ChatGPT

Al-Ghazali's Attitude Toward Science, Empirical Study, and Philosophy

Abu Hamid al-Ghazali (1058–1111) was a towering Islamic theologian, jurist, and mystic often remembered for his critique of the philosophers. A persistent myth holds that *al-Ghazali "condemned rationalism and declared mathematics the work of the devil,"* supposedly discouraging scientific inquiry. In reality, *al-Ghazali did not reject the scientific method or empirical sciences as a whole*. He drew careful distinctions between **the exact sciences** (like mathematics, astronomy, medicine) – which he deemed valuable and demonstrable – and **metaphysical philosophy** – certain speculative doctrines he deemed **theologically problematic** [1] [2]. His seminal works *"The Incoherence of the Philosophers"* (Tahāfut al-Falāsifa) and *"Deliverance from Error"* (al-Munqidh min al-Ḍalāl) make these nuances clear. Below, we explore *al-Ghazali's views on natural science, logic, and metaphysics*, and how his ideas influenced later Islamic thought (notably provoking Ibn Rushd's rebuttal) as well as Western reflections on scientific methodology and causality.

Al-Ghazali on the Natural Sciences: Mathematics, Astronomy, and Medicine

Al-Ghazali held the **mathematical and natural sciences** in high regard as *certain and non-threatening to faith*. In *Deliverance from Error*, he explicitly states that fields like **arithmetic, geometry and astronomy** "treat demonstrable matters which in no way can be denied once they are known and understood" [3]. In other words, **empirical and mathematical truths are factual** and do not conflict with Islam. He wrote that *"nothing in them [the mathematical sciences] relates positively or negatively to religious matters"* [3]. Indeed, al-Ghazali considered such scientific knowledge so evident that denying it would be absurd.

- **Mathematics & Astronomy:** Al-Ghazali affirmed that astronomy's explanations (e.g. the causes of solar and lunar eclipses) rest on *geometrical and arithmetical demonstrations that leave no room for doubt* [4]. He **criticized religious scholars who ignorantly reject scientific facts**: *"Whoever thinks that to engage in a disputation for refuting such a theory [about eclipses] is a religious duty harms religion and weakens it. For these matters rest on demonstrations… that leave no room for doubt."* [5]. He even cited the Prophet's saying about eclipses (that they are signs of God, not caused by anyone's death) to show that **Islam does not forbid scientific explanations** [6]. Al-Ghazali warns that if a Muslim denies demonstrable scientific truths "claiming that they contradict Islam," an educated person will not doubt the science but rather *"will doubt the basis of Islam, believing it to be founded upon ignorance and a denial of truth."* [7]. Thus, he *condemns those who attack science thinking they defend religion*, calling them *"ignorant friends" who harm Islam more than its enemies* [7] [8].

- **Medicine & Physical Sciences:** Al-Ghazali likewise included medicine and general **natural philosophy (physics)** among the useful sciences. He classed medicine as an indispensable worldly science (farḍ kifāyah, a communal obligation) for society's welfare [9]. In *Iḥyā' 'Ulūm ad-Dīn*, he wrote: *"Sciences whose knowledge is deemed legally obligatory comprise those…indispensable for the welfare of this world such as: medicine which is necessary for the life of the body, [and] arithmetic for daily*

transactions…" [10] . Regarding the study of nature, he explicitly stated that **Islam does not require rejecting physics**: *"Just as religion does not require the repudiation of* science and medicine*, so it does not require the repudiation of the science of* physics*."* [11] . Al-Ghazali's view was that natural phenomena – the heavens, stars, elements, animals, etc. – should be studied just as anatomy or medicine are studied [12] . The **only proviso** was that one remember such phenomena do not operate independently of God: "nature does not act of itself, but is used in the service of the Creator... Nothing in [nature] is able to act independently by itself" [13] [14] . In other words, *the physical world follows regular laws, but those laws are ultimately subject to God's will.* This theological framing (often termed **"occasionalism"**) did not lead al-Ghazali to abandon empirical inquiry – it simply meant that **studying nature's ways was, in his view, an effort to understand God's customary *patterns*** (sunna or ʿāda) rather than to ascribe autonomous power to nature [13] [15] .

- **Two Cautions:** While *al-Ghazali championed the value of mathematics and science*, he did issue **two cautions** about their study, aiming to prevent misguidance in either direction [16] [7] . First, he cautioned students **not to be misled by the prestige of the exact sciences into accepting philosophers'** unproven metaphysics*. Because mathematical sciences are so demonstrably precise, some students assumed all teachings of the Greek-inspired philosophers were equally certain. Al-Ghazali notes that many ancient philosophers excelled in math but floundered in metaphysics, and one should not uncritically extend mathematicians' authority to theological matters* [17] [2] *. His worry was that* admiration for mathematical brilliance *might seduce a Muslim into believing un-Islamic doctrines (like eternity of the world) simply because famed mathematician-philosophers held them* [2] *. His* Incoherence**** was in part written to refute such unsound metaphysical extrapolations.

Second, al-Ghazali warned **not to make the opposite mistake of rejecting genuine science wholesale** out of religious zeal [7] . He observed that some "ignorant, if faithful" Muslims thought defending Islam meant denouncing *all* philosophy and science – even basic astronomy. Al-Ghazali calls this attitude extremely harmful: when obvious truths (like eclipse phenomena) are denied in the name of religion, it *"envenoms"* people against religion [18] [19] . In *Deliverance*, he vividly argues that a skeptic well-versed in science will only conclude Islam is ignorant if religious folks insist on rejecting demonstrable facts [7] . *In short, al-Ghazali upheld the praiseworthy status of mathematics, astronomy and medicine, rebuking both those who abuse these sciences and those who erroneously shun them.* As one historian summarizes his position: *"Ghazali makes it plain that his purpose is to refute the philosophers' metaphysical theories and not their natural science… The misguided zealot who attacks science…inflicts damage, not on science, but on religion… precisely because science is demonstrable and certain"* [8] .

Embrace of Logic and Reasoning

Far from rejecting rational thought, al-Ghazali *studied and integrated logic* **into his works. He learned** Avicennian logic **in his philosophical training and later wrote books on logic (e.g. *Miʿyār al-ʿIlm*). In *Deliverance from Error*, he affirms that** formal logic – *rules of valid reasoning – has "nothing to do with faith, which it neither approves nor disavows"* [20] . Logic, as the study of sound proof and definition, is a neutral tool: *"It is restricted to an examination of methods of demonstration, syllogisms and the conditions of premises… What connection is there between such logic and religious questions, which would require one to reject or condemn it?"* he asks [21] [22] . Al-Ghazali even chides theologians who shun logic, noting that doing so only makes religion look foolish – *"If you condemned it you would gain a poor reputation… above all for the religion which you claim to be founded on this denial."* [23] . He *admired the philosophers' rigor in logic*, admitting they surpassed the theologians in that field [24] .

Much like with math, he gave a **balanced caution**: he opposed **rejecting logic outright**, and likewise cautioned that overestimating the philosophers' logical acumen could lead one to swallow their ungrounded doctrines blindly [25]. Overall, al-Ghazali's stance was that **sound reasoning is an essential instrument** – one he himself used extensively in theology. In fact, his works helped **"naturalize" Aristotelian logical methods into Islamic theology** thereafter [26] [27]. He believed **revelation and reason** ultimately coincide when properly understood, but where speculative philosophers overstepped the limits of demonstrable proof (especially in metaphysics), he pulled the reins.

Rejecting Perilous Metaphysics – *The Incoherence of the Philosophers*

What al-Ghazali *did* attack vehemently was not science or reason, but **certain branches of philosophy – primarily metaphysical doctrines** – that he believed contradicted core tenets of Islam. His famous work *Tahāfut al-Falāsifa* (*"The Incoherence of the Philosophers"*) zeroes in on **20 specific philosophical assertions** (drawn mostly from Avicenna and al-Farabi) and systematically refutes them [28] [29]. Notably, these issues are largely **cosmological and metaphysical**: for example, the philosophers' claims that the world has no beginning in time (is eternal), or that God does not know particular events, or that there is no bodily resurrection [30]. Al-Ghazali branded *three* of these positions outright **heresy (kufr)** – namely: **(1)** the doctrine of the world's pre-eternity, **(2)** the claim that God only knows universals and not individual particulars, and **(3)** the denial of physical resurrection and the afterlife's bodily rewards/punishments [30] [31]. These three, he said, *"have excommunicated their holders from Islam"* [32] [31]. The other points (such as denial of divine attributes, or various cosmological speculations) he considered heterodox or philosophically mistaken, though not always full heresy [33].

Importantly, *al-Ghazali was careful to note that his dispute was with the philosophers' unfounded* metaphysical *claims, not with the practice of rational investigation itself.* He even highlights that the title is *"Incoherence of the Philosophers,"* **not** "Incoherence of **Philosophy**" [1]. In his view, the **falāsifa** (philosophers) were incoherent because they strayed beyond proven knowledge into theological speculation that conflicted with revelation and even with each other [34]. For instance, he points out that in metaphysics the philosophers had no consensus and no demonstrative proofs, yet made grand claims (e.g. about the cosmos or God's nature) that undermined Islamic doctrine [34] [33]. Al-Ghazali – after mastering their philosophy himself – concluded that on **many metaphysical questions "the philosophers contradict each other … and cannot furnish the logical proofs their own method requires"** [34]. Thus, he sought to *"refute these twenty errors"* of theirs in the *Tahāfut* [35].

Example: One target was the philosophers' **denial of miracles and insistence on unbreakable causality**. Avicennan philosophy held that causal connections in nature are fixed and necessary, so miracles like reviving the dead or the Prophet Moses' staff turning into a snake would be impossible. Al-Ghazali countered this in his 17th discussion of *Tahāfut*, arguing that such *inflexible* natural necessity is not proven – God can suspend normal cause-effect relations if He wills [36] [37]. He charged the philosophers with *incoherence* for arbitrarily limiting God's power. This brings us to al-Ghazali's famous view on **causality**, which has a direct bearing on how he saw empirical science.

Causality, "Occasionalism," and Empirical Inquiry

A centerpiece of al-Ghazali's critique is his **rejection of the philosophers' doctrine of necessary causation**. In *The Incoherence*, he argues that what we perceive as cause and effect in nature is *not a self-*

sufficient, necessary linkage, but rather the consistent **habitual order ordained by God** [15] [36]. This view is often termed **"occasionalism."** Al-Ghazali illustrates it with a vivid example: *when fire comes into contact with cotton and the cotton burns, it is not the fire by itself that necessarily causes the burning – rather, God directly causes the cotton to burn at the occasion of the contact* [15]. God has created a regular pattern (fire *usually* burns cotton), but He can always withhold the effect or alter it. Al-Ghazali writes that according to the philosophers, *"the disruption of causality is impossible"* – but he refutes this, maintaining that **God's will is absolutely free** and not bound by so-called natural "laws" [38] [39]. *In his theology, "events in the world aren't governed by logical necessity or immutable laws, but by God's will alone."* [39] **Thus miracles are possible: if God wants a man to remain alive after being decapitated, or a fire** not** to burn a prophet, it will be so [40] [41].

Crucially, this did **not** mean al-Ghazali denied the *empirical reality* of cause and effect or discouraged studying how causes operate *most of the time*. In fact, he acknowledged that **God has established a consistent natural order (sunna)**. We rely on this order in practice – for example, one cooks with fire expecting heat, and takes medicines expecting a cure, because God's habits are knowable. Al-Ghazali's point was that the connection is not *logically necessary* – it's contingent on God's continuous decree [42] [43]. He even offered a **proto-empirical perspective** on unexplained phenomena: in one part of *Tahāfut*, al-Ghazali suggests that some miracles might actually have unknown *natural causes*. He writes that when Moses' staff turned into a serpent, *perhaps the material underwent a rapid transformation through a hidden cause – something the philosophers "cannot exclude," even if it normally takes ages for wood to turn into animal matter* [44] [45]. In other words, al-Ghazali allowed that **human knowledge of nature's causes was incomplete**, so an event deemed "miraculous" might have an explanation within the *broader natural order known only to God* [44] [46]. (He presents this as an *alternative* interpretation, while in other contexts he emphasizes direct divine intervention – a matter of scholarly debate on his exact stance [47] [48].)

The net effect of al-Ghazali's view on causality was to **assert the contingency of natural laws**. Rather than undermine the scientific impulse, this *can be seen as redirecting it*: since causes are not known with absolute *a priori* certainty, one must investigate the world *empirically* to discover how God usually orders things. Indeed, he *"accepted demonstration (apodeixis)"* in the sciences [49] and helped foster a more precise discourse on *epistemology* in later theology. Modern scholars note that *al-Ghazali's nominalist critique of Aristotelian science – his denial that objects have fixed natures that necessitate outcomes – parallels the critiques of later 14th-century European nominalists* [50]. By denying intrinsic necessity in causes, both al-Ghazali and the nominalists opened the door for **inductive science**: one must learn by observation *how* God customarily operates, rather than assume philosophy can deduce all truths. It is thus a mistake to think al-Ghazali "discouraged" experimentation; if anything, he insisted that **certainty about the natural world comes from God's observed patterns (empirical evidence), not from abstract reasoning alone** [8]. He valued **"demonstrative science"** – empirical or mathematical proof – so highly that he warned undermining it would backfire on religion [8]. This outlook prefigures key questions in the *philosophy of science*, such as the problem of induction (David Hume, centuries later, echoed al-Ghazali's point that we infer causation from habit, not logical necessity [39]).

It's true that critics in al-Ghazali's time worried his occasionalism *could* erode scientific inquiry. **Ibn Rushd (Averroes)**, the great Andalusian philosopher, argued exactly this: that if one denies real secondary causes in nature, one undermines human knowledge. In his response *Tahāfut al-Tahāfut* ("Incoherence of the Incoherence"), Ibn Rushd insists al-Ghazali's view *"would be counter-productive to scientific knowledge and contrary to common-sense"*, because it denies the **"causal principles"** and **"particular natures"** things have [51]. Averroes, an Aristotelian, held that events *do* have inherent causes (material, efficient, etc.) and that

without accepting that, *"there can be no conclusive scientific knowledge"* [51] [52]. He famously quipped that according to al-Ghazali's doctrine, one might say **no** medicine heals and no bread nourishes – God directly does it – a stance Averroes found dangerous for any practical science. Al-Ghazali, however, would reply that **recognizing God as the ultimate cause does not negate our studying proximate causes**. We should still bake bread or prescribe medicine – trusting God's habit – but remain humble that *"if He so desired, He could simply will fire not to burn or medicine not to heal on occasion."* He saw this as upholding divine omnipotence without requiring any abandonment of empirical *investigation* of how, *in general*,, God sustains the natural order [13] [53].

Later Influence on Islamic Thought and Science

Medieval Muslim astronomers and instrument-makers at work, illustrating the continued pursuit of science in the Islamic world. Al-Ghazali's legacy in the Islamic world was profound, but it *did not spell an end to scientific activity*. In theological terms, **Sunni orthodoxy increasingly adopted al-Ghazali's balanced approach** – embracing useful sciences and Aristotelian logic within an Ash'arite theological framework, while remaining wary of unchecked metaphysical speculation [54] [27]. Al-Ghazali himself, through works like *Iḥyā' 'Ulūm al-Dīn*, fortified the integration of worldly sciences as "praiseworthy" so long as they served humanity and did not contradict religious belief [9] [11]. Subsequent scholars of the East, such as Fakhr al-Din al-Razi (1149–1209), built on this legacy – Razi was a theologian who used philosophical arguments (and even wrote on cosmology and physics in a kalam context) while upholding al-Ghazali's theological principles. The **study of logic** became standard in madrasa curriculums largely due to al-Ghazali's influence, producing later luminaries like al-Tusi and al-Qushji who excelled in logic, astronomy, and mathematics.

Meanwhile, in Al-Andalus (Muslim Spain), **Ibn Rushd** led the charge to defend Aristotelian philosophy. In his *Tahafut al-Tahafut*, Ibn Rushd meticulously rebutted each of al-Ghazali's 20 points, arguing that the philosophers' positions had been misunderstood or unjustly condemned [55] [56]. Averroes maintained that philosophy and Islam are not at odds when properly understood – he even wrote *Fasl al-Maqal* ("Decisive Treatise") to argue that **Islamic law itself encourages learned inquiry**. However, Ibn Rushd's rationalist revival did not significantly reverse the course in the Eastern Islamic world: *philosophical theology (kalam) remained dominant* and outright **falsafa** (Avicennian philosophy) as an independent discipline waned in the

East after al-Ghazali. *Ibn Rushd's writings, notably his Aristotle commentaries, found greater appreciation in Latin Christendom than among his own contemporaries* [57] [58]. Indeed, as historian Frank Griffel notes, **"al-Ghazali's approach…was accepted by almost all later Muslim theologians"** [59], whereas *Averroes died in relative isolation in 1198, with his works soon falling under official disfavor in the Muslim West as well* [60] [61].

Did Islamic science decline because of al-Ghazali? The historical evidence suggests *no*. While al-Ghazali's critiques shifted the **epistemological framing** of science, they did not stop scholars from pursuing mathematics, astronomy, medicine, or engineering. In fact, the century after al-Ghazali saw a *flourishing of science in the Western Islamic world*. **"Spanish Aristotelians"** like **Ibn Bajja (Avempace, d. 1138)**, **Ibn Tufayl (Abubacer, d. 1185)**, and **Nur al-Din al-Bitruji (Alpetragius, d. 1204)** made original contributions to astronomy, physics and medicine [62] [63]. Ibn Bajja, for example, wrote on botany and devised an alternative cosmology with circular planetary orbits (influencing later Copernican ideas) [62]. Ibn Tufayl, inspired partly by Avicenna and perhaps al-Ghazali's mystical ideas, authored the philosophical novel *Hayy ibn Yaqzan* and also wrote on medicine and astronomy [64]. Al-Bitruji developed a new astronomical model without Ptolemaic epicycles and his work was later cited by Copernicus [63]. None of these scholars display any sense that scientific inquiry was off-limits – on the contrary, they thrived **after** al-Ghazali. In the Eastern lands, too, science continued: e.g. the great observatory of Maragha (in 13th-century Iran) was led by **Nasir al-Din al-Tusi**, who advanced planetary theory (his "Tusi-couple" mathematical device anticipated aspects of Copernicus's system). Another example is **Ibn al-Nafis (d. 1288)** in Syria/Egypt, who, operating within an Ash'arite orthodox milieu, made the landmark discovery of pulmonary blood circulation. These figures demonstrate that **the Islamic scientific tradition persisted and evolved** – often in conversation with Ghazalian theology rather than in opposition to it. As modern analyses conclude, *al-Ghazali's target was the philosophers'* metaphysics*, not the practical sciences, and he "did not have some chilling effect on the study of mathematics and science in Islam,"* contrary to popular misconception [65] [66].

Influence on Western Thought and Scientific Methodology

Al-Ghazali's ideas traveled to the Latin West in complex ways. Interestingly, the *first exposure* many European scholars had to "Algazel" was not as a skeptic of philosophy but as a transmitter of it. Al-Ghazali's work *Maqāṣid al-Falāsifa* ("The Doctrines of the Philosophers"), a neutral summary of Avicennist philosophy, was translated into Latin (12th century) as *Logica et Philosophia Algazelis* [67] [68]. Latin readers often treated "Algazel" as a philosophical authority in his own right, sometimes unaware that this work was a prelude to Ghazali's *Incoherence* critique [69] [70]. Nevertheless, through this and through the rebuttals of **Averroes** and discussions by **Jewish thinkers like Maimonides**, many of al-Ghazali's *questions* entered Western discourse [59]. For example, *the conflict between Aristotelian eternity vs. religious creation* – which al-Ghazali had debated – became a major issue for Christian scholastics in the 13th century. *Thomas Aquinas* cites "Algazel" a number of times, usually via Avicenna or Averroes, on topics like the first cause and the nature of the soul. Aquinas and others took note of al-Ghazali's claim that philosophy had limits, and they attempted to secure a place for Christian doctrine against overly deterministic Aristotelianism (a struggle epitomized by the Condemnation of 1277 in Paris, which banned certain Aristotelian propositions as contrary to God's absolute power – a move quite consonant with Ghazali's insistence on divine freedom).

In terms of **scientific methodology and the philosophy of science**, al-Ghazali's legacy finds resonance in later European thought. His rigorous distinction between necessary logic and contingent natural laws anticipated the late medieval *voluntarist* philosophy. Thinkers like **John Duns Scotus** and **William of Ockham** in the 14th century echoed the idea that *God's omnipotence means the laws of nature are contingent – God could always create a different world* [71]. This encouraged the notion that the actual laws of our world

must be discovered empirically, not assumed by reason alone. In fact, al-Ghazali had articulated a form of **"possible worlds"** theory – he argued that out of all *possible* worlds God chose the present one (which is the **"best of all possible worlds"** in an Avicennian sense) [71]. Scotus developed a parallel idea of *alternate possible world scenarios*, and while direct influence is uncertain, both he and al-Ghazali drew on Avicenna's modal metaphysics [71]. Such concepts fed into the changing medieval outlook that allowed more freedom in imagining different physical realities, a mindset conducive to scientific innovation.

Moreover, **David Hume's famous 18th-century skepticism about causation** – the idea that we never perceive a necessary connection, only constant conjunction – is often compared to al-Ghazali. It's an insightful parallel: *over 600 years earlier, al-Ghazali had made essentially the same point in theological terms* [39]. Of course, Hume likely arrived at his conclusions independently, but al-Ghazali's work shows that the question of inductive uncertainty was "in the air" much earlier in a religious context. In general, al-Ghazali contributed to a tradition of rigorous **epistemological examination** – questioning how we know what we know. In *Deliverance from Error*, he even describes a period of radical doubt, where he questioned the reliability of sense perception and pure reason, foreshadowing the Cartesian method of doubt centuries later [72] [73]. His ultimate resolution was illumination through God's grace, rather than Descartes' "clear and distinct ideas," but the *methodological skepticism* is notable. This introspective approach influenced later Sufi thought and indirectly impressed some Western observers of Sufism.

Finally, via **Averroes and the Jewish philosophers (like Maimonides)**, al-Ghazali's challenges helped sharpen medieval Latin debates on science and religion. Maimonides, for instance, while critiquing the Islamic theologians (mutakallimūn), addressed similar issues of creation versus eternity and divine omnipotence, striving (like Averroes) to defend a more rationalist view against occasionalist extremes. The *Latin Averroists* of the 13th century (such as Siger of Brabant) held positions closer to Ibn Rushd, but the very need to address whether philosophical truth could contradict revelation was a legacy of the discourse al-Ghazali sparked. In summary, **al-Ghazali's insistence on the limits of human reason and the contingency of natural order fed into Western thought's gradual move toward empirical methods** and acknowledgment of God's absolute power in nature. Historians note that this *"nominalist critique of Aristotelian science"* championed by al-Ghazali in the 11th-12th century anticipated the nominalism that arose in 14th-century Europe, which in turn was significant in the eventual rise of modern science [50].

In conclusion, far from being a simple anti-science zealot, *Imam al-Ghazali was a sophisticated thinker who* **distinguished the valuable fruits of scientific reasoning from the rotten branches of speculative metaphysics**. He ardently defended mathematics, astronomy, medicine, and logic as disciplines founded on sound evidence – urging Muslims to study them and warning that Islam loses credibility if it rejects proven knowledge [7] [8]. At the same time, he scrutinized philosophical claims about the universe and the divine, rejecting those he found unsupported or theologically hazardous. This nuanced stance *did not halt scientific inquiry in the Islamic world*; on the contrary, it helped **naturalize** the sciences within an Islamic epistemology [54] [27], albeit under the aegis of a theology that insisted all causal power lies with God. Al-Ghazali's work provoked fruitful debate (exemplified by Ibn Rushd's response) and his ideas rippled into medieval Europe's own wrestling with faith and reason. In the development of the philosophy of science, his legacy is seen in the emphasis on **empirical demonstration over arbitrary assumption** and the recognition of nature's regularities as *contingent*, not absolute – an insight that aligns with the foundations of the modern scientific outlook.

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