges based solely on the conceptualising of its terms, such as the knowledge that one is half two and that the same body is not in two places at the same time ... Qushjī clarifies that constructive *a priori* knowledge is that which the self attains based on either the external senses, which is also called *al-ḥissīyāt* (sensory *a priori* knowledge) such as the knowledge that the Sun is illuminated and that the fire is hot, or based on the internal senses in which case the knowledge would be that of the inner findings (*wijdānīyāt*), which includes what one finds in him or her self without the use of bodily instruments, for example the sensing of one's self and its states. As to the dispositional *a priori* knowledge (*fiṭrīyāt*), it involves those premises whose syllogism is imbedded within it (*qiyāsātuhā ma'ahā*), such as the example of four being even because it is divided into two equal parts. On the other hand, the time-tested *a priori* knowledge (*mujarrabāt*) comprises of the premises that the intellect rules with based on the involvement of repeated experience, as well as a hidden syllogism (*qiyās khafī*) that allows for certainty of knowledge to be drawn based on the concept that a repeated occurrence in the same manner has to have a reason even if its quiddity is not known and in which case every time the existence of the cause is known, the existence of the effect is [also] known.⁹⁴

⁹⁴ See Appendix III, Figure III.36-7.

[Folio 285] As to the intersubjectively-tested knowledge (*mutawātirāt*), it comprises of knowledge that is based on a large number of reporters for a matter whose occurrence is a possibility and whose number of reporters amounts to an extent that prevents them from conspiring together to lie ... This matter is also considered to be sensory, given that rational beings are often without certitude, and thus the large number of reports do not imply certainty of judgement. If it were said about a report that was heard once, and which was accompanied by other evidence, that it constitutes certainty or that it provides concomitants that convey the truthfulness of the reporter, therefore, falling under the intersubjectively-tested narrative by way of general classification as it does not fulfil the requirements of being a tested narrative without incertitude, [in response] we say that the true report, whose truth is known through rationality (*naẓar*), falls outside the scope of the divisions [of *a priori* knowledge], and if it were known by way of *a priori* inferential intuition (*ḥads*), it would fall within the category of *ḥadsīyāt* (inferential *a priori* knowledge). The same applies to a report which is surrounded by concomitants, whereby it constitutes certainty either by way of rational evidencing or *ḥads* from these concomitants. According to the former it falls outside the divisions and on account of the latter, it is subsumed under the *ḥadsīyāt*.⁹⁵

[Comment] In the following section and after elaborating on each of the six categories of empirical knowledge, Qushjī embarks on raising contingencies related to these categories and how they relate to one another further clarifying how each corresponding procedure produces its subjective *a priori* knowledge.

⁹⁵ See Appendix III, Figure III.38.

[Folio 285] I say, know that inferential intuition (*ḥads*) could take place by way of repeated observation and a comparative hidden syllogism as it happens with the time-tested *a priori* knowledge (*mujarrabāt*) and the difference between the two is on whether a relation is utilised or not. Some have differentiated between the two based on the causal relation whose causation is known with the experimental type but not the quiddity of it. It is for this reason that the same comparative syllogism was used here and which is that if it weren't for a causal connection then the concomitant relation would not have been witnessed in general or in the majority of the cases. [On the other hand] the causation with the inferential intuitive type is known as well as its quiddity, and it is for this reason that the comparative syllogism is of a different inferential relation depending on the specific situation and the quiddity of the causal relation. [On a different account] it was also said that the difference [between the two] is that experimentation relies upon the action that the human does in order for an effect to take place ... This is contrasted to inferential intuition, which does not rely upon that ... Al-Imam [Fakhr al-Dīn al-Rāzī] limited them [i.e. the six divisions] to two categories *al-badīḥyāt* (intuitive *a priori* knowledge) and *al-mushāhadāt* (empirical *a priori* knowledge), and he made the apologetic plea for that in two ways. The first is that the *badīḥyāt* subsumes the *fiṭrīyāt* (dispositional *a priori* knowledge) for the reason being that the mediation required is the conceptualising of the two terms whereby all the intellect needs is such a conceptualisation. Similarly, the *ḥissīyāt* (sensory *a priori* knowledge) includes the *mujarrabāt* (time-tested *a priori* knowledge) and the *mutawātirāt* (intersubjectively-tested knowledge) based on the fact that the intellect judges with these categories due to the senses, except that it is with repetition. The same argument also applies to inferential *a priori* knowledge

(ḥadsīyāt). The second justification given for this classification by Rāzī as described in his *al-Mulakhkhaṣ* is that the occurrence of the *mujarrabāt*, the *mutawātirāt* and the *ḥadsīyāt* as *a priori* constructive knowledge is a matter of speculation for the reason that each of these classes are based on the consideration of a hidden syllogism. This also applies to the class whose syllogism is analytically imbedded.⁹⁶

[Comment] Constructivism is the subjective process for individuating *a priori* knowledge in the mind by way of a learnt universal concept. *A priori* knowledge here is particular, and it is an individuation of either sensory input (i.e. empirical *a priori* knowledge) or of mental consideration alone (i.e. rational knowledge). Constructivism is pre-rational and it relates to acquiring empirical knowledge as *a priori* knowledge. The epistemological divisions of knowledge can be seen as being constructive which is founded on conceptual empirical intuition and on a voluntary rational process. The division of knowledge into the *kasbīyāt* (acquired or rational knowledge) and the *ḍarūrīyāt* (*a priori* constructive knowledge), therefore, follows.

II.3.1.1 Universal Concepts

Realism involves the idea that knowledge of the perceived relies on abstracting, from the object, the universal forms that are known *a priori*. In this manner empirical knowledge is considered to be *a posteriori*, i.e. rational, while the *a priori* universals or presuppositions are considered to be intuitive and obtained by induction. In order to demonstrate the particular empirical knowledge, logic or deduction is then proposed to be used as a tool in accordance with the idea of necessitarian causation. Intuition in its original sense is used to describe the *a priori* and pre-rational process for the acquisition of constructive knowledge. Induction, on the other hand, relates to acquiring universal

⁹⁶ See Appendix III, Figure III.39.

knowledge from empirical observation. The two processes, therefore, need not overlap as we see under a realist philosophy that holds that universal concepts are themselves the content of *a priori* knowledge. In doing so, realists constrained *a priorism* in knowledge to universals and approached empirical knowledge as being *a posteriori* (i.e. rational).

Constructivists, on the other hand, hold that induction through learning is the basis for obtaining universal mental concepts while intuition through individuation is the process for obtaining *a priori* particular knowledge. While the two processes converge with the realists on universals vacating a place for abstraction as that dealing with the particular, for constructivists the two converge on the particular by eliminating the universality of human knowledge, which itself is associated with a particular human psyche that is contingent and subjective⁹⁷. In this way, universal mental concepts are learnt ideas that the mind intuitively utilises within the involuntary mental process of individuation to construct the *a priori* knowledge. In other words, constructivism replaces the dualism of the realist process of *a posteriori* abstraction and its associated *a priori* induction with a normative theory of knowledge. In this way also we find that contingency does not conflict with human knowledge being *a priori*, because while the empirical objects are contingent in themselves, our knowledge of them is subjectively certain; giving rise to an intersubjective universality that realists were never able to empirically demonstrate.

Furthermore, constructivism systematises the pre-rational process of intuition by incorporating into it conceptual learning from prior experience, whereby the universal concepts are not themselves the object of *a priori* human knowledge.

⁹⁷ Subjective here does not equate with relative as it is considered under a realist philosophy.

Similarly, these mental concepts do not imply a deterministic cause and effect connection, which realists have unjustifiably assumed in order to preserve the Aristotelian idea of universal laws of nature that forms the basis for a necessitarian method couched in the language of logic as prediction⁹⁸. In the way of constructivism, however, empirical knowledge acts as *a priori* to human rationalism and its involuntariness stems from the subjective perspective that no rational choice is involved in determining its characteristics. *A priori* human knowledge, therefore, implies a sense of involuntariness that involves no rational participation by the knower, rather, it is constructed in the mind in a nonconscious psychic process. Constructivism, consequently, emerges as being conceptual empirical intuition, providing with its contingent modality the scientific alternative to necessitarian logic and its speculative nature as causation.

II.3.2 The Learning of Causal Concepts

[Folio 286-7] I say ... the conceptualising of the cause requires the conceptualising of the effect if the cause in its mental existence is a cause to the effect in the mind, in which case, the effect would be apparently concomitant to the cause ... The rule that says that the knowledge of the cause necessitates the knowledge of the effect is used by them [the *falāsifah*] in various avenues ... [In response] I say, that this [claim] is settled with the same observation made earlier that the connection of the cause to the effect is made in accordance to the outside, but this does not yield the intuitive relation between knowledge of the cause and knowledge of the effect, rather what yields this connection is to have the cause and effect constructively

⁹⁸ By dropping *a priori* presuppositions from their method, positivists replaced it with the hypothesis as a starting point and maintained the deductive aspect of a necessitarian method, which they called the hypothetico-deductive method.

established as conceptual concomitants in the mind. [To given a case study] if it were known for example that ‘A’ is a complete cause for ‘B’, and it was known that ‘A’ exists, then it is known that ‘B’ also exists due to what is known of a specific relation between ‘A’ and ‘B’, without the opposite being true. For, if it were known that ‘B’ exists, it is not correspondingly known that ‘A’ exists due to the possibility of there being another cause for it other than ‘A’. Therefore, the knowledge of the existence of a specific cause conceptually requires the knowledge of the existence of a specific effect, without the opposite being true.⁹⁹

[Comment] Qushjī’s presentation above and his refutation of the *falāsifah*’s necessitarian claim as a foundation for causality clearly indicate that the *mutakallimūn*’s assertions on the contingency of the physical beings did not result in an abandonment of the idea of *a priori* knowledge. To the contrary, it was the constructivism of *kalām* as elucidated by Qushjī that ultimately provided the foundation for science and the constructive methodology for *a priori* knowledge. This theme is the topic of our next discussion in part III on the foundations of science.

[Folio 291]¹⁰⁰ [The intellect] is the ability to acquire [true] speculative knowledge after the acquisition of constructive *a priori* or involuntary knowledge. It is called intellect by way of mastery [of this process].

⁹⁹ See Appendix III, Figure III.40.

¹⁰⁰ See Appendix III, Figure III.41.

III. FOUNDATIONS OF ASTRONOMY

III.1. INVESTIGATING CELESTIAL BODIES

[Folio 186-7] It is stated that an attempt to prove a specific orb arrangement is based on false foundations taken from the Peripatetic philosophers, such as the denial of the Free Omnipotent, or the refusal of the possibility of the rupturing and mending of an orb or that its movement neither intensifies or lessens nor does it reverse, descend, halt or any other form of change, rather, it is always a slow basic movement in the same direction. In addition [these claimed foundations include] other matters within theology, metaphysics or natural philosophy some of which are contrary to Revealed knowledge and others not considered as such, given that their proofs are mixed [with empirical evidence]. On the other hand, if it [i.e. astronomical arrangements] were not based on these foundations, we say that the Free Omnipotent in accordance to His Will moves these orbs in the observed order, or [with that] we say that celestial bodies¹⁰¹ move in orbit¹⁰² as whales move in water¹⁰³, speeding and slowing, returning and stopping and standing without the need for the numerous [physical] orbs. In accordance to these Peripatetic foundations, what they [their proponents] have stated is an affirmation of a cause

¹⁰¹ In his translation of this passage in *Freeing Astronomy* (pp. 66-70), Ragep says that the word *kawākib* applies to both stars which are *kawākib thābitah* and the planets which are *kawākib sayyārah*. The difference here is significant as Qushjī is proposing the concept of the orbits to be applicable to the planets whose motion is categorised as “speeding and slowing, returning and stopping and standing still” while the stars do not undergo such visible motion and further the stars are not considered by the Peripatetic philosophers as being arranged by “numerous orbs” as opposed to the planets.

¹⁰² The word used in the analogy is the singular word *falak* (orbit) as common space that applies to stars and planets (*kawākib* - plural) the same way the singular word *mā'* (water) is applied to the whales (*hītān* - plural). When compared to what is being opposed, which is the concept of the *aflāk* (plural), i.e. the physical orbs considered by the Peripatetic philosophers as necessary causal structures, we then can understand the significance of the singular usage of the word *falak* with the proposed new context of an orbital planetary motion without the need for restraining physical orbs.

¹⁰³ Ījī says: الماء في الأفلاك كالحيتان في المياه (al-Jurjānī, *Sharḥ al-Mawāqif* ..., 2: 400). Taftazānī says: الماء في الأفلاك كالحيتان في المياه (Taftazānī, *Sharḥ al-Maqāṣid*, 1: 657).

[i.e. the orbs] based on the existence of an effect [i.e. the planetary motion], but this is not valid without relational equivalence (*musāwāt*)¹⁰⁴. However, this is not known [to be the case] given that there is no necessary condition nor a demonstrative proof against the fact that these observed [planetary] irregularities could be for reasons other than those mentioned by them. Therefore, such a statement is invalid given that its origin is their lack of examination of the details of this discipline and its proofs; the majority of which are empirical and intuitive *a priori* premises¹⁰⁵ that the intellect affirms as being true, upon [the time of] observing the aforementioned irregularities, [and it does so] based on the perceived [recurring] order and with the aid of geometric premises that are not subject to even the faintest of doubt. For example, the sighting of the various phases of the full and crescent-shaped Moon necessitates the certain knowledge (*yūjīb al-yaqīn*) that the Moon light is gained from the Sun and that the lunar eclipse is a result of the Earth coming between the Sun and the Moon, and that the solar eclipse is due to the Moon interposing between the Sun and the eyesight, while affirming the Free Omnipotent and the denial of the aforementioned foundations. Furthermore, the affirmation of the Free Omnipotent and the refusal of accepting these foundations does not conflict with the case [of the Moon light and the eclipse] being as mentioned. The fact of the matter is that this makes other intellectual

¹⁰⁴ The *musāwāt* (relational equivalence) is between cause and effect, whereby it means that the effect relates to the cause in the same general closure that the cause relates to the effect. But this is not the case in a contingent physical world, where, the same effect that is empirically observed could have resulted from various causes as opposed to a specific cause which is known to result in a specific effect.

¹⁰⁵ The *muqaddamāt* do not mean conjecture but rather they mean *a priori*. This means that while the aforementioned Peripatetic foundations are classified as false conjectures what Qushji is proposing here from intuitive *a priori* premises is surely not classified by him under conjecture, and this is further supported by his words “*yajzim al-‘aql bi thubūtihā*” i.e. the intellect confirms as being true. The labelling of such a premise as obligatory is based on his defence against *al-qādiḥīn fī al-darūrīyāt* (the sceptics in *a priori* knowledge) by which he ends this section on the *muqaddamāt al-hadsīyah*. Ragep also uses, “resolves to posit” for *yajzim al-‘aql bi thubūtihā* instead of “the intellect confirms as being true” in line with the idea of conjectural premises that he proposes.

possibilities foreseeable (*yujawwiz al-iḥtimālāt al-ukhar*), for example by affirming the Free Omnipotent it is intellectually foreseeable that the Free Omnipotent in accordance to His Will darkens one face of the Moon upon an eclipse without the interposition of the Earth [Folio187] and [darkens] the face of the Sun during a solar eclipse without the interposition of the Moon. Similarly, it is intellectually foreseeable that He darkens the face of the Moon in accordance with the observed variations in the lunar and crescent shapes. Furthermore, on the assumption of considering an irregularity in celestial motion and states, it is intellectually possible that half of each of the two luminescent bodies (the Sun and the Moon) is lit and the other [two] halves not, and that they rotate on their own axis in such a way that their dark sides become apparent to us in the event of an eclipse, either fully in the case of a full eclipse, or only partially in the case of a partial one, [while being] in correlation with the gradation of the eclipse, and that the lunar and crescent shapes are established in a similar way. However, we affirm (*najzim*) despite the intellectual possibility of the mentioned description that the actual occurrence of events (*anna al-ḥāl*) is in accordance with what we first mentioned with the Moon gaining its light from the Sun and the lunar and solar eclipses being due to the interjection of the Earth and Moon. Similar intellectual possibilities are considered with contingent and time-tested *a priori* sciences (*al-ʿulūm al-ʿādīyah wa al-tajribīyah*), and indeed with all types of *a priori* knowledge [i.e. the six divisions of *al-ḍarūrīyāt*]. For we affirm (*najzim*) after leaving the house that its utensils have not turned into meritorious verifying scholars who investigate metaphysics and geometry despite the fact that it is intellectually possible that the Free Omnipotent does transform them as such in accordance to His Will. Further, by assuming that the cause has been necessitated, it is intellectually possible that an unusual celestial

occurrence relates directly to an unusual event as is believed by the proponents of the idea of necessary causality, who relate worldly events to celestial occurrences. This is in addition to other matters raised by sceptics who doubt the existence of *a priori* knowledge. In summary, that which is ascertained in astronomy is not built upon physical and metaphysical presuppositions, such as those commonly listed by the authors of this discipline [who do so] in the introductory sections of their texts. They only do this by way of following the Peripatetic philosophers, as such [a doing] is not a scientific requirement. To the contrary, it [i.e. the premises of astronomy] could be proven without the reliance on these presuppositions, as that which is mentioned thereof [i.e. in astronomy] involves (1) geometric premises, which are not subject to incertitude, while some others are (2) premises based on inferential intuition (*hads*) as has been described, others still are (3) presuppositions that the mind judges based on that which is considered more aesthetic or more appropriate, as they say that the convex side of the deferent touches the convex of the paretic in a common point and the same for their relative concavities. They have no other basis for this except that it is more desirable to have no redundance in celestial matters. They also say [under this category] that the orb of the Sun is above the orb of Venus and Mercury, because it is more orderly and a better arrangement to have what is farther out and of a greater circuit having the slower motion amongst the planets and for the Sun to be in the middle of this arrangement, the same way the middle jewel of a necklace is, between those that extend to the four elongations away from it, the sextiles, the quadratures, the trines and opposition [i.e. the superior planets], and between those that only extend as far as the least of the mentioned distances, the sextiles [i.e. the inferior planets]. Other presuppositions are (4) mentioned by way of

uncertainty without any confirmation, as they say that the irregularity of the speed and slowness of the Sun's motion is either based on an eccentric hypothesis or an epicyclic one without any definiteness for either of the two. [Consequently] to assume that the arrangement of the orbs that they [i.e. the *falāsifah*] have mentioned could be proven based on those false foundations, no doubt follows with the practitioners of this discipline claiming that this arrangement could only be as was described. However, had their claims been that the arrangement can be in the mentioned manner (*yumkin an yakūn 'alā dhālika al-wajh*) and if possible it could also be according to other arrangements, then no objection would follow. Indeed, it is a praiseworthy matter that they were able to construct in their minds from among the possible arrangements that which helps organise the states and motions of the planets with its numerous irregularities in order to facilitate the specifying of the positions of the planets and their interconnectedness for any chosen time, in such a way that conforms to sense perception, and that, consequently, makes the minds and intellects full of wonderment. He who ponders the state of the shadows on the surface of astronomical plates witnesses that such is a wondrous matter and thus praises them with abundant extolment.¹⁰⁶

III.1.1 *Kalām* Program of Astronomy

[Comments] The rule of the *mutakallimūn wa ulḥiqa iḥālat dhālika kulluhu ila al-Qādir al-Mukhtār* (all such [planetary motion] has been submitted to the Free Omnipotent), which we see in Ījī's next passage does not imply there are no causal relations, but it means that the *falāsifah*'s rule *istidlāl bi al-lāzim 'alā wujūd al-malzūm* (affirming a cause by way of an effect) without the knowledge of their relational equivalence

¹⁰⁶ See Appendix III, Figure III.23-5.

(*musāwāt*) implies that such causal relations are not ontologically necessary and thus cannot be used as a foundation for a scientific methodology, as it is assumed with Aristotelian logic. In his *al-Mawāqif fī 'Ilm al-Kalām*, Ījī states the following:

[Passage A] When they [the *falāsifah*] believed that the movement of the orbs must be cyclic they wondered as to the source of these [planetary] irregularities, and they did not comment on it in any convincing manner. What destroys their foundations are the orbs of Mercury¹⁰⁷, which we have already introduced [whereby what they claimed is based on affirming a cause by way of an effect without the knowledge of their relational equivalence] and which requires the uniformity of the motion of the epicycle center around the center of the deferent. [But] the conceived observation is to the contrary, as it [i.e. the circular uniformity] has been found on another point which is called the equant and which is between the center of the world and the center of the eccentric ... For you [i.e. the reader] have been informed that it is not sufficient for ascertaining the particular movements, to [merely] rationalise some universal. All this [planetary motion] has been submitted to the Free Omnipotent [Jurjānī, his commentator, adds “as in this position one finds a settlement for these irregularities and its like”].¹⁰⁸

When Qushjī raised the possibility of planetary orbits as circuits without the need for the physical orbs and did so by referring to the analogy of whales swimming in water, Qushjī was basing this possibility on the *mutakallimūn*'s basic rule on the contingency of physical beings. This position in fact saves astronomy from the difficulties associated with the Aristotelian program and its aforementioned abrogated foundations (*uṣūl fāsīdah*) that propagate necessitarianism in the relationship between planetary motion and their assumed orbs. With the idea of contingency as applicable to the celestial world, such difficulties are overcome. Qushjī asserts that one can consider contingent science and still have astronomy as an empirical discipline subject to

¹⁰⁷ Mercury shows this phenomena more than other planets because it has the most elongated circuit of all the planets. As we see in the next chapter it is for this reason that Mercury was also a main focus for Qushjī with his astronomical work.

¹⁰⁸ Ījī says in al-Jurjānī, *Sharḥ al-Mawāqif* ..., 2: 451:

أنهم لما اعتقدوا أن حركة الأفلاك يجب أن تكون دورية تحيروا في مبدأ هذه الاختلافات ولم ينيسوا فيه بذات شفة والذي ينحي بالهدم على قاعدتهم أفلاك عطارد بعد ما قدمناه [من أن ما ذكره استدلال باللازم على وجود الملزوم مع عدم العلم بالمساواة] أنها تستلزم تشابه حركة مركز التدوير حول مركز الحامل والمدرك بالرصد خلافه فإنها وجدت لنقطة تسمى مركز معدل المسير وهي بين مركز العالم ومركز الخارج ... إذ قد علمت أنها لا يكفي في الحركة الجزئية التعقل الكلي وإلحاق إحالة ذلك كله إلى القادر المختار [فإنها منجاة عن هذه الإشكالات وأمثالها].

constructive *a priori* knowledge and not to speculative presuppositions. The *falāsifah*'s program in astronomy is clarified further in Ījī's following words:

[Passage B] What they [the *falāsifah*] have mentioned [Jurjānī: “about such and such orbs rotating in the mentioned manner and that manifests in those planetary states”] is an affirmation of an effect [Jurjānī: “the motional states”] based on the existence of a cause [i.e. the moving orbs], and it is only valid if the relational equivalence [Jurjānī: “between the cause and the effect”] is known, but it is not known, given that it is possible that another arrangement [of the assumed orbs] could manifest in those movements. [This is so] because different matters could share the same effects and its denial [Jurjānī: “i.e. the denial of the other possible arrangements”] is neither necessary nor has been demonstrated to be so.¹⁰⁹

In contrast, the *falsafah* program in astronomy as represented by Ṭūsī's program at Maragha had a different approach as it made its purpose the attempt to solve the difficulties (*ishkālāt*) left behind by Ptolemaic astronomy and natural philosophy, but to do so within the same necessitarian realist framework. On the other hand, Qushjī's *kalām* astronomical program asserted that no certainty can be achieved by causally constructing celestial orb structures and so relied instead on inferential intuition (*ḥads*) as a subjective foundation for acquiring *a priori* constructive knowledge of astronomical phenomena. In fact, the *mutakallimūn* were well aware of the difficulties that arise against necessitarian causality as found in the practice of Peripatetic astronomy. Taftāzānī says in his *Maqāsid*:

[Passage C] All the foundations that they [i.e. the *falāsifah*] have given to astronomy have tumbled from the denial of the Free Omnipotent, because it is the case that the irregularities of the motions and their observed states are due to the Will of the Free Omnipotent. Therefore, what they have asserted from movement and orbs cannot be proven.¹¹⁰

¹⁰⁹ Ījī says in al-Jurjānī, *Sharḥ al-Mawāqif* ..., 2: 449:

ما ذكره [من أن ... أفلاك كذا وكذا متحركة على الوجوه المذكورة المتقتضية لتحقيق تلك الأحوال] استدلال بوجود اللازم [الذي هو تلك الأحوال] على وجود الملزوم [الذي هو تلك الأفلاك المتحركة على تلك الوجوه] وإنما يصح إذا علم المساواة ولم تعلم إذ يجوز أن يكون ثمة وضع آخر يستلزم هذه الحركات لجواز اشتراك الأمور المختلفة في اللوازم وليس انتفاؤه [أي انتفاء الوضع الآخر] ضروريا ولا مبرهنا.

¹¹⁰ Taftāzānī, *Sharḥ al-Maqāsid*, 1: 678:

فقد سقط جميع ما بنوا من أصول علم الهيئة على نفي الفاعل المختار إذ يجوز أن يكون اختلاف الحركات والأوضاع المشاهدة مستندا إلى مشيئة القادر المختار فلا يثبت ما أثبتوا من الحركات والأفلاك.

Inferential intuition, which is central to empirical astronomy, does not relate to proving the orbs (*aflāk*), as they are no longer considered to be part of the subject matter of constructive astronomical knowledge as it was defined within the *kalām* scientific program. Taftāzānī further adds:

[Passage D] It might be delusionally thought that affirming the particular orbs and simple motions, according to their specified way based on what is seen and perceived in observation from the binding irregularities, and on the assumption of its necessity, is an affirmation for a cause based on the existence of its effect. But this is not an upright argument except if the causal relational equivalence is known and it is not known given that there is no such necessity, nor any demonstrative proof that it is impermissible for these irregularities to be for other reasons. The response [therefore] is that they [i.e. the premises of astronomy] are empirical premises based on inferential *a priori* knowledge (*ḥadsīyāt*), with which the affirming intellect judges that celestial matters are considered orderly whenever these premises are affirmed for explaining the perceived irregularities, [and this is so] without any consideration for a middle concept or structure [such as their physical orbs]. They [i.e. the *falāsifah*] confess to this and explicitly state it with the lunar and solar eclipses and its like, and it is for this reason that they diverged in their opinions on those matters that were not judged by way of inferential intuition (*ḥads*). As a counter example [to refute the speculative use of the orbs in astronomical methodology], we cite the variation of the speed and slowness of the Sun being built [in their system, either] upon the epicyclic or the eccentric models.¹¹¹

III.1.2 Constructive Mathematics and Inferential *A Priorism*

[Comment] Qushjī emerges from the same empirical tradition developed by Taftāzānī, which resorts to inferential *a priori* intuition (*ḥads*) in order to provide a foundation for the constructive knowledge of mathematical astronomy. In contrast to Taftāzānī's theory of *ḥads*, however, Qushjī's approach to inferential intuition relies on a “*wasaf*”

¹¹¹ Taftāzānī, *Sharḥ al-Maqāṣid*, 1: 668:

قد يتوهم أن إثبات الأفلاك الجزئية والحركات البسيطة على الوجوه المخصوصة بناء على ما يشاهد ويدرك بالرصد من الاختلافات اللازمة على تقدير ثبوتها إثبات للملزم بناء على وجود لازمه وليس بمستقيم إلا إذا علم المساواة وليست بمعلومة إذ لا ضرورة ولا برهان على امتناع أن تكون تلك الاختلافات لأسباب آخر والجواب أنها مقدمات حدسية حيث يحكم العقل الجازم بانتظام السمويات بثبوتها عند أدراك الاختلافات من غير ملاحظة وسط وترتيب وهم معترفون بذلك مصرحون به في أمر الخسوف والكسوف ونحوهما ولهذا اختلفوا وترددوا فيما لم يحكم الحدس به [ككون] اختلاف الشمس بالسرعة والبطء مبني على التدويرا والخارج المركز.

(middle concept) and “*tartīb*” (structure) based on mathematical modeling which is different to the above mentioned position by Taftāzānī in Passage D.

The idea that *ḥads* is a subjective experience that cannot be used as evidence against an opponent, and, therefore, it limits its use in demonstrable scientific disciplines, such as astronomy, had appeared earlier in Ījī’s *Mawāqif*, despite him making it a base for scientific knowledge of physical phenomena. Ījī asserts:

[Passage E (D)] It might be said that the induction from particulars with a strong inferential *a priori* intuition (*ḥads*) by perceptive minds attains its possessor the state of certitude by way of specific cases. The same applies to many aspects of scientific knowledge with which one relies on a strong and incisive intuition, [but] which does not stand as evidence against another [i.e. an opponent] despite it being known with certainty.¹¹²

[Passage F] The sensory and the intuited knowledge are the [two] relied upon categories with the sciences, and they stand as evidence against an opponent; absolutely for the intuited knowledge, and conditionally for the sensory one, i.e. whether its reasons are shared; from time-testing, to intersubjective-testing, inferential intuition and empirical observation.¹¹³

[Passage G] The inferential and the intersubjectively-tested *a priori* knowledge despite being a form of subjective evidence, however, they do not apply as proof against an opponent, except if he or she share what corresponds to it from time-tested knowledge, to inferential *a priori* or intersubjectively-tested knowledge, [given that] one cannot convince its denier by debate alone.¹¹⁴

A similar sentiment is repeated by Taftāzānī, whereby while stressing the certitude obtained in the physical sciences by way of inferential *a priori* intuition (*ḥads*), he also repeats the notion that this human capacity varies from one person to another,

¹¹² Ījī says in al-Jurjānī, *Sharḥ al-Mawāqif* ..., 2: 7:

وقد يقال إن استقراء بعض الجزئيات مع الحدس القوي من الأذهان الثاقبة يفيد الجزم [بمعلول] على وجه مخصوص وكذا الحال في كثير من المسائل العلمية يستعان فيها بالحدس القوي الصائب فلا تقوم حجة على الغير مع كونها معلومة يقينا.

¹¹³ Ījī says in al-Jurjānī, *Sharḥ al-Mawāqif* ..., 1: 80:

الحسيات والبديهيات هما العمدة في العلوم وهما يقومان حجة على الغير أما البديهيات فعلى الإطلاق وأما الحسيات فإذا ثبت الاشتراك في أسبابها أعني فيما يقتضيها من تجربة أو تواتر أو حدس أو مشاهدة.

¹¹⁴ Ījī says in al-Jurjānī, *Sharḥ al-Mawāqif* ..., 1: 198:

والحدسيات والمتواترات فهي وإن كانت حجة للشخص مع نفسه لكنها ليست حجة له على غيره إلا إذا شاركه في الأمور المقتضية لها من التجربة والحدس والتواتر فلا يمكن أن يقنع جاحدها على سبيل المناكرة.

and thus it does not constitute evidence in demonstrating a physical premise. Taftāzānī opines:

[Passage H] The certainty obtained through inferential *a priori* intuition (*hads*) varies between one person and another, where certitude is attained by some and not by others.¹¹⁵

[Passage I] [Premises, such as some astronomical ones,] lead to certainty for the observer based on inferential *a priori* intuition, but it does not constitute evidence against the opponent in debate.¹¹⁶

On the other hand, Qushjī's breakthrough was to deploy mathematical modeling as a middle concept (*wasat*) or an aid to inferential *a priori* intuition (*hads*) in order to achieve empirical knowledge, which is *a priori* and based on contingency as a foundation. Qushjī's incorporation of mathematical modeling into the process of inferential intuition, therefore, also allows him to use geometric models as a demonstration or even as a simulation for what one knows by intuition. In this way, mathematical constructivism emerges as a process for the acquisition of empirical *a priori* knowledge, whereby inferential intuition is aided by a learnt mathematical concept that is represented by a geometric model. We also note here that mental individuation (*tashakhkhus dhihnī*) of particular knowledge, which is a core component of constructivism, becomes reliant upon a relational concept, including a mathematical one that is used by the mind to represent both change in space and across time. This new understanding and approach to *hads*, which involves mathematical concepts, is, therefore, based on the new developments in the theory of constructivism. Knowledge obtained through *hads*, hence, involves more than *tajrubah* (time-testing), which itself is repeat *mushāhadah* (sense-perception), as it engages an imbedded relational concept

¹¹⁵ Taftāzānī, *Sharḥ al-Maqāṣid*, 1: 698:

اليقين الحدسي ويختلف ذلك باختلاف الأشخاص فيحصل اليقين للبعض دون البعض.

¹¹⁶ Taftāzānī, *Sharḥ al-Maqāṣid*, 1: 385:

ربما يفيد يقينا حدسيا للناظر لكن لا يقوم حجة على المناظر.

or a mathematical model in the mind as an added description to the grouped individual observations.

The theory of inferential *a priorism* or *ḥads* under constructivism, therefore, becomes a subjective process beyond what Gutas describes in relation to the *falāsifah*, where he says, “It [*ḥads*] is a mental act whereby the human intellect comes into contact (*ittiṣāl*) with the active intellect (‘*aql fa‘āl*) and receives what Avicenna frequently describes as ‘divine effluences’ (*fayḍ ilāhī*), i.e. knowledge of the intelligibles through the acquisition of the middle terms. *Ḥads* constitutes the only point of epistemological contact in Avicenna’s thought between the sublunar and the supralunar realms or between the mundane and the transcendental and it refers to a strict and precise syllogistic process.”¹¹⁷. Roxanne D. Marcotte also says that “in the works of Avicenna ... intuition becomes an essential method for grasping metaphysical truths”¹¹⁸. A strong distinction, thus, appears between the Avicennan usage of *ḥads*, as a syllogistic process that relies on the idea of necessary causal inferencing, i.e. the affirmation of a cause from an effect, and that used by the *mutakallimūn* whose usage of *ḥads* is grounded in a scientific approach that deals with the contingency of the physical world, which involves no such determinism in its foundations of science.

¹¹⁷ D. Gutas, “Avicenna vs. Mysticism” in *Encyclopaedia Iranica Online* (Accessed 12 July, 2013), 79b-80a. Nasr also says on *ḥads*, “... there is another type of knowledge [based on *ḥads*], possible for all men, but in practice attained only by the few. It is a knowledge which is direct and immediate without the knowledge identified with the heart. The knowledge of the heart has the immediacy and directness of sensual knowledge but concerns the intelligible or spiritual world” (Seyyed Hossein Nasr, “Intellect and Intuition: Their Relationship from the Islamic Perspective”, *Studies in Comparative Religion*, vol. 13, no. 1 & 2. (Winter-Spring, 1979), 9). He thus reflects the mystical program associated with the *falāsifah*’s understanding of *ḥads* which is contrary to the empirical/mathematical theory of *ḥads* presented by Qushjī and his predecessors who contributed to the *Kalām* scientific program.

¹¹⁸ Roxanne D. Marcotte, “Reason (‘*aql*) and Direct Intuition (*mushāhadah*) in the works of Shihāb al-Dīn al-Suhrawardi (d. 587/1191)” in *Reason and Inspiration in Islam*, edited by Hermann A. Landolt, Todd Lawson (London: Islamic Publications UK, 2005), 222.

III.1.3 Constructive Astronomy and Reality

[Comment] For the program of *kalām*, reality (*ḥaqīqah*) in the natural sciences is dependent on the empirical object of the human inquiry, i.e. if astronomy is the study of observed phenomena, then the reality that it uncovers becomes what is ascertained of the phenomena, and not the metaphysical orbs that are unobserved but assumed by realists to be the genuine objects of astronomical knowledge. In this way, inferential *a priori*sm (*ḥads*) was considered as the basis for astronomical knowledge of the lunar and solar eclipses, while for the realists it was taken to be by way of causal relations that relate back to the orbs (*aflāk*).

Without an alternative methodology for astronomy, those early *mutakallimūn* who were claiming that astronomy does not relate to reality were in fact responding to the realist definition of astronomy, as that dealing with the idea of the physical orbs being necessary. During the late fourteenth or early fifteenth centuries, Ibn Khaldūn (d. 1406) summarises the scientific scene in the Muslim world, where astronomy was not considered to give the reality of orbs, with the defence being the aforementioned issue of the non-relational equivalence of causal connections. Ibn Khaldūn states the following, in his *Muqaddimah*:

Astronomy (*‘ilm al-hay’ah*): It is a science that investigates the motion of fixed polar stars, rotating stars, as well as planets. It is relied upon their movements for inferring the forms and states of the orbs, which are considered to be required by these observable movements based on utilising geometric means ... This study is a noble practice, but it is not as is famously understood that it gives the structure of the heavens and the order of the orbs and the planets in reality, rather, it only relates to the idea that the shapes and forms of the orbs are [geometrically] inferred from these movements. You [i.e. the reader] know that it is not unlikely that one thing is an effect for two different things, and if we were to say that the movements are necessary, then this would be according to the affirmation by way of an effect for the existence of a cause, but this does not in any way [hold nor] yield reality.¹¹⁹

¹¹⁹ Ibn Khaldūn (d. 1406), *Muqaddimat Ibn Khaldūn* (Al-Qāhirah: Dār al-Tawfīqīyah lil-Turāth, 2010), ch. 6:21:

Ījī brings astronomy closer to a popular accepted position by attempting to remove any fear related to it, given, as he asserts, that what is spoken of in this discipline are mere imaginary spheres. Jurjānī (d. 1413), however, says that there is truth to it “*fi nafs al-amr*” (in actual fact) despite it being “*mawhūmah*” (imaginary), thus, the orbs for him are considered to be useful for the orderly arrangement of the planetary motion. The orderliness referred to by Jurjānī is not to indicate that this would give a picture of the orbs, rather, it is only for arranging the planetary movements, and which astoundingly despite it only being in the mind makes one wonder about how it is then used to locate the celestial objects. Ījī says in *al-Mawāqif* [with Jurjānī’s commentary in his *Sharḥ*]:

For these [i.e. the spherical lines and orbs] are fictional matters that do not exist in the outside and there is no prohibition [Jurjānī: “from a religious point of view”] for its like nor does it relate to doctrinal matters that are subject to proof or disproof. We have only made reference to it, here, in order to consider their [i.e. the *falāsifah*’s] ends in astronomy. Consequently, if it is seen as mere imaginings feebler than a spider’s web, than hearing its corresponding [sapless] expressions won’t frighten those sounding off their solid armament. [Jurjānī: “This, and its like, even if it were non-existent in the outside, however, it is fictional matters that have been imagined as being true and a matter of fact, as it could be attested to by sound human nature. It is not nonobjective imaginings such as the fangs of monsters of emerald mountains or a two-headed human. With these matters the order of celestial motion is studied from speed and slowness, as well as direction, in accordance to sense perception and observational instruments. Further, with these matters the various phenomenal states in the heavens and on Earth are conveyed to indicate the delicacies of the wisdoms and the wondrous natures imbedded thereof and which overwhelms and awes those contemplating it when considering the greatness of its Creator; inspiring them to say, ‘Our Lord you have not created this in vain’. This [additional] remark contains a valuable note within its expressions that one should consider closely without paying heed to anyone who derides it based on mere stereotype”].¹²⁰

علم الهيئة: هو علم ينظر في حركات الكواكب الثابتة والمتحركة والمتحيرة. ويستدل بكيفيات تلك الحركات على أشكال وأوضاع للأفلاك، لزمتم عنها هذه الحركات المحسوسة بطرق هندسية ... وهذه الهيئة صناعة شريفة، وليست على ما يفهم في المشهور أنها تعطي صورة السماوات وترتيب الأفلاك والكواكب بالحقيقة، بل إنما تعطي أن هذه الصور والهيآت للأفلاك لزمتم عن هذه الحركات. وأنت تعلم أنه لا يبعد أن يكون الشيء الواحد لازماً لمختلفين، وإن قلنا إن الحركات لازمة فهو استدلال باللازم على وجود الملزوم، ولا يعطي الحقيقة بوجه.

¹²⁰ Ījī says in *al-Jurjānī, Sharḥ al-Mawāqif* ..., 2: 410:

Going back to our earlier analysis of the differences between Ījī's empiricism and Jurjānī's mysticism, one can then understand more easily their proposals in astronomy as stemming from their theories of knowledge. By calling the orbs as mere imaginings, Ījī is indicating their subjectiveness which is inline with the earlier comment that mathematical knowledge produced by inferential *a priori* intuition (*ḥads*) is not binding against an opponent who does not share its construction in the mind. This perspective, therefore, clearly places mathematical models as being outside that which describes reality, but rather a kind of relativity whose foundation is the human intellect and not the outside world. This perspective, as we later see, fits that of an empirical idealist, who holds that mathematical entities, which are non-existent in the outside, remain pure subjective entities that are only considered as secondary intelligibles. On the other hand, the position of Jurjānī closely fits that of a mystical idealist or an existentialist, who holds that the mind mystically accesses reality (*nafs al-amr*) in his bid to overcome the existential dualism left behind by the empirical idealists. By attempting to normalise against Ījī's dualism, he, therefore, raises the prospects of mathematics, despite its subjective nature, as being true in itself and, thus, debatable against an opponent, as it is reflective of reality, albeit, by way of a mystical union with extramental abstractions.

Qushjī, on the other hand, gives a foundational system for astronomy, which does not resort to mysticism, but rather remains purely empirical, and, thus, affirms the

فهذه أمور موهومة ولا وجود لها في الخارج ولا حجر [من جهة الشرع] في مثلها ولا تتعلق باعتقاد ولا يتوجه نحوها إثبات وإبطال إلا أنا أوردناها لتقف على مقصدهم [في علم الهيئة] وإذا رأيت محض تخيلات أو هن من بيت العنكبوت لم يهلك سماع هذه الألفاظ ذوات القعاقع [فهذه وأمثالها وإن لم تكن موجودة في الخارج لكنها أمور موهومة متخيلة تخيلا صحيحا مطابقا لما في نفس الأمر كما تشهد به الفطرة السليمة وليست من المتخيلات الفاسدة كآنياب الأغوال وجبال الباقوت والإنسان ذي الرأسين وينضبط بهذه الأمور أحوال الحركات في السرعة والبطء والجهة على الوجه المحسوس والمرصود بالآلات وينكشف بها أحكام الأفلاك والأرض وما فيها من دقائق الحكمة وعجائب الفطرة بحيث يتحير الواقف عليها في عظمة مبدعها قائلا ربنا ما خلقت هذا باطلا وهذه فائدة جليلة تحت تلك الألفاظ يجب أن يعتنى بشأنها ولا يلتفت إلى من يذريها بمجرد العصبية الباعثة على ذلك .

study of astronomy as a scientific discipline. Qushjī's wonderment with the science of astronomy, as we see in Jurjānī's comment above, is at how the astronomical models - redefined within an empirical *kalām* program - simulate the outside planetary motions, despite being constructions of the mind. The mathematical constructive solution offered by Qushjī, however, is in a stark contrast to that of Jurjānī's, despite sharing with it the need to overcome the dualism of empirical idealism and the requirement to normalize a theory of knowledge that ultimately achieves *a priori* and constructive human knowledge. Qushjī, begins with the central idea that the mathematical non-existent entities are subject to the same theory of constructivism that existent objects of perception undergo. Hence, he replaces the idea of secondary intelligibles with his process of individuation that characterises our perceptual knowledge with the learnt concepts of the mind. In the case that the learnt concept is a mathematical relational one, we note that the process of individuation becomes a representation of our inferential intuition (*ḥads*), by which way *a priori* inferential knowledge is attained. This then facilitates for mathematical description to serve as being a derivational attribution (*ittiṣāf ishtiḳāqī*), rather than being a secondary intelligible that is devoid of reality and actual fact. In this way, we note that there is place for co-occurring predication (*ḥaml tawāṭu'ī*) that duplicate the outside objects in the mind, and under which mathematical attribution became a relative medium.

A normalised theory of knowledge according to Qushjī's explication is a theory that does not bifurcate reality into that which is primary and secondary so long as the individuation of the constructive knowledge is founded upon a learnt concept that resides as a universal in the mind. Whether the mental concept represents a static geometric relation in space or relational calculus across time, or whether it is relational in the first place or just a concept of a color, so long as it has been learnt from prior

experience, the concept then serves the process of individuation in the same way to become representative of one of the six *a priori* empirical divisions, that were discussed earlier, and by which way one constructively attains *a priori* knowledge.

Furthermore, by using constructive mathematics as a scientific framework for establishing relations between phenomenal objects, Qushjī was announcing the death of the unobserved orbs as being irrelevant to scientific investigation. In this way, Qushjī, for example, asserts that the Sun, the Moon and the Earth align in an observable eclipse, but he doesn't assert either of the eccentric or the epicyclic models for the Sun's observed motion. Without mathematical constructivism in astronomical modeling, which is Qushjī's unique contribution to physical science, the Ptolemaic models were only used for predicting the locations of individual celestial objects, but they were not themselves devised for ascertaining astronomical phenomena that involves more than one object as that was relegated to natural philosophy, which studies the assumed orbs, and not to mathematical astronomy. In contrast to realists, who held to the reality of the orbs as being necessary to a physical theory, Qushjī only considers epicycles and eccentrics etc as mathematical aids to simulate the observed cyclic motion of the planets but not as causal tools to demonstrate planetary motion, like the Aristotelians did. In fact, Aristotelian realism only results in fallibilism given that it considered the epicyclic models as being metaphysically real in themselves and descriptive of unseen physical world.

[Folio 190] Their [i.e. the *mutakallimūn*'s] words on this topic are based on what appears to the senses, and which is the consideration of the bodies that we have mentioned by way of *wijdān* (inner finding), *tajrubah* (experimentation) and *taftīsh* (research), for its qualities are based on using the method of *istiqrā'* (empiricism)

and not based on syllogism and the classification of intellectual possibilities, as this [in itself] does not produce any positive results hereof.¹²¹

III.2 INVESTIGATING BASIC ELEMENTS¹²²

[Folio 194] In the year 837 Hijrī (i.e. 1433), while the sun was in the beginnings of the sign the Balance [the sun is in the constellation Libra from about September 23 to October 22] a comet appeared close to the northern constellation Corona Borealis, and it was rising and setting with it without parting from it. Then after some time it became apparent that it had its own slow motion in the direction between East and North, while its volume was decreasing and its light was diminishing gradually until it disappeared after about eight months, as it had separated from Corona Borealis by a few degrees. In what we have observed, there is a clear indication that the sphere of fire [the comet] moves with the daily motion.

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[Comment] In his commentary on Ṭūsī's *al-Tadhkirah*, Ragep speaks of the relation between Earth's motion and the rotation of the comet. He says, "Some have used this as an empirical evidence for the Earth's rotation on its axis, but what it demonstrates is that if the comet does not follow the existing orbs then the whole system presented [by the *falāsifah*] is broken as the comet seems to cross from one orb into another and thus its motion like the planets has variation from the daily motion of the stars. According to Aristotle the comets are a phenomenon of the sublunar region and not of the celestial realm."¹²⁴ Therefore, accordingly, while the sighted comet does not provide

¹²¹ See Appendix III, Figure III.26.

¹²² *Al-'anāṣir al-baṣīṭah*.

¹²³ See Appendix III, Figure III.27.

¹²⁴ F. J. Ragep, *Nāṣir al-Dīn al-Ṭūsī's Memoir on Astronomy (al-Tadhkira fī 'ilm al-Hay'a)* (NY: Springer-Verlag: 1993), 384.

direct evidence for Earth's motion, it also does not supply evidence against it. Rather, what it provides for Qushjī is further evidence in support of the *kalām* program for a scientific methodology of astronomy against that of the *falāsifah*. The *kalām* program turned Aristotle's physical orbs that were considered as necessary causal structures into imaginary spheres that form no causal basis but merely aid in describing the phenomena.

In what follows, Qushjī responds to the view [by Shīrāzī]¹²⁵ that says, “had the comet followed the daily motion it would have been in parallel to the equator [as Ṭūsī had stated] but that is not the case as it moves to the north of the equator at times and to the south of it at other times”. This view would eliminate the possibility of Earth's motion as it assumes that the comet is not subject to the daily rotation and, therefore, its own motion as seen from Earth would be independent of it. Qushjī, hereby, defends the possibility of Earth rotation but eliminating any empirical evidence against such an idea, and he relegates the study of such rotation, as we see in the next chapter, to constructive astronomical modeling.

[Folio 194] [Qushjī says in response] This view just raised is nothing [of validity] because as we have observed, it [i.e. the comet] moves in this way [i.e. with its irregularity from daily motion] with its own specific motion. Similarly, all the planets move with the daily motion, while having their own unique motions, which are at times to the north of the equator and at times to the south of it. ¹²⁶

[Comment] In addition to the response above, Qushjī also responds to the assertion that, “the convex surface of the Moon's orb is the place of the fire, whereby if the fire moves longitudinally with the movement of the orb of the Moon by being fixed on it, the way

¹²⁵ According to Ragep, Qushjī disputed Shīrāzī's dismissal of the daily motion of the comets in conformity with the orbs by citing the comet of 837 *Hijrī*, which he claimed to have personally observed (Ibid.).

¹²⁶ See Appendix III, Figure III.27.

the seated on the ship moves with their place, then the fire would be moving due to the motion of its own location”. In fact, in this latter response, Qushjī had another purpose, which is to show that the *falāsifah*’s system of the orbs with its specified number of orbs (inner and outer) does not in fact account for the comets which according to their philosophy would mean that each comet has its own different system of orbs with inner rotational units (epicycle, eccentric circle, etc.). By denying this in accordance to the philosophy of the *falāsifah*, Qushjī was raising difficulties against such a system of orbs. Qushjī concludes, “that the above opinion [he responds to] must be invalid, otherwise, all the other four elements [according to their philosophy] would be moving as well with this lunar motion”. Further, he adds that “the analogy to the seated on a ship is fictitious as that analogy is used [by them] for straight motion, while the discussion here is over a circular one [which has different dynamics]”.¹²⁷

[Folio 195]¹²⁸ [Comment] Ṭūsī’s opinion on Earth’s immobility follows his account on the motion of the comet, as according to Qushjī’s *Sharḥ*, Ṭūsī considered the following argumentation as evidence for Earth’s stillness. The first argument itself is framed within a system of physical orbs, whereby, he says that had Earth being mobile it would have moved (1) from the center of the world, (2) to the center of the world or (3) on the center world. Ṭūsī rejects the first two on the assumption that would result in the Moon not having its eclipse according to its real rotational phases [i.e. unpredictable] and which he considers invalid, while concerning the third possibility, Ṭūsī holds that this would require the motion in a circular manner for that which contains the principle of straight line motion, and which he rejects as having been disproven. According to

¹²⁷ Ragep says that Copernicus appeals to the analogous motion of the comets in the manner defended by Qushjī to legitimize the possibility of Earth’s rotation (Ibid.).

¹²⁸ See Appendix III, Figure III.28.

Qushjī's commentary, Ṭūsī, then attempts to prove the fixity of the Earth by giving two case studies. The first relates to throwing two rocks horizontally - one in the direction of the assumed motion of Earth and in the other in the opposite direction - resulting in scenarios that are contrary to empirical evidence, such as the rocks being superseded by a faster Earth or otherwise overcoming the Earth's motion if the rocks were thrown faster than Earth's assumed motion. The results are, therefore, rejected according to Ṭūsī based on the condition that the air is not adjoined to the Earth, unlike the ether that adheres to the orb. On the contrary condition, however, that the adjoining air is assumed to move with the Earth, Ṭūsī holds that Earth's motion would be disproven based on the other case where two rocks of different sizes are thrown in the vertical direction, i.e. perpendicular to the surface of the Earth. With this case Ṭūsī assumes that the smaller one would be moved less than the bigger one resulting in the rocks falling in non-parallel lines, which again he rejects on what he cites as being empirical evidence. Ṭūsī adds that, consequently, his above argumentation would refute what some ancients have mentioned about the Earth having an established diurnal motion from west to east by which way the planets have their faster daily motion due to Earth's rotation, and with which they give the example of the ship on water that appears to be still, while the shore appears to be moving in the opposite direction. Qushjī's response to all this argumentation comes in the following manner:

[Folio 195] The answer to the first proposition is that it has not been affirmed that it is denied for that which contains the principle of straight line tendency to have circular motion [i.e. if the parts of Earth moved in straight lines this does not prevent Earth itself from rotating in circular motion]. Regarding the second, what is meant by adhering to the air is the adherence to it of all that it contains from

rock or other matter, whether small or big. Consequently, no inadmissible conclusion follows [from Earth's motion]. ¹²⁹

[Comment] Qushjī with this passage is not seeking to establish any counter alternatives to the Aristotelian natural philosophy, rather, he is engaged in a project that sees the removal of all presuppositional impediments that the Aristotelian natural philosophy had imposed upon natural phenomena. On the possibility of Earth's motion, which as we saw Qushjī permits, the motion itself would, for realists, be non-existent in the outside as existing in the outside under realism is only established through direct sense-perception and no such motion is sensed. But Qushjī turns this necessitarian worldview into one that is contingent with regards to the natural world, and in doing so he dispenses altogether with the speculation of Aristotelian natural philosophy, or in other words, he universalises physics by making it founded purely upon empirical and mathematical premises.

4.3 CONCLUSION: FROM CONSTRUCTIVE *KALĀM* TO UNIVERSAL SCIENCE

Indeterminacy and contingency in natural science are harnessed by a constructivist theory of *a priori* knowledge, whereby in disassociating from realism, determinism is not taken to be a feature of the physical world. In fact, indeterminacy with the common meaning of non-necessitarianism or contingency is a basic premise of constructivism, as the assumption of determinacy which is a cornerstone for all realist theories is hereby rejected as an unverifiable presupposition. With constructivism the place given to ontological determinism by Aristotelian logic, is, alternatively, reserved for mental existence and its associated learnt concepts. In order to systematically achieve this,

¹²⁹ See Appendix III, Figure III.28.

constructivism as a theory of *a priori* knowledge relies upon universal concepts in the mind in order, for example, to study and establish the apparent phenomena of both the celestial and the terrestrial worlds. The scientific method that follows is, therefore, not one that is based on the idea of *a priori* presuppositions, nor on its later offshoot under the hypothetico-deductive method.

The key terms intuition and induction, which form a cornerstone to a realist theory of knowledge are not abolished, with constructivism, but rather are reformed to fit within a scientific view of knowledge stemming from the subjectivity of the human endeavour for *a priori* constructive knowledge. Constructivism, indeed achieves this by establishing constructive knowledge as being *a priori* to human rational analysis. With determinacy rejected, constructivism also refuses the assumption that the future necessarily resembles the past and maintains that physical order is mentally constructed through an ongoing process of experiencing and conceptual learning from the world. In fact, within such a worldview the problem of induction, which is closely associated with indeterminacy does not hold, and induction is itself replaced with an active cognitive process of learning concepts in the mind. Induction as an empirical process is not based on absolute uniformity in nature, as is widely held under the idea of laws of nature. Therefore, any claims about indeterminacy leading to a scientific conundrum, as is held by the many realist interpretations of quantum mechanics, are refuted under the normative approach of constructivism and its subjective and conceptualist dimensions.

Constructivism's approach to reality establishes *a priori* knowledge as that particular empirical knowledge, which is individuated from the mentally existing universal concepts that have been learnt from the prior experiencing of the physical world. The Qushjān approach to constructively derived attribution, therefore, could be contrasted to realism's co-occurring predication to be regarded as an alternative to

reality under ontological realism that focuses on the epistemic reality of phenomena as perceived by a human mind. To the contrary, the positivist approach to reality resorted to the use of a “hypothesis” or to “guesswork” alongside a necessitarian deductive method that rejected empirical *a priori* knowledge leading eventually to various forms of idealisms and instrumentalisms. The safe route for Qushjī was that he did not get entangled in the *falāsifah*’s realism, as he adhered to the *kalām* tradition, which rejected the deterministic causal approach to science. Alternatively, as we see in the next chapter on the foundations of Qushjī’s astronomical models, Qushjī considers that the actual motion and the mechanics of the planets and other celestial objects is what is actually central to his scientific study of astronomy.

By making astronomy purely empirical, Qushjī was indeed the first post-Ptolemaic scientist to universalize astronomy by bringing it into the realm of demonstrability and constructivism of knowledge. This was achieved by founding astronomy on constructed universal concepts in the mind of the astronomer that are individuated to allow the astronomer to attain the particular constructive knowledge of astronomy’s planetary states and motions. Constructive astronomical models, therefore, are a representation of the universal mental concepts that are learnt from drawing mathematical relations between celestial objects. In this way constructive knowledge is considered to be foundational knowledge with the meaning that it precedes the premises and presuppositions of theology, as those result from a process of reasoning that itself relies upon the *a priori* nature of empirical knowledge. Universalism, therefore, in its original sense does not imply a state of being anti-theological, it merely means that in the process of human knowledge, it is the positing of the empirical as being *a priori* to the rational, which is the category that theology belong to. Therefore, no conflict arises under a constructivist theory of *a priori* knowledge between science and theology. In

fact, as we saw, the whole development of constructivism, as a framework for the foundations of science, under the meticulous research of generations of *kalām* scientists only attests to the foundational role that *kalām* played in the rise of the new scientific methodology.

Our next and final chapter before the conclusion applies the above explication onto the constructivist foundations of Qushjī's astronomical models.

CHAPTER FIVE

CONSTRUCTIVE FOUNDATIONS OF QUSHJĪ'S ASTRONOMY

5.1 PROGRAMS IN ASTRONOMY: REALISM, INSTRUMENTALISM AND CONSTRUCTIVISM

Realism or direct correspondence in astronomy, and more generally in science, implies that perception involves having forms in the mind that are abstracted from the outside objects. In this way, universal forms themselves are considered to exist in the outside - defining what is taken to be objective or intersubjective. By applying this realist theory of knowledge to astronomy, it has been stated by realists that because no immediate sensory effect is experienced from the motion of Earth, hence, the presupposition follows that Earth is stationary and does not move. For realists, the application of mathematical sciences to the physical world is based on the same process of mental abstraction from the outside that sees mathematical entities acting as mere abstractions. Under a realist philosophy, mathematical analysis is, therefore, not considered to be a tool for discovery, but rather only one for the purpose of demonstrating what has already been perceived to exist in the outside. By applying this method to the problem of Earth's motion we note that the establishment of Earth's motion would not be mathematically attained, but rather only postulated as an *a priori* presupposition. In Ptolemaic terms, this would mean that the role of mathematical astronomy is only limited to the description of what the realist astronomer metaphysically considers to be the cause of the perceived phenomena that is observed on the celestial ecliptic. The idea of the spherical orbs then becomes mathematically intertwined with realist astronomy as a foundation for its practice and without which the whole discipline would become meaningless to realists.

Far removed from such presuppositions, the scientific doorway to Earth's motion was opened up by a new philosophy of science that allowed for mathematical modeling as a constructive rather than a realist process. As described earlier, constructive mathematics or modeling begins with the known concepts of the mind to intuitively individuate the particular knowledge of perception that intertwines the sensory input with the learnt universal concepts of the mind. Constructivism holds that *a priori* knowledge is intuitively or involuntarily constructed in the mind by merging the learnt mental concepts, including the relational ones, such as mathematical relations, with the sensory input. Under constructivism, therefore, empiricism becomes an exercise of mental derivation (*ishtiqaq*) from the outside and not a static reoccurrence (*tawātu*) of abstract forms in the mind. Qushjī's revolutionary acceptance of the idea of a moving Earth, as we saw in the previous chapter, was done under the purview of constructivism as a new development in theory of knowledge that allows for mathematics to serve as an intuitive *a priori* tool to draw relations about empirical existence.

Furthermore, scientific discovery is about proceeding from foundations to empirical knowledge as opposed to the reversed method of demonstration that can only claim to approximate reality. Constructivism as a scientific methodology that facilitates discovery drops the idea of universal *a priori* presuppositions and substitutes it with empirical *a priori* knowledge that is constructed by the individuation of a universal mental concept. In this way, one can proceed in science to mathematically discover what is conceptually perceivable, as opposed to using mathematics to demonstrate what has already been hypothesised, by guesswork, and claimed to be known *a priori* by fitting the collected observations reckoned from the fixed apsidal reference into this hypothetical scheme. To be a constructivist in astronomy, therefore, is to seek the

empirically founded reality of planetary motion beyond the idea of the physical orbs and its restrictions and associated *a priori* presuppositions, as we later see in practice when studying Qushjī's astronomical models.

As a simple application, however, we can apply these ideas to the Sun model. Whether we represent the Sun's motion with an epicycle or an eccentric equivalent, the real motion of the Sun is what is sought, and this means that the empirical knowledge produced as far as the observable motion is concerned is actually the same. The problem with interpreting the epicyclic and the eccentric models was introduced, into an otherwise simple mathematical parallelogram transformation, by a realist theory of knowledge that considers the epicycle-deferent system as a motion compounder, while the eccentric model as one that only indicates motion that is assumed to have been reckoned from a fixed apside. In fact, the issue of fixing versus moving the eccentric of the carrier of the planet's epicycle becomes a central theme, as we see later, for Qushjī's revolutionary program in astronomy.

The problem of non-uniqueness in the modal relationship between concomitant cause and effect, as was raised in the previous chapter, could be related here to how the realist program deals with the equivalence of the epicyclic and eccentric models. In particular, the case of Solar model under epicyclic and eccentric hypotheses exposes the fallibility of the realist program, whereby the apparent motion of the Sun as an effect could be represented by two mathematical models that realists hold to be a causal representation of the orbs. This shows how the realist method of fitting orb-models onto a phenomena does not result in unique modeling, but rather leads to the instrumentalist Platonic program of "saving the phenomena". On the other hand, to constructively build an astronomical model is to describe the apparent phenomena using known relational concepts that the mathematics becomes a symbolic language to express. On the other

hand, to only display eccentric or epicyclic features in a model that merely saves the phenomena would be an instrumentalist philosophy that only epitomises what remained of Ptolemaic astronomy. Mathematics under constructivism is, therefore, a conceptual language of description that could constitute the human empirical knowledge of reality.

Subjective idealists, on the other hand, such as Ṭūsī (the philosophical head of the Maragha Observatory), despite their subjectivism, still retained a form of realism¹. In fact, they took mathematics to be a secondary intelligible that only existed in the mind, i.e. not a real description of the outside. Under such a relativist philosophy of mathematics, only the primary intelligibles, which were considered to exist in the outside, were taken to constitute the objective and the real. This explains Ṭūsī's approach to astronomy as an instrumentalist domain, and it also helps us understand, as we further explore later, the philosophy of the Ṭūsī couple and the 'Urḍī lemma as modeling tools that were utilised by the Maragha astronomers, until the time of Ibn al-Shāṭir, and which later reappeared in Copernicus' works and arduously stretched to re-satisfy the stronger realism of Copernican philosophy.

Ṭūsī's method of mathematical demonstration, as followed by Maragha astronomers, is based on the Aristotelian method of presuppositions that are assumed to be universal abstractions from particulars. In such an approach to perception, mathematical forms are assumed to be abstracted from the outside, which means that only static geometric forms are assumed to be instantaneously obtained without any mechanical philosophy of change in time and space, which in fact is needed for adopting a moving eccentric or a constructive circle. In this way, observation is not a static realist activity, but rather a constructive relational process that includes multiple objects in

¹ Ṭūsī is also the author of the text *Tajrīd al-Kalām* that we saw Qushjī write his popular commentary and critique on in his *Sharḥ al-Tajrīd*. The philosophical theory of knowledge followed by Ṭūsī has been extensively reviewed in our previous chapter.

space across various moments in time. Constructivism, therefore, allows physical change across time (i.e. motion) to be mathematically conceptualised based on mental concepts, whether they are relational mathematical or otherwise. In this way, astronomical modeling becomes an exercise of calculus aimed at describing the phenomena.

Constructivism, as we see in this chapter, as opposed to realism, was a theory of knowledge that provided both the physical foundations, which allowed for the conceptual elimination of any empirical impediment to Earth's motion, as well as the perceptual basis for empirically establishing such a possibility using constructive mathematical modeling. In this way, uniform circularity was used as a constructive foundation to indicate the basic unit of uniform compounded motion. In fact, historically this is not very different to the uniform polar rotations that Euler much later introduced into complex mathematical analysis².

Here, we can already note three different programs in astronomy; the older two of realism and instrumentalism that originated with the Greeks and the later one of constructivism from the *kalām* program of astronomy. The issue here is, therefore, one of foundations and philosophy of science. With the gradual exposure of the fallible foundations adopted by the realist program, instrumentalism came to replace realism as an approach to science that gives up the idea of *a priori* presuppositions being a viable foundation for science. At the same time, in the absence of a genuine theory of knowledge to replace realism, instrumentalists satisfied themselves with the utility of

² In 1748 Leonhard Euler obtained Euler's formula of complex analysis, Euler's formula is ubiquitous in mathematics, physics, and engineering. The physicist Richard Feynman called the equation "our jewel" and "one of the most remarkable, almost astounding, formulas in all of mathematics". This formula can be interpreted as saying that the function e^{ix} traces out the unit circle in the complex number plane as x ranges through the real numbers. This can be represented in a polar coordinate system which is a two-dimensional coordinate system in which each point on a plane is determined by a distance from a fixed point and an angle from a fixed direction thus facilitating a basic unit of mathematical constructivism.

scientific practice irrespective of the methodology or foundations of science. The three theories of knowledge can, therefore, be summarised under the following philosophical approaches:

- A. The realist seeks to know the actual structure of the universe but does so based on a realist theory of knowledge. In the Middle Ages, this was thought to be the job of the philosopher, not the astronomer, so, regardless of what Ptolemy's actual views were, astronomers took an instrumentalist attitude to much of his theory. Ptolemy might have been a realist about the Earth being at the center of the universe, but Ptolemaic astronomers were instrumentalist about epicycles, equants, and other mathematical constructions.
- B. While realism remained a foundationalist theory of knowledge, in the face of the various challenges posed against it, instrumentalism gave up on the idea of foundational science by taking the step of abandoning all foundations, both realist ones as well as those constructive foundations that are needed for attaining empirical knowledge. According to the instrumentalist, therefore, what we want out of our scientific knowledge is accurate predictions, i.e. the idea that the mathematical model in one's theory should "save the phenomena" or appearances.
- C. The constructivist, on the other hand, seeks to construct the understanding or knowledge of reality based on a constructive theory of *a priori* knowledge. This was the path initiated by the *kalām* scientists whose philosophy of science was foundational and constructivist. This path reached its maturity, as historical and philosophical evidence presented in this dissertation seem to indicate, under the scientist Qushjī in the fifteenth century; a man who had spent his final days and died in Constantinople under its new Ottoman rulership.

5.2 PTOLEMY'S EQUANT PROBLEM: A CHALLENGE FOR REALISM

Astronomy, as a mathematical discipline, holds that planetary motion with its retrograde arcs³ and other anomalies could be reconstructed by way of compounding uniform circular rotations. In order to achieve this in its pure form, the observer would have to be at the center of the constructive astronomical model. The observer's centrality, however, does not mean that motion has to be truly centered on the Earth, as a constructive model is not a physical reconstruction of absolute motions, although it

³ Planetary retrograde motion is when the planet reverses its motion, slows, halts and then rejoins the stars again.

should provide the foundation for such a physical explanation. After all if geocentrism was true in its pure form then astronomy would be able to reconstruct planetary motions with ease, something which wasn't to be in the history of astronomy, and which, consequently, raised questions about the reality of planetary, solar and lunar motions. In this way, we see how constructive astronomy is not based on any causal theories or assumptions of necessary presuppositions to represent the reality of planetary motion. Further, the mathematical tool of using uniform circular motion to construct planetary models is not one that relates to spheres and their causal effect as we earlier saw in our analysis of Qushjī's *Sharḥ al-Tajrīd (Commentary on Abstracting Kalām)*, rather this is a rational foundation based on the idea of repeat uniform patterns which when combined with the *kalām* idea of an inanimate celestial world results in circular motion as a basic notion for modeling the recurring patterns of apparent planetary motion.

With hindsight, Aristotelian or realist astronomers, beginning with Hipparchus (2nd century BC), accepted a realist aberration into mathematical astronomy, when they introduced an eccentric circular hypothesis to model the Sun's elliptical apogee and perigee motions (i.e. the faster and slower apparent motions). In fact, such a hypothesis which was to be verified by observation was ultimately exposed as empirically nonviable when Ptolemy introduced into this eccentric circular hypothesis his infamous equant point, which bisects the circular uniformity of the upper planets into a center of uniform motion and a center of physical uniformity. By empirically noting the synchrony of the upper planet's retrograde motion and the Sun's motion through the opposition of the Sun to the retrograde arc, one can then relate the equant point and its modeling of the speed of the planet's epicycle center to the Sun's apparent motion. Furthermore, with Mercury, whose retrograde arcs act as a magnifier for small variations in the Sun's motion exposed the circular hypothesis of the Sun's model even

further when Ptolemy was forced to introduce a director to control the shape of the epicyclic center, which in Ptolemy's model coincided with the mean Sun.

In fact, the circular hypothesis to represent the Sun's apparent motion is related to realism and its hypothetico-deductive logic which when combined with Occam's Razor gives the problematic circular model for the Sun as a circle is simpler than other elliptical curves including the ellipse. Another defect of realism is that it attempts to verify science by demonstration or later by experimental time-testing, which in neither case can claim to have produced certain knowledge. Without high observational accuracy, due to a lack of precise instrumentation, this meant that a false theory could not be falsified according to realism. In this way one's hypothesis always seems to be awaiting falsification due to some future experimentation. Contrast this to constructivism, which as we saw in the previous chapter does not rely upon a hypothetico-deductive method, and one can start to see how a timely methodological revolution was introduced into astronomical practice.

Perhaps the crisis with the realist approach to astronomical planetary modeling is best captured by Ptolemy's rejection of the eccentric model for the second anomaly of the lower planets the way he had allowed it for the upper planets. Qushjī's summary of this crisis with Ptolemaic astronomy, and with realism more generally, comes in the preface to his treatise on disproving this Ptolemaic claim. Qushjī says:

The author of *Almagest* asserted that the eccentric model is only applicable to the three [upper] planets that are found at all distances from the Sun, and that it is impossible for the lower ones, because this model represents such a motion, while they [i.e. the two lower planets] are not distant from the Sun except by a small margin. Consequently, only an epicyclic model is possible for them. Most verifying bookmen agreed with him on this including the Mulla and scholar, the author of *al-Tuhfah* [i.e. Shīrāzī]. Perhaps, they judged this to be so when they initially observed that the middle of the direct and the retrograde motions according to the eccentric model happen at the apogee and perigee and such positions are in opposition on the celestial sphere. With that they perhaps thought that under this model, when the planet is in the middle of its direct

motion it is in conjunction with the Sun and so during retrograde motion it would according to this model be in opposition to the Sun and vice versa. Consequently, according to this model, the planet would undergo, between the middle of direct and retrograde motions, all distances from the Sun. This is in contrast to the epicyclic model where both the middle of the direct and retrograde motion happen at the apogee and perigee of the epicycle, while both positions are one on the celestial sphere. Therefore, the two lower planets according to the epicyclic model are in conjunction to the mean when they are in the middle of direct and retrograde motions and thus they do not undergo all distances from the Sun between the two positions, rather they are only as far from it as the epicyclic radius.⁴

Following such exposition, Qushjī adds as we later explore that “the matter is not as they have speculated”. Empirically speaking, we can note that the Sun’s apogee appears to be fixed against the stellar background. This, according to realist astronomy, is linked to a circular eccentric hypothesis for the Sun that implies that the motion of the Sun is a result of one circular uniform rotation. Matters get more complex for the Ptolemaic realists when the eccentric model is investigated for the lower planets. In this case, as Qushjī notes above, the eccentric rotation is considered to be independent of the Sun’s rotation, as being two objects of sense perception, which means that as the planet rotates on the celestial sphere it is assumed that under an eccentric model it would come in opposition with the Sun’s fixed celestial apogee. On this basis the eccentric model was rejected for the lower planets in favour of the epicyclic one, which by design links the mean Sun to the epicycle apogee and perigee by avoiding the conceptual challenge around the eccentric model.

The critical issue here is, thus, the fact that the apside is taken to be a static reference for the planet’s rotation as realist hypotheses are presupposed to fit the data without any imbedded conceptualism or constructivism. In this case, the two observations of the Sun and the planet are not associated together according to a

⁴ This treatise has been edited and translated in Ragep’s *‘Alī Qushjī and Regiomontanus: Eccentric Transformations and Copernican Revolutions*.

geocentric hypothesis and it would be totally farfetched to assume that a realist astronomer proposed a moving Earth hypothesis in order to disprove Ptolemy's rejection of the eccentric model for the second anomaly of the inner planets. On the other hand, Swerdlow (1973) was the first to suggest that it was the eccentric model for the lower planets in particular, and which Ptolemy has disallowed, that contained the conceptual breakthrough leading to a Copernican revolution in astronomy. In other words, realism is based on non-constructive referencing that delinks the apside of the Sun from the inner planet's rotation showing them under an eccentric model to be in opposition. The reason behind this is that realism begins its modeling experience with the group of observations, without any constructive *a priori* foundationalism, while Qushjī's compounded double motion (or more) to produce the same observation, as we later see, is founded on the *a priori* constructivism that his theory of knowledge allows. Consequently, it was Ptolemy's theory of knowledge, which was the actual reason that prevented him from accepting the eccentric model for the lower planets. Therefore, Ptolemy prevented such transformation between epicyclic and eccentric models for philosophical reasons and not based on any empirical or mathematical grounds. The realist assumption about the circular hypothesis for the Sun's apparent motion, therefore, stems from the same philosophy that disallowed them from using an eccentric model with its encompassing rotation to represent the association between the Sun's apogee and the lower planet's own motion on the celestial sphere. Confusion in astronomy, therefore, arose as Aristotelian realism was adopted as a philosophy and as a theory of knowledge in mathematical astronomy.

To return to our topic of empirical modeling, we can now better understand why the equant point arose in the first place as it was the circular hypothesis for the Sun's model that ultimately failed to empirically account for the first anomaly of the upper

planets, which as we stated earlier is a feature associated with the Sun's apparent motion. The reason why the upper planets do not appear to be uniformly rotating around the center of a circular rotation is because the celestial objects trace a non-circular path, whose form is crucial to constructing a model of reality. The equant is, therefore, a result of the realist program in astronomy and is more a philosophical failure than an empirical one, as the unicircular hypothesis is in itself a philosophical *a priori* presupposition and not an empirical result. Consequently, the revolutionary solution proposed by Qushjī, and which we study in a later section, was a conceptual reform to Ptolemaic astronomy and one that relates to the theory of knowledge and the astronomer's understanding and modeling of physical reality.

5.3 POST-PTOLEMAIC MARAGHA ASTRONOMY

In the post-Ptolemaic era, the issue of the circularity of celestial motion was itself being questioned as the equant problem continued to occupy a central place in relation to the foundations of astronomy. In fact, instrumentalism is a name that could describe an astronomy, such as that of Ptolemy's, that no longer proceeded from known foundations to phenomena, but that rather only tried to fit the celestial observations within a speculative hypothesis. Such, however, as we saw was a crisis of realism as a theory of knowledge and not of astronomy itself as a mathematical discipline to model celestial reality.

With the arrival of the Arabs onto astronomy's civilisational arena, the instrumentalist separation between astronomy and its foundations was rebuked by a new era of Arab philosophers and mathematicians. After the fall of Baghdad to the Mongols in the thirteenth century, the Maragha Observatory was established under the patronage of the Mongols and the leadership of Ṭūsī. The Maragha astronomers, who were

philosophically following the program devised by Ṭūsī, attempted a solution to the equant, which ultimately was not a general solution to the equant as it failed the test for Mercury's Ptolemaic equant and which remained an unresolved issue within their epicyclic alternative models. The reason behind this was that the Maragha approach retained the unicircular hypothesis for the Sun's motion that was a result of the realist program that they had inherited through Ptolemy's *Almagest*. An epicyclic model, used by the Maragha astronomers to replace the equant, avoids, as we saw in the previous section, the conceptual debate around the utility of the eccentric model, which we further explore later and which under Qushjī relates directly to the constructive breakthrough in astronomy.

In other words, Maragha astronomy is based on a form of idealist or transcendental-realism that although attempts, in an *a priori* manner, to construct the feature of the equant point, it nevertheless ultimately remains captive to a realist theory of knowledge. To understand the place of Maragha astronomy in the history of Islamic science, one needs not go beyond the philosophy of Ṭūsī, who himself was a philosopher in the Avicennan realist tradition that had written a *kalām* text, and so was influenced by both camps (i.e. the *falāsifah* and the *mutakallimūn*) as he maintained his general Avicennan framework⁵. Consequently, Maragha astronomy remained within the fold of a realist philosophy that was itself part of the problem with Ptolemaic astronomy. The Maragha approach was, therefore, to reconstruct the Ptolemaic unicircular equant point (*falsafah* realism) using constructive uniform rotations (*kalām* constructivism). However, such a syncretic methodology did not result in an ultimate generalised

⁵ Ṭūsī had accepted the thesis of *al-wujūd al-dhihnī* (mental existence) of the *mutakallimūn* under a mystical or an illuminationist interpretation. As mystical realists, the Maragha astronomers, therefore, devised rational tools that do not describe the phenomenal world except by instrumentally "saving" it, as they believed that the reality is hidden from the phenomenal world and belongs to another abstract realm (*nafs al-amr*) that is perfect in itself.

solution to the equant problem that could cater for Mercury's and the lunar models, as Qushjī's could with his constructivist practice and foundations.

The problem with the post-Ptolemaic practice of Maragha was, therefore, with the conceptual philosophy of the astronomer himself and not one that related to the level of observational precision or to the trigonometric transformations and proofs, as the direction that the Maragha program seems to have taken. In fact, with such historical turns one can easily note the failure of realism in providing the foundation for the progress of science and the emergence of instrumentalism as an approach that syncretised constructive practices with realist foundations in the manner that the Maragha astronomers had done.

An applied Ṭūsī couple and a 'Urđī lemma, being the proposed Maragha solutions to the equant, give the same curve pictured below in Figure 5.1.

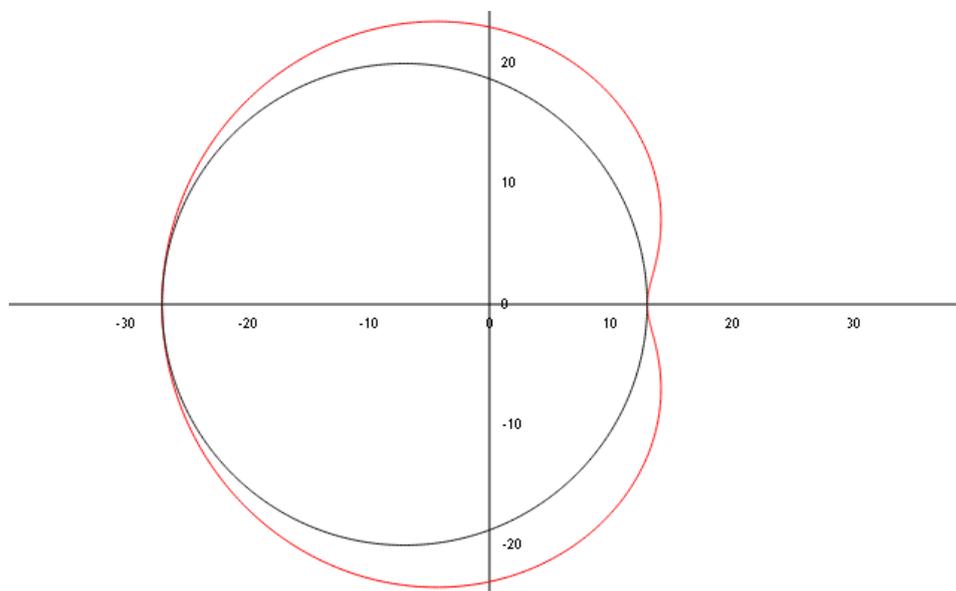


Figure 5.1 'Urđī lemma applied to the problem of the equant for the upper planets is represented here by the outer curve, while the perfect eccentric circle (-7) is represented by the inner one. The two do not actually coincide. The ratio of 20:7 for the deferent radius to the radius of the 'Urđī epicycle have selected to better show this discrepancy. The above figure was plotted as a parametric function with $x = 20\cos(\alpha) + 7\cos(2\alpha - \pi)$ and $y = 20\sin(\alpha) + 7\sin(2\alpha - \pi)$.

In Figure 5.2, we only provide the *Urđī* construction of this solution due to the fact that Ibn al-Shāṭir’s models contain this solution as a core component, as well as those of Copernicus (irrespective of the argument for transmission or parallel development). In analyzing the construction it could be noted that the model indeed satisfies Ptolemy’s equant feature⁶, but the produced curve in Figure 5.1 is, however, not a uniform circle as Ptolemy had hypothesised but is rather at a discrepancy from a pure circle as we see in the figure, with the outer one being *Urđī*’s proposition and the inner one being the circle⁷. If, on the other hand, one notes that the two points that the proposed Maragha solution tries to reinstate, i.e. the equant point and the circle center, are actually the points defined by Ptolemy based on his unicircular hypothesis one then realises the imbedding of this realist presupposition within the Maragha models. What this implies is that the curve in Figure 5.1 is intended to approximate the Ptolemaic eccentric circle upon which the points were empirically fitted. In this way, the only way the Maragha astronomers can verify their constructions is by the margin of error from the uniform circle, and this means that the much celebrated supposed solution to the equant, based on the *Urđī* lemma that Ibn al-Shāṭir later uses and which also appears in its exact form in Copernicus’s models, is not a real solution to the equant but rather only an “apparent” solution with the actual discrepancy based on empirical evidence between the two being non-discernible to a human observer due to its small margin of error (relative to Figure 5.1 which was a conceptual demonstration – for parameters closer to the actual values please refer to Figure 5.3 below).

⁶ The curve that results from the bisected eccentricity of the *Urđī* lemma, which was used to resolve the equant problem of the upper planets, does itself produce a curve whose motion is uniform at the equant point as we see in Figure 5.2, where lines EC and MF are parallel, which indicates that the produced curve in Figure 5.1 that results from tracing point C is actually uniform at E representing Ptolemy’s original equant for the upper planets.

⁷ The ratio of epicycle to deferent in the plotted curve has been increased to highlight the discrepancy.

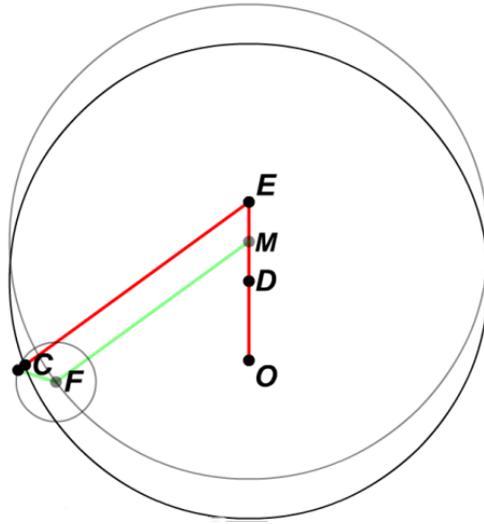


Figure 5.2 'Urđī lemma in epicyclic form applied to the problem of the equant for the upper planets. The lines EC and MF are parallel which indicates that the produced curve in Figure 5.1 that results from tracing point C is actually uniform at E, the original Ptolemaic equant.

The Maragha solution to the equant although constructive, it nevertheless is an arbitrary solution that fits a realist/instrumentalist philosophy. The Maragha astronomers only reconstruct Ptolemy's points and they do that as we saw in Figure 5.1 by way of two rotations with speeds α (deferent) and $2\alpha - \pi$ (epicycle) that do not produce a symmetric curve around point D (Figure 5.2), despite their best efforts to do so in bisecting Ptolemy's eccentricity value with the center of their constructive configuration at point M . By reconstructing Ptolemy's two points (the center of the circle and the equant point), which in the case of the upper planets are based on a unicircular hypothesis for the Sun's model, the Maragha astronomers were keeping their solution within the confines of a realist approach to astronomical modeling that begins with a realist *a priori* presupposition. The result is that while the curve they construct is no longer circular as it is composed from two motions, but nevertheless it attempts to reconstruct the Ptolemaic realist points (refer to Figure 5.3 below). We have, therefore,

named the philosophic approach of the Maragha astronomers as transcendental-realism or instrumentalism, rather than being a constructive and a conceptual solution, as we later find in the works of Qushjī.

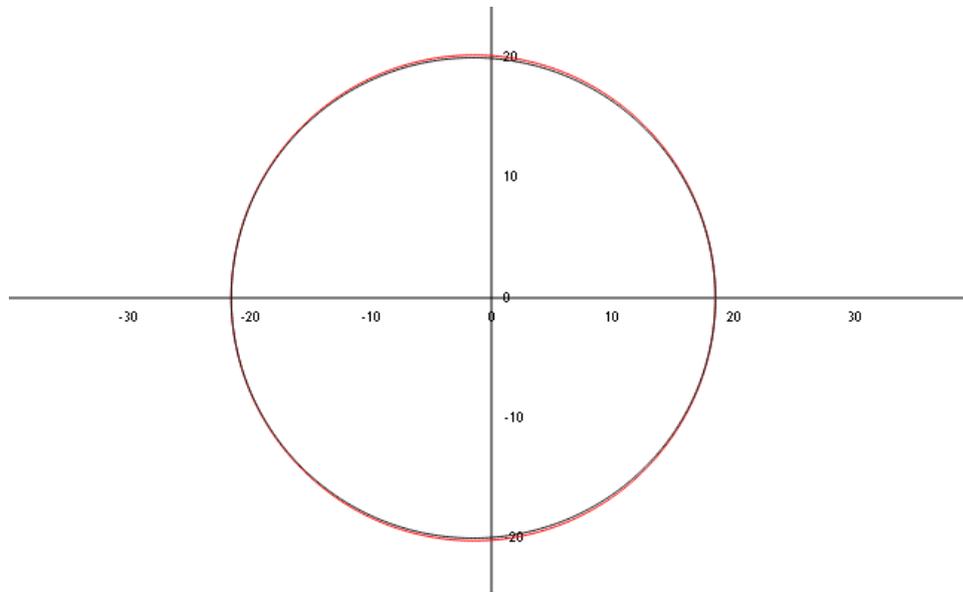


Figure 5.3 This is a repeat of Figure 5.1, however, with parameters that are closer to the actual values. The ratio of the epicycle to the deferent radii selected here is 1.5:20. We also note that the outer 'Urđī curve (in red) is almost identical to the eccentric circle centered at -1.5.

So from a realist perspective 'Urđī can be seen to have resolved the problem of the equant, because the curve formed in Figure 5.3 by the above model in Figure 5.2 does actually closely approximate a perfect eccentric circle for the empirical parameters used in the case of the upper planets. However, the use of the 'Urđī lemma in the way done by the Maragha astronomers, and later repeated by Copernicus, does not in reality resolve the problem of modeling the real planetary motions due to a conceptual failure in construction that realism's unicircular solar hypothesis and its static non-compounded apside impede in practice. Therefore, from a constructive perspective, an astronomical model should not only attempt to meet the observation with compounded uniform circles, but it should also conceptually free astronomy from the *a priori*

presuppositions of realism. Accordingly, the model invented by 'Urdī to solve the equant falls short of being a foundational solution to the equant problem.

Furthermore, the Maragha model for the upper planets also falls short of being a general solution to the equant, as it does not resolve Mercury's equant problem. In fact, Ījī in the century proceeding that of the Maragha Observatory states in his *al-Mawāqif* that it was exactly the equant of Mercury that remained an outstanding problem that exposes the realist approach to the discipline of mathematical astronomy. This indicates that a general solution to the equant that covers the motion of Mercury has not been satisfactorily provided by the Maragha astronomers. Ījī says:

What destroys their [the *falāsifah*'s] foundations are the orbs of Mercury ... and which require the uniformity of the motion of the epicycle center around the center of the deferent [which is rotated by the director]. [But] the conceived observation is to the contrary, as it has been found on another point which is called the equant.⁸

Therefore, it was noted in the century preceding Qushjī and by no less than the well-known *mutakallim* 'Aḍud al-Dīn al-Ījī that the *falsafah* program of astronomy, represented by the Maragha astronomers, with Ṭūsī at its head, has in fact been destroyed by the challenge posed against it by the Mercury model. Therefore, for the *kalām* program to supersede that of the *falāsifah*, then a resolution was needed which would have to be conceptually different than all the attempts provided by the preceding Ptolemaic astronomers. In other words, the solution would have to come from within the philosophy of *kalām* itself as an alternative foundation to understanding and mathematically-modeling reality: a challenge that was to be taken up by the other great mathematician and *mutakallim*, 'Alā'uddīn Qushjī. In fact, as we discuss in the next

⁸ Ījī, *al-Mawāqif*..., 2:451.

section, the constructivist perspective on solving the equant problem lies at the heart of the philosophical revolution associated with the new *kalām* program of astronomy.

5.4 QUSHJĪ'S ASTRONOMICAL TREATISES

5.4.1 Constructivism and the Foundations of Mathematics

The mathematical sciences deal with what we construct in our mind and how we quantify it, i.e. mathematics deals with spatial relations across conscious moments in time, and it is this which gives it its discrete nature when describing what appears of motion and change. In this way, mathematical entities are not abstracted from sensory data, but are rather attained through human activity such as counting, ordering, comparing, etc. On the other hand, the Aristotelian position of considering mathematical entities as abstractions is due to the realist definition of knowledge as an abstraction of forms (*suwar*) from matter. In contrast, knowledge, as we saw in previous chapters, is considered by mainstream *mutakallimūn* to be a relation (*idāfah*) between the subject who knows and the object that is known. Building on this latter definition, constructivism then gives way to empirical analysis that involves instantaneous constructions at each moment of time making it compatible with serving as a foundational tool for a contingent physical worldview.

Under a constructivist theory of *a priori* knowledge, mathematical physics becomes equivalent to the cognitive processes of perception that construct our empirical knowledge of the physical world. In other words, mathematical physics becomes synonymous with constructive mathematics. Further, by being conceptual entities in the mind, mathematical concepts that are used to describe physical events and objects are thus dependent upon both the external world and the learnt universal concepts of the mind, both of which play a role in the individuation of particular empirical knowledge.

In fact, the reality of mathematical sciences stems from the idea that it constitutes the constructed knowledge by which way we describe the physical world, i.e. mathematical entities are concepts that are held in the mind in the same way that other semantic and semiotic concepts exist in the mind. For Qushjī, as we explored in the previous chapter, it is by way of mental existence (*al-wujūd al-dhihnī*) that mathematical entities, as universal quiddities of physical objects, form the basis for individuating particular knowledge about an outside reality.

Constructivism in mathematics is, consequently, the belief that mathematical objects are not mind-independent entities or abstractions from physical reality but rather are constructive relations drawn by the mind. Mathematical constructivism is, thus, a bridge between discrete individual experience and the problem of universals in the mind. With constructivism, the ‘point’ in space (and by extension the moment in time) becomes the basic unit of physical knowledge as a simple concept that can be in a relation with the knower. Unlike subjective idealism or instrumentalism, a constructivist philosophy holds mathematical models to be a description of reality that is intersubjective, because they are constructed from basic units of thought, and which is conceivable when knowledge is taken to be a relation, as opposed to a realist theory that involves the occurrence of forms in the mind. At the same time, that which is non-existent in the outside but which exists as a concept in the mind falls under the category of existence that Qushjī describes as ‘mental existence’ and which he uses to refute the remnants of realism, as we saw in the previous chapter with his analysis of the concepts of evenness and oddness. In this way, the mentally existing is not like the “mountain of emerald” that is an imagined physical object that does not exist in the outside, but is rather like the concept that is non-existent in the outside and which we use to describe and to communicate our knowledge about that which exists in the outside. Hence, the

division of existence from the perspective of constructivism is not related to a theory of verification or truth but is rather foundational to the very idea of human knowledge and understanding. Only under such an understanding do we then find a place for mathematics as a conceptual non-existent in the outside, which is then used to construct our knowledge of reality. The pre-constructivist theory of mathematics, which could be called subjectivist (as we find with some early *mutakallimūn*), had some difficulties especially with those categories related to the “non-existent”. This approach described mathematical entities as being non-existent in the outside, by saying that had they existed thereof they would have been ... so and so. In this way, mathematical entities for the likes of Taftāzānī, a Qushjīan predecessor in Samarqand, became like the “mountain of emerald” whose existence in the mind is considered to be a sign of its non-existence in the outside. This was a difficulty that Qushjī ultimately resolved (the topic of the previous chapter) by completing the constructivist development of thought that the earlier *mutakallimūn* had began, and with that constructive foundations gave rise to a new mathematical practice for astronomy (and by extension for all other physical scientific disciplines).

In summary, Qushjī developed a constructivist theory of *a priori* knowledge that does not bifurcate reality, like dualism does, into that which is primary and that which is secondary. It rather deals with the foundations upon which knowledge of reality can be acquired. In this way, physics which is the product of a particular theory of knowledge, whether realism or constructivism, which directs mathematics on a different path; with the former ending in instrumentalism and the latter in a normative description of reality.

5.4.2 [Text] Treatise on the Eccentric Model Being Possible for the Two Lower Planets: Translated Anthology with Annotations⁹

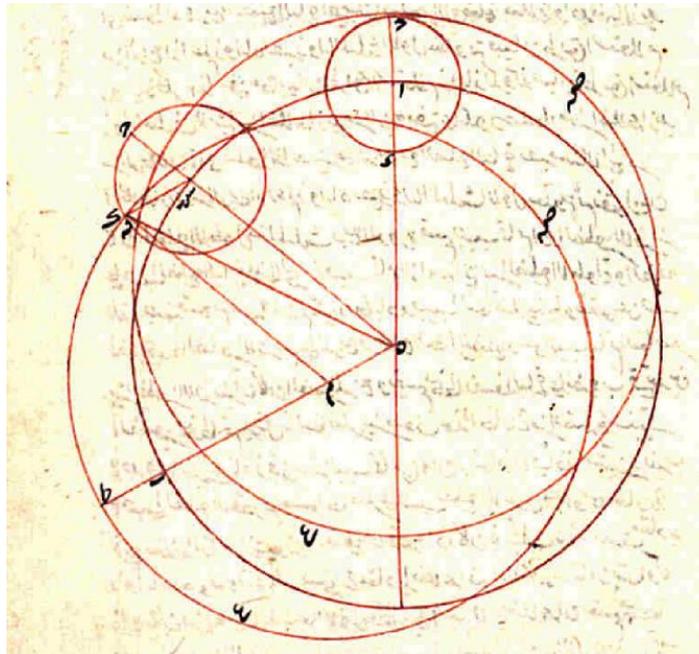


Figure 5.4 Qushjī, *Risālah fī anna aṣl al-khārij...*, Carullah MS 2060, f.137a. Reproduction courtesy of the Suleymaniye Library, Istanbul.

The purpose of this treatise has already been mentioned in the first section on Ptolemy's equant the crisis with the realist approach to astronomical planetary modeling. We discussed there that Ptolemy had rejected the eccentric model for the second anomaly of the lower planets while he accepted it for the upper planets. For completeness, we repeat here Qushjī's summary of this Ptolemaic problem, which is more symptomatic of realism as a theory of knowledge applied to astronomy. Below we present a translation of an anthology taken from Qushjī's treatise, followed by some analysis and commentary of my own:

⁹ The treatise *Risālah fī anna aṣl al-khārij yumkin fī al-suflayayn* has been published in Ragep's *Alī Qushjī and Regiomontanus*. The translations appearing in this section are my own.

[Folio] The author of *Almagest* asserted that the eccentric model is only applicable to the three [upper] planets that are found at all distances from the Sun, and that it is impossible for the lower ones, because this model represents such a motion, while they [i.e. the two lower planets] are not distant from the Sun except by a small margin. Consequently, only an epicyclic model is possible for them. Most verifying bookmen agreed with him on this including the Mulla and scholar, the author of *al-Tuḥfah* [i.e. Shīrāzī]. Perhaps, they judged this to be so when they initially observed (*ra'ū fī bādi' amrihim*) that the middle of the direct and the retrograde motions according to the eccentric model happen at the apogee and perigee and such positions are in opposition on the celestial sphere. With that they perhaps thought that under this model, when the planet is in the middle of its direct motion it is in conjunction with the Sun and so during retrograde motion it would according to this model be in opposition to the Sun and vice versa. Consequently, according to this model, the planet would undergo, between the middle of direct and retrograde motions, all distances from the Sun. This is in contrast to the epicyclic model where both the middle of the direct and retrograde motion happen at the apogee and perigee of the epicycle, while both positions are one on the celestial sphere. Therefore, the two lower planets according to the epicyclic model are in conjunction to the mean when they are in the middle of direct and retrograde motions and thus they do not undergo all distances from the Sun between the two positions, rather they are only as far from it as the epicyclic radius.^{10, 11}

¹⁰ See Appendix IV, Figure IV.1 for the original Arabic.

¹¹ Ragep says, “In the course of his presentation Qushjī remarks that Ptolemy had mentioned that it was not possible to assign an eccentric as a substitute for mercury’s epicycle to represent the second anomaly, i.e. having to do with the planet’s relationship with the Sun. This was because observation showed that the time between the fastest motion and mean motion was always greater than between mean motion and

[Commentary] In a nutshell under realism the Sun would be considered to having an independent motion that is delinked from that of the planet given that the two separate objects of perception and no *a priori* presupposition is detected under Aristotelianism between the Sun and the planet. The outcome of this scenario would be that the planet in its rotation between its own eccentric apogee and perigee positions would scan all positions on the celestial sphere away from the fixed apogee of the Sun, in such a way that the applied eccentric model would lead to the situation that the planet is in opposition to the Sun. Given that this is against the empirical evidence realists, such as Ptolemy, claimed that the eccentric model is consequently inapplicable to the lower planets that have not been seen to be in opposition to the Sun. Following such an explanation, Qushjī gives his constructive solution (below) to prove that the eccentric model is indeed applicable to the lower planets.

[Folio] The matter is not as they have speculated. [Alternatively] the motion of the middle [of direct or retrograde motion] according to the eccentric model is subjected sequentially to what results from the sum of the two motions of the mean Sun and the anomaly [of the planet] and that of the eccentric counter-sequentially in the amount of the motion of anomaly. Therefore, the amount by which the eccentric circle rotates the center of the planet away from the mean Sun counter-sequentially, the deferent of the eccentric returns it sequentially in such a way that what remains of distance between the center of the planet and the mean Sun is the

least motion, a situation Ptolemy contended could be represented by an epicyclic hypothesis (in which the epicycle rotation at the apex was in the same direction as its deferent) but not by an eccentric hypothesis." In *Almagest* IX.5 Ptolemy "denied that an eccentric hypothesis could account for the asymmetrical times in the second anomaly" (Ibid.)

amount of the equation of the planet [i.e. as seen from the observer]. In the same way, for the epicyclic model the distance [between the two] is that of the equation.¹²

[Commentary] In modeling the motion of a lower planet, realism delinks the planet from the Sun's rotating position. Therefore, a realist astronomer rejects the eccentric model for the lower planets. Qushjī's constructivism, on the other hand, makes no such assumed de-linkage and proceeds to prove how the eccentric model could be mathematically equivalent to the epicyclic one. Qushjī's main constructive idea is that if the planet's apparent motion is founded upon the compounding of two motions, then the result can still be the same apparent motion. He explains this novel astronomical conception by saying that the motion of the carrier of the director circle could rotate the point representing the planet with the sum speed of the mean Sun and the anomaly of planet *with respect to* the observer and that of the motion of the director moving in the opposite direction (from another center of rotation) with the speed of anomaly. The result of the two motions, Qushjī explains, would be for the planet to be separated from the mean Sun position by the amount of the equation, therefore, matching the observation and the epicyclic equivalent. With such striking constructivism, Qushjī had therefore successfully placed the planet under two foundational uniform motions that encompass the observer and that produce the same appearance as an epicyclic system does. This implies that rather than assuming that the solar apside acts as a stationary and independent reference for the motion of the planet in anomaly, as the realist scenario assumes, Qushjī now introduces the case whereby the Sun's apparent motion is linked to the apparent motion of the planet.

¹² See Appendix IV, Figure IV.2.

A realist, who continues to refuse any foundational link between the Sun's motion and the planet, based only on this eccentric model for the lower planets, however, would assume that the linkage is due to the Earth's actual motion as well as that of the planet around the stationary apside of the Sun. Could this be how Copernicus found his realist heliocentric twist to the eccentric model for the lower planets, whose use Swerdlow (1973) found evidence for in Copernicus' Uppsala hand-notes? This seems plausible given that the model itself was based on a constructive conceptual scheme that was devised as a reaction to realism, while heliocentrism itself is a realist theory that maintains a fixed apsidal reference for the Sun, while it accepts a constructivist double rotation as the foundation of the apparent planetary motions. In contrast to this planetary double motion, heliocentrism however retains realism's assumption about the unicircular hypothesis for the Sun apparent motion, in this case the unicircular rotation is attributed to the Earth rather than the Sun. Conceptually, however, the same realist theory of knowledge is used to oppose any constructivism for the Sun's apparent motion in itself, which with hindsight, we now know is not a circular rotation but rather an ellipsoidal adjustment. Consequently, heliocentrism is a realist model that follows the same conception as that followed by the Maragha astronomers and thus falls squarely within their model for resolving the equant problem. It is no surprise therefore that Copernicus relied upon the same epicyclic solution to the equant that failed the constructive test that now Copernicus was claiming for the planets motion and therefore based on this eccentric model for the lower planets. In fact, this inconsistency only points to a lack of understanding by Copernicus for the functionality of this eccentric model, which only points to a possible transmission route for this model as some historians beginning with F. Jamil Ragep (2005) have suggested, including Owen Gingerich (2008), Michael Shank (2008) and Robert Morrison (2010) among

others. In contrast, we can see in our study of Qushjī's next model (i.e. his treatise on the resolution of the equant problem) how he was consistent in his constructive approach to both the first anomaly and the second anomaly models for Mercury.

In fact, the implications of a double motion to construct the basic ellipsoidal shape of Mercury's first anomaly (i.e. solar associated) model, as well as that used here, is in itself strikingly new (even by today's standards) and remains a new area of original historical finding as well as contemporary astrophysical discovery that could be our new post-heliocentric revolution (more on this in the concluding chapter). Therefore, we can summarise our earlier points by observing that the idea of imbedding the Sun's motion within a two motion foundation for the lower planets' apparent motion is not a realist concept, but is rather based on a different conceptual frame which would produce a different solution to the equant problem; other than that reproduced in the Maragha or the Copernican models. In the case of Qushjī, the two models for the first and second anomalies for Mercury complement one another, as they indicate that what Qushjī was giving as a geometric proof for the equivalence of the epicyclic and eccentric models for the lower planets is not in itself a true representation of the motion of the lower planets, as the Sun's apparent synchrony in the first anomaly model is not circular in effect. To demonstrate the idea of a non-realist, yet empirically fixed apside for the Sun, one can imagine the rotation of two circles with equal but opposite speeds resulting in a fixed apsidal ellipse. In this case, an analyst can view the motion of the point tracing the ellipse on the fixed apside and think that such motion is a simple motion, but in actual fact it is compounded from two different rotations seemingly at two different centers of motion that offset each other in such a way that leave an equation of motion at one of centers; giving the appearance of the fixed apsidal ellipse. In a similar vein, Qushjī argues in his geometric proof that the apparent motion of the planet could be the

result of two motions that offset each other in such a way that produces the observational planetary appearance. Consequently, the eccentric model for the lower planets, studied here, acts as a constructive tool that shows the foundational uniform circular motions, which could produce a non-circular repeated pattern such as a retrograde arc or even, as we've just learnt, an ellipse. In fact, a celestial ellipse could also be reproduced, as we see in our next treatise, by two circular rotations in the same way that the planetary retrograde arcs were reproduced by Copernicus from two circular rotations, although Copernicus did not seem to understand the full scope of constructive astronomy in the way that Qushjī did both conceptually and practically in the generation preceding him in the European (and now Islamic) city of Constantinople.

the eccentric, for the reason that the observations have attested to the fact that the time between the fastest motion and the mean motion was always longer than the time between the mean motion and the slowest one. That could not have taken place according to the eccentric principle (*aṣl*), for then the conditions would be in the reverse. The condition stated by Ptolemy is not true however. For according to the eccentric principle as well, the time between the fastest motion and the mean motion is also always longer than the time between the mean motion and the slowest motion. I have a geometric proof of that statement, but this is not the place to expound it.¹⁴

[Commentary] Qushjī repeats here his position on Ptolemy's rejection of the eccentric model for the second anomaly of the lower planets. This relates to our discussion on the first treatise and indicates that Qushjī wishes to use the same constructive solution for his resolution to the equant as that used for his refutation of Ptolemy's aforementioned claim. In fact, this constructive solution of compounding two motions to produce a fixed apsidal curve, such as an ellipse, or to link two phenomenal entities, such as the Sun and a lower planet, that realism treats as independent objects of perception is the topic of the next section in which we study this general compounding tool as a feature of the new constructive program that Qushjī inaugurates.

[Folio] Then after considering the successive observations of the particular motions which are composed of both types of variations, and comparing these with one another, he found that the farthest distance (i.e. the apogee) does indeed move along the ecliptic in the same fashion as the fixed stars.¹⁵

¹⁴ See Appendix IV, Figure IV.3.

¹⁵ See Appendix IV, Figure IV.4.

[Commentary] As we saw in our analysis of the previous treatise, a fixed apside could be the result of the compounding of two uniform rotations. In particular, an ellipsoidal curve could be produced from the rotation of two concentric circles with equal speeds running in the opposite direction. This configuration also translates into a compounding of two rotations, i.e. the center of the second circle rotates on the circumference of the first circle, with the speed of the second circle being double that of the first and counter to it in direction. Therefore, in the comment above for the apogee to move in the same fashion as the fixed stars means that the apside of the celestial path is indeed fixed. Given the failure of the unicircular hypothesis in the case of Mercury, we note that Ptolemy resorts to a director and a deferent whose center moves on the director in a non-uniform manner giving rise once again to an equant point that lies on the fixed apside away from a rotating deferent centre¹⁶. This shows how the failure of Ptolemy was a conceptual failure of realism as a philosophy of astronomy and science and how Qushjī's solution to the equant came with a new theory of knowledge that could resolve this conceptual issue.

[Folio] As a result, objections were raised against him (*intahada 'alayhi al-ishkāl*) on two counts. The first is on account of a body moving uniformly around a point other than the center of its revolution, and thus the positions of this point with respect to the center of the revolution would vary by sometimes coinciding with it, sometimes being separated from it, sometimes being somehow distant from it, and then returning to coincide with it ... The second is on account of the variation in

¹⁶ Jones says, "In the model for Mercury, for Ptolemy, the centre of the epicycle travels along a revolving eccentre with uniform angular velocity as seen not from the centre of the eccentre but from a point whose position relative to centre O is sidereally stationary ... So for Ptolemy the definition of uniform is that it has uniform angular velocity from some reference point and uniform circular motion even if it is from another point for the same motion thus varying in its speed with respect to the centre of circularity." (Alexander Jones, "A Route to the Ancient Discovery of Non-uniform Planetary Motion", *Journal for the History of Astronomy*, vol. 35, no. 121 (2004): 375).

the motion of its center, I mean the motion through which the epicyclic center draws away from the apogee, in the direction of the order [of the signs], by an amount equal to the daily motion of the sun. That is so because the motion of the deferent is uniform with respect to the equant, and the motion of the Director is uniform with respect to its own center. Then the difference between the two, which is the motion of the center, will not be uniform with respect to the equant, despite the fact that it should be uniform with respect to it, as the observations would attest.¹⁷

[Commentary] Ptolemy empirically obtains the equant by finding the time-related symmetric point at the quadrature position on the apside¹⁸. The equant point, therefore, does not signify anything in reality. It is just a constructive point. It is perhaps for this reason, that realist astronomers, like Copernicus, wanted to abolish the equant, while the Maragha astronomers, who philosophically were constructive realists, did not abolish it but rather relied upon it for the equant's epicyclic reconstruction. It is odd at the least, without an argument for transmission, to then find Copernicus utilising the same solution to the equant as that of *'Urđī*'s despite their differing philosophies and their conceptual schemes. Consequently, in attempting to represent the equant in a satisfactory mathematical model that represents (or explains) the various planetary motions (and Mercury in this case) Ptolemy was found at fault for the following reasons. The first of Qushjī's two objections is that "a body [is] moving uniformly around a point other than the center of its revolution". The second reason is related to the motion of the deferent in Ptolemy's model whereby Ptolemy claims that its motion is uniform with

¹⁷ See Appendix IV, Figure IV.5.

¹⁸ Qushjī says, "Then by observing the sum of its two elongations, the matutinal and the vespertine, when the mean position [of the epicyclic center] was in quadrature with the apogee, he determined the position of the point around which the motion of the epicyclic center was uniform. He found it to be between the center of the world and the center of the Director." (Saliba, *Al-Qushjī's Reform...*, 181).

respect to the equant point and not its own center of motion.¹⁹ Therefore, with both reasons, we don't find the scathing vitriol against the equant point that Copernicus launches in his realist preface to the *Commentariolus*. On the other hand, we find a criticism of the construction itself, while the equant is taken to be an empirical point that should be retained and constructed within the model rather than abolished.

[Folio] [Qushjī's approach as he states] conforms with the foundations of science and matches the observations. [He adds] Both of these objections could be rebutted by adding two epicycles to the famous configuration (i.e. Ptolemy's model) and by changing the positions of the centers of the circles. That [can be achieved] by positing the center of the well known epicycle to be at the apex (*awj*) of another epicycle whose radius is equal to one part and a half. Let us call it the small encircling [circle]. Let the center of the small encircling [circle] be at the apex (*awj*) of another epicycle whose radius is [also] one part and a half. Let us call that (i.e. the latter epicycle) the large encircling [circle]. Let the center of the large encircling [circle] be at the apogee (*awj*) of the deferent. Let the center of the small encircling [circle] be on the Inclined circle. The center of the deferent is at a distance of one part and a half from the center of the Director, in the direction of its apogee. The center of the Inclined is at a distance of one part and a half from the center of the deferent, in the direction of its apogee. The center of the Director is at a distance of four parts and a half from the center of the world. All of these [measures] are in the same units that make the radius of the deferent sixty. Now,

¹⁹ Saliba comments on this section by saying, "Qushjī notes correctly that such a model violates the principle of uniform motion on two counts: First, the deferent does not move uniformly around its own center *F* [Figure 5.4], but rather around another point *E* [Figure 5.4], which sometimes coincides with point *F*, but mostly does not ... [In the next paragraph] Qushjī raises a more formal objection to the way in which the motion of the "center" of the planet is calculated in such a model." (Ibid.)

if we assume the motion of the Director, in the direction opposite to that of the order [of the signs], to be equal to the motion of the Sun's center, and the motion of the deferent, in the direction of the order [of the signs], twice that much, and the motion of the large encircling [circle] in conformity with the motion of the deferent, in direction as well as magnitude, in the upper half, then the motion of the encircling [circle] would be uniform with respect to the center of the Director; Then if we assume the motion of the small encircling [circle] to be equal to the difference between the motion of its center, which is uniform with respect to the center of the Director and in the direction of the order [of the signs], and the motion of the Director, which is opposite to the order [of the signs], I mean that it is equal to the motion of the center of the sun, then the motion of the epicyclic center will be uniform with respect to the center of the equant.²⁰

[Commentary] Qushjī resolves the challenge posed by Ptolemy's equant by making the deferent uniform with respect to its center like he did with the director, and he then proceeds to show how the motion of the center [point *G* in Figure 5.5] is uniform with respect to the equant point on the fixed apside of the apogee. To do this Qushjī resorts to the same constructive manner in the first treatise by which he resolved the issue of the applicability of the eccentric model to the second anomaly of the lower planets. In other words, Qushjī proceeds with his solution to construct a perceived motion from two or more compounded circular motions that offset each other from the perspective of one of the centers of rotation. To clarify the solution further we notice how in order to model a sequential motion similar to the daily motion of the Sun, Qushjī compounds two uniform circular rotations; one moving sequentially with twice the speed of the

²⁰ See Appendix IV, Figure IV.6.

Sun's motion and one moving counter-sequentially with the speed of the Sun's motion. In this way, the sum of the two motions would be the desired sequential motion that is equal to that of the Sun. The crucial next point for Qushjī is to indicate that given the two centers of rotations this leaves an equation of motion or an offset with respect to the first center of motion (i.e. a potential observer).

At this stage it would be a useful and very fruitful exercise, as we shortly see, to use a constructive diagram as well as an electronic plotter to analyse the curve that Qushjī's constructive methodology produces. Even at this stage, we can appreciate, how without hypothesising about the shape of the constructed curve, Qushjī is able to discover a specific curve by empirically constructing the planetary motions from uniform circular rotations and by way of matching the construction with certain empirical features; ironically such as the equant as a point of time-related symmetry. This is not very different from the way complex analysis utilizes the basic rotation of the Euler formula that is ubiquitous in engineering and mathematical applications in physics.

Figure 5.6 below is a constructive plot of the curve that is produced at point *B* in Qushjī's overall model (Figure 5.5) for solving the equant problem. The striking result is that the double compounded motion which forms the basis for Qushjī's constructive model is a perfect ellipse. In other words, Qushjī's constructive astronomy discovers the general ellipsoidal shape associated with the first anomaly of planetary motion and without resorting to any hypothetical methodology as the case is with realist astronomy. This, in fact, as we discuss further in the next section, reveals a characteristic of constructive astronomy, as an outgrowth of constructivist philosophy that leads to physical discoveries by way of constructive mathematics and analysis.

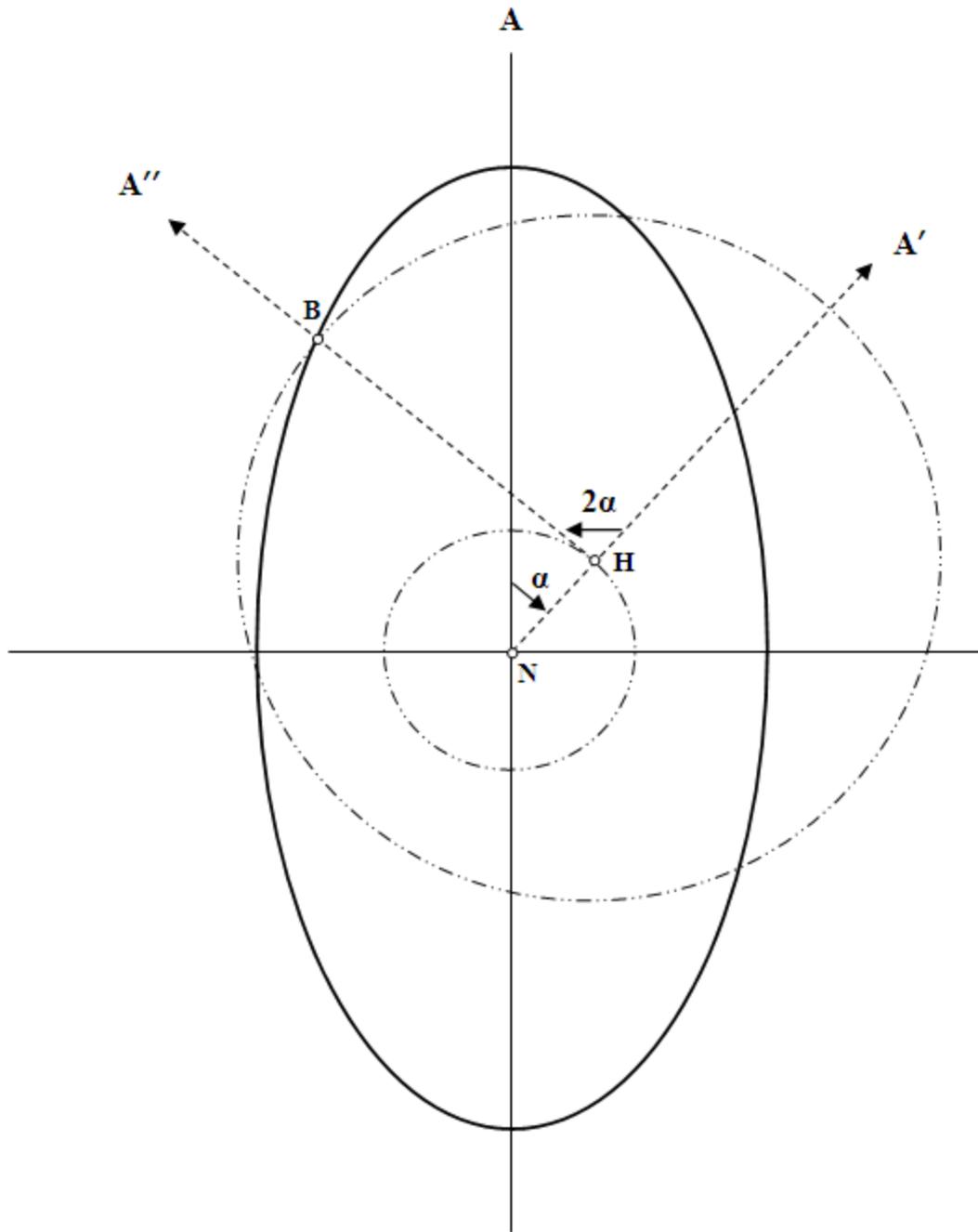


Figure 5.6 The construction of a curve from two uniform circular rotations: (1) one centered at N counter-sequentially rotating with speed α [A - A'] and (2) another centered at H sequentially rotating with speed 2α [A' - A'']. The points used in this figure match those in Figure 5.5.

Next, Qushjī proceeds to modify the ellipse constructed at point B using uniform epicyclic rotations in order to match the observation from the perspective of the astronomer. Qushjī's empirical point to be constructed in this case is no other than the

equant point, which Ptolemy had determined by “observing the sum of [the] two elongations, the matutinal and the vespertine, when the mean position [of the epicyclic center] was in quadrature with the apogee”²¹. In order to do so Qushjī employs two epicycles that shift the observer’s position from the A' (Figure 5.6) axis to the A'' then back to axis A , which is the fixed apside of observation that is fixed against the stellar background and upon which the equant point was empirically determined. Figure 5.7 shows the two inner curves at points B and D as well as at point G , which is the epicycle center or the position that coincides with the Sun’s position. On point D Saliba comments, “Qushjī realizes that this combination of motions makes point D look as if it is moving uniformly around point N at the same speed as the mean motion of the sun”, while for point G he remarks, “This, in effect, means that point G , or the center of the epicycle in Qushjī’s model, will look as if it is moving uniformly around the Ptolemaic equant point E , as was required by the observations.”²²

²¹ Saliba, *Al-Qushjī’s Reform...*, 181.

²² *Ibid.*

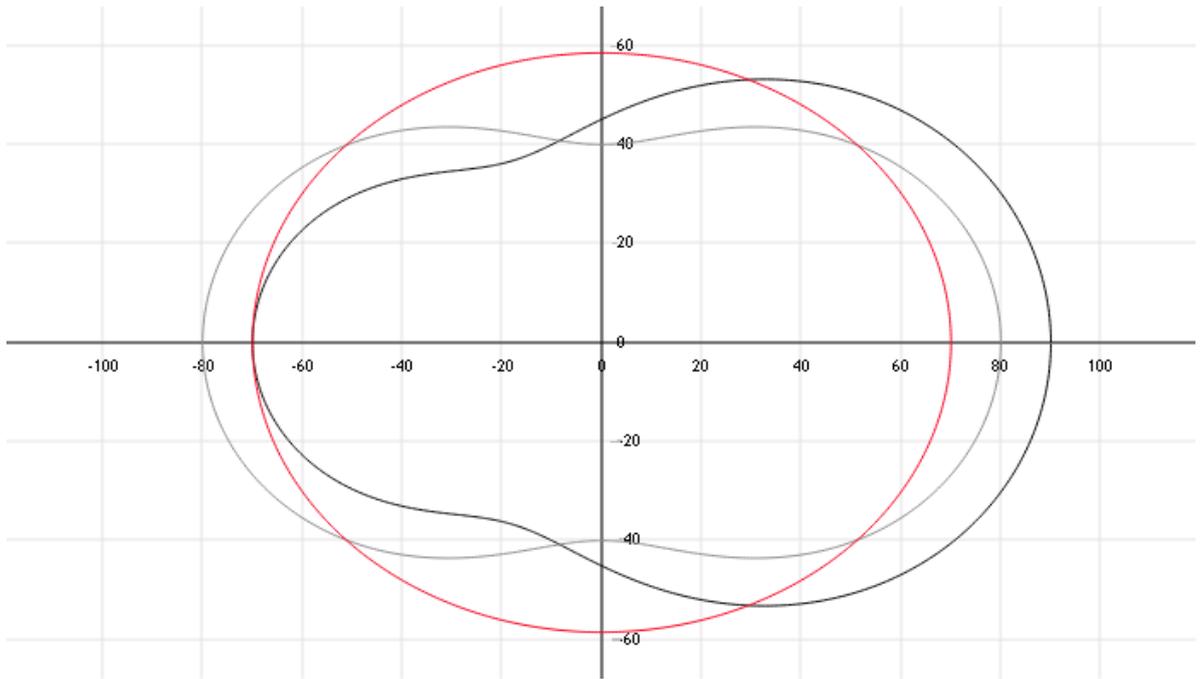


Figure 5.7 The inner most curve is the constructed ellipse at point *B* in Qushjī's model (Figure 5.5)²³. The elliptical shape with the two depressions is the constructed curve at point *D*²⁴. The outer most curve is the observational (pear-shaped) Qushjīan curve²⁵ which satisfies the empirical points, such as the nearest distance being at the trines from the apogee. The values in the above figure are based on the ratio of 1:6 between the director/epicyclet radii and the deferent radius, which have been exaggerated from the 1.5:60 ratio in order to highlight the distinction between the curves.

Another striking development in Qushjī's constructive model is that it discovers another feature of the Sun's rotation as exhibited in the model for Mercury, namely the trine positions (120° and 240°) being the nearest distance twice in one revolution, i.e. the maximum elongations being at the trines from the apogee. This occurs in Qushjī's model as a consequence of him constructing the equant point at its observational position on the apside, and he does this by way of the two epicyclets²⁶. Saliba says,

²³ The parametric function of the curve is $x = 10\cos(-s) + 60\cos(s)$ and $y = 10\sin(-s) + 60\sin(s)$.

²⁴ The parametric function of the curve is $x = 10\cos(-s) + 60\cos(s) + 10\cos(3s)$ and $y = 10\sin(-s) + 60\sin(s) + 10\sin(3s)$.

²⁵ The parametric function of the curve is $x = 10\cos(-s) + 60\cos(s) + 10\cos(3s) + 10\cos(2s)$ and $y = 10\sin(-s) + 60\sin(s) + 10\sin(3s) + 10\sin(2s)$.

²⁶ Saliba says, "The net effect of this model is that it allows the planet Mercury to reach a minimum distance from the earth twice in one revolution: once when the center of the epicycle is at about 120° from the slow-moving apogee determined by the direction *OEM*, and once when it is at the symmetrical position at about 240° from that same apogee. With the appropriate dimensions, the model also accounts for the observational data gathered by Ptolemy for the planet Mercury when it is at the apogee or at the point diametrically opposite to it." (Saliba, *Al-Qushjī's Reform...*, 181).

“The most remarkable result of the new model is that it produces no variations at all at the critical [observational] points, namely when $a = 0^\circ$, 120° or its symmetric point 240° and 180° .”²⁷ Qushjī focuses on matching the common opinion (*‘alā ra’ī al-jumhūr*) in order for him to indicate how his foundational astronomy matches the observations²⁸.

In addition, we also note that the center of uniform motion for the ellipse, rather than being a fixed point on the apside, is a constructive point which lies on the circumference of the first rotation, which is the moving center of reference for the second²⁹. To convert the moving center of uniformity of the ellipse to a fixed equant point on the stellar apside is mathematically achievable, as Qushjī demonstrates, but that is only done at the expense of the true position on the axis that determines the radial distance of nearness and farness from the center of symmetry as opposed to the longitudinal change that determines speed. So from the perspective of point N at the center of the two axes of the ellipse (Figure 5.6), H is the point of uniform motion which rotates on the director, i.e. the smaller of the two foundational motions that is centered on N . Shifting the center of uniformity of the epicycle center (or in this case the ellipse) from an instantaneously changing point to a fixed point that is empirically detectable by observation is Qushjī’s next move in order to ultimately construct the equant point. In order to do that Qushjī makes two modifications to the ellipse. The first involves epicyclet, which results in D , shifts the center of uniform motion from H to D and the

²⁷ Ibid.

²⁸ Hartner (1957) says, “[T]he “Ptolemaic curve” (about which no word can be found in PTOLEMY’S *Almagest*) is practically interchangeable with the ellipse as defined above, which it has been our aim to prove. the maximum error committed by substituting the ellipse for the Ptolemaic curve was 0.07e (attained only twice: for $\phi = 35^\circ$ and $\phi = 95^\circ$, cf. column “ $r - p$ ” in the preceding table)” (Willy Hartner, “Astronomical Part” in “The Mercury Horoscope of Marcantonio Michiel of Venice”, *Vistas in Astronomy*, vol. 1 (1955): 115), 0.07 times 60 is 4 minutes which is exactly the maximum variation found by Qushjī in comparison with Ptolemy. Saliba says, “Qushjī calculates the divergence in paragraph [20] to be around four minutes, when the epicyclic center reaches a distance of 90° from the apogee.” (Saliba, *Al-Qushjī’s Reform...*, 185)

²⁹ If we refer to Figure 5.6 it is the rotating point H that every point B is instantaneously uniform on while point B traces an ellipse if observed from N .

second shifts this center from D to the equant point at G . In fact, Qushjī was well aware of the meaning of these two transformations as he himself states, as we saw in the passage above, that “if we assume the motion of the small encircling [circle] to be equal to the difference between the *motion of its center (D)*, which is uniform with respect to the center of the Director (N) and in the direction of the order [of the signs], and the motion of the Director, which is opposite to the order [of the signs], I mean that it is equal to the motion of the center of the sun, then *the motion of the epicyclic center will be uniform with respect to the center of the equant (E)*.” In Figure 5.7, this translates to the curve in grey or the shape with two depressions on the vertical axis being the modified curve from the ellipse in order to have its center of uniformity at the fixed position of N . What is interesting to note is that this modified elliptical curve with the fixed center of uniform motion is almost identical with another ellipse that has double the eccentricity as the original ellipse³⁰ that had the moving center of uniformity (as we see in Figure 5.8).

³⁰ The fact that Qushjī’s modified curve closely matches an ellipse with double eccentricity reminds us of the issue of bisecting the eccentricity that began with the Maragha astronomers, then appeared in Copernicus’ Sun model and later in Kepler’s ellipse.

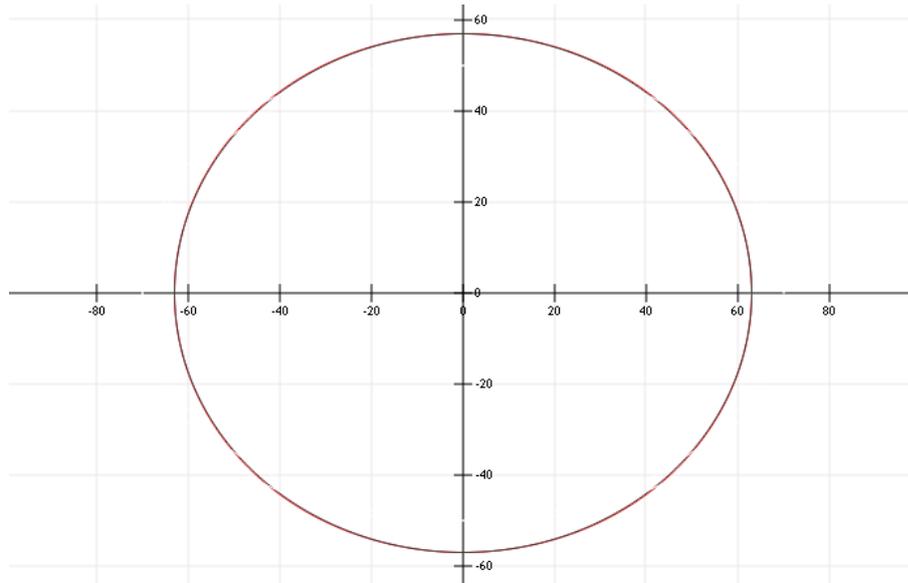


Figure 5.8 The figure contains two superimposed curves (that are almost identical): (1) The output at point D in Qushjī's model to solve the equant³¹ (in red), (2) a perfect ellipse³² (in black) with double the eccentricity as the ellipse that was modified to have the center of uniform motion shifted from a moving point on the Director to a fixed point on the apside.

However, by exaggerating the degree of the eccentricity for the above figure from 1.5:60 to 5:60, we can highlight the real discrepancy between the original constructed ellipse with a moving center of uniformity and the modified curve that has a fixed center of uniformity on the apside.

³¹ The parametric function of the curve is $x = 1.5\cos(-s) + 60\cos(s) + 1.5\cos(3s)$ and $y = 1.5\sin(-s) + 60\sin(s) + 1.5\sin(3s)$.

³² The parametric function of the curve is $x = 3\cos(-s)+60\cos(s)$ and $y = 3\sin(-s)+60\sin(s)$.

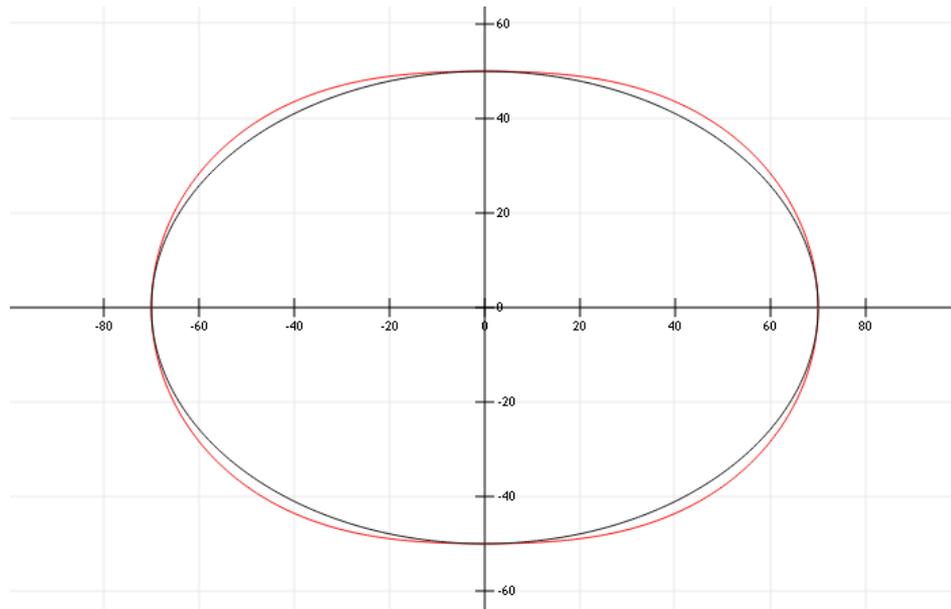


Figure 5.9 This figure is a repeat of Figure 5.8, however, this time the ratio of the first rotation that the ellipse is constructed from relative to the second compounded rotation is 5:60 rather than the empirical values of 1.5:60 used by Qushjī. The two superimposed curves are not seemingly identical any longer with the maximum discrepancy being within each quadrant.

With such constructive analysis, we can notice that the real curve, which is the constructed one (outer curve in red) from the compounding of three uniform circular rotations, has a clear discrepancy from the hypothesised ellipse that Kepler predicted. This shows the limitation of a realist hypothetic-deductive method that distorts reality in actual fact, while, as we saw in the previous figure (Figure 5.8), it might seem that empirically speaking the two curves (i.e. the constructive one and the realist one) appear to be identical. What this means is that the realist method of hypothesising and verifying failed with the Kepler ellipse to arrive at the real curve of the apparent Sun motion, despite it being a very close approximation that is hardly discernible from observation, especially given the identical values between the two at the apogee and its opposite and at the quadrature positions (as we can see in Figure 5.9). From a constructivist perspective, what this all means is that while realism accepts the limitation of discovery to what is detectable on the fixed apside of observation (in a guesswork manner),

constructivism approaches the problem of discovery from the known empirical concepts of the mind to construct a foundation for the sense-perception. In this way only can one say that he has constructively discovered an empirical reality whose certainty is beyond the reach of realism.

For Qushjī, resolving the problem of the equant was actually about solving the Sun model, which although through Mercury's elongations exhibited the aforementioned characteristics, such as the trine positions. However, when the parameters used for plotting the curves are the non-exaggerated real values, i.e. in the ratio 1.5:60, then the figure produced is also not easily discernible to a realist astronomer, such as Kepler, from an eccentric ellipse. Figure 5.10 demonstrates our analysis.

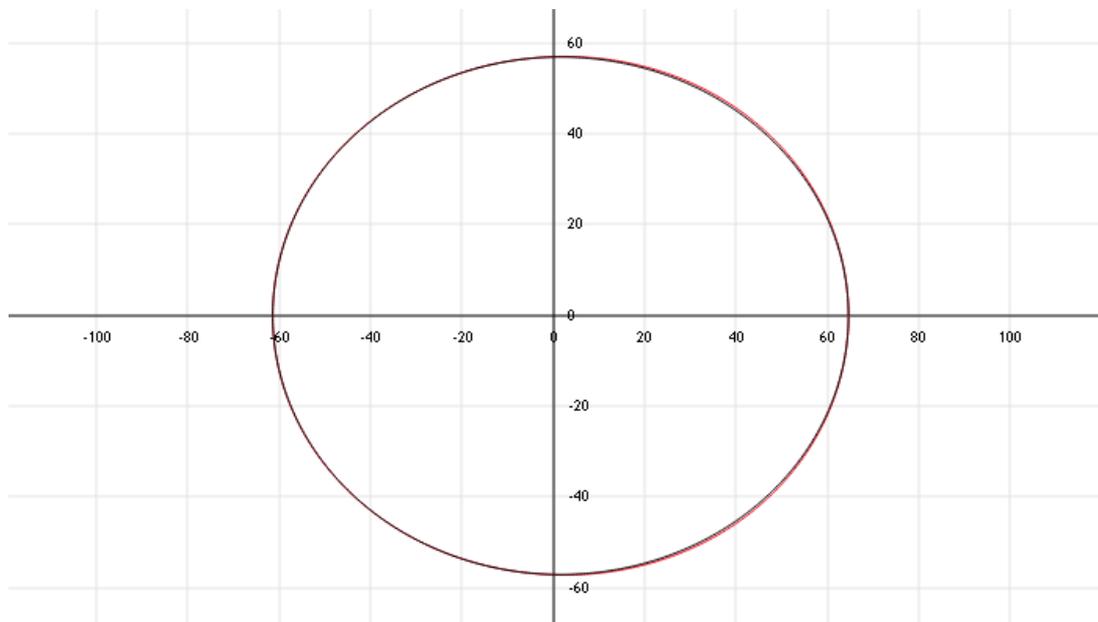


Figure 5.10 The figure contains two superimposed curves: (1) The output at point *G* (i.e. the epicycle center) of Qushjī's model to solve the equant³³ (in red), (2) an eccentric ellipse³⁴ (in black). This figure shows that the two curves are hardly discernible from a realist perspective.

³³ The parametric function of the curve is $x = 1.5\cos(-s) + 60\cos(s) + 1.5\cos(3s) + 1.5\cos(2s)$ and $y = 1.5\sin(-s) + 60\sin(s) + 1.5\sin(3s) + 1.5\sin(2s)$.

³⁴ The parametric function of the curve is $x = 3\cos(-s) + 60\cos(s) + 1.5$ and $y = 3\sin(-s) + 60\sin(s)$.

Given that by way of constructive modeling the distance from the observer (as well as the shape of the curve) is discovered by way of construction, therefore, the output of the model (i.e. G) represents the Sun model given that it coincides with the true Sun position on the ecliptic sphere³⁵. In Figure 5.10, therefore, while a realist can fit his or her true solar observations onto a slightly eccentric ellipse hypothesis³⁶ (in black above) or even onto an ellipse hypothesis (as Kepler does) and be satisfied with the match, a constructivist, on the other hand, discovers the Qushjān curve (G) of Figure 5.7 despite the differences between the two not being easily discernible by observation alone.

In conclusion, the above analysis, for figures 8-10, implies that while realist astrophysicists (even contemporary ones) are satisfied with a planetary ellipsoidal hypothesis or even with an eccentric ellipsoidal one under advanced barycentric theories, the striking truth is that neither of the two hypotheses is considered by constructive astronomy to have achieved the real solar curve that Qushjī's above model empirically discovers. This revolutionary challenge by constructive astronomy to realist or heliocentric astrophysics (including contemporary theories) is taken up in the next section and again in the concluding chapter.

5.4.4 The *Qushjī* Compounder as a Solution to the Equant Problem

Under realism, the equivalence of the epicyclic and the eccentric models for the Sun are only equivalent in resultant curve but are physically considered to lead to two different configurations. This is so given that the former involves two opposite but equal motions,

³⁵ It is this elements of discovery in constructive astronomy that Copernicus, as we later explain in more details, builds his realist interpretation of heliocentricism upon, and he does so by noting the distance of the planets from their centers of rotation, which according to him coincided on the Sun.

³⁶ To cater for barycentric/non-heliocentric planetary motion.

while the latter is taken to only involve one motion, i.e. an eccentric circle. It was for this reason that Ptolemy opted for the eccentric model for the Sun as being the simpler of the two, and which ultimately gave rise to the equant problem under such a unicircular hypothesis. Under constructivism, however, the equivalence of the epicyclic and the eccentric models for the Sun, and more generally for all planets, are not equivalent in resultant curve only but also in meaning and explanation. With the Sun model, for example, both the epicyclic and the eccentric equivalents imply that there are two compounded motions rotating in opposite directions although how such motions are reckoned might differ.

The constructive methodology of science which abandons the idea of universal *a priori* presuppositions, as described in our earlier commentary on Qushjī's *Sharḥ al-Tajrīd*, led Qushjī to overcome Ptolemy's presuppositional restrictions in the application of the moving eccentric model to the inferior planets. By utilising a moving eccentric deferent as a general tool for his constructive modeling, Qushjī was able to compound two basic uniform motions to give an explanation for what is observed without any reliance upon the spheres. It was explained in previous chapters how the idea of the necessitarian causality of the spheres was repugnant to the *mutakallimūn*, who with Qushjī alternatively constructed their circular structures as a subjective or a cognitive scheme to convey empirical meanings. In order to do this, Qushjī devised a new mathematical tool that serves as a constructive compounder to superimpose uniform circular rotations by having the center of the next rotation lie on the circumference of a previous one. In this, we, therefore, find the rise of a new astronomical tool that could be called a *Qushjī compounder*, which is conceptually different to the Ṭūsī couple and the 'Urḍī lemma in that it is a constructivist tool with a philosophical underpinning in a new non-realist theory of knowledge, as opposed to the

two Maragha tools that are constructive in practice but remained realist in foundation. Further, the *Qushjī compounder* is a general constructive tool that can reproduce, under specific parameters, both a Ṭūsī couple and a 'Urḍī lemma.

In fact, we can reconstruct the whole edifice of observed retrograde planetary motion by utilising a *Qushjī compounder*, i.e. a constructive compounder of uniform circular motions. The rates of motion and the radii of the circles as well as the location of their centers of uniform motion, which need not coincide, determine their visual effect. Consequently, we notice that while Qushjī constructs his basic astronomical model by using a *Qushjī compounder*, neither Ṭūsī, 'Urḍī, Ibn al-Shāṭir nor Copernicus utilise such a mathematical tool in their demonstrative models, because they were merely reconstructing Ptolemy's centers of motion on the fixed apside, as opposed to reconstructing the observational models with the new conceptual scheme of a constructive philosophy of astronomy.

In summary, the Maragha, as well as the Copernican, approach to the equant problem is, as we saw earlier, only an instrumentalist approach, because it does not overcome the realist assumptions of a unicircular hypothesis for the solar model. On the other hand, the challenge is alternatively met, under a constructivist theory of *a priori* knowledge, by rotating the eccentric circle allowing for the fixed apside to be compounded from two motions that offset each other in such a way that produces an ellipse with respect to the observer, as opposed to the unicircular hypothesis that gave rise to the equant problem in the first place.

5.4.5 The Ellipse and Earth's Motion in Context

In taking the particular case of the dynamic construction of an ellipse from two uniform circular rotations with a speed magnitude ratio of 2:1 and moving in opposite directions,

we note that this is mathematically equivalent to two homocentric rotations with speeds of α and $-\alpha$. The 2α speed for the second rotation, though, instead of α is a matter of perspective as this speed is measured with respect to the moving axis of the first rotation. In fact, the selected description of the rotations by Qushjī as being the sum of two rotations that results in a positive motion, as opposed to the dynamically neutral representation of $\alpha/-\alpha$ that adds up to zero, is itself an indication of how Qushjī arrived at his constructive solution, which is by observing compounded motions from the perspective of a fixed point despite its actual rotation. In this way, we find that Qushjī actually presents a solution to the equant based on a scenario that replicates the dynamic reality of Earth, whereby observations against the stellar background seem to be against a fixed axis despite the actual rotation of the Earth.

Furthermore, given that constructive astronomy discovers and does not propose an *a priori* hypothesis that is pending experimental verification, therefore, in Qushjī's modeling we find that the mathematical foundations for Earth's motion are incorporated into the equant solution, as a discovery in its own right. Qushjī does not identify such an empirical discovery as an *a priori* hypothesis, due to the fact that his constructivist methodology does not rely upon such a hypothesising process. As a matter of fact, by using a constructive compounder, Qushjī was giving astronomy a new practice based on a constructivist theory of *a priori* knowledge that discovers astronomical reality in ways realism, as a conceptual frame, is incapable of facilitating. The issue of whether Qushjī explicitly asserted Earth's motion or not in his model for solving the equant, therefore, is not central to Qushjī presenting a successful model that has imbedded in it the conceptual structure for Earth's motion. The very idea that Qushjī removed all empirical impediments to such a scenario by explicitly stating in his *Sharḥ al-Tajrīd* (Folio 195) as we saw earlier that “no inadmissible conclusion follows [from Earth's

motion]” and him relegating the study of such a rotation to constructive astronomical modeling is testimony to our conceptual analysis.

On the other hand, the eccentric model of the Sun model accepted by Hipparchus, Ptolemy, the Maragha group, as well as Copernicus are all symptomatic of realism’s unicircular hypothesis (i.e. the use of only one motion) to represent the Sun’s apparent orbit around the Earth. In fact, the quest since the Greeks and right through Copernicus, Kepler and Newton has been to find how the various anomalies, now called perturbations, could be fitted into this ‘one motional’ hypothesis of realism. Therefore, without the consideration of a constructive or an active ‘mental existence’, perception would be believed to be that of a static image or a form in the mind, as existence by the realists is considered to be an accidental quality of the mind. For realist astronomers, this translates into a stationary reference for the observer that is represented by the fixed apside. Since perception for them is only of the observed image and nothing beyond that. This leaves their concept of reality strictly limited to what is seen without any consideration for the empirically intuitive dimension that defines constructive astronomy and that today can be noted in complex analysis’ *i* axis.

Therefore, while realism represents observational points with a hypothesis, constructivism compounds circular rotations to construct a representation of the real celestial curve that is discovered by constructing certain empirical features into the model, such as the equant point itself. As a result, realism’s hypothetical method historically only accepted the ellipse as a basic curve to replace the unicircular hypothesis, rather than constructively founding the ellipse on two circular rotations that could both give a foundation to observational reality and permanently resolve the equant issue, which incidentally is only a problem under realism. In contrast, under constructivism the equant point is an empirical constructive point that is incorporated

into the model rather than abolished and overcome as a crisis. In this way, under realism, Kepler accepted the ellipse and gave up on the circularity of basic uniform motion, as his rotations were considered to be real in themselves. Kepler, therefore, adhered to the ellipse hypothesis despite its imbedded perturbations (a challenge for contemporary astrophysicists), in the same way that earlier Greek realists had adhered to unicircular models for the Sun despite the anomalies - and later equant challenge - that arose from such adherence.

In contrast to realism, constructivism does not represent reality with the uniform circular rotations themselves, which early realism began by hypothesising about based on various spherical configurations that ultimately ended with Kepler relinquishing altogether with his 'orbit' argument. In this way, we find that Qushjī's approach to constructive astronomy was not based on spherical configurations as the *mutakallimūn* rejected the idea of causal necessity associated with celestial spheres in favour of a subjective foundation for empirical *a priori* knowledge as being constructive or intuitive knowledge based on an individuation process of known mental concepts. Consequently, the mathematical constructive circles are descriptive of reality as symbols that have meanings, in the same way that language contains semiotic meanings, but that are not themselves static reflections of an inner spherical reality that is hidden from sight and that is considered to be part of the domain of metaphysics.

In summary, by introducing two epicyclets to modify the constructed ellipse, Qushjī was not pointing to a metaphysical reality concerning added hypothetical spheres but was rather constructing a mathematical representation of a reality that is considered to be empirical. With constructivism, the study of perspective and dynamic motion, therefore, arises. Consequently, if the dynamically constructed ellipse represents the observer's perspective of homocentric rotations, then the modifications Qushjī

introduces to the ellipse, in order to satisfy certain empirical features, and which he represents with additional constructive rotations, could be reflective of a non-homocentric cosmology in which the two rotations are each around its own unique barycenter. In other words, the modifications to the ellipse allow under a closer analysis the empirical situation whereby the two centers of rotation are non-concentric points, and it could also cater for a slight variation on the 2:1 ratio of the two speeds. The fact of the matter is that constructive mathematics discovers relational features of the empirical realm such as the distance of the planet from its center of rotation or the real curve of the apparent path followed by a planet, the Sun or the moon but it does not provide hypothetical explanations about why such empirical features appear. This is contrasted to a realist instrumentalist approach that attempts to save the phenomena by way of *a priori* presuppositions that are then tested through certain spherical configurations but that never achieve a level of certainty or verifiability of knowledge. A barycentric cosmology with non-homocentric centers of rotation is, therefore, a viable explanation for Qushjī's foundational models. On the other hand, a heliocentric model collapses when subjected to the test of Qushjī's constructive astronomy. This, in fact, as we discuss further in the next section, reveals a characteristic of constructive astronomy, as an outgrowth of constructivist philosophy, that leads to physical discoveries by way of constructive mathematics and analysis and that represents a historical shift from mathematical demonstration and verification to mathematical constructivism and discovery.

Moreover, it was the mathematical utility of a *Qushjī compounder* that allowed Qushjī to defend a central foundation of planetary motion, namely its reproduction from the compounding of uniform circular motions as basic building blocks. This certainly freed astronomy from realism and its speculative presuppositions, such as Ptolemy's

non-generality of the eccentric model, and it founded it upon concepts that are part of the constructivist process, such as the simplicity of uniform circular motion and the compounding of planetary motion as a result of the inanimateness of celestial objects. In fact, Qushjī's foundations for astronomy are based on a dynamic uniformity that is associated with the inanimate nature of celestial entities. This idea has been part of long debates between the *mutakallimūn* and the *falāsifah* that we can find in Ījī's works. In one passage in his *al-Mawāqif*, Ījī ends with his usual rhetoric refrain:

If the movements of the spheres considered [by Ptolemy³⁷] as being volitional (*irādīyah*) is inseparable from his view of the heavenly sphere as a celestial animal (*ḥayawān falakī*) whose movement according to him are by impulsion (*inbi'āth*) transmitted by psychic power (*quwwah nafsānīyah*) [as indeed was the assumption of writers on *hay'a* from Ptolemy to Ṭūsī and later in the *falsafah* program], then why not explain such irregularities by a succession of particular volitions?³⁸

With Qushjī such a *kalām* position meant that while constructivism relinquished hypothetico-speculation as a universal scientific methodology, it nevertheless, did not fall into the trap of an instrumentalist position. At the same time, constructive mathematicians were willing to accept that while their models are a true indication of observational reality, which includes such unobserved empirical features as the distance of a planet's rotation from its center³⁹, this, however, does not translate into a physical or a causal explanation that necessitarians and determinists seek as a first step to their empirical hypotheses.

³⁷Bernard R. Goldstein, "The Arabic Version of Ptolemy's Planetary Hypotheses", *Transactions of the American Philosophical Society New Series*, vol. 57, no. 4 (1967): 3-55.

³⁸ Sabra, *Science and Philosophy...*, 37-8.

³⁹ Copernicus relies on a solution to the equant similar to that presented by Qushjī for figuring out the distances of the planets from their center of motion and for proposing his heliocentrism, at a time the solution he himself provided to the equant as we saw earlier violates this distance aspect of the uniformity of planetary motion.

In the end, by moving the eccentric, Qushjī was relinquishing the realist idea of absolute space for the mentally and conceptually constructed space⁴⁰, whereby to see whether a mass moves the observer now looks at another mass for relative motion. The fixed reference (or apside) as a stationary stabilizing backdrop is now gone. On the other hand, a mathematical instrumentalist, like Ṭūsī, chose as his definition of space, “a definition ascribed by many Muslim scholars to Plato, namely that space is an external abstract extension (*bu ‘d mawjūd mujarrad*)”⁴¹. In fact, Hassan ‘Abdel-Latif explains in his important 1977 Ph.D thesis at the University of London (SOAS) that Ṭūsī “rejects ... the idea of space as a subjective extension of emptiness” and “agrees with the philosophers (*falāsifah*), that space is an external finite existent”⁴². Once again this is part of the foundational differences between the *kalām* program of constructive astronomy and that of *falsafah*’s program of realism and later transcendental-realism. Conceptually, this was allowed by a constructivist theory of *a priori* knowledge that describes reality by constructing knowledge from basic concepts of the mind and not by assuming that a description of reality is in itself found in what is sensed or abstracted from that without any recourse to the conceptual considerations of the mind.

⁴⁰ This is a theme of extended discussions that has already been covered in our previous chapter on Qushjī’s foundations of science in his *Sharḥ al-Tajrīd*.

⁴¹ Hassan Mahmud ‘Abdel-Latif, *Nasir Al-Dīn Al-Ṭūsī and his Tajrīd Al-‘Iṭiqād - an edition and study* (Ph.D thesis, University of London - SOAS, 1977), 394.

⁴² *Ibid.*, 393-4.

CHAPTER SIX

FROM QUSHJĪ'S CONSTRUCTIVISM TO KANT'S COPERNICAN REVOLUTION

6.1 QUSHJĪ'S CONSTRUCTIVE FOUNDATIONS OF ASTRONOMY

Astronomy in its pure form is a study of the uniform circular rotations that facilitate a direct reconstruction of recurring celestial patterns and motions, such as the planetary retrograde arcs or the solar ellipsoidal path. Realist astronomers, arguably beginning with Hipparchus (2nd century BC), made the first realist aberration of mathematical astronomy by introducing an eccentric model for the Sun, i.e. a model based on the hypothesis of one uniform circular motion to represent the apparent ellipsoidal path of the Sun. In following such a precedence realist astronomers fell captives to a static philosophy which promotes speculative hypotheses that correspond to the individual points of observation rather than advancing the discovery of models by way of constructive mathematical analysis. Within the one perceptual experience of a group of related observations, realism has an imbedded necessitarian philosophy, which considers that all the sensible points share the same hypothesis that is considered to be associated with an unchanging 'essence'. What this mathematically translates to is that all the points are then considered to share in the same static observational hypothesis. In this way, mathematics is only considered to be a demonstrative tool that verifies the closeness of the fit of the individual data points onto the presupposed hypothesis with anomalies or perturbations from such a hypothesis considered like a margin of error from a mean value.

Constructivism, on the other hand, as the fully developed theory of *a priori* knowledge of the *mutakallimūn* and as a foundation for constructive mathematics

(themes of chapters one, two, and three), frees astronomy from Aristotelian “essences, natures, forms, or necessary causes”¹ as its concepts are learnt from the contingent world without any *a priori* presupposition being assumed as a necessary law of nature. Mathematically, this philosophy translates into a situation whereby each observational planetary point, as an example, would itself be reconstructable as empirical *a priori* knowledge from the compounded concept of uniform circular motion, as opposed to being fed into an observational *a posteriori* hypothesis. Therefore, the equant problem that Ptolemy left behind as an aberration of realism turns out to be solvable only under constructivism, as the apparent ellipsoidal motion of the Sun is taken to be due to the compounding of two uniform circular motions. In other words, the equant problem was only produced due to the flattening of the two uniform circular motions that constructively produce an ellipse into one circular motion initially modelled as an eccentric with Hipparchus, then as an eccentric with an equant with Ptolemy for the upper planets, and then as an eccentric with an equant and a director for the Mercury model. In fact, in all three cases what is being modelled is the Sun’s motion represented by the first anomaly of planetary motion. In the case of Mercury, we note that the use of an equant and a director to represent the center of the epicycle is only due to the motional characteristic of this celestial object which expresses more of the finer details of the Sun’s motion due to its intricate relationship and nearness to the Sun. It is no wonder then that Qushjī only focuses on Ptolemy’s Mercury model to resolve the general problem of the equant as this point appears in the various Ptolemaic models².

¹ A statement used by Sabra in his *Science and Philosophy* (39) to raise an argument about an alleged instrumentalism shared by the *mutakallimūn* (the opponents of the Aristotelian *falāsifah*) which we dispute in the context of the next section.

² It is true that Ptolemaic astronomy is based on the double motion of an epicycle and deferent in the case of the upper planets and which he allows to be translated into an eccentric model. However, in the case of the lower planets and especially Mercury where the epicyclic model no longer holds due to the introduction of the director circle that rotates the center of the deferent, we note that Ptolemy now disallows the eccentric equivalent model and which becomes a point of contention for Qushjī who wrote

It is in a constructive solution to the equant problem, as we see with a constructive compounder or what we call a *Qushjī compounder*, that we have a solution, which could go beyond the general ability of a hypothesis to approximate the longitudinal location of a celestial object, i.e. real analysis, in order to reform the location of the object on the perpendicular dimension, i.e. how close or far from the observer the object is, or what is known as the *i* axis in complex analysis. It is this dimension which exposes an aberration of realism from reality as it presupposes a planetary hypothesis that does not take this dimension of reality into consideration. In fact, this is the biggest observational dilemma with the realist astronomy of Ptolemy, which is exposed though his lunar model that misrepresents in a ratio of 2:1 the size of the true Moon.

On the other hand, constructive philosophy approaches this problem from a foundational perspective that constructs the apparent motion from the principle of compounded circular motions that is tied to inanimate celestial objects, whereby the observed uniformity of the recurring planetary patterns is composed of the most basic unit of uniform motions; namely uniform circular motion. In the case of realism, an observational point is not considered to be a result of the compounding of motion, but rather only forming a subset of a hypothesis that is presupposed by the realist astronomer as being an *a priori* hypothesis in order for it to then be claimed as being perceptual knowledge and a necessary law of nature. Contrast such speculation and determinism with a constructive approach that discovers by way of constructive mathematics what forms the concepts of *a priori* perceptual knowledge according to a

a treatise (*Treatise on the Eccentric Hypothesis Being Possible for the Two Lower [Planets] Just as for the Others*) refuting Ptolemy's latter claim. With Ptolemy, therefore, the door to discovery was closed and reduced to speculation with the epicycles becoming a demonstrative tool that gives non-constructive models that lead to the rise of instrumentalism in mathematical astronomy.

constructivist theory of *a priori* knowledge. In fact, this is the core philosophy of Qushjī's breakthrough in astronomy as he introduces constructive mathematics into the general process of human perception and empirical knowledge. His method, as a further development within his school of *kalām*, in no way implies an instrumentalist modeling scheme, rather his radical constructivist philosophy provides us with the foundation for the idea of mathematical physics with all its subsequent ubiquitous use in physics and engineering sciences.

Realism, which is a static theory of perception, reduces the foundational double motions of an ellipse to a one motion hypothesis that now faces various challenges in order to maintain its hypothetical uniformity. The reason behind this is that realism only considers what is positively seen and when the double motions are not themselves directly seen, it was assumed in the case of the Sun model that the apparent motion is only due to one motion rather than two. Consequently, this later uni-motional approach of realism would end up in either one of the two presuppositions; either a geocentric hypothesis with the one motion belonging to the Sun or a heliocentric hypothesis with the one motion belonging to the Earth. Again we can contrast this with constructive astronomy that has imbedded in it the two phenomenal circular motions that now presents Earth's motion as an empirical outcome of the double-motion of the Sun's apparent ellipsoidal path. The very fact of the de-animation of celestial objects implies that the Sun's motion is itself uniform circular, leaving us with Earth occupying the other uniform rotational place. It is in this way, therefore, that Qushjī provides us with the foundations for returning astronomy to its pure form by allowing us to construct, from the compounding of uniform circular motions, the apparent motions of the planets, the Sun and the Moon.

Arabic astronomers in the Maragha tradition, such as 'Urđī and Ibn al-Shāṭir, along with Copernicus did not resolve the Ptolemaic problem of the equant, because their alternative models for the upper planets were devised to replicate the physical center of the rotation as well as its equant point, at a time the curve produced by their models was a non-symmetric curve that only approximated a uniform circle (as we saw in Figure 5.1). In this way, they did not provide a real solution to the equant but an arbitrary construction of the equant point based on Ptolemy's unicircular hypothesis for the Sun, without any conceptual solution to the problem and the question of why the problem arose in the first place. On the other hand, and as far as historical accounts seem to indicate, Qushjī was the first mathematician in the history of astronomy to present a conceptual resolution to the equant problem, when he introduced his constructive mathematical solution of the *Qushjī compounder*.

Under realism, a mathematical discovery of Earth's motion is methodologically unattainable, as a hypothesis from a group of observations is considered to be viable when it could - within some margin of error - approximate the data, without it being attainable from any one observational point. On the other hand, a constructivist concept would be viable when it can serve as a foundation for each point, i.e. it would be an explanation to how each point is constructed. For the case of the points that lie on an ellipse, the realist mathematician would speculate by observation about a matching curve, depending on the number of available points, and then commonly demonstrate its viability or close fit by way of a plot that charts the hypothesis and the separate points showing any margin of error. Alternatively, the constructive mathematician would prove that the points fall on an ellipse by showing how each point could be constructed

from the compounding³ of two uniform circular motions that rotate with the same speed but opposite directions⁴. In this way, while the realist can only give a hypothetical model, the constructivist can give a proof of existence⁵. In other words, constructive mathematics is about algorithms; that is procedures that one carries out in order to arrive at a desired proof or a result, and which are centered around the idea of sequential stages. The main difference between classical or realist mathematics and constructive mathematics is that a realist mathematician claims as a proof of existence for an object the idea that it is impossible for it not to exist (i.e. necessitarian existence). On the other hand, a constructive mathematician presents an algorithm⁶ that constructs the object as a proof for its existence (i.e. contingent and foundational existence). With this analysis we have an example of how realism as a correspondence theory approximates reality, as opposed to a constructive procedure that constructs our real understanding of what we perceive.

Consequently, only under a constructive approach, can Earth's motion be mathematically discovered, as a realist mathematician, following the Aristotelian philosophy of essence, natures, forms and necessary causality, would not allow for the

³ Compounding here, as in the case of the Qushjī compounder, means that the center of the second rotating circle is carried on the circumference of the first rotating circle.

⁴ Stated otherwise, “the vector addition of the two oppositely rotating circular vectors causes the tip of the combined vector to trace out an ellipse over one complete cycle.” (W.J. Emery, R.E. Thomson, *Data Analysis Methods in Physical Oceanography* (Amsterdam: Elsevier B.V., 2004), 428). On the other hand, within a realist worldview an ellipse is commonly described with a static formulation, i.e. as an accumulation of a set of points, for example, “an ellipse is the set of all points where the sum of distances from two points, called the foci, is the same” (Rocky Kolb, Edward William Kolb, *Blind Watchers of the Sky* (NY: Oxford University Press, 1999), 301).

⁵ Dear says, “Constructability in geometry asserts the potential existence of a figure by maintaining the possibility of actualising its existence through construction” (Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago: University of Chicago Press: 1995), 219). In astronomy this proof of existence can allow one to reach certainty of knowledge when uniform circularity is considered to be a feature of de-animated celestial objects (with no will) whose uniform motion would trace a symmetric circular path around their own centers of rotation.

⁶ An algorithm relates to computation that can be carried out in a finite number of steps and a finite period of time. This explains why constructive mathematics would be of great importance to the field of computer science and in particular artificial intelligence.

possibility of Earth's motion in the first place, given that this would be considered contrary to a moving Sun whose motion as in Ptolemaic astronomy is believed to fit a singular eccentric circular hypothesis. In fact, it was through reforming the equant problem with its empirical intricacies in relation to the Ptolemaic Mercury model that Qushjī with his constructive foundations of science was able to present a solution to the Sun's motion based on an apparent compounding that is constructed from two uniform circular motions in such a way that produces an ellipsoidal path. In this we, therefore, see how constructive mathematics systematically discovers, or at least presents the foundations of discovery, for the ellipse that represents the apparent solar motion that results from the compounding of the Earth-Sun motions. In fact, such a construction can proceed even from Ptolemaic observations. Compare this to a realist approach, which in the case of the Brahe-Kepler connection took a whole generation by Brahe to produce the observational planetary tables based on advanced instrumentation, and later by Kepler it took years-long laborious mathematical guesswork and recalculation to finally arrive at the ellipse; albeit only as another conjectural theory.

The Qushjān solution to Ptolemaic astronomy's biggest difficulty, the equant, and the imbedded discovery of the Sun's apparent ellipsoidal curve with its implications on Earth's motion, was, therefore, only resolved by Qushjī's constructive compounder as a novel astronomical tool. This tool was based on an entirely new philosophy of motional change that is different to the idea of necessitarian causality that Aristotle had tied to another fixity, namely the idea of an object's *a priori* 'nature' and 'essence', that had consequently hampered the study of change for generations of Ptolemaic astronomers until the fall of the realist Maragha Observatory and the rise of the constructive one in Samarqand.

6.2 KALĀM VS. FALSAFAH: A DEBATE OVER THE FOUNDATIONS OF SCIENCE

In an important debate between Harvard's A. I. Sabra and Columbia's George Saliba⁷, which I believe is important not just for the history of Arabic astronomy but also more widely for the general history of science, we can traverse the following discussion that can help us intellectually locate our current study. Sabra's criticism of *hay'a* astronomers is that they were not verifying the mathematical models with observations and they were not questioning cosmology but only attempting a fit between *a priori* presupposed cosmology and mathematical models. Without stating it as such, Sabra seems to have been criticising the realist program in astronomy. Using the practitioners of the *hay'a* tradition in the Maragha school as a case study, Saliba responds by saying, "the stress was placed on the manner in which the physical world was described with specific mathematical models, and that those models should be consistent with the physical reality they represented"⁸. Sabra's position, however, was that this reality is defined by Aristotelianism and not by empiricism, hence, he calls such astronomers "instrumentalists"⁹ or "positivists"¹⁰, whose "main issue was not the validity of the argument from observations, but rather the consistency of mathematical explanations with the accepted cosmological armature"¹¹. The central issue of the debate, therefore, seems to be over foundations of science versus the utility of mathematical tools that

⁷ The debate extends from the publication of a review essay by A. I. Sabra in the journal *Perspectives on Science*. Sabra's review itself was based on four books (all in the 1990s), two of which were written as dissertations by Sabra's students, and the last two were written by Saliba. The articles involved in this debate are therefore three and they are as follows: (1) A. I. Sabra, "Configuring the Universe: Aporetic, Problem Solving, and Kinematic Modeling as Themes of Arabic Astronomy", *Perspectives on Science*, vol. 6, no. 3 (1998): 288-330. (2) George Saliba, "Arabic versus Greek Astronomy: A Debate over the Foundations of Science", *Perspectives on Science*, vol. 8, no. 4 (Winter 2000): 328-341. (3) A. I. Sabra, "Reply to Saliba", *Perspectives on Science*, vol. 8, no. 4 (Winter 2000): 342-345.

⁸ Saliba, *Arabic versus Greek Astronomy...*, 335.

⁹ Sabra, *Configuring the Universe...*, 302.

¹⁰ *Ibid.*

¹¹ *Ibid.*, 302-3.

merely fit a cosmological worldview that is not real in the first place, and which ultimately constitutes a task that is deemed to failure. Saliba responds to all this by saying, “The problem was not that the models began to fail to account for the observations and thus new models based on new observations had to be devised as Sabra and others seem to think. It was to devise the best models that were consistent with the cosmological presuppositions and still account for the already accepted observations.”¹² But such cosmological presuppositions are themselves not real, so how can such a task be taken as a success, when the models themselves are only instrumentally devised to save the phenomena?

However, while it seems agreeable to support the thesis about the Maragha astronomers being instrumentalists and we saw ample evidence for this position when we were studying Qushjī’s critique of Ṭūsī’s *Tajrīd al-Kalām*, to carry this thesis across from the *falsafah* camp into that of their opponents, the *mutakallimūn*, such as Ījī and Qushjī is rather problematic. We, therefore, dispute Sabra’s earlier 1994 statement about the *kalām* scholar, Ījī, where he says:

Ījī’s sentence about the mathematical hypotheses of astronomy being neither an object of belief nor subject to affirmation or negation” and hence beyond the reach of religious prohibition, “clearly implies that such hypotheses are neither true nor false and this suggests an instrumentalist (or factionalist) view of the mathematical astronomy of his time. In this sense Ījī’s sentence is proposing an interpretation of Ptolemaic astronomy not unlike that of Andreas Osiander.¹³

With this analysis, Sabra extrapolates his point to somewhat hastily conclude, “it would seem that a thoroughgoing instrumentalism would suit an Ash‘arite view of a world ... of regularities that allow for a science that is descriptive and predictive but not by itself explanatory”¹⁴. So while we would agree with the analysis that the early *hay‘a*

¹² Saliba, *Arabic versus Greek Astronomy...*, 337.

¹³ Sabra, *Science and Philosophy ...*, 39.

¹⁴ *Ibid.*

proponents were generally instrumentalists due to them being under the purview of *falsafah* and therefore realism, we, however, dispute the conflation of the *kalām* proponents such as Ghazālī and Ījī with those of *falsafah* given the long history of disputations by the *mutakallimūn* against the *falāsifah*. A closer reading is, therefore, required in order to ascertain the finer details of the Ash‘arite’s worldview “in which there are no essences, natures, forms, or necessary causes”¹⁵, yet still there is *a priori* knowledge (*‘ilm ḍarūrī*) that stems from the knower’s intuitive construction of empirical knowledge. In light of our study in Chapter Two on the Ash‘arite *mutakallimūn* being pre-constructivists with a different theory of knowledge to that of the *falāsifah*’s realism, one therefore should not hurriedly apply the label “instrumentalist” upon Ījī, nor more generally upon the Ash‘arite *mutakallimūn*, the way they would apply it to Ṭūsī, Khafrī or any other astronomer pre or post Qushjī in the Maragha tradition. In the following few paragraphs, we, therefore provide a finer reading of the new emerging constructive program of *kalām*.

Ījī’s take in *al-Mawāqif fī ‘Ilm al-Kalām* (Stations in the Science of *Kalām*) on the mathematical circles of astronomical modeling, as discussed earlier, is related to his general theory of knowledge. Ījī in no way classifies the human semantic domain as an instrumentalist endeavour and his treatise on constructive semantics (*Risālah fī ‘Ilm al-Waḍ‘*), studied earlier through Qushjī’s commentary on it, is a sign of his struggle towards achieving a linguistic framework that expresses reality and not a realist structure that sets out to speculatively or instrumentally express the unknown intention of the human speaker (as is the case with realist semantics). In this way, I would question the description of Ījī as an instrumentalist, given that he was not an astronomer

¹⁵ Ibid.

but a foundational scholar, who presented a critique against realism and neither produced a realist/instrumentalist astronomy nor a constructivist one in the manner that Qushjī later does when he further develops Ījī's foundational works in both semantics and *kalām*. Ījī rather stopped his investigation, where he had no further methodical or empirical knowledge to present. His contribution from a constructivist perspective is, therefore, attested to by the reliance of the likes of Qushjī upon his work to further complete the development of constructivism as a comprehensive approach to *a priori* human knowledge and understanding.

As far as the Ash'arite *mutakallimūn* are concerned, their attacks on “essences, natures, forms, or necessary causes” (in the words of Sabra) is a sign of their constructivist theory of *a priori* knowledge and their scientific program, which was initiated by establishing knowledge as a subjective relation and not as a realist form that is statically transported to the mind. This, like in the case of Ījī, implies that one cannot classify the *mutakallimūn* from a realist perspective to say that their scientific program was merely “descriptive” and not “explanatory”, as their constructive approach means that empirical or involuntary *a priori* knowledge (*al-‘ilm al-ḍarūrī*) is in-line with their imbedded physical philosophy of contingency as opposed to determinism. In fact, it is this philosophy that allows for constructive or empirical *a priori* knowledge to be attained as an involuntary classification of knowledge that provides the foundation for rational and volitional human thought. Furthermore, support for our line of argumentation can also be found in recent academic research that focuses on the figure of Ghazālī, the Latin “Algazel” who himself was a *mutakallim*. Kukkonen states the following:

Ghazālī rethinking of the meaning and use of the modal terms is a bold and in many ways proung departure from the customary theory of Arabic

Aristotelianism ... advances made here may even have been instrumental in ushering in the so-called modern era of philosophy and science.¹⁶

Kukkonen adds that the parallels between medieval nominalism and the Ghazālīan contingency doctrine are “hardly coincidental and highly suggestive” and states that he is “left to wonder about what might have been achieved in the Arabic world had someone but picked up the discussion from where it was left in the *Tahāfut al-Tahāfut*. Alas that was not to happen”¹⁷. While agreeing with the first half of Kukkonen’s observation about Ghazālī, and which backs our claim about the *mutakallimūn* not being instrumentalists, we, however, find, as our research has shown, that “the discussion from where it was left in the *Tahāfut al-Tahāfut*”, was in fact further taken up by the fourteenth and fifteenth century *mutakallimūn* whose efforts culminated in Qushjī’s constructivism as an alternative reading of reality to that of Aristotle’s impotent realism and its imbedded instrumentalism. In addition, despite its laudatory appraisal of Ghazālī’s figure such often-made reduction of the influence of the philosophy of *kalām* to one *mutakallim*, whether al-Ash‘arī, Ghazālī, Rāzī or any other, reduces the scope of the civilisational achievements and the currents of thought that defined a worldview to mere individual geniuses of eclectic fortune or insignificant instrumentalist overtures.

Similarly, we also find Ahmad Dallal’s commentary on Ījī unconvincing in relation to the *mutakallimūn*’s methodology of science being a “positivist” program. Dallal’s remarks are as follows:

Al-Ījī’s ultimate purpose was to undermine the comprehensive claims of philosophy to be a complete system of knowledge, [and] not to produce an alternative comprehensive system. This is what underlies al-Ījī’s recurrent assertion that it is possible to imagine explanations for various natural

¹⁶ Kukkonen, *Possible Worlds ...*, 23.

¹⁷ *Ibid.*

phenomena that are different from the ones presented by philosophers as definite and conclusive.¹⁸

Rather than drawing the conclusion that Ījī's anti-*falsafah* (or anti-realism) expositions imply a positivism or a non-philosophy of sorts, we alternatively hold that Ījī is part of a constructivist *kalām* school that was still under development during his time. Therefore, our own conclusion follows that the *mutakallimūn* in the tradition of Ījī are not instrumentalists or positivists, but rather scientists who accepted their shortcomings and were not willing to follow the method of the *falāsifah* by filling in their theoretical gaps with mere speculation and ad-hoc presuppositions. In this unique feature, which could be contrasted to modern academic objectivity, we find that the *mutakallimūn* were able to maintain a coherent school for centuries and it was this school, despite the various differences between the *kalām* researchers, that ultimately resulted in constructivism, as a comprehensive theory of *a priori* knowledge and human understanding. Dallal repeats his above claims in his latest book *Islam, Science, and the Challenge of History*, where he says in a section named *kalām*, “they [*kalām* works] were not aimed at providing a comprehensive alternative to Greek philosophy, nor did they claim to be a comprehensive system of thought that underlay all other sciences”¹⁹. In fact, such a non-foundational reading of the history of *kalām*, as indicated in a previous section in our study entitled *The Development of Constructive Kalām*, misses what Qushjī, himself, describes in an introductory section in his *Sharḥ al-Tajrīd*. In following of his *kalām* predecessors, Qushjī defines the foundational place that *kalām* occupies within the pursuit of reality and truth. Qushjī says, “[The] evidential support

¹⁸ Ahmad Dallal, “The Adjustment of Science”, *Bulletin of the Royal Institute for Inter-Faith Studies*, vol. 4, no. 1 (Spring/Summer 2000): 97-107.

¹⁹ Ahmad Dallal, *Islam, Science, and the Challenge of History* (New Haven: Yale University Press, 2010), 131.

[of the science of *kalām*] is the strongest of proofs ... and with it any veil that hides the reality of the quiddity of things is removed ... It is a prioritised discipline that efforts should be exerted towards acquiring and great intellectual vigour should be dedicated towards the pursuit of its completion”.²⁰ It is no wonder then that Qushjī’s breakthrough in astronomy and constructive mathematics had its very foundations presented in a text on *kalām*.

In order to comprehend let alone appreciate the *kalām* program in astronomy one would have to understand constructivism as being a foundation for constructive mathematics and as a source for contrasting it with the realist astronomical program of *falsafah*. In light of this, what then emerges is a way forward for identifying the underlying features that symbolise the *kalām* astronomical program and its active overtake of the helm of astronomy in fifteenth century Samarqand under the patronage of Ulugh Beg. In this way, we can understand how constructivists wrestled mathematics from the Platonists and freed astronomy from the Aristotelians by replacing such philosophies with the empirical and normative foundations of a constructive program. Subsequently, it was constructive mathematical astronomy rather than positivist modeling, as Dallal and Saliba seem to think, that overran realist astronomy in the fifteenth century, i.e. at the onset of the Scientific Revolution which historically began around the territorial boundaries of Ottoman land.

Having refuted the “instrumentalism” attack on *kalām*, we now turn to researchers like McGill’s F. Jamil Ragep, who rather than capturing the essence of the emerging alternative *kalām* program of astronomy that Ījī, Şadr al-Sharī‘ah and Qāḏīzada consolidated and that Qushjī was its fifteenth century pinnacle, Ragep rather

²⁰ Qushjī, *Sharḥ al-Tajrīd*, fol. 2.

gives somewhat conflicting accounts of Qushjī's astronomy between instrumentalism and realism without identifying his constructive mathematical modeling and therefore missing much of its astronomical breakthroughs. The closest Ragep gets to a constructive position is when he states that for Qushjī “the correspondence between our ‘human constructions’ and external reality is itself a source of wonder”²¹. However, his lack of determination for this relation between “human constructions” and “external reality” in accordance to Qushjī's foundations of science makes him fluctuate between conflicting accounts. One such example is found in the following two assertions. The first is his saying, “Qushjī, though, in rejecting the view that somehow we can know true reality [i.e. Qushjī as an instrumentalist]”²², and the second is his statement, “I do not think Qushjī's position is instrumentalist in the same sense as Ījī's (or Osiander's)”. This vagueness is, therefore, problematic as it attempts to analyse Qushjī's works from a Tūsīan *falsafah* perspective that considers perceptual knowledge as “an image or representation of the external reality, and not the reality itself”²³. In fact, this position seems to be the general accepted definition of perceptual reality that is shared by mystically leaning philosophies, such as that of Tūsī who, as we saw in the previous chapter, is a founding figure of what is known as *al-hikma al-muta'āliyah* (Transcendental Theosophy). Qushjī, however, does not reject “the view that somehow we can know true reality”, nor does he hold that instrumental “human constructions” merely “correspond” to “external reality” as these are ideas that are associated with exactly the type of realism and theory of correspondence that Qushjī, the *mutakallim* mathematician, rejected in his *Sharḥ al-Tajrīd* (as we saw in an earlier investigation).

²¹ Ragep, *Freeing Astronomy ...*, 63.

²² *Ibid.*

²³ Sayyid Naquib Al-Attas, *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: International Institute of Islamic Thought and Civilisation, 1995), 150.

Qushjī holds that reality as a constructive understanding is derivational (*ishtiqaqī*) and descriptive (*ittiṣāfī*), rather than being an essentialist correspondence (*tawāṭu*) between an internal captured reality and an external “true” one. Qushjī’s sense of “wonder” in astronomy is, therefore, at the way man can attain reality by way of constructive mathematical modeling and not at how instrumental models “correspond” to “external reality”. In fact, such a reading of Qushjī promotes a theory of dualism of reality, which contradicts the very foundation of the contingency program that Qushjī and his predecessor *mutakallimūn* introduced into the study of astronomy²⁴.

On the other hand and somewhat different in approach is Ihsan Fazlioglu, a noted Turkish biographer of Qushjī, who writes:

Ali Kushji makes a clear distinction between the certain and the possible for attaining knowledge of the universe/cosmos. In his example of astronomy he states that the astronomers never defend an idea like "there is no other solution or way other than the one we explained". Instead, what they defend is the idea that "although our choice is the correct one, there may be other possibilities." In some way, the astronomers imagined "one of the possible approaches/methods related to nature and systemized it according to the correspondence of the feeling/observation and reality."²⁵

Again, we note here the shadows of a reading of Qushjī that characterises him as a proponent of representationalism or the correspondence theory of knowledge, which is another name for dualism and instrumentalism. This approach, therefore, dilutes the revolutionary philosophical work of Qushjī, which Fazlioglu has the acumen, as we show below, to notice and write about despite him missing a core component of

²⁴ My translation for the relevant section in *Sharḥ al-Tajrīd* that Ragep quotes from, and which is provided in the previous chapter, is as follows: “Indeed, it is a praiseworthy matter that they were able to construct in their minds from among the possible arrangements that which helps organise the states and motions of the planets with its numerous irregularities in order to facilitate the specifying of the positions of the planets and their interconnectedness for any chosen time, in such a way that conforms to sense perception, and that, consequently, makes the minds and intellects full of wonderment.”

²⁵ Ihsan Fazlioglu, “Forcing the Boundaries in Religion, Politics and Philosophy-Science in the Fifteenth Century”, 13-15 January 2005, <<http://www.ihsanfazlioglu.net/EN/publication/articles/1.php?id=151>>, (Accessed 5 July, 2013).

Qushjī’s foundations of science. A modal “possibility” for Qushjī does not qualify as an actual “solution” in the contingent physical world, as Fazlioglu’s words seem to be stating. Therefore, the saying that there may be “other possibilities” is not the same as there is “[an]other solution or way”. Fazlioglu appears to be implying that the solution is relative, whereby others might have their own certain solutions, which only amounts to an idealist or an instrumentalist interpretation that treats Qushjī as sharing the same philosophy of astronomy as that of the Ṭūsīan astronomers at Maragha. This is ironic, especially given that Fazlioglu himself speaks of Qushjī’s philosophical school in which he produces a new mathematics and a new physics²⁶. In his encyclopaedic biography of Qushjī he also adds that Qushjī worked to cleanse Mathematical sciences from Pythagoras’ Hermetic mysticism and physics from Aristotelian philosophy, which he reiterates as being a project that is formulated to cleanse the Aristotelian physical and metaphysical principles out of astronomy and optics²⁷. As we’ve argued repeatedly in this dissertation, this noted outlook is a core element of the *mutakallimūn*’s program for the rational sciences, which goes well beyond what realism could offer as an impotent foundation for the rational and mathematical sciences. Fazlioglu’s position on Qushjī is therefore mixed despite it being the closest yet, i.e. apart from our new research, to state the revolutionary program of Qushjī in all three of its mathematical, physical and conceptual dimensions.

In the end, rather than being an epitome of instrumentalism, who “freed astronomy from philosophy” as Ragep asserts²⁸, Qushjī represents the active program

²⁶ This theme appears in the following three sources: (1) Ihsan Fazlioglu, “Qushjī”, in *The Biographical Encyclopedia of Astronomers*, edited by Thomas Hockey et al. (New York: Springer, 2007), 946-948. (2) Ihsan Fazlioglu, “Ali Kuscı” in *Encyclopedia of the Ottoman Empire*, edited by Gabor Agoston, Bruce Masters (NY: Facts On File, 2009), 35. (3) Ihsan Fazlioglu, “Astronomy in Ottoman Land”, <<http://www.ihsanfazlioglu.net/EN/publication/articles/1.php?id=185>>, (Accessed 5 July, 2013).

²⁷ Ibid.

²⁸ This claim is the title of Ragep’s article *Astronomy from Philosophy: An Aspect of Islamic Influence on Science*.

of affirming conceptual foundations for astronomy, whereby in order to achieve this he reformed foundational philosophy itself from realism to constructivism, and he did so by following the pre-constructivist tradition of his predecessor *mutakallimūn*. In doing so, Qushjī also returned astronomy to its pure program, in which uniform circular motion is utilised to reconstruct the apparent patterns of uniform planetary motion. For a constructivist, like Qushjī, the planets' contingent uniformity, as seen from Earth, becomes a compounding of simple rotating circles (i.e. the center of one circle rotates on the circumference of another), as opposed to a static form of homocentricity for which the circles share the same referential point or center. For Qushjī, the uniformity of circular motion is fundamental to a de-animated celestial realm, and he explicitly states this in his *Sharḥ al-Tajrīd (Commentary on Abstracting Kalām)*. In fact, with such a foundational philosophy one can already ascertain the agenda of the *kalām* program of astronomy, which endeavours to recover the uniform circles that constitute a construction of the models that both describe the apparent planetary motions and give a foundation for a corresponding explanatory account. Philosophy, as constructivism, is, therefore, no longer the speculative presuppositional approach of the realists, but is rather a foundation for astronomical, and more generally, scientific discovery.

6.3 CONCEPTUAL TRANSMISSION AND THE COPERNICAN REVOLUTION

As we have seen numerously in previous chapters, a constructive model of a real curve does not rely upon the realist idea of necessitarian causal explanation in the analysis and understanding of observable natural effects. Copernicus, as a realist, who was utilising a constructivist planetary model attempted to find his *a priori* presupposition from such a model in order to proceed in an Aristotelian manner, whereby mathematics is a mere

demonstrative, i.e. non-constructive, tool. In this fact alone is a conceptual conflict between a constructive model that is contingent in outlook and a realist philosophy that is necessitarian. As a result, we find that Copernicus gives his heliocentric explanation as a deduction from a constructive approach, and ends up with a theory that reverses the apparent rotations of the Earth and the Sun to be correct about Earth's motion but wrong, from a constructive perspective, about the Sun's stationariness. In fact, a heliocentric cosmology is conceptually tied to geocentrism, where too only one rotation is perceived to give the apparent motion of the Sun.

Furthermore, in overcoming the equant challenge posed by Ptolemaic astronomy, the Maragha astronomers, as well as Copernicus, despite giving a solution to preserve uniform motion, they, however, don't arrive at the real curve of the epicycle center but at an arbitrary construction that is merely an approximation of Ptolemy's unicircular hypothesis. In this way, we find another use of a constructive practice by an astronomer, such as Copernicus, who remains squarely within a realist theory of knowledge. As a consequence, under such a conflict between foundation and practice one can excusably ponder the idea of conceptual transmission from the *kalām* program of astronomy to explain how a constructive practice is employed without a conceptual scheme to match its practice. In either case, however, the transmission theory is not important under a conceptual study of the Scientific Revolution, such as ours, as a non-constructivist solution despite its syncretism with constructive mathematical practice remains within a realist conceptual scheme that can be, accordingly, refuted, the way that it can be done with Copernicus' heliocentrism.

We, hence, observe that while Copernicus retained uniform circular motion in astronomy, he, nevertheless, remained a realist in theory of knowledge, as is attested to by his work *Commentariolus*, which he opens with a list of *a priori* presuppositions that

he ironically calls “axioms”. In the opening pages, Copernicus had this to say, “After I had attacked this exceedingly difficult and nearly insoluble problem [i.e. the equant problem], it at last occurred to me how it could be done with fewer and far more suitable devices than had formerly been put forth if some postulates, called axioms, are granted to us”²⁹. Among his “axioms” is one that postulates Earth’s motion and the fixity of the Sun in the center of the world. Such a position means that given the presuppositional acceptance of Earth’s motion, Copernicus was ready to shift the realist fixation of the reference from the Earth to the Sun, which now becomes the center of the fixed frame of reference that realists rely upon for their theory of correspondence and its necessitarian causal worldview. It is clear, therefore, that Copernicus did not understand, the function of a constructive compounder (i.e. a *Qushjī compounder*), so how can it then be said, as Swerdlow (1973) claims, that Copernicus used such a utility in a constructive mathematical transformation to obtain what is ultimately a constructive view of Earth’s motion? The difficulty with such an interpretation especially arises when we know that Copernicus remained a realist, who conceptually trapped his perspective on reality within a fixed heliocentric frame of reference.

In actual fact, had Copernicus understood the implications of a constructive compounder and its moving eccentric model that Swerdlow says Copernicus had hinged his heliocentric transformation upon, then it would have been logical for him to have used this more advanced conceptual structure for the first anomaly of the planets and for resolving the problem of the equant that he himself presented in his *Commentariolus* as the biggest challenge facing sixteenth century astronomy. Copernicus, as we see in the same text, instead uses a weak instrumentalist model (as a less developed conceptual

²⁹ Swerdlow, The Derivation..., 435-6.

frame) that had appeared earlier in the works of the Maragha astronomers (whether through direct transmission or parallel development). It was this epicyclic resolution to the equant that according to Qushjī's constructivist theory of *a priori* knowledge fails to explain or provide a foundation for the empirical evidence that defines Ptolemy's equant point that had been posed as a dilemma for astronomers who believed in the reality of their models. According to Qushjī, therefore, neither realism, as an Aristotelian theory of knowledge, nor instrumentalism, as a response to realism, could provide a comprehensive answer to the equant problem. The only resolution to it was to be found in constructive mathematics, the same conceptual scheme that constructs a mathematical representation of Earth's motion. To deploy a constructive framework for Earth's motion without using the same scheme to resolve the equant problem would, thus, raise new questions of its own: Questions about transmission, in the late fifteenth or early sixteenth centuries, across Islamo-European boundaries.

On the other hand, statements such as the one by Swerdlow and Neugebauer (1984) that "the question therefore is not whether, but when, where, and in what form he [Copernicus] learned of the Maragha theory" become somewhat insignificant in the face of the philosophical failure of realism, whether in its Maraghan geocentric form or its Copernican heliocentric one. In fact, there is no evidence that the constructive astronomer, Qushjī, was either a geocentric or a heliocentric astronomer, as his own aforementioned words in *Sharḥ al-Tajrīd* do not speak of Earth's motion as a mere intellectual possibility but rather speak about there not being any empirical objections that follow from Earth's motion. Therefore, Qushjī is explicitly not a geocentric astronomer, which in itself is revolutionary for a fifteenth century astronomer in the post-Ptolemaic tradition. Furthermore, based on his constructive philosophy of science, Qushjī does not need to state the idea of Earth's motion as an *a priori* presupposition,

as Copernicus and any Aristotelian would do, but, conversely, constructivism as a methodology of astronomical discovery instead arrives at reality based on what could be constructed by way of constructive mathematical modeling. Only under such constructive analysis, can we then understand the role of the *Qushjī compounder* in founding the apparent motion of the Sun on two uniform circular rotations that represent two phenomenal objects (i.e. the Earth and the Sun) and which leads us to the scenario whereby both Earth and the Sun have their own uniform circular motions while not necessarily sharing the same center of rotation. Even without stating this particular conclusion as such, the very fact that Qushjī's new developments in constructive mathematics provide the foundation for such a scenario is itself the major conceptual revolution in astronomy and the return to its pure origins that are neither realist nor instrumentalist but simply involve the constructivist exercise of discovering through simple circular models the reality of the rotations of the Sun, the Moon and the planets.

Realism as a non-constructive or positivist approach to perception only monitors one uniform motion in relation to the encompassing eccentric rotation of the Sun and the deferent (i.e. the epicycle center) of the Moon and the upper and lower planets. In doing so realists limit the observable points to a unicircular hypothesis and try to fit any irregularities within it under a varying margin of error. It is for this reason, that Ptolemy raises the problem of the equant in the first place, as it was his way of finding the elusive point within his unicircular hypothesis around which the uniformity of motion appeared to be centered. It is also for this reason, that Ptolemy's equant seemed to vary in apsidal location from the model of the upper planets to that of Mercury despite the first anomaly of planetary motion being a feature of the Sun's apparent motion and not that directly of the planet. Qushjī's solution was to break this non-justifiable *a priori* presupposition about the Sun's apparent motion being restricted to only one motion and to allow

constructivism as a methodology of discovery to arrive at the two compounded motions that lead to the Sun's seemingly ellipsoidal curve. In fact, realists were only speculating when they assumed that the Sun's apparent motion is an eccentric circle, which they then linked to another *a priori* presupposition about an immobile Earth.

In summary, Qushjī's constructive solution promotes the knowledge that the Sun's motion, as well as that of the planets, is a result of two compounded circular motions, while within a realist conceptual frame only a scientifically-untenable heliocentric cosmology was able to accommodate for Earth's motion within a unicircular hypothesis to represent the Sun's apparent motion. Copernicus reasoned that if the Earth rotates, while the Sun's apparent motion is an eccentric circular rotation, then this means that the Sun is fixed - leading to his heliocentric hypothesis. On the other hand, under a constructive mathematical approach Earth's motion would not be presupposed but rather discovered from the situation that the equant is a feature of two rotating circles that together represent the Sun's apparent motion, which when accompanied by an inanimate planetary system (as explained before) would strikingly lead us to a barycentric cosmology, where both the Earth and the Sun rotate.

Furthermore, with the theme about Earth's motion being a constructive mathematical discovery we note that this sheds light on a few factors in the relationship between the foundations and the practice of mathematics. Under constructivism, the concept of the mind which becomes the basis for individuating particular empirical knowledge plays the same role in the constructive *a priori* formulation of empirical knowledge and in the epitome of constructive mathematics as a relational concept that serves as a foundation during the process of sense perception. In this way, constructive mathematical practice is a development of constructivism as a theory of *a priori* knowledge, and consequently the philosophy of constructive mathematics becomes a

reflection of constructivism as a general approach to semantics and human understanding. In this way, constructive philosophy emerges as a universal conceptual scheme for understanding the empirical world giving rise to an astronomy of discovery and not one for an instrumental demonstration of a presupposed cosmology. With Qushjī, we find that it is this constructive conceptual scheme, as it is found in his *Sharḥ al-Tajrīd*, that justifies eliminating the empirical impediments to Earth's motion³⁰. This, thus, allows for constructive mathematics to run its course in discovery based only on the rational tools of construction, such as the simple circular rotation as a basic unit of patterned uniform motion; not very different from the basic polar rotation in Euler's formula of complex analysis which is ubiquitous in mathematics, engineering and other physical applications.

Today, empirical evidence has watered down the heliocentric cosmology with the idea of the barycenter as a non-heliocentric center becoming common parlance amongst astrophysicists. However, what remains to be completed is the launch of a new accompanying constructivist revolution in science, which would abolish a heliocentric cosmology in the same manner that a geocentric cosmology was abolished. This new insight instead adopts a constructive barycentric cosmology that allows us to reconstruct the Sun's apparent curve from the compounding of the two uniform circular motions of the Sun and the Earth that in themselves rotate around a their own barycenters (or in a simple form around a common barycenter). Similarly, the motions of the planets and

³⁰ As we saw in Chapter Four, unlike Ṭūsī, Qushjī refuses to settle the matter of Earth's motion by appealing to Aristotelian natural philosophy. He first states that "it is not established that what has a principle of rectilinear inclination is prevented from [having] a circular motion," which is in answer to the view that the Earth cannot rotate because its natural motion is rectilinear, and which is a position held by Ṭūsī and others in his tradition. Secondly, Qushjī counters Shīrāzī by asserting that the "conformity of the air [with a rotating Earth] would be its conformity along with all that is in it, whether it be a rock or something else, whether small or large." To Qushjī the situation was summed up by his perceptive assertion that "no falsities (*mafāsīd*) are henceforth necessitated by the conclusion of Earth's rotation." (Qushjī, *Sharḥ al-Tajrīd*, fol. 195)

the Moon would be reconstructed from the two circular rotations of the planet or the Moon and that of the Earth around their corresponding barycenters. In uncovering the foundations for such a cosmology, the *Qushjī compounder* indeed provides a basis for such reconstructions by giving the equivalent compounding models that allows an astronomer to directly provide a conceptual explanation of the perceived motions. In this new cosmology, it follows that the ellipse is neither the basic natural motion of the planets, nor the Moon, nor that of the Earth, rather what is contingently natural is the uniform circular motion around a barycenter, and the ellipse is only a feature of the apparent motion of the Sun from Earth given the two rotational speeds and their oppositional directions.

In conclusion, constructive mathematics in astronomy involves the adoption of a new constructivist theory of *a priori* knowledge that serves as a philosophy for the ubiquitous idea of mathematical physics. In this way, constructive mathematics becomes the foundation for mathematical physics. In any case, our contemporary situation is as such that what Qushjī introduced - and Copernicus missed - of constructive mathematics occupies a central stage in current scientific debates over methodology; especially in light of the challenge that quantum mechanics poses and its quest for the universal foundations of physical science.

6.4 KANT'S COPERNICAN REVOLUTION

By approaching the issue of knowledge of reality from a reversed direction to that of realism, i.e. by starting with the foundational known concepts to construct the empirical knowledge of human understanding, constructivism provides a normative path that leads to the knowledge of reality. A constructivist theory of *a priori* knowledge, therefore, involves a cognitive inversion of realism that was named "Kant's Copernican

Revolution” almost three hundred years after Copernicus himself put forward a proposition of astronomy that can only be provided as a result of constructive mathematics and its conceptual framework and theory of knowledge. To then claim that Earth’s motion can be reproduced under realism, as is claimed by Copernicus, is both philosophically untenable as well as mathematically indefensible. Under such an argument, there is something fallacious with the order of proceeding from the foundation to the practice, whereby contrary to Qushjī’s philosophy of science as a foundation for his astronomy, in the story of post-Copernicanism we see the formulation of the foundation of Copernicus’ revolution attempted in both the Cartesian tradition and that of the British empiricists, which later Kant tries to synthesise into a philosophy for the synthetic *a priori*. Perhaps this is the core quest of Western philosophy since Copernicus, which approaches philosophy as a philosophy of science that is ultimately taken in-line with a historical reading of intellectual developments; namely the history of science.

Kant characterizes his new constructivist view of experience in the *Critique of Pure Reason* through an analogy of the revolution brought forward by Copernican astronomy:

Up to now it has been assumed that all our cognition must conform to the objects; but all attempts to find out something about them *a priori* through concepts that would extend our cognition have, on this presupposition, come to nothing. Hence let us once try whether we do not get farther with the problems of metaphysics by assuming that the objects must conform to our cognition, which would agree better with the requested possibility of an *a priori* cognition of them, which is to establish something about objects before they are given to us. This would be just like the first thoughts of Copernicus, who, when he did not make good progress in the explanation of the celestial motions if he assumed that the entire celestial host revolves around the observer, tried to see if he might not have greater success if he made the observer revolve and left the stars at rest.³¹

³¹ Kant, ed. Paul Guyer, Allen W. Wood, *Critique of Pure Reason*, Cambridge University Press: 1998, 110 (Bxvi).

In his *Prolegomena to Any Future Metaphysics*, Kant further notes that the concept of causality “was not derived from [nature or] experience, as Hume had attempted to derive, but sprang from the pure understanding”³². According to Michael Rohlf’s entry on Immanuel Kant in *The Stanford Encyclopedia of Philosophy* such accounts by Kant are likened to the geocentric revolution of Copernicus in astronomy as they both involve an active contribution by the knower/observer in order to explain the known/observed. Rohlf says:

The way celestial phenomena appear to us on Earth, according to Copernicus, is affected by both the motions of celestial bodies and the motion of the Earth, which is not a stationary body around which everything else revolves. For Kant, analogously, the phenomena of human experience depend on both the sensory data that we receive passively through sensibility and the way our mind actively processes this data according to its own ... rules.³³

It is this philosophy which was noted in 1804 by Schelling in his obituary of Kant, in which he states that like Copernicus who removed the Earth from the center to the periphery of the solar system, Kant transformed the subject from a passive, receptive subject to an active subject³⁴. Philosophers of science such as Popper have also accepted the analogy. In a section on “Kant’s Copernican Revolution”, he sums this up in *Conjectures and Refutation*, where he quotes Kant’s statement that “our intellect does not draw its laws from nature but imposes its laws upon nature”³⁵.

In fact, in his recent works, Rockmore is more explicit in identifying that Kant’s Copernican revolution is itself a constructivist revolution against realism. Rockmore asserts, “Kant’s Copernican revolution of 1781-7 is constructivist. The central insight consists in a thesis of the identity between subject and object, knower and known.” Such

³² Beryl Logan, *Immanuel Kant's Prolegomena to Any Future Metaphysics: In Focus*, Routledge: 1996, 24

³³ Michael Rohlf, “Immanuel Kant”, *The Stanford Encyclopedia of Philosophy* (Fall 2010 Edition).

³⁴ See “Immanuel Kant” (1804), in *Schellings Werke*, ed. Manfred Schröter (Munich: Beck, 1958), 3:599. The German can be found in note 49 of Rockmore’s *Kant and Phenomenology*, p.227.

³⁵ Popper, *Conjectures and Refutation: The Growth of Scientific Knowledge*, Harper & Row: 1965, p180.

an observation by Rockmore on the knower and the known in fact brings us back to the early 1900s when the Arabist Duncan Macdonald made certain observations about the *mutakallimūn*'s theory of knowledge³⁶, who as we saw in Chapter Two, establish that knowledge is a relation between the knower and the known. The *mutakallimūn* gave an epistemic anti-thesis to the realist worldview of the *falāsifah* and their definition of knowledge as the outside form that is transported into the mind. Our current philosophical debates over the place of realism versus constructivism, therefore, has roots in an earlier clash that is epitomized by Ghazālī's *Incoherence* attack on the realist *falāsifah*. This battle eventually materialized in the person of 'Alī Qushjī, whose death was in Constantinople in the same year (1473) that Copernicus was born in East Europe.

Furthermore, with such Kantian readings, Putnam claims that "Kant made a decisive advance over all previous philosophers in giving up the [realist] idea that any description of the world [is] simply a copy of the world"³⁷. Again we note with Putnam the same presumptuous attitude towards the Kantian inversion of philosophy as being the first of its kind in the history of ideas. While we do not contend the relationship between such a Copernican revolution in philosophy and the preceding revolution in Copernican astronomy, however, we do put up for dispute the idea that constructivist philosophy, which in the case of Kant was separated from the onset of the Scientific Revolution by two to three centuries, is a true indication of the time when constructivism historically first appeared in the context of the Scientific Revolution. Our argument here is that while Kant's philosophy seems to be *reverse engineering* a

³⁶ MacDonald says, "The Lucretian atoms raining down through the empty void, the self-developing monads of Leibnitz, pre-established harmony and all, the Kantian "things in themselves" are lame and impotent in their consistency beside the parallel Ash'arite doctrines; and, on the other, not even the rigors of Calvin, as developed in the Dutch confessions, can compete with the unflinching exactitude of the Muslim conclusions" (MacDonald, 200).

³⁷ Putnam, *Pragmatism* (Oxford: Blackwell, 1995), 30.

conceptual structure from the Copernican moment, historically speaking and in the case of Qushjī it was a constructivist conception that gave rise to a constructive mathematical practice, which itself is arguably the greatest practical feature of the Scientific Revolution.

We can also note that while Kant's Copernican revolution is about his claim that metaphysical realism fails and that the subject in some way constructs what he knows, a problematic direction with his particular theory, however, arises that is partly due to his use of incompatible representationalism with constructivism. The speculative nature of Copernicus' heliocentric hypothesis (which he proclaims as an *a priori* presupposition as opposed to it actually being a constructive mathematical conclusion) ends up in Kant's idea of the 'unknown' true nature of reality. In this way, Kant remains, like the Cartesians and the empiricists (including Locke) before him, committed to some form of representationalism. In fact, the rationalist and the empiricist traditions, initiated by both Descartes and Locke, had both assumed there was a dichotomy between ideas about reality and the real world itself. In other words, they were dualist philosophers who held to a representative realist approach to knowledge. Consequently, against both these traditions the following question then arises: How could a proponent of such traditions be sure that the ideas in one's mind correspond to the real world? According to both approaches one cannot, therefore, define a core element of the crisis of realism. Post-Kantians according to Rockmore, therefore, knew that "Kant's position was an unfinished project as an incomplete revolution"³⁸. Bringing this back to our point on Qushjī, we can note that unlike Kant, Qushjī, who was a foundational scholar and who had also attested that *metaphysical realism fails and that the subject in some way*

³⁸ Rockmore, 3.

constructs what he knows, actually resolved the issue of the *a priori* knowledge under a comprehensive constructivism with no lingering realism. This led him to develop a new constructive mathematics or mathematical physics that gave him the intellectual tool to reform astronomy and to systematically provide the mathematical foundation for Earth's motion. In this, Qushjī remains, even in our current days, at the forefront of scholarship on the foundations of science.

6.5 THE CONSTRUCTIVE STRUCTURE OF THE SCIENTIFIC REVOLUTION

Given realism's non-constructive mathematics, which does not methodically discover but merely demonstrates what was already presupposed, one then raises the conceptual question of why Copernicus suggested, in the first place, Earth's motion as one of his *a priori* presuppositions (or what he mistakenly calls an axiom) in his *Commentariolus*. It seems mistaken to then think that Copernicus mathematically discovered Earth's motion, as Swerdlow (1973) seems to suggest. On the other hand, the aesthetic argument presented by Gingerich seems equally indefensible. Arguing against a section in Thomas Kuhn's *The Structure of Scientific Revolutions* entitled "Crisis and the Emergence of Scientific Theories" in which Kuhn says, "If awareness of anomaly plays a role in the emergence of phenomena, it should surprise no one that a similar but more profound awareness is prerequisite to all acceptable changes of theory ... The state of Ptolemaic astronomy was a scandal before Copernicus' announcement."³⁹ Gingerich responds:

Nevertheless, my own researches have convinced me that this supposed crisis in astronomy is very elusive and hard to find ... What has struck Copernicus is a new cosmological vision, a grand aesthetic view of the structure of the Universe. If this is a response to a crisis, the crisis had existed since A.D. 150.

³⁹ Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Chicago University Press: 1962, pp.67-68.

Kuhn has written that the astronomical tradition Copernicus inherited "had finally created a monster", but the cosmological monster had been created by Ptolemy himself. In this view, there is no particular astronomical reason why the heliocentric cosmology could not have been defended centuries earlier, and it is in fact shocking that Copernicus, with the accumulated experience of fourteen more centuries, did not come up with a substantial advance in predictive technique over the well-honed mechanisms of Ptolemy. The debased positivism that has so thoroughly penetrated our philosophical framework urges us to look to data as the foundation of a scientific theory, but Copernicus' radical cosmology came forth not from new observations but from insight ... But why, if all this is true, did a Copernicus come in the sixteenth century, and not in the fourteenth or even the tenth century?⁴⁰

In stating the aesthetic origins of the Copernican revolution, however, Gingerich does not explain how Copernicus was able to conceptually use constructive mathematics, when he clearly had not invented it himself, especially given that constructive mathematics is based on a completely different conceptual structure that is founded upon the contingency of the physical world and that consequently rejects the *a priori* presuppositional conception that was clearly at the heart of Copernicus' approach in the *Commentariolus*.

In a similar vein, Swerdlow also asks the following pertinent question, "Why did it [i.e. the Copernican revolution] take so long and why did it happen when it did? These are important chapters in Kuhn's argument, particularly because it is in them that the intellectual history component of his exposition is shown to be essential"⁴¹. Perhaps, Gingerich and Swerdlow's tantalizing questions on the timing of the Copernican Revolution can be answered by simply taking into consideration, by way of our study, what is now known about the history of the intellectual development of constructive mathematics, as an outgrowth of constructive semantics, which our earlier analysis in Chapter Three has shown that it was considered as the alternative core logic for *kalām*'s

⁴⁰ Owen Gingerich, "Crisis" versus Aesthetic in the Copernican Revolution, *Vistas in Astronomy* 17(1): 1975, 85-95.

⁴¹ Noel M. Swerdlow, "An Essay on Thomas Kuhn's First Scientific Revolution, The Copernican Revolution", *Proceedings of The American Philosophical Society*, vol. 148, no. 1 (March 2004): 81.

emerging philosophy of constructivism. In support of this interdisciplinary approach to constructivism, we find that in *The Copernican Revolution*, Kuhn has the following observation to make:

The conception of a planetary [i.e. moving] Earth was the first successful break with a constitutive element of the ancient [Aristotelian] world view. Though intended solely as an astronomical reform, it had destructive consequences which could be resolved only within a new fabric of thought. Copernicus himself did not supply that fabric; his own conception of the universe was closer to Aristotle's than to Newton's. But the new problems and suggestions that derived from his innovation are the most prominent landmarks in the development of the new universe which that innovation had itself called forth ... The Copernican theory created tremendous controversies in religion, philosophy and social theory which have set the tenor of the modern mind.⁴²

Such a conceptual approach to the philosophy of history of science is also supported by the assertion that although astronomy's Ptolemaic difficulties might have given an astronomer the motive for experimenting with the conception of a moving Earth, he could not do so without upsetting the accepted basis of terrestrial physics in the process. Therefore, Kuhn argues that the very notion of a moving Earth would be unlikely to occur to him [i.e. to Copernicus], because, for reasons drawn from his non-astronomical knowledge, the conception seemed so implausible⁴³. It is, therefore, interesting that Kuhn can identify the gap between the Copernican Revolution and the conceptual scheme or the foundations of such a revolution, as this relates back to our earlier distinction and our argument about the order of proceeding in the case of Qushjī, whose constructive mathematical practice was an outgrowth of his constructive foundations of science.

In further support of the insight that the history of constructive mathematics provides the origins of a general constructivist philosophy, Dear argues that

⁴² Thomas S. Kuhn, *The Copernican Revolution : Planetary Astronomy in the Development of Western Thought* (Cambridge: Harvard University Press: 1992), 264.

⁴³ *Ibid.*, 86.

mathematical constructivism was a bridge between discrete individual experiences and the problem of real universals.⁴⁴ In common with Qushjī's constructive foundations, he also argues that “a distinction stresses the contingently descriptive [i.e. Qushjī's *ittiṣāf ishtiḳāqī*], rather than ontologically necessary, relationship of mathematics to the physical world which characterized an important aspect of the nominalist epistemology, and this approach, I argue, resonated beyond the strict nominalist tradition.”⁴⁵ Dear's conclusion, however, is most striking as he accentuates that “the mathematical sciences [i.e. constructivist mathematics] achieved a final triumph over scholastic natural philosophy [i.e. realism]”⁴⁶. Given that the foundations of constructive mathematics is still an open academic question in the West, let alone having been resolved at the birth of the Scientific Revolution, it would then tantalizingly seem that Dear is alluding to some existing conception at the onset of the Scientific Revolution which was integrated into the practice of constructive mathematics and which philosophically outmanoeuvred realism as an imbedded foundation for modern scientific growth and development. In this way, it would seem that Kant's delayed eighteenth century Copernican Revolution was only attempting to historically unearth these imbedded constructive foundations that he himself says began as a “sudden outcome of an intellectual revolution [*Revolution der Denkart*]”⁴⁷ at a time it took much longer for natural science to enter “upon the highway of science” than it did for mathematics. On this, I. Bernard Cohen in *Revolution in Science*⁴⁸ states that Kant held the opinion that this “intellectual

⁴⁴ Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago: University of Chicago Press, 1995), 219.

⁴⁵ *Ibid.*

⁴⁶ *Ibid.*

⁴⁷ Immanuel Kant, *Critique of Pure Reason* (1781), trans. Norman Smith (Hampshire: Palgrave Macmillan, 2nd edition, 2007), Preface to Second Edition, 19.

⁴⁸ I. Bernard Cohen, *Revolution in Science* (Cambridge: Harvard University Press, 1987), 237-253.

revolution” was “far more important than the discovery of the passage round the celebrated Cape of Good Hope”!

The above historical challenges for a Euro-Christian reading of the history of science can also be compounded with growing interest in Qushjī’s predecessors, in the tradition of pre-constructive *kalām*, whose modal theories and position on contingent causality have been seen as dealing with the “most pertinent points of what we call a modern western outlook”⁴⁹. On this theme Kukkonen has the following to say about Ghazālī: “But then it seems that we may credit an eleventh-century Baghdadian Muslim [i.e. Ghazālī] with having grasped some of the most pertinent points of what we call a modern western outlook! If nothing else, perhaps this should persuade us to check our picture of "modernity" and our conception of where the lines are drawn”.⁵⁰

On the theme of the causes of the Scientific Revolution, David C. Lindberg says:

There are two widely-held theories, both involving religion. One maintains that the scientific revolution was the product of European secularization, as Christianity lost its hold on educated Europeans. The other claims that the scientific revolution was a product of religious reform - specifically, the Protestant Reformation. In my opinion, neither of these positions is defensible ... So neither Protestants nor Catholics invented modern science. Their theology or worldview was not the ground or source from which modern science emerged.⁵¹

Again such observations by one of the fathers of the western history of science invitingly raises questions about the civilisational boundaries of Europe in the fifteenth century when the Ottoman Sultan was crowned in Constantinople⁵² as his new scientific

⁴⁹ Kukkonen, *Plenitude* ..., 556.

⁵⁰ *Ibid.*

⁵¹ David C. Lindberg, Interview, “The Christian Face of the Scientific Revolution” in *Christian History and Biography*, Issue 76, 2002.

⁵² After the new Ottoman rule in Constantinople in 1453, Moscow claimed succession to the legacy of the Eastern Roman Empire. Ivan III made the Byzantine double-headed eagle his emblem that later became the Russian coat-of-arms. In development of the idea of a Third Rome, the Grand Duke Ivan IV (the "Terrible") was officially crowned in 1547 as the first Tsar (or Caesar) of Russia. Ortayli, however, the Turkish historian finds Russia's claim to the title as only being a nominal one, while Sultan Mehmed II had already based his court on forming a third, albeit Islamic Rome.

and cultural powerhouse was being built on the western shores of the Bosphorus. In fact, Qushjī himself was part of this scientification initiative as he migrated to Constantinople at the invitation of the new Sultan to be posted as the head of the Ayasofya College. It would be mistaken to think that the court of the Sultan during this era was a closed fortress. In fact, the famous portrait we have of Sultan Mehmed II is a painting undertaken by an Italian artist called Gentile Bellini whom the Sultan had brought over from Venice. It also seems that through the history of astronomy we can shed more light on the intellectual milieu in the court of the Sultan. Shank notes that, “The cardinal [Bessarion] had prevailed on Pope Paul II to imprison George [of Trebizond] after discovering that the latter had sought to dedicate his works on the *Almagest* to Mehmed II, the conqueror of Constantinople, in 1466”⁵³. Such an affair by Bessarion who was a Roman Catholic Cardinal Bishop and the titular Latin Patriarch of Constantinople from 1463 to 1472, indicates that a certain competition in astronomy had already began between the Ottoman constructive scientists and those around the Pope in Italy. Bessarion himself later invited Peurbach to Rome to study Ptolemy in the original Greek. He accepted on condition that Regiomontanus go with him. Following Peurbach's death, Regiomontanus, whose textual relation to Copernicus has been reported, continued the translation of Ptolemy's *Almagest*, which was noted earlier to have contained a replica of a *Qushjī compounder*!

While this study does not attempt to (nor does it propose to) carry out a historical project of connecting the dots to reconstruct the network of men and women that could explain a specific transmission account from Constantinople to Southern and Central Europe, it does, however, support the conceptual study of history that allows us to trace

⁵³ Michael H. Shank, “Regiomontanus Johannes” in *Complete Dictionary of Scientific Biography* (NY: Charles Scribner's Sons, 2008), 216.

the development of ideas and their historical rise and continuity in time. Therefore, if we accept, as an outcome of our inquiry that the Scientific Revolution was a constructivist revolution against Aristotelian realism, a certain picture then starts to slowly emerge as we historically connect a new set of dots on a different timeline; namely that of ideas and intellectual change. In its own constructive way, this study is, therefore, a conceptual reading of the history of peoples that uses the rise and continuity of ideas as a way of reconstructing how ideas travel across cultural and civilisational boundaries.

At the time that the religious figure of the Pope was clashing with the political figure of the Sultan to prevent the territorial expansion of the Ottomans into Eastern Europe, it seems that wars could not prevent the passing of ideas and the human intellectual upsurge that came accompanying the organic movement of Ottoman subjects into the South-Eastern Europe. A crisis, however, remains with the way constructive ideas and practices were received in Europe in that they were subjected to a realist lens in philosophy. The result of such adaptation was a heliocentric realist revolution. As the pace of human movement, however, changed after World War II and as people began relocating into Europe and the West from the Ottoman domain of the Middle East and beyond something new and exciting is happening as constructivist practices slowly reconnect with their original conceptual schemes to advance science beyond what impotent realism has historically allowed.

It would, therefore, seem quite telling to end this dissertation with a quote from one of the most famous physicists of the twentieth century and the father of quantum mechanics. His opinion on the challenges facing modern science, seem to tie in with Kukkonen's earlier comment on the "most pertinent points of what we call a modern western outlook". In a *Foundations of Physics* article in 1971, Heisenberg asserts,

“Even major modifications of present physical theories [i.e. realist theories] would not transform them into the desired new theory, as quite different and novel ideas are required ... the need is for a whole revolution of thought, which can be carried through only by nonconformists [i.e. constructivists]”⁵⁴. It is my major contention that such nonconformism actually lies in the origins of the Scientific Revolution itself and that constructive mathematics and its conceptual philosophy of constructivism is what Heisenberg calls “novel ideas”, as it is the very same “revolution of thought” that introduced the positive model of constructive mathematical practice into the study of astronomy in the fifteenth century. Once unravelled, this very first revolution in astronomy could help us carry out a much anticipated revolution in quantum physics and the quest for the universal foundations of science.

⁵⁴ Werner Heisenberg, “Verbal communication to Andre Mercier”, *Foundations of Physics*, vol. 1 (1971), 285.

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APPENDIX I: ARABIC EXCERPTS

Qushjī's commentary on al-Ījī's *al-Risālah al-waḍ'īyah* is available at Princeton University Library (2271-502-897). The MS has been digitised by Google and made available online at <<http://hdl.handle.net/2027/njp.32101076411956>>, (accessed January, 2013). The original lithograph version was published in Istanbul by Dār al-Ṭibā'ah al-Āmirah in 1851/1261.

(اللفظ قد يوضع لشخص بعينه)

Figure I.1 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 111.

فنعول
اقسام اللفظ الموضوع من حيث تشخص المعنى وعمومه وخصوص
الوضع وعمومه على ما يقتضيه التقسيم العقلي ابتداء اربعة لان المعنى
اما تشخص اولا وعلى كلا التقديرين فالوضع اما خاص اولا فالاول
ما يكون موضوعا لتشخص باعتبار تعقله بخصوصه ويسمى هذا
الوضع وضعاً خاصاً لموضوع له خاص
والتسائي ما وضع لتشخص باعتبار تعقله
لا بخصوصه بل بامر عام ويسمى ذلك الوضع وضعاً عاماً للموضوع له
خاص
والثالث ما وضع لامر كلي باعتبار تعقله كذلك اى
على عمومته ويسمى هذا الوضع وضعاً عاماً للموضوع له عام
والرابع ما وضع
لكلي باعتبار تعقله بخصوصية بعض افراده وهذا القسم مما لا وجود له
بل حكموا باستحالته لان الخصوصيات لا يعقل كونها امرآة ملاحظة
كلياتها بخلاف العكس واكتفى بذكر القسمين من تلك الاقسام
الاربعة لعدم تحقق الرابع وظهور الثالث وعدم تعلق الغرض به فيما
هو المقصود الاصلى من تلك الرسالة وهو تحقيق معنى الحرف والمضمر
واسم الاشارة والموصول

Figure I.2 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 111.

وقد يوضع باعتبار امر عام وذلك
بان يعقل امر عام مشترك
بين الشخصيات ثم يقال هذا اللفظ موضوع لكل واحد من هذه
الشخصيات بخصوصه

Figure I.3 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 112.

وذلك الامر العام
ملحوظ باعتبار كونه مرآة للملاحظة تلك الافراد التي هي المسماة
الموضوع لكل منها اللفظ وليس ذلك الامر العام موضوعا له

Figure I.4 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 112.

(يجب لا يفهم ولا يفاد منه الا واحد بخصوصه دون القدر المشترك)

Figure I.5 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 112.

لئلا يتوهم ان ما وضع له اللفظ
ههنا مفهوم كل واحد من افراد ذلك الامر المشترك حتى يستعمل
فيه ويفاد ويفهم هو منه فان ذلك باطل بل المقصود ان الموضوع له
والمستعمل فيه هذا الشخص من افراده على حدة وهذا كذلك دون
القدر المشترك فانه غير مفاد وغير موضوع له
فلا يقال هذا مثلا ويراد به الامر العام الذي هو مفهوم المشار اليه
المفرد المذكور

Figure I.6 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folios 112-3.

(فتعقل) الواضع: ذلك المشترك
آلة للوضع) ووسيلة الى حصوله (لانه) اى المشترك (الموضوع له)
فالوضع كلنى والموضوع له شخص (وذلك) (مثل اسم الاشارة)

Figure I.7 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 113.

فَعُوْهُنَا نَزَلَ ذَلِكَ الْاَمْرَ الْكُلِّيَّ مَزْلَةً
الْمَشَارِ اِلَيْهِ الْمَعِيْنَ لِيَمَالَ التَّمْيِزُ الْحَاصِلُ بِالْبَيَانِ السَّابِقِ فَاسْتَعْمِلَ فِيهِ
ذَلِكَ الْمَوْضُوعَ لِلشَّخْصِ

Figure I.8 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 113.

(فان هذا مثلا موضوع وتسمياه) اى .معناه (المشار اليه الشخص)

Figure I.9 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 113.

اى كل واحد من افراد مفهوم المشار
اليه مطلقا والشخص صفة لكل واحد من حيث انه المراد بالمشار
اليه ههنا ولا يجوز ان يكون صفة للمشار اليه

Figure I.10 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 113.

(بحيث لا يقبل الشركة)

Figure I.11 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 113.

تأكيد
لما استفاد من الشخص يعنى ان مفهوم هذا ما صدق عليه المشار
اليه الشخص الذى لا يقبل الشركة لامفهومه الذى يقبل الشركة
والخاص ان معنى لفظ هذا كل مشار اليه مفرد مذكر مشخص
لوحظ بامر عام وهو مفهوم المشار اليه المذكر المفرد الصادق على
هذا المشار اليه الشخص وعلى ذلك الآخر كما اذا حكمت على كل رومى
بانه ابيض بهذا العنوان فقد لاحظت جيع الشخصيات الروميين
من زيد وهجرو وغيرهما بامر عام وهو الرومى وحكمت عليه بانه
ابيض

Figure I.12 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folios 113-4.

(ما هو من هذا القبيل)

Figure I.13 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 114.

اي ما صدق
عليه اللفظ الموضوع لشخصات باعتبار اندراجها في امر عام

Figure I.14 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 114.

(لا يفيد الشخص الإقرينة معينة) (لاستواء نسبة الوضع الى الشخصات)

Figure I.15 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 114.

اي لا شترالك الكل في تلك فلا بد
في افادة التعيين من امر ينضم اليه به يحصل ذلك التعيين وهو المعنى
بالقرينة
واحتياج القرينة فيما نحن فيه وفي المشترك لدفع مزاحمة المعاني
الحقيقية وفهم المراد لا للاستعمال فيه

Figure I.16 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 114.

تقسيم اللفظ
باعتبار مدلوله او الى قسمين ماهو مدلوله كلي وما هو مدلوله مشخص
(اللفظ)
اي الموضوع (مدلوله) اي المعنى الموضوع له فان الحاصل في العقل
من حيث حصوله فيه يعبر عنه بهذه العبارة ومن حيث انفهامه
مطلقا يسمى مفهوم ما ومن حيث انفهامه بانفهام غيره مدلوله ومن
حيث وضع اللفظ بازانة موضوعه ومن حيث القصد اليه من اللفظ
افادة منه معنى (اما كلي او مشخص) لان مدلوله اما ان يمتنع من فرض
صدقه وحله على متعدد فهو الشخص ويسمى جريبا حقيقيا
اولا يمتنع كذلك وهو الكلي

Figure I.17 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 114.

(فالوضع)
(اما شخص) ايضا بان يكون الموضوع له
مشخصا واحدا لوحظ بخصوصه اى بما يعينه (او كلى) اى عام
بان يكون الموضوع له كلا من الشخصات لو حظت اجالا بامر
كلى يعمها صدقا

Figure I.18 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 117.

(والاول) اى اللفظ الموضوع لشخص وضعها
خاصا (العلم) اى الشخصى واما العلم الجنسى فخارج عن مورد القسمة
ازمعناه كلى (والثانى) اى اللفظ الموضوع لشخص وضعها تاما
اقسام اربعة الحرف والمضمر واسم الاشارة والموصول

Figure I.19 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 117.

(الخاتمة تستدل) (على تسيهات) (الثانى الاشارة العقلية لا تفيد
التشخص) هذا اشارة الى الفرق بين الموصول وبين الضمير واسم
الاشارة بان الموصول مع القرينة التى هى الصلة لا تفيد التشخص
وعلى ذلك بقوله (فان تقييد الكلى بالكلى لا يفيد الجزئية)
(بخلاف قرينة الخطاب
والحسن) فان كلا منهما يفيد التشخص فيفهم السامع منهما ما يمتنع
فيه الشراكة (فلذلك كانا) اى الضمير واسم الاشارة (جزئيين وهذا)
اى الموصول (كليا)
يقال المراد ان الموصول عد كليا نظرا الى فهم السامع من مجرد
قرينة الصلة والاشارة العقلية مع قطع النظر عن الانحصار الخارجى
لا ان الموصول كلى حقيقة

Figure I.20 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folios 119-20.

(اذ اربع تبيين لك من ههنا)
(ان معنى قول النحاة الحرف ما يبدل على معنى
فى غيره انه لا يستقل بالمفهومية)

Figure I.21 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 121.

ان المعاني
قد تكون ملحوظة قصدا وبالذات وقد تكون ملحوظة تبعا غير
مقصودة بذواتها بل على انها آلة للملاحظة غيرها ومرآة لمشاهدة
ماسواها

واستوضح ذلك من قولك قام زيد
وقولك نسبة القيام الى زيد فانت في الحالتين مدرك نسبة القيام اليه
وهذا كما ان المبصر قد يكون مبصرا بالذات مقصودا بالابصار
وقد يكون مبصرا تبعا على انه آلة لابصار غيره كالمرآة

فنسبة البصرة الى مدركاتها كنسبة البصر الى محسوساته

فقد انضح ان ذكر متعلق
الحرف انما يجب ليتحصل معناه في الذهن اذ لا يمكن ادراكه الا بادراك
متعلقه وهو آلة للملاحظة لا لان الواضع اشترط في دلالة على معناه
الافرادى ذكر متعلقه

واما بيان عموم الوضع
في كلمة من فهو ان الواضع تعقل معنى الابتداء مطلقا وهو امر مشترك
بين الابتداءات المشخصة التي هي كل منها ملحوظة تبعا ووضع لفظ
من له اى لكل منها وقس على هذا سائر الحروف

Figure I.22 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folios 121-2.

(التاسع الفعل مدلوله كلّي)

Figure I.23 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 127.

(اعلم ان الفعل باعتبار بعض
معناه وهو الحدث كلّي واما باعتبار تمام معناه وهو الحدث
ونسبته في زمان معين الى موضوع ما ففي كليته نظير بل هو
باعتبار تمام معناه كالحرف فكما ان لفظه من موضوعه وضعا عاما
لكل ابتداء معين خاص بخصوصه كذلك لفظه ضرب موضوعه
وضعا عاما لكل نسبة للحدث الى فاعل ما بخصوصها فجعله من
اقسام اللفظ الموضوع لمعنى كلّي غير مستقيم

Figure I.24 Qushjī, *Sharḥ al-Risālah al-waḍ'īyah*, folio 127.

APPENDIX II: ARABIC EXCERPTS

The following excerpts are based on 'Alī Qushjī's *Unqūd al-Zawāhir fī al-Ṣarf*, which was edited by Professor Aḥmad 'Afīfī from the Department of Dār al-'Ulūm, Cairo University and published in 2001 by Dār al-Kutob al-Masrīya in Cairo.

والوضع لغة على ما قيل : جعل الشيء في حيز معين ، وفي الاصطلاح تعيين
الشيء للدلالة بنفسه على شيء
والمراد بالدلالة بنفسه أن يكون العلم بالتعيين كافيًا فيها ولا تفتقر إلى
قرينة ، فعلى هذا لا يكون اللفظ موضوعًا لمعناه المجازي

Figure II.1 Qushjī, *Unqūd al-Zawāhir*..., folio 170.

الوضع إما شخصي أو نوعي ، والمراد من الوضع الشخصي أن يتخيل
الواضع لفظًا خاصًا ، ويتصور معنى معينًا إما جزئيًا أو كليًا .
ويعين اللفظ لعين ذلك المعنى ، كما في زيد ورجل وضرب ، أو لكل
واحد مما يصدق عليه ذلك المعنى كما في المضمرات وأخواتها
فيترتب على هذا الوضع انفهام ذلك المعنى من
اللفظ أو فرد منه بعد العلم به ، وجواز استعمال هذا اللفظ بخصوصه في عين
ذلك المعنى أو في فرد من أفراده لا غير

Figure II.2 Qushjī, *Unqūd al-Zawāhir*..., folio 171.

محتاج إلى تمهيد مقدمة هي أن المضمرات وأسماء الإشارات
والمعرفات بلام العهد لأي شيء وضعت ، فوقع في كلام النحاة أنها
وضعت للمعاني الكلية ، لكن الغرض من وضعها لها استعمالها في أفراد تلك
المعاني لا فيها أنفسها ، فاشتراط الواضع ألا يستعمل شيء منها إلا في فرد من
أفراد معناه الكلي ، ولم يجوز أن يستعمل فيه نفسه ،

Figure II.3 Qushjī, *Unqūd al-Zawāhir*..., folio 172.

مثلاً وضع لفظ هذا المفهوم المفرد المذكور المشار إليه ، لكن شرط أن يستعمل البتة في واحد مما يصدق عليه هذا المفهوم ، ومنع من استعماله في هذا المفهوم الذي هو الموضوع له ، وعلى هذا القياس غيره ، وحينئذٍ أولوا تعريف المعرفة بما وُضِعَ لشيء بعينه بأن المراد ما وُضِعَ ليستعمل في شيء بعينه ، ولما في هذا من البعد حيث يقتضى أن يفهم العالم بالوضع بين لفظ هذا مثلاً المفهوم الكلى لما علمت من معنى الوضع مع أن أحداً ممن يعلم الوضع لا يفهم منه عند سماعه إلا الفرد المشخص ، ويفضى أيضاً إلى أن تكون هذه الألفاظ الشائعة الاستعمال جداً مجازات دائماً بحيث لا يسوغ استعمال شيء منها بطريق الحقيقة

Figure II.4 Qushjī, 'Unqūd al-Zawāhir...', folio 173.

وخرُجَ بعض المحققين لهذه الألفاظ والحروف أيضاً وجهاً حسناً ، وهو أنها موضوعة لواحد واحد من أفراد المفهومات الكلية التي لاحظها الواضع عند الوضع ، وبها صارت أفرادها ملحوظة له إجمالاً بهذه المفهومات آلات لملاحظة الموضوع لها ، لا نفس الموضوع لها ، فيكون تعريف المعرفة بما ذكر محمولاً على ظاهره غير محتاج إلى التأويل الذي ذكر أولاً ؛ فعلى هذا هذه الألفاظ شبيهة بالمشارك اللفظي بل بالأعلام المشتركة ، لا فرق بينهما إلا بأن المشترك موضوع لمعان متعددة بأوضاع متعددة ، وهذه بوضع واحد فلا بد لها عند الاستعمال من قرينة مُعَيَّنَة للمراد

Figure II.5 Qushjī, 'Unqūd al-Zawāhir...', folio 173.

فإن قيل : أنتم قد اعتبرتم في تعريف
بأ الوضع قيد بنفسه ، وفسرتموه بالاستغناء عن القرينة فإذا احتاجت هذه
الألفاظ إلى القرينة لم يكن لها وضع ، قلنا : في تقريرنا تنبيه على أن المراد
بالاستغناء عن القرينة الاستغناء عنها في نفس الدلالة وانفهام المعنى ،
والاحتياج إليها هنا في تعيين المراد لا في نفس الدلالة وبينهما بون ، وتحقيق
هذا المقام أن المراد بالدلالة في قولنا : تعيين اللفظ للدلالة بنفسه أو بالقرينة
على معنى الدلالة عليه من حيث إنه مراد منه لا مجرد حصوله في الذهن ،
وهذه هي الدلالة المعتبرة عند أهل العرف ، وكذا المراد بالانفهام في هذا
المقام ، فإذا سمع العالم بوضع لفظ هذا مثلاً إياه من غير اطلاعه على إشارة
المتكلم إلى فرد مما يصلح أن يشير إليه يفهم أن المراد منه إما هذا الفرد أو
ذاك ، وذلك من غير أن يكون أحدهما مرجوحاً في هذا الفهم بالقياس إلى ما
عده ، فقد فهم كل واحد منها على أنه مراد منه ، لكن على التردد والتساوي ،
وباطلاعه على الإشارة إلى واحد يندفع مزاحمة / الغير ويتعين دلالته عليه
بخلاف المجاز فإن السامع إذا سمع اللفظ بلا قرينة لم يفهم كون
المعنى المجازي مراداً لا على التعيين ولا على التساوي ، بل يتعين عنده
المعنى الحقيقي للإرادة ، وبالقرينة يزول هذا ويحصل الدلالة على المعنى
المجازي

Figure II.6 Qushjī, 'Unqūd al-Zawāhir...., folios 174-5.

إذا تمهد هذا فنقول قد يكون الوضع والموضوع له كلاهما
خاصين بأن يتعقل (معنى مشخصاً ويضع لفظاً له كما في الأعلام ، وقد
يكونان عامين) بأن يتعقل مفهوماً كلياً ويضع لفظاً له كالرجل والضرب ، وقد
يكون الوضع عاماً ، والموضوع له خاصاً كما في المضمرة وأخواتها ، وأما كون
الوضع (خاصاً) والموضوع له عاماً فمتعذر ؛ لأن بالكليات تدرك مشخصاتها
إجمالاً ، وذلك كافٍ في وضع اللفظ للمشخصات وليست المشخصات
كذلك بالقياس إلى الكلي ، كما لا يخفى ، هكذا قيل ، وينبغي أن
نتنبه أن المراد مع الوضع العام أو الخاص أن يكون متعقل الواضع عند الوضع
مفهوماً كلياً أو مشخصاً ، فيكون الوضع عاماً بهذا المعنى ، لا ينافي كونه قسماً
من الوضع الشخصي بالمعنى الذي سبق .

Figure II.7 Qushjī, 'Unqūd al-Zawāhir...., folio 175.

قال به شيخنا النحرير (رحمة الله تعالى عليه) وهو أن الوضع إما
قصدي كما ذكرناه بأقسامه ، وإما غير قصدي وهو وضع كل لفظ وُضع لمعنى
اسماً كان أو فعلاً أو حرفاً لنفسه . وجعله علماً لها .

لكن هذا وضع غير قصدي لا يصير به (اللفظ
مشاركاً ، ولا يفهم منه بذلك معنى مسماه) ، وأنكر عليه الفاضل الشريف -
رحمه الله

Figure II.8 Qushjī, 'Unqūd al-Zawāhir...., folio 176.

والكلام فى تعيينه من قضايا العقل ، إن دلالة اللفظ على شىء دون شىء
مع تساوى نسبه إليهما ممتنعة ، فلا بد لها من اختصاص بالأول مترتب على
تخصيص صادر من مخصص ، وذلك المخصص بالتقسيم العقلى إما ذات
اللفظ أو غيرها ، والغير إما الخالق أو المخلوق

وذهب كثير من المحققين ، إلى
أن دلالة الكلى بتعيين الله تعالى وتوقيفه عليه واحداً أو جماعة
بالوحى أو بخلق علم ضرورى فيه أو فيهم ، أو بخلق أصوات دالة وإسماعها له
والظاهر أن المآل فى الكل
العلم الضرورى

Figure II.9 Qushjī, 'Unqūd al-Zawāhir...., folio 180.

وذهب جماعة ، إلى أن الكلى بتعيين طائفة من
البشر وتعريفهم غيرهم بالترديد والتكرير والإشارة كتعليم الأطفال اللغات ،
ويسمى مذهبهم مذهب «الاصطلاح»
وتوقف البعض

فإن كان مراده الوقف عن القطع بواحد من
المذاهب فصحيح / ، لكن لا يكون هذا مقابلاً لتلك المذاهب ؛ لأن
الظاهر أن أصحابها لا يدعون القطع بما ذهبوا إليه ، وإن كان مراده التردد
والتوقف عن الحكم فغير صحيح ، وقال بعض المحققين : بعد إبطال كون
اختصاص الألفاظ بالمعاني من ذواتها فى وجه ضبط المذاهب لما ثبت أن
دلالة الألفاظ بالوضع ، فالواضع هو الله تعالى أو الخلق أو بالتوزيع ، ثم أن يجزم
بأحد الثلاثة أو لا ، فهذه أربعة أقسام قال بكل قسم منها قائل ، ثم نسب
المذاهب إلى أصحابها ، ويظهر لك من النظر فى المذاهب أن الاحتمال
الثالث ؛ أعنى الجزم بالتوزيع لم يقل به قائل

Figure II.10 Qushjī, 'Unqūd al-Zawāhir...., folios 181-2.

تمسك الرابع بأنه لو لم يكن القدر المحتاج إليه في تصرف
الاصطلاح توقيفًا لزم الدور أى فساده يعنى توقف معرفة ذلك القدر على
أنفسها ، أو التسلسل أى توقفها على معارف غير متناهية مترتبة لأنه لو لم
يكن معرفة ذلك القدر بالتوقيف لكانت بالاصطلاح
والجواب أنا لا نسلم أنها لو لم تكن بالتوقيف لكانت
بالاصطلاح لجواز أن يكون بالترديد والقرائن كما للأطفال .

Figure II.11 Qushjī, *Unqūd al-Zawāhir*..., folio 191.

وهو النقل لا غير ، إما بطريق التواتر كنقل السماء والأرض وأمثالهما ،
وإما بطريق الأحاد كغيرها ، واتفقوا على امتناع ثبوتها بالقياس الفقهي وهو
تعديّة حكم بشيء إلى غيره ، لمشاركته له فى علة ذلك الحكم

Figure II.12 Qushjī, *Unqūd al-Zawāhir*..., folio 192.

اللفظ إما أن يوضع لكل واحد من معنيين أو أكثر وضعًا ابتدائيًا فهو
المشترك ، وإلا فغيره ، والمراد من الوضع الابتدائي ألا يكون مبنياً على مناسبة
للموضوع له مع شيء آخر

Figure II.13 Qushjī, *Unqūd al-Zawāhir*..., folio 195.

والقسم الأول من النوعى
لا يشمل الموضوع ليحتاج إلى إخراج ، وهذا هو
المشترك اللفظى ، وقد يقال للفظ المشترك المعنوى ، وهو الموضوع لمعنى كلى
يصدق على متعدد ، سواء كان فى الجميع على السواء ، ويقال له المتواطئ
ويقال له : المشكك

Figure II.14 Qushjī, *Unqūd al-Zawāhir*..., folio 196.

وقد يتمسك أيضًا على وجود المشترك بأنه لو لم
يكن واقعًا لكان إطلاق الوجود فى الواجب والممكن إما بالاشتراك المعنوى
أو بالحقيقة والمجاز ، وكلاهما ممتنع .

Figure II.15 Qushjī, *Unqūd al-Zawāhir*..., folio 200.

والجواب أن ليس معنى الاشتراك إلا أن في الواجب شيئاً ،
وفي الممكن آخر يصدق على كل منهما مفهوم الوجود ولا يلزم من اشتراك
الشيئين بهذا المعنى اتحادهما في الوجود والإمكان
مثلاً: لو كان مفهوم الإنسان
مشاركاً بين الأفراد ، لكان متحداً فيها وإلا لم يكن مشتركاً فإن كان مقارناً
للعلم لزم عالمية الجاهل

Figure II.16 Qushjī, *Unqūd al-Zawāhir*..., folio 201.

APPENDIX III: ARABIC EXCERPTS

This appendix contains the translated folios that were selected for the study on Qushjī's *Sharḥ Tajrīd al-Kalām*. The images below are based on the following MS: [Qushjī 'Alī Ibn Muḥammad, *Sharḥ Tajrīd al-'Aqā'id*, (Tabriz: As'ad Kitabfurush, 1301 [1883 or 84]), lithograph, 218 folios). The MS was obtained from the Widener Library at the Middle Eastern Division, Harvard University. The digitization note associated with the manuscript record is as follows:

Cambridge, Mass.: Harvard Colleges Library Digital Imaging Group, 2009. (Open Collections Program at Harvard University. Islamic Heritage Project). Copy digitized: Widener Library: OL 22800.10.5.

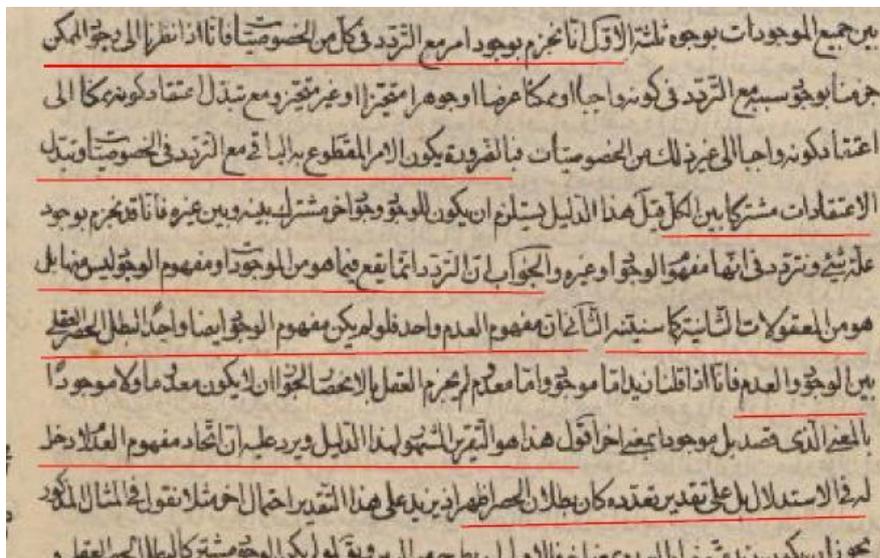


Figure III.1 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 7.

فيه بديهية فكما لا واسطة بين اثبات مفهوم علم وسلب كك لا واسطة بين اثبات مفهوم خاص وسلبه أقول المحل العقل
هو الوجود نظر بالبحر في العقل بالاختصاص وهذا الحرز العقل بواسطة مقدمات اجنبية هي ان الشيء لا يكون موجودا
بوجود غيره ولا معدوما معدوم غيره اذ لو قطع النظر عن هذه المقدمات لم يكن قولنا ان يعدم بعد الخاص في معنى قولنا
ليس موجودا بوجود الخاص بل كان اختص منه فانه اذا وجد زيد بوجوده اذ اعدم بعدم اخر فثباته ليس موجودا بوجوده
الخاص وكذا لو معدوم بعد الخاص فالعقل بحر في الاختصاص في قولنا الشيء اما موجود بوجود الخاص طالما ليس موجودا
الخاص ولا يجرى بالاختصاص في قولنا الشيء اما موجود بوجوده الخاص واما معدوم بعده الخاص لا بعد ملاحظة تلك المقدمات
الاجنبية فلا يكون حصرا عقليا ان يكون يجعل اتحاد مفهومه العدم دليلة لغيره ان يقع مفهوم العدم واحدا لم يكن مفهوم
الوجود ايضا واحدا لكان العدم الواحد يقضي الكل واحدا من الموجودات المتعددة وذلك بطلان التناقض لا يتحقق الا
بين مفهومين لا يقان لم يكن مفهوم العدم واحدا يكون المفردا شذلا على هذا التقدير ان لم يكن مفهوم الوجودا
واحدا يتحقق التناقض بين العدم والوجود وهو احد من ان يتحقق التناقض بين العدم الواحد الوجودا الا انقول
على هذا التقدير يكون لكل وجود خاص عكسه خاص وهو يقضي له فلا يكون التناقض الا بين مفهومين قيل ان لم ان مفهوم
العدم واحدا لكل حقيقة سلبها الف سلب حقيقة اخرى لا حيل ان السلب المطلق المحول على تلك السلوب مفهوم
واحد ولا شك ان هذا التقرير بعضه جار في الوجود فمن لا يسلم الاشتراك لا يسلم الاشتراك في مطلق السلب
المشترك بينها عند مطلقا السلب كما في الوجود الثالث ان تقسم الوجود الوجود الواجب وجودا الممكن ووجود الممكن
ووجود الجوهري ووجود العرض ومورد القيمة مشترك بين اسمان قيل اشتراك مورد القيمة بين جميع افرادها لا قسما

Figure III.2 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 8.

هذا القائل الحق في ذيل هذا البحث وبينه بان الجهل التبعي كان له الاشتراك في جميع الموجودات في حاله تمايزها عن
المعدومات وتبين في المعتبرة الوجود والكون في الفارسية هيته وبؤدن كك ذلك ان مفهومها خارج عنها توصيف
بها عمل عليها وبها القدره بهذا الوجه عزوان من ان المتعلق ليس الا زيادة وهو المطلق المشترك كما لا يخفى ولا انفكاكهما تعقلا

الذم فلا تالاسم ان تعقل هو الوجود في الذم لو سلم فتعقل الشيء لا يستلزم تعقل تعقله ومثل هذا الانفكاك لا

الاستدلال صحيح ولكن لا يلايم كلام المتن لان معنى الانفكاك تعقلا ان يكون احدهما متعلقا ودون الاخر والثالث في
الوجود انما ياتي في التصديقه لا تعقل بل يستلزمه فاننا اذا تعقلنا المهيته وشككنا في وجودها فمع كون كلاهما متعلقين لنا
فان الانفكاك وكلام الشارح صريح في خلافه حيث قال فان قيل لا تم انما تعقل المهيته مع الغفلة عن وجودها قيل

Figure III.3 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 10.

غيره ريب الجواب انما يمد على عدم كون الوجود اخلافا لكل ولا يلزم من ذلك كونها خارجا عن الكل اقول يمكن ان يجاب
الوجود الثالث الاخير بالفرق بين انصاف شيء بشي وحمله عليه مواطاة وبين الانصاف والمحل اشتقاقا اما عن الاول فاما
نقول الامكان هو ان لا يتفق المهيته الانصاف بالوجود اشتقاقا ولا الانصاف بالعدم كك وهو المراد بقاى نسبة المهيته
الى الوجود والعقد قبوله لو كان الوجود نفس الماهية لم يتصور هذا النسب فضلا عن التساوي ثم فان النسب بين شي ونفسه اشتقاقا
مما يتصور بل قد يصير معنى للعقل وبتنازعون منها ايضا واذا فان النسب بين الوجود ونفسه اشتقاقا فامعركة لا لا راجح
ذهب كثير المتكلمين الى ان الوجود موجب وبعضهم وطائفه من الحكماء كالفارابي وابن سينا الى انه ليس بواجب بل بالمعقول انما
وايقه قوله نسبة الشيء الى نفسه لا يكون كمنسبه الى سلبه وانما تقوله ونسبه الشيء الى غيره لا يكون كمنسبه الى سلبه ذلك الجوز
كلامه في النسبة الاشتقاقية اذ هي في التحقيق نسبة الشيء الى ما يعايره والى ما يعاير غيره فانك اذا قلت الوجود موجب فنسبه
الى الوجود مفقود في نحوها استعاريا انما هي اشارة الى ان منع قوله كان قولنا السواء موجب من قولنا الشيء اسواء الوجود
موجب وقول بل بنسبه قولنا السواء وسواء الوجود ذوقا ولا شك في ان مثل هذا المحل مفيد انما عن الثالث فان منع قوله
كان قولنا الشيء السواء من قولنا السواء السواء السواء السواء السواء السواء السواء السواء السواء السواء السواء

في محركات الوجود فالواذات الواجبة من خاص الوجود المطلق قائم بنفسه من جميع المحركات والمنكسرة بقولهم كما ان في المحركات
ما هيته ووجودها مطلقا وحضرة من الوجود نادر عليها كك في الموجب عينه انما الاشاعة فلعلهم ارادوا بقولهم في كل شيء هو مهيته
وايضا عليها انما يربطها في الخارج الى ليس الخارج شيء هو المهيته واخر هو الوجود قائم برقا ما خا جريا كما يريد ان يقع في انهم
ولا نزاع مع في ذلك وقيا مبراهية من حيث هي هنا جواب عن استدلال الخصم بان الوجود لو كان انما على المهيته لكان مفسر
قائمتهما فان ان تقوم المهيته المحضة او المهيته المحضة بقوله الدائمة كما هي انما الوجود السواء السواء السواء السواء السواء

Figure III.4 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 11.

حيث هي وهذه المحيثة إنما ثبت لها في العقل فاللأنه مع زيادة على المعتبرة في القول في الوجوه العينية أقواله في نظر
 المعتبر من حيث هي موجودة في الخارج فيجب أن ثبت لها امر في الخارج ولا يصدق في ذلك كون هذه المحيثة إنما ثبتت
 لها في العقل كما أن الحجر موجود في الخارج وبعضه في الخارج اعراض موجودة في الخارج لا يمنع من ذلك كون المحيثة إنما
 خارجياً وليس كذلك فإن البياض مثلاً ليس إنما بالحجم الأبيض ولا بالحجم اللابيض بل بقيامه بالحجم من حيث هو وهو
 هذه المحيثة إنما ثبتت له في العقل وهو ينقسم إلى الذهب في الخارج لا شبيهة في النار مثلاً لها وجود يظهر منها
 هذا فنقول الوجوه الذهبية تحققوا لا يثبت الحقيقة في لم يتحقق هذا التسم من القضايا وهي التي يحكم بها على ما يصدق
 على نفس الامر الكلي الواقع عنوانها ما كان موجوداً في الخارج محققاً ومقدراً ولا يكون موجوداً في اصلا وذلك لأنه
 لو لم يكن الوجوه الذهبية لا يختص الوجود في الخارج في الاحكام الإيجابية الصادقة في القضايا الحقيقية على ما ليس موجوداً
 الخارج باطلة ضرورية ان صدق الإيجاب محلي بثبوت المحمول الموضوع وإذا لم يكن شيئاً ثبوت لم يتصور ثبوت المحمول له
 ثبوت شيء لاخر يوقف على ثبوت الاخر في نفسه ويكون القضايا الحقيقية باطلة لكن القضية الحقيقية بالمعنى المذكور لا يقر
 عند المحققين يرد عليه ان لا لزوم بطلان الحقيقة للوجود الموضوع في الخارج لا بطلان كل الحقيقة بل لزوم
 عدم تحقق هذا التسم من القضايا كما هو مدعى في محسن الدعوى بالكتابة منها كما انه مخصوص بالوجهية يكون معنى
 الكلا...
 الحقيقية ما نعلم يقيناً ان تصدق ويلزم على هذا التقدير ان لا يكون صادراً فان قولنا اجتماع التقيضين مستلزم
 لكل منهما او معاير لاجتماع الضدين قضية موجبة حقيقة صادقة ولو لان يكون لاجتماع التقيضين افراد موجودة في
 الذهني لم يثبت هذا الحكم الايجابي في هذا القضية الحقيقية واعلم ان هذا الدليل يرجع في الحقيقة الى ما امتدوا

Figure III.5 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 12.

مخت شوت المعدم زيادة كلام في هذا المقام وقد استدل على الوجوه الذهبية باننا نتقل امور الوجودها في الخارج
 ولا بد في فهم الشيء ونقله وتميزه عند العقل من تعلق بين العاقل والمعقول وان كان العلم عبارة عن حصول صورة الشيء
 في العقل وعن اضافة مخصوصة بين العاقل والمعقول او من صفة ذات اضافة والتعلق بين العاقل والعدم القوي
 نعم بالضرورة فلا بد للمعقول من ثبوت في الجملة واذ ليس في الخارج في الذهب والموجود في الذهب انما هو الصورة

نعم بالضرورة فلا بد للمعقول من ثبوت في الجملة واذ ليس في الخارج في الذهب والموجود في الذهب انما هو الصورة
 الخالفة في كثير من المواضع هذا جواب عن استدلال المكبرين بانه لو كان للاشياء وجود في الذهب لزم ان يكون الذهب
 حاداً بارداً عند حصول الحرارة والبرودة فيه وكذا مستقيماً معوماً عند حصول الاستقامة والاعوجاج فيه الى غير
 ذلك من الصفات المتضادة المستقيمة عن ذلك ويجوز هذه الاشياء في المحل بوجوب تضاد المحل بها وايضاً حصول
 حقيقة الجبل بالتمتع عظمها في ذهنا لا يعقل وتقرر الجواب عن حصول هذه الاشياء في المحل بوجوب
 تضاد المحل بها وانما حصول صورها واشباهها فيه فلا يوجب والموجود في الذهب انما هو صورها: الاشياء
 واشباهها الا انها فلا يجب تضاد المحل بها والصور والاشباح لا يباينها في الصور والاشباح في اللوات
 بل بخلافها في كثير منها وادد عليه ان الصورة الحاصلة من الحرارة في الذهب انما تكون مهية الحرارة ولا يظن
 الثاني لوجود الحرارة في الذهب بل يكون ما في الذهب امر مخالف في المهية للحرارة فلا يمتنع ان الاشياء وتجويز
 خارجياً وذهنياً لا يبق لا معنى لوجود الشيء في الذهب الا بوجود صورته فيه وان كانت مخالفة له في الحقيقة لا يتناول
 ما تمسكوا به ان تم دل على وجود الاشياء انما في الذهب لان الحكم على الثالث بما ذكره يقتضيه ثبوتها لا ثبوت امر
 مخالفة له في الحقيقة في وعلى الاقل يلزم ان يكون للذهب حاداً وبارداً اذ لا معنى للحرارة والبارد الا ما فيه مهية
 الحرارة ومهية البرودة واجب بان الموجود في الذهب مهية الحرارة والبرودة وكذا حقيقة الجبل وانما الكنهها

Figure III.6 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 13.

موجودة بوجوه ظلي ويكون محل الحرارة موصوفاً بما من احكامها المتعلقة بوجوهها الغير وكذا تضادها مع
 البرد تماماً هو في الوجوه الغير دون النقل وبالجملة فالصور الذهنية كلية كانت كصور المعقولات وبعين شية
 كصور المحسوسات مخالفة للخارجية في اللواتم المستندة المخصوصية احد الوجوه وان كانت مشاركة لها
 في لواتم المهية من حيث هي وما ذكرتم من امتناعه هو حكم الخارج لان منشأه الوجوه الخارجية فغير الخلق
 يمنع حصولها في الذهب وتضادها للبرودة وغير الجبل يمنع حصولها في الذهب فلم قلتم ان الذهب في كلنا قول غير
 مخت لان هذا الجواب مخصوص بما اذا ادعى الخضم تضاد الذهب بالصفات الموجودة في الخارج كالحرارة والبرودة
 واما الهما ولا يقطع مادة الشبهة فانه لو تشبث بلواتم المعينات كالزوجة والفردية مثلا او بصفات المتعددة
 كالامتناع واما الهما بان يقول لو حصلت لزوجة والفردية في الذهب لزم ان يكون للذهب زوجا وفردا اذ لا
 معنى للزوج والفرد الا ما حصل فيه الزوجة والفردية وكذا الوصل الامتناع في الذهب لزم ان يكون للذهب
 متفعا اذ لا معنى للتمتع الا ما حصل فيه الامتناع لم يكن يقتضيه عن هذا الجواب اذ لا يتسلخ ان يبق كون محل الشيء
 موصوفاً بما من احكامها المتعلقة بوجوهها الغير وكذا تضادها مع الفردية انما هو في الوجود الغير دون النقل

اذ لا وجود عيني الا مثالها الا تمامين لو انهم المهيئات وكذا الكلام في الاستماع وامثاله اذ لا يمكن ان يقال
 كون محل الاستماع موصوفا به من احكامها المتعلقة بوجوده العيني اذ لا يتصور له وجود عين والجواب الخامس لما ذكره
 هو الفرق بين الحصول في الذهن والقيام به فان حصول الشيء في الذهن لا يوجب تصانف الذهن به كما ان حصول
 الشيء في المكان لا يوجب تصانف المكان به وكذا الحصول في الزمان فانه لا يوجب تصانف الزمان بالحاصل فيه
 وانما الموجب لتصانف الشيء هو قيامه به لا حصوله فيه وهذه الاشياء هي الحرارة والبرودة والزرنيخة
 والزرنيخة والاستماع وامثاله التي هي في الذهن لا قائمه به فلم يوجب تصانف الذهن بها وانما كانت توجب تصانف
 الذهن بها ان لو كانت قائمه به لولا ان يكون هذا الشيء في موضع اشكال فثبت بره على المثالين بوجود الاشياء
 انفسها لا صورها واشياها في الذهن هو ان مفهوم الحيوان مثلا اذ انما في الذهن فانها تصانف في انفسها
 امر بها عدم موجود في الذهن وهو معلوم وجوه في كل معنى مفهوم الحيوان اذ المراد بالحيوان هو ما يشترط وجوده في
 الخارج كانت لافي موضع وثانها موجود في الخارج وهو علم وجوه وعرض على طريق المثالين بالشعر والمثال
 الموجود في الذهن هو مفهوم الحيوان الذي يشترط قائم بالذهن اذ المراد بوجود امر في الذهن على هذه الطريقة قائم بشعر

Figure III.7 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 13 (continued).

ومثاله بالذهن وهو كل وجود معلوم والموجود في الخارج هو هذا الشيء القائم بالذهن التخصيصي الموجود في الخارج
 فهو ايضا جنس وعرض من الكليات المتسانية وعلم فلا اشكال او اقل على طريقة المثالين بوجود الاشياء وانفسها في
 الذهن فيشكل ان الموجود في الخارج الذي هو علم جنس وعرض من الكليات المتسانية ما هو اذ ليس هذا العلم
 هذه الطريقة الا مفهوم الحيوان الذي هو موجود في الذهن وقائم به ومعلوم وعمل حقيقة هذا القول ان مفهوم الحيوان
 مثلا اذ حصل في الذهن فيقوم بالذهن كيفية تسانفه هو العلم بهذا المفهوم وهو عرض وجوه لكونه قائم بنفس
 شخصيته ومتشخصا بتخصصات ذهنية وهو الموجود في الخارج وانما الموجود في الذهن فهو مفهوم الحيوان الحاصل
 في الذهن وهو كل وجود معلوم وليس الوجود بمعنى يحصل به المهيئة في العين بل الحصول ذهب طرافته

Figure III.8 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 13 (continued).

متصفا بالصيغ في الخارج ولا يجعل التصانف به موجودا او ثابتا في الخارج فان قيل قد سبق انه ليس بين
 المهية والوجود تصانف بحسب الخارج كما بين البياض والجسم طماننا ذلك بحسب الذهن ففظ كل منهما
 المهية متصفة بالوجود في الخارج اقول تاثير القدرة ان تجعلها بحيث لو اعتبرها معتبر وجودها لم يوصف
 بالوجود الخارج اقول بقدر الاستدلال على هذا الوجه احسن من تقرير الشارحين حيث قالوا تاثير القدرة

Figure III.9 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 17.

فقط لغوا بمحض الامل في الجواب واما ثانياً فلان المتأخر ان يقول لما كان قابلية المهية للوجود
 انضمامها بحسب العقل وكفى لذلك في تقدم العلة القابلية تقدمها بالوجود العقل فاعلمت بالوجود
 اي بحسب العقل فليكن في تقدم العلة الفاعلية تقدمها بالوجود العقل من غير ان يكون لها تقدم
 محسوس في الخارج كما ان ماهية الارضية علة فاعلية لزوجيتها ولا تقدم لها بحسب الوجود الخارجي
 فان خرج في ذلك من العدم وسائر التناقضات كان ذلك من جهة الوجود لا من جهة الوجود

Figure III.10 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 56.

هذا ولذا لا يخرج عن ماهيتها او كليهما على غير وجه لا يصدر عن غير وجه بل على وجهين
 العقل بلا حظ ولا مفهوم الحيوان مثلاً ثم يقبله الى زيد وعمرو ويكر مثلاً ويحكم بان هذا المفهوم الموجود
 في العقل كلى يصدق على كثيرين وذات لتلك الافراد وحيز لها فالكليته والذاتية والجنسية امور عقلية
 عرفت العقول الخزوه مفهوم الحيوان فهي من العقولات الثابتة العقل ولا كلك الوجود الخارجي الثابتة
 الالهية فان الوجود في الخارج اما عرض للمهية من حيث هي على ما سبق بيانه للمهية الموجودة في
 الذهن فان الوجود في الخارج ليس هو المهية الموجودة في الذهن فليس الوجود مما لا يعقل الاعراض والعقولات
 اخرجت كون من العقولات الثابتة ولعل من هذا الاستنباط انهم انما راوا ان تلك المهية بالوجود
 ليس انضماماً خارجياً كما انضمام الجسم بالباقي كما بان انضمامها بعقلها وان المهية انما تكون قابلية
 للوجود عند وجودها في العقل فقط كما وقع في كلام المصنف على ما نقلناه من شرحه للاشارات فيلزم من هذا
 ان يكون الموصوف بالوجود هو المهية للعقولة وان يكون الوجود من العقولات الثابتة وليس كذلك
 انضمام المهية بالوجود بحسب هذا الامر على ما سبق في تلخيص دليل الحكماء والموصوف بالوجود هو
 المهية من حيث هي لا المهية الموجودة في الذهن على ما سبق اذا تخففت ما تلونه عليك انكفك

Figure III.11 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 59.

لما صدقت هي علمها من العقولات الأولى في الذمة الثانية من العقل وقد يرد بالذات ما صدقت عليه المهية
 من الافراد والحقيقة الجزئية تسمى هوية وقد يرد بالتخصيص وقد يرد بها الوجود الخارجي حقيقة كذا في غيره
 لما عرض لها من الاعتبارات لا رتبة كانت تلك العوارض ومفارقة كل زوجية والفرعية والوجود والعدم

Figure III.12 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 82.

ثم فرض الكلية هو للمعلوم من الصور
 العقلية التي هي علوم ورون للوجودات الخارجية التي هي اشياء حقا اذا رايان بلمشاهدة حصولها
 مفهوم الحيوان مثلا كان هذا الامور ثلثة زياد وهو شخص موجود في الخارج لا يمكن ان يوصف بالكلية
 والصورة العقلية لفهوم الحيوان وهي ايج لا تنصف بالكلية لانها صورة جزئية في فرضه فيجب ان اعتبر
 بهذا القائل مفهوم الحيوان وهو غير صورته العقلية لانه معلوم لاعلم بصورته العقلية علم للمعلوم
 وهو الموصوف بالكلية والاشتركت بين الكثيرين بمنح جملة عليها ايجابا

Figure III.13 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 87.

والمعلوم كل شئ يصيد عنه امراما بالاستقلال او بالانضمام فانه صفة لذلك الامر والامر معلول لهذا
 التعريف انما يصدق على العلة الفاعلية اما وحدها او مع اخوذة مع غيرها ولا يصدق على غيرهما من
 العلة الا لصدور عن شئ منها فانها غير مؤثرة فلا يصح تسمية العلة بهذا المعنى الى الا تمام الا بغير بقوله
 وهي فاعلية وما ذرية وصورية وغاية فالصواب ان يوق العلة ما يحتاج اليه امر في وجوده ثم يحتاج
 اليه امر اخر للمحتاج او ما يحتاج عنده والاول اما ان يكون به الشيء بالفعل كالهية للتبريد في الصورة
 لا يوق صورة السيف قد تحصل في الخشب مع ان السيف ليس حاصل بالفعل الا نأقول الصورة السيفية
 المعينة اذا حصلت بشخصها حصل السيف بالفعل قطعا وليست الحاصلة في الخشب عين تلك الصورة
 بل في اخر من نوعها هكذا قيل واقول في نظر لانه لما تحقق ههنا فري من نوع صورة السيف وجبان
 يتحقق فري من نوع السيف ولما لم يتحقق فري السيف بالفعل علمنا ان صورة السيف لم تتحقق ههنا
 فالصواب في الجواب ان يوق لانه ان صورة السيف تحصل في الخشب واما ان يكون الشيء به بالقوة
 كالخشب للتبريد في المادة وليس المراد بالعلة المادية والصورية ما يتحقق الاجسام من المادة والقوة
 الجوهرية بل ما ينتمها وغيرهما من الجواهر والاعراض التي يوجد بها امر بالفعل والقوة وهاتان

Figure III.14 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 125.

أقول فيه نظر ما أولا فلا تختار أن المعلول لم يتقدم بافتمام العلة الأولى بل أن افتمام العلة الأولى وحدها
 علة ثانية واستمر وجود المعلول بهذا السبب قوله وان لم يتقدم كان أصل الوجود حاصله قلة ان راد
 بأصل الوجود الوجود الحاصل للمعلول في الزمان السابق مختار ان العلة الثانية لا تقيد واستقلالها لا
 يقتضيه ذلك وان راد بأصل الوجود نفس الوجود اعم من ان يكون في الزمان السابق وغيره مختار انما
 تقيد وجود المعلول ولكن في الزمان الذي هو زمان وجود العلة الثانية قوله بلزم تحصيل الحاصل قلة
 ثم فان وجود المع في زمان وجود العلة الثانية الذي هو اثر العلة الثانية غير الوجود في الزمان السابق
 الذي هو اثر العلة الأولى لا ينفصل عن هذا يكون فائدة العلة الثانية وجود المع في الزمان الثاني بل استمرار
 وجوده ولا معنى للمعنى الا هذا فالعلة الثانية تقيد بقاء وجود المع الحاصل بالعلة الأولى فلم يكن مستقلة
 لا نقول العلة الثانية تقيد نفس الوجود من غير اشتراط ان يكون في الزمان الثاني او الاول لكننا وجدنا
 العلة الثانية في ان افتمام العلة الأولى بحيث لم يتخلل بين زمان وجود العلة الثانية زمان اخر ولم يستمر

Figure III.15 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 129.

الخارج انما الوجود فيه اشخاصها وقول المصنف ان الواحد بالتوابع يكون له علة متعددة ليس معناه ان
 الطبيعة النوعية الواحدة يكون لها علة متعددة بل معناه ان افرادها التي هي واحدة بالتوابع يكون له
 علة متعددة بان يقع بعضها بهذه وبعضها بتلك والعلة انما هي العلية والمعلولية من توان بالمعقول
 اقول لاشك في انها من الامور الاعتبارية والالزام والشبه وانما انها من المعقولات الثانية فغيره

Figure III.16 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 134.

العرض بالتبعية وما تحتها بل زاد عليها انها من المعقولات الثانية ولم يرد في الدليل على استلزام
 في المشهور على عرضية هذين المفهومين ووجه ذلك بانها ثابت كونها زاندين على ما تحتها
 لزم ان يكونا من المعقولات الثانية بل ليس في الجملة امر متحقق زائد على ذاته هو الجوهرية ولا في السوا
 مثلا امر متحقق زائد على ذاته هو العرضية اقول وانت خبير بانها ثابتا بل ذلك كونها امرين
 اعتباريين غير متصلين في الوجود لا كونها من المعقولات الثانية فانها كما عرفنا مرارا اعتباريين
 عوارض الوجود الذهني وظانها ليسا منها واستدل ايضاً بان الجوهر لو كان جنساً للجواهر
 لكان تمايزها لا تخلف بفضول على ما هو شأن الانواع المتدرجة تحت جنس فتلك الفصول انما يكون

Figure III.17 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 154.

تسمى سرعة او بطيئة ولو سلم ان السرعة والبطول ليس لهما التكنات فطبقا للحركات المتحركة
والسرعة والبطول عايدان الى لذاتيات دون العرضيات وهما ما الاعتبارات الملاحقة للحركة بحسب
الاضافة الى الحركة اخرى بقطع المسافة المعينة في زمان اقل واكثر ولهذا تختلف على اختلاف الاضمار فيكون
السرعة بطيئة بالنسبة الى الامرع وبالجملة فليس هناك عرض هو الحركة واخر هو السرعة والبطول واستدلوا
على امتناعه بوجهين الاول ان معنى قيام العرض بالمثل انه تابع له في التعريف فما يقوم به العرض يجب ان يكون

Figure III.18 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 158.

لا يتم ان معنى قيام الشيء بالشيء التعريف في التعريف بل معناه اختصاص احد الشئين بالآخر بحيث يكون الاول
ثابتا والثاني متغيرا وان لم يكن ماهية ذلك الاختصاص معلومة لنا كما اختصاص الياض بالجسم
لكن لا بالاستقلال يريد بان يبين حقيقة الجسم الطبيعي وعرفوه بالجوه المقابل للابعاد الثلاثة و
ارادوا بالابعاد الثلاثة خطوطا ثلاثة متقاطعة على وياقوائم وارادوا بالقبول الامكان يعني
يمكن ان يتحقق فيه خطوط كك وانما اعتبروا الامكان دون الوجود لان تلك الابعاد رتبيا
الوجه للاحتراز عن التحط على ما قيل يخرج عن الحد بالجوه كما ان الجسم التعليمي على الكلية السارية
في الجهات الثلث خرج به فقول الجسم الطبيعي تام مفرد وهو الذي لم يتألف من اجسام اخرى
وهو الذي يتألف من اجسام اخرى

Figure III.19 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 159.

اخرى ان قول القائل للابعاد الثلاثة بالحقيقة هو الجسم التعليمي اعني الكمية الثابتة
في الجهات الثلث والجسم الطبيعي انما يتصف بالقابلية بالعرض وببعية كونه معرضا للجسم
التعليمي فالجسم اذا طر عليه الانفصال انعدم عارضه لادانته اجزاء الجسم التعليمي الذي كان قبل
الانفصال وحدث عارضان اخران غير الجسمين التعليميين الحادثين بعد الانفصال وقابلية
الابعاد لارتمه الجسم الطبيعي لا ينفك عنه لعدم انفكاك الجسم التعليمي ما عنه فهو مع الجسم التعليمي
الواحد متصل واحد ومع الجسم التعليمي المتعدد متصل متعدد كما يقولون ان الهوى مع الصوة
الجسمية الواحدة متصلة واحدة ومع الصور المتعددة متصلة متعددة فانهم يقولون ان الصوة
الجسمية متصلة في ذاتها لا يقبل الانفصال بل يعدم عند الانفصال ويحدث صورتان اخريان
والهوى لكونها في حد ذاتها المتصلة ولا منفصلة باقية في الحالين ونحن نقول المتصل في
ذاته انما هو الجسم التعليمي وهو الذي يعدم ويحدث والجسم الطبيعي لا متصل في حد ذاته ولا
منفصل بل هو موجود باقية في الحالين فلا حاجة الى اثبات الهوى بل نقول لان الجسم اذا
طره عليه الانفصال لم يكن قابلا للابعاد الثلاثة غاية ما في الباب ان كان قبل الانفصال قابلا
للابعاد فصار بعد الانفصال جسمين كل منهما قابل للابعاد الثلاثة بالحقيقة انعدم من الجسم
وطر عليه كثرة والجسم حال الوحدة هو بعينه حال الكثرة لم يعدم قط فكم يقولون ان المادة
شخص هو عند الاتصال هو بعينه عند الانفصال كقولنا الجسم شخص هو عند الوحدة
اعني الاتصال هو بعينه عند الكثرة اعني الانفصال غاية الامر انه لا نقول ان الجسم شخص شخص واحد
بل اشخاص متكثرة فان قيل اذا كان هناك قطعتان في كل منهما قدم من الماء فلا شك ان كل

Figure III.20 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 170.

العناصر فأنما لا تقضي مواضع معينة بل تقع في أماكنها حيث تنفتت فان الجزء المائي رتباً
استقر في جزء من وكان للمعورتها استقر في جزء اخر من مع جريان الدليل فيها ورفع عن الاجزاء
السطحية من العناصر اذا اخلت وطبعاً انما يتكامل انما في اجزاء من جودها

افضاء الطبع اذا لاقى سها الناقول هذا الدليل لا يفيد القموى الكلية وقال ثابت برقة
ليس شيء من الامكنة حال الخيق يردون غير حتى يتصور ان جسم معيناً طاله بطبعه دون
ماعداه وانما ممددة الى فوق فانهما يعود الى مركز الارض لان الجزء يميل الى كلة الذي يجذب
بغلبة الجبسية لان الطبيعة الارضية طالته له كما توهم ولو جعل الارض مضمين وجعل كل
نصف في جانب اخر لكان طلب كل منهما مساوياً ان طلب ما حبه حتى يلتقي في وسط المسافة
التي بينهما ولو فرض ان الارض كلها ارتفعت الى فلك الشمس اطلق من المكان الذي هي فيه
الان حجران تقع ذلك الحجر اليها لطلب الامر الذي هو شبيهه ولو فرض انها تقطعت ونفقت

ولان كل جزء يطلب جميع الاجزاء طلباً واحداً ومن انجح ان يلقى الجزء الواحد كل جزء لاجرم طلب
يكون قربة من جميع الاجزاء قربة متساوية وهذا هو طلب الوسط ثم ان جميع الاجزاء شأنها ان
من ذلك استدانة الارض وكرويتها وان يكون كل جزء منها طالبا للمركز وما كان مذهب
المصن ان المكان هو المعدل السطحا ما سحر كارهه كاحد كانه لا بد لل 1 - فاقه

Figure III.21 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 173.

احدهما على الاخر ساريا فيه بكتبة فذلك بعد الذي هو المكان اما ان يكون امر هو يتغير
الجسم ويملاؤه على سبيل التوهم كما هو مذهب المتكلم واما ان يكون امر موجودا ولا يجوز ان يكون
بعدها ماداً بالحس اذ يلزم من حصول الحس فيه تداخل الاجسام فهو بعد محذور ويجب ان يكون

Figure III.22 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 176.

خصوصاً على حالها وما يقرب من ان اثبات الافلاك على الوجه مخصوص مبنى على
 اصول فاسدة مأخوذة من القلاسة من نفي القادر المختار وعدم تجوز الخرق والالتزام على
الافلاك وانها لا تستد في حركاتها ولا تضعف ولا يكون لها رجوع ولا انعطاف ولا قوف
 ولا اختلاف حال غيرها بل يكون ابداً متحركة حركة بسيطة في الجهة التي تحرك اليها الى غير ذلك
 من المسائل الطبيعية والالهية التي بعضها مخالف للشرع وبعضها لم يثبت لكون دلالتها ^{على}
 اذ لو لم يثبت على تلك الاصول نقول ان القادر المختار بحسب رادته تحرك تلك الافلاك على
 النظام المشاهد ونقول ان الكواكب تجر في الفلك كالجبان في الماء تسرع وتبطى و
 ترجع وتقف وتقيم من غير حاجة الى تلك الافلاك الكثرة وعلى قدر ثبوت تلك الاصول
 فاذ كره اثبات الملزوم بناء على وجود لا زوم ولا يصح الا اذا علم المساواة وليست بمطلوبة
 اذ لا ضرورة ولا برهان على امتناع ان يكون تلك الاختلافات المشاهدة لاسباب ^{الاصول}
 غيرها ذكرها فليس شيو اذ من شأنه عدم الاطلاع على مسائل هذا الفن ولا ثلاثة فان اكثرها
 مقدمات حدسية يجزم العقل بثبوتها عند مشاهدتها الاختلافات المذكورة على النظام
 المشاهد والاستعانة بالمقدمات الهندسية التي لا يتطرق اليها شائبة اشتباه مثلاً
 التشكلات السدزية والهلالية على الوجه المصوب بوجوبه ليقين بان نور القمر مستفاد من
 الشمس وان الخسوف انما هو بسبب حيلولة الارض بين الشمس والقمر والكسوف انما هو بسبب
 حيلولة القمر بين الشمس والابصار مع القول بثبوت القادر المختار ونفي تلك الاصول المذكورة
 فان ثبوت القادر المختار وانتفاء تلك الاصول لا يفيان ان يكون الحال على ما ذكره غاية الامر
 انهما يجوزان الاحتمالات الاخر مثلاً على تقدير ثبوت القادر المختار يجوز ان يثبت
 القادر المختار بحسب رادته وجه القمر عند الخسوف من غير حيلولة الارض مكرراً عند

Figure III.23 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 186.

الكوف وجه الشمس من غير حملولة القرو وكذا يجوز ان يُؤدَّب ويؤرَّج القرو على ما هدم من التشنكلا
 البدئية لئلا يثيروا أيضاً على تقدير جواز الاختلاف في حركات الفلكيات وسائر احوالها يجوز ان
 يكون احد بضفي كل من التبرين مضيئاً واخر مظلماً ويمتلك التبرين على مركزيهما بحيث يصير
 وجههما المظلمان موجهين لنا في حالتي الحسوف والكسوف اما بالتمام وذلك اذا كانا
 تامين واما بالبعض على قدرهما اذا كانا غير تامين وعلى هذا القياس حال التشكلات البدئية و
 الصلاية لكننا نجزم مع قيام الاحتمالات المذكورة على ان الحال على ما ذكر من استفادة القرو
 من الشمس وان الحسوف والكسوف انما يكونان بسبب حملولة الارض والقرو مثل هذا الاحتمال القائم في
 العلوم العاديه والتجريبية بل في جميع الصناعات فاننا نجزم بان اول البيت بعجزه عن ان يصير
 اناس فضلاء محققين في العلوم الالهيه والهندسيه مع ان القادر المختار يجوز ان يجعلها
 كذلك بحسب ارادته بل على تقدير ان يكون المبدأ موجهاً يجوز ان يتحقق وضع غير هذا الذي
 الفلكية فيقتضي ظهور ذلك الامر المرتب عليها وهو مذهب الفالسين بالاجاب من استناد الحسوف
 الى الاوضاع الفلكية وعندها تمامه مركزه في شبه الفالسين في الصناعات والحاصل ان
المدكور في علم الهيئة ليس مبنياً على المقدمات الطبيعية والالهيه وما جرت به العادة من تصدق
المضفين كتبهم بها انما هو سلب المناسبه للفلاسفة وليس ذلك امر واجبا بل يمكن اثباته من
 ابتداء عليها فان المذكور في بعض مقدمات هندسية لا يتطرق اليها اشبهه وبعض مقدمات
 هندسية كما ذكرنا وبعض مقدمات بحكم بها العقل يجب الاحتياط بها هو الاثبات والاول كما يقولون

Figure III.24 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 187.

مبدأ الحاصل من سلب المبدأ على نقطه مشتركة وكذا مقرة لبقوم ولا مستند لهم غير ان الاول ان لا يكون
 في الفلكيات فضل الاتجاه البروج ان يقولون ان ذلك التمرقون فلك التهرق وعطارد لان حسن الترتيب في
 يقتضي ان يكون ما هو اكثر بعدا واعظم مدارا ابطل حركته من الكواكب وان يكون الشمس سطر في القطب والرتبه
 بمنزلة سطره الفلاده بين ما يجعلها الابعاد الاربعه اعني التسديس والتربع والتثنية والمقابله
 وبين ما لا يجعلها الاقل الابعاد المذكوره اعني التسديس وبعض مقدمات يذكرها في سطره
 دون الجزم كما يقولون ان اختلاف حركه الشمس بالسر والبطو اما بنا على اصل الخارج واما بنا
 على اصل التسديس من جزه باحد الوسل ان اشياء لا تطلع على الوجه الذي ذكره يتوقف
 على تلك الاصول الفاسده فلا شك انما يكون ذلك اذا اعجاب هذا الفلاسفة ان لا يمكن الا
 على الوجه الذي ذكرنا انما اذا كان معويهم ان يمكن ان يكون على ذلك الوجه وان يمكن ان يكون على
 الوجوه الاخر فلا يتصور التوقف وكويهم فضلا انهم تحياوا من الوجوه الممكنه ما ينضب بلوجوا
 تلك الكواكب مع كثرة اختلافها على وجه تيسر لهم ان يعينوا موضع تلك الكواكب في القسا لا يجتمعها
 مع بعض في كل قسارادوا بحيث يطابق الحسوف والعيان مطابقه يتغير فيها العقول والاذهان ومن
 قائم في احوال الاطلاق على سطوح الزخامان سئل بان هذا الذي عجابوا به علمهم بنيتا

Figure III.25 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 187 (continued).

وكلامهم في هذا المقام سبق على الظاهر الذي هو اعتبار
الاجسام التي تلبس بالوجلان والقرية والتفتيش عنها بالاستفراء لاعلى الميانات القياسية ووسط
الاحتمالات العقلية فان ذلك مما لا سبيل ليهيما

Figure III.26 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 190.

ذوات الازدباب فانه قد ظهر في ستة سبع وثلاثين وثمانمائة هجرية والشمس في اول الميزان ذات ذنب
يقرب الاكليات السماوية كالتقطع وتغريبه بعد اذ تقاررت ثم بعد اذ تقاررت لها حركة خاصة بطبيعتها
بين المشرق والشمال وكانت يصغر حجمها ويضعف ضوئها بالتدريج حتى انحلت بعد ثمانين شهرا
تقريبا وقد بعدت عن الاكليات في الجهة المذكورة فذكر في بعضها شاهدا دلالة ظاهرة على ان كوة
الاشياء تتحرك بالحركة اليومية وما قبل من ان لو كان كل واحد كانته في ذوات الازدباب على موازاة المعدل
لكنتها ليست كذلك بل انارة الى الشمال من المعدل وقارة الى الجنوب منه اقول ليس ينبغي لانها على ما هو
شاهدنا انما تتحرك كل بحركتها الخاصة وجميع الكواكب كذلك تتحرك بالحركة اليومية مع ان لها
خاصة تارة الى الشمال من المعدل وقارة الى الجنوب منه والاستدلال بان السطح المقعر لضلك القمر وكما
التار فاذا تحرك ذلك بحركة ذلك القمر تحرك المتمكن فيه بالعرض كبحركته السقيمة تتحرك بحركة
مكانة بطواله وان يقول ما زالوا صراحيما والتشبيه بحال السقيمة وهم لان ذلك قول الكواكب
السقيمة وكلامنا في الاستدرة لها طهقة واحدة اذ ما يجالط منها ما مع الهواء عدتها من طبقات

Figure III.27 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 194.

الجوايب عن الوجه الدال ان لم يثبت امتناع الحركة المستدرة على ما فيه مبدئيا مستقيم وعلى ذلك ان المراد
بمشايقة الهواء هي مشابهته مع جميع ما فيه جها كانا وجزوا صغيرا كانا وكبارا ولا يلزم شي من انفاستدرة
اقول المحل كونه الذي يوضح الكلام

Figure III.28 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 195.

الاجسام فتم تارة بالعرض وذهب لتكاملها الى انها مرتبة بذاتها واختار المصنف هذا المذهب
 وادعى القوي ذلك و اشار الى الجواب عما قاله لوقى الهواء من انه غير مرفى لخلوه عن الاضواء واللوان
 بان رؤية الاجسام مشروطة بنكفها بهما واستدل اشاعرة باننا نرى الطويل والعريض والطول
 لا يجوز ان يكون عرضا لثابت كون الجسم مركبا من الاجزاء التي لا تجزى فلو كان الطول عرضا لثابت
 محله الجزء الواحد لاستحال قيام العرض الواحد باكثر من محل واحد فالجزء الموصوف بالطول يكون
 اكثر مقدارا مما ليس موصوفا به فيكون الطويل قابلا للقصه وهو ممتنع واذا كان الطول نفس الجوهري

Figure III.29 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 206.

كان محركة التي هي مقدارها اية قديمة فكذلك الجسم الذي هو محل الحركة والجواب بان الزمان موجود
 حتى يلزم ان يكون حادثا او قد يماثل هو امر موهوم كما هو مذهبنا ولو سلم تلك القبلة لاستلزم انما
 فان اجزاء الزمان يتقدم بعضها على بعض تلك القبلة ولقد تقدمت بالزمان وقدرة تحققة بمصنفه

Figure III.30 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 212.

اقول وان حيرت بان لوجود الذهب على ما حققناه ليس ارسام الصورة في الذهب وقيامها به فلا يتم
 الاستدلال وبعده انقسامه الى احوال تجردا لقبه بقره ان النفس الناطقة غير متضمنة ولا شيء من الماديات

Figure III.31 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 224.

من ذلك السواء وذلك ضعف من هذا وانواع الكم المتصل لها احوال الخط والسطح والجسم التعليل قد
 تكون تعليمية وذلك بان يوضع كل منها الا بسطه وهو ان يصور المقدار من حيث هو موهوم غير تعليمية
 الى شيء من المواد واحوالها فاذا تخيلنا الغرض على المقدار المتشدد في الجحش الثلث من غير ان نلفظ الى
 من المواد واحوالها كان ذلك المتخيل جسميا تعليميا قبل ان لا يمكن ان نتخيله الا متخليا لان
 الخط اذا تخيلناه مع الغضلة عن السطح وعوارضه كان ذلك المتخيل خطا تعليميا وانما سميت بالخط
 الماخوذة على هذا الوجه تعليمية لان العلو التعليمية عن الرياضيات يتجس من هذه الانواع الماخوذة
 هذا الوجه وانما سميت العلو الرياضية الباخة عن احوال الكمية المتصلة والمنفصلة اعني الهندسة
 والحسنة التعليمية والرياضية لانهم كانوا يبتدون بها في التعليم والرياضة النجومية انفسها عن الخط
 فانها علو متسقة قليا متصل الفكر فيها وان كانت تختلف نوعا من الاعتناء اى هذه الانواع
 الثلاثة تختلف نوعا من الاعتناء فان الجسم التعليمي كما يمكن ان يوضع لا يسطر على ما يمكن

Figure III.32 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 251.

هذا ولا شك ان تصور الامور المستقلة التي ليست فعلا كوضوئها قسما سنة ومكتب
 بغض ان العلم ينقسم الى ما يحتاج حصوله فكرو وهو المكتسب الى ما يحتاج حصوله وهو
 الصريح وقسما سنة بلدها وشاهدنا وفطرات ويجرب وحديثا ومتواترا واقول وجه
 الضبط ان القضايا امان يكون تصور اطرافها بعد شرط الادلة من الاثبات وسلا الا لان كايضا
 في حكم العقل ولا فالاول البديهي والثاني ان يتوقف على واسطة غير مستوية ولا اثبات المشاهدة
 والاول ان كانت تلك الواسطة فيه لا يفرغ عن العقل عند تصور اطرافه وهي الفطرية وان كان
 غير لا ينفذ ما ان يستعمل فيها المحل او لا فالاول الحديث والاثبات ان كان الحكم فيها من شأنه
 بالاختصاص في المتواتر ولا في المحل امانا البديهي وبينه والاثبات في قضايا يحكم بها العقل بغير
 تصور اطرافها كالحكم بان الواحد ضعف الاثنان والجسم لو ايسر لا يكون زمان واحد مكانين ويتوقف
 لعدم تصور الطرفين كقولنا الممكن محتاج الى المؤثر والفضة الغيرة كما في البك والصبغ والند
 الفطره والعفايد المصنعة كالمزج في بعض الجواهر والآن الله تعالى لا يخالفه على ما هو من الاشياء واما
 المشاهدة في قضايا يحكم بها العقل بواسطة الحواس اظاهروا بالباطن ويحكم بها كالحكم بان الشمس
 نيرة والارض حارة والباطن والشمس وجدانك ومنها ما يجد بقوسنا الا بالاثبات البديهي كقولنا
 ما ذننا واحولنا واما الفطرية في قضايا يحكم بها العقل بواسطة لا يفرغ عنه تصور اطرافه
 ليس قضايا فانها معها كالحكم بان الاربعه زوج لا نقسما مما بين وبينها المتواتر في قضايا
 يحكم بها العقل باجتماعها كالمشاهدة النبوية التي المنج لليقين اليها وهوان الوقوع المترك
 على وجه واحد لا بد من سببان ليرتفع بهي وكما علم وهو السبب وهو المستبعد وذلك كالحكم بان

Figure III.37 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 284 (continued).

معها قلنا بل يحصل جوازي غير تلك الوجوه وانما انكرنا المشاهدة حصل هذا القياس بغير نظر ولا
 حدس او ادلة اليقين واما الحديث في قضايا يحكم بها كالحكم بان الشمس نيرة والارض حارة
 كالحكم بان نور القمر مستفاد من نور الشمس لما وجدنا اشكاله في اشكاله من اشكاله من اشكاله وذلك
 دائما جازية لكن على الشمس في العقل انه لو لم يكن نور من الشمس كان كل ما المتواتر في قضايا يحكم
 بها العقل بواسطة كثر وشهادة اليقين بانهم يمكن مستحدا المشاهدة كثر متين تواترهم على الكذب
 في الاختصاص المتواتر كون الخبر ممكن لو علم لان المستبعد لا يحصل اليقين وان كثرنا لا يخلصه

Figure III.38 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 285.

وعلى الأول يخرج من المنضم وكلام الشارح يدخل في الحديث وأقول واعلم ان الحديث لا يحصل بذكره
 وحيث ان القياس المحض كما في الجريان والقاد قد علمنا ذكرنا هو استعمال الحد من عدوتهم من غير تباين
 والجريان معلو السببية وهو المهية فلذلك كان القياس المفرد لها قياسا واحدا هو انه لو لم يكن له
 لم يكن ذا ثمان ولا اكريرا وان السبب الحديث معلو السببية والمهية معا فلذلك كان القياس المفرد لها
 اعمته مختلفة بحيث لا ينفذ في العالم خصياها ويقتل الفرق ان الجربة يتوقف على فعله الا ان
 يحصل له بسببه فان الاك انما لم يحجب التدويرا ولما اعطاه سرع بعد ان لا يحكم على ذلك
 او بعد مجاز الحد فانه لا يتوقف على ذلك منهم من جعل لا تستاسعه فوما يكون واسطة فيهما هي
 الحسرة فان كان هذا الحسرة هو الوهم فهو الوهم وان كان حقا اخر فهو المشاهدة والاشهاد
 في قبيلين ليدبها والمشاهدة واعند زاه بوجهين احدهما ان اليد بهما يشتمل القدر
 نظرا الى الوسط لما كان لازما لتصور الطرفين وكان العقل لم يقف على الا ان تصورها وان حث استدل
 الجريان والمنواتر ان نظرا الى استنا الحكم العقل فيها الى الحسرة لكن مع الذكر وكذا الحديث وانما هما
 ان كون الجريان والمنواتر ان والحديث من قبيل الضرر في موضع بحيث علمنا فصله الامانة المخلص
 شئنا كل منها على ملاحظة قياضه وكذا المضايقات قياضها معا وانواع بعضهم في كون الجريان
 والحديث من قبيل القيدنا فضلا عن كونها ضررية جعل كثير من العلماء والحديث من قبيل القيدنا

Figure III.39 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 285 (continued).

قوله في نظر لان تصور القلة انما يوجد في المجمع اذا كانت القلة
 بوجودها الذهني على لوجها المجمع في الذهن وح يكون المجمع لا يقابن للقلة
 فيلان هذه القاعدة الفاعلة بان العلم بالقلة يستلزم
 بالعلم مستغلة عندهم في موارد متعددة
 اقول وفي نظر المذكور انما فان اقتضا القلة
 معلومها انما هو بحسب التحقق الحان في ذلك لا يثبت الاستلزام العلم بالقلة للعلم بالمجمع انما المقيد للعلم
 هو الاقتضا بحسب التصق الذهني نعم اذا علم ان امثلا على فانه لم يعلم مع اللسان اموجه علم ان ب
 ايضه موجه لما علم ان حقيقته ان مقتضيه لخصه فان ب دون العكس فانه اذا علم ان ب موجه لا يعلم
 ان اموجه لا مكانا بوجه القلة انما غيرنا العلم بوجه القلة المعينة يستلزم العلم بوجه المعلوم المعين
 في العكس

Figure III.40 Qushjī, *Sharḥ Tajrīd al-Kalām*, folios 286-7.

وهو استعدادها التحصيل لتطبيقات بعد حصولها الضرب باسم عقل الملكة

Figure III.41 Qushjī, *Sharḥ Tajrīd al-Kalām*, folio 291.

APPENDIX IV: ARABIC EXCERPTS

This appendix contains the translated folios that were selected from Qushjī's two astronomy treatises:

(1) *Risālah fī anna aṣl al-khārij yumkin fī al-suflayayn* (A Treatise on the Eccentric Hypothesis Being Possible for the Two Lower Planets) which was published by F. Jamil Ragep in 2005 as 'Alī Qushjī and Regiomontanus: Eccentric Transformations and Copernican Revolutions (Journal of the History of Astronomy, vol. 36, no. 4, 359-371).

(2) *Risālah fī ḥall ishkāl al-mu'addil lil-masīr li 'utārid* (A Treatise Regarding the Solution of the Equant Problem for Mercury) which was published with a translation by George Saliba in 1993 as *Al-Qushjī's Reform of the Ptolemaic Model for Mercury* (Arabic Sciences and Philosophy, vol. 3, 161-203).

ذهب صاحب المجسطي إلى أن أصل الخارج إنما يمكن في الثلاثة التي يبعد
عن الشمس كلّ البعد ولا يمكن في السفليين لاقتضاء هذا الأصل كلّ الأبعاد
وهما لا يبعدان عن الشمس إلا بقدر يسير ففيهما لا يمكن إلا أصل التدوير
ووافقته على ذلك أكثر المحققين ومنهم مولانا العلامة صاحب التحفة ولعلهم
إنما حكموا بذلك لما رأوا في بادئ أنظارهم أن وسطي الاستقامة والرجعة على
أصل الخارج إنما يكونان عند الأوج والحضيض وموضعاهما على الفلك متقابلان
وظنّوا أن الكوكب على أصل الخارج إن كان في وسط الاستقامة مقارناً
لوسط الشمس فهو عند وسط الرجعة يصير مقابلاً له وبالعكس فيحصل له في
وصوله من وسط الاستقامة إلى وسط الرجعة جميع الأبعاد من الشمس بخلاف
أصل التدوير فإنّ وسطي الاستقامة والرجعة منه إنما يكونان عند الذروة
والحضيض وموضعاهما على الفلك واحد .
فالسفليان على أصل التدوير يقارنان وسط الشمس عند وسطي الاستقامة
والرجعة معاً فلا يحصل لهما في وصولهما من وسط الاستقامة إلى وسط الرجعة
جميع الأبعاد من وسط الشمس بل لا يبعدان عنه إلا بقدر ما يقتضيه نصف قطر
التدوير .

Figure IV.1 Qushjī, *Risālah fī anna...*

وليس الأمر كما ظنوا فإنَّ حركة الوسط على أصل الخارج إنّما يتعرّض إلى التوالي بمقدار مجموع حركتي وسط الشمس والاختلاف وحركة الخارج إلى خلاف التوالي بمقدار حركة الاختلاف فيمقدار ما يبعد الخارج مركز الكوكب عن وسط الشمس إلى خلاف التوالي يرده حامل الخارج بحركته على التوالي ولا يبقى البعد بين مركز الكوكب ووسط الشمس إلاّ بمقدار التعديل كما أنّه على أصل التدوير لا يبعد عنه إلاّ بمقدار التعديل والتعديل في كلّ حين على الأصليين واحد فمركز السفليين على كلا الأصليين لا يبعدان عن وسط الشمس إلاّ بمقدار واحد .

Figure IV.2 Qushjī, *Risālah fī anna...*

إن بطلميوس وجد لعطارد أحوالاً مختلفة تابعة لتشكلاتها من الشمس ، وهي كالظهور والخفاء والاستقامة والرجوع والوقوفين والسرعة والتوسط والإبطاء ، وأحوالاً مختلفة تابعة لأجزاء من البروج بأعيانها لا تنتقل عنها إلاّ في مدّة طويلة ، وهي كعظم القسي والأزمنة التي تقع فيها تلك الأحوال وصغرها وتوسطها .
فاسند الصنف الأوّل من الاختلاف إلى التدوير . وقال لا يمكن إسناده إلى الخارج ، معللاً بأنّ الأرصاد شهدت على أنّ زمان ما بين أسرع سيره وأوسطه يكون أبداً أعظم من زمان ما بين أوسطه وأقله . وذلك لا يمكن أن يقع على أصل الخارج لأنّ الأمر فيه بالعكس . وليس الحال كما قال بطلميوس . فإنّ زمان ما بين أسرع السير وأوسطه على أصل الخارج أيضاً يكون أبداً أعظم من زمان ما بين أوسطه وأقله . ولي على ذلك برهان هندسي ليس هنا موضع بيانه .

Figure IV.3 Qushjī, *Risālah fī hall...*

ثم إنه يتأمل الأرصاد المتوالية للمسيرات الجزئية المركبة من الاختلافين ، واعتبار البعض البعض ، وجد البعد الأبعد ينتقل في أجزاء البروج انتقال الثوابت .

Figure IV.4 Qushjī, *Risālah fī hall...*

فانتفض عليه الإشكال من وجهين: أحدهما تشابه حركة المتحرك حول نقطة غير مركز مداره فتتبدل أوضاعها بالنسبة إلى مركز المدار من الانطباق عليه ، ثم الاقتراق منه ، إلى أن يبعد عنه قدرًا ما ، ثم العود إلى الانطباق .
 وثانيهما لزوم الاختلاف في حركة مركزه ، أعني الحركة التي يبعد بها مركز التدوير عن أوج المدير إلى التوالي كل يوم بقدر مركز الشمس . وذلك لأنَّ حركة حامله متشابهة حول مركز المعدل للمسير ، وحركة المدير متشابهة حول مركزه . فالفضل بينهما ، وهو حركة مركزه ، لا يكون متشابهاً حول مركز المعدل للمسير ، مع وجوب تشابهه حوله ، كما شهدت به الأرصاد .

Figure IV.5 Qushjī, *Risālah fī ḥall...*

وأنا بعون الله وحسن توفيقه أبين وجهاً يوافق الأصول ويطباق الأرصاد . ويندفع هذان الإشكالان بزيادة تدويرين على الهيئة المشهورة ، وتغيير مواضع مراكز الأفلاك . وهو أن يفرض مركز التدوير المشهور على ذروة تدوير آخر نصف قطره جزء ، ونصف . ولنسمه المحيطة الصغرى . ومركز المحيطة الصغرى على ذروة تدوير آخر نصف قطره أيضاً جزء ، ونصف . ولنسمه المحيطة الكبرى . ومركز المحيطة الكبرى على أوج الحامل . ومركز المحيطة الصغرى على دائرة المائلة . ومركز الحامل على بعد جزء ونصف من مركز المدير في جهة أوجه . ومركز المائل على بعد جزء ونصف من مركز الحامل في جهة أوجه . ومركز المدير على بعد أربعة أجزاء ونصف من مركز العالم . كل ذلك بما به نصف قطر الحامل ستون .

فإذا فرضنا حركة المدير إلى خلاف التوالي بقدر حركة مركز الشمس ، وحركة الحامل إلى التوالي بقدر ضعفها ، وحركة المحيطة الكبرى موافقة لحركة الحامل قدرًا وجهة في النصف الأعلى ، لزم تشابه حركة مركز المحيطة الصغرى حول مركز المدير ؛ أبعاده بالنسبة إلى نقطة بعدها من مركز الحامل في جهة أوج الحامل أبداً كبعد مركز الحامل عن مركز المدير ، لما تبين في أصل المحيطة . فمركز المحيطة الصغرى يتحرك بمجموع حركتي المحيطة الكبرى والمائل على دائرة مساوية لمنطقة الحامل ، يتحرك مركزها بحركة المدير حول مركزه على مدار <نصف> قطره ثلاثة أجزاء .

ثم إذا فرضنا حركة المحيطة الصغرى بقدر فضل حركة مركزها المتشابهة حول مركز المدير إلى التوالي على حركة المدير إلى خلافه ، أعني بقدر حركة مركز الشمس ، لزم تشابه حركة مركز التدوير حول مركز المعدل للمسير ، لما تبين في أصل المحيطة .

Figure IV.6 Qushjī, *Risālah fī ḥall...*