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「兩個世界交會在極點」：瑪格麗特．柯芬蒂詩《炫麗異世界》和約翰尼斯．克卜勒《夢》融合科學與文學之敘事策略對比

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摘要

本文旨在探討瑪格麗特．柯芬蒂詩《炫麗異世界》(1666) 和約翰尼斯．克卜勒《夢》(1634) 中的敘事策略對比，分析兩位作者如何將科學論述與文學元素融合在其作品中。筆者主張柯芬蒂詩利用虛構的角色和對話模式，將其自然哲學理念無縫整合到文學敘事中，創造多層次且動態的交流觀點。相較之下，克卜勒採用單一敘事模式和邊界明確的框架敘事，使其核心科學論述與框架性的虛構敘事相對分離且較為僵硬。本文透過比較柯芬蒂詩和克卜勒在融合科學與文學元素上的不同敘事策略，探究作者的專業背景、個人興趣以及作品的創作歷史如何影響其敘事策略選擇，並形塑讀者對作品的解讀與歸類。筆者利用文氏圖模型(a Venn diagram model) 視覺化呈現兩部作品中科學與文學的交疊程度與類型，顯示柯芬蒂詩的《炫麗異世界》更側重文學面向，而克卜勒的《夢》則以科學論述為核心。藉由探討科學論述與文學想像的互動關係，本文企圖深化對早期現代科學與文學錯綜關係的理解。

關鍵詞：瑪格麗特．柯芬蒂詩、《炫麗異世界》、約翰尼斯．克卜勒、《夢》、科學與文學

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"Two Worlds Joined at Their Poles": Contrasting Narrative Strategies of Conflating Science and Literature in Margaret Cavendish's *The Blazing World* and Johannes Kepler's *Somnium*

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Abstract**

This essay examines the contrasting narrative strategies in Margaret Cavendish's *The Blazing World* (1666) and Johannes Kepler's *Somnium* (1634), highlighting how both authors blend scientific discourse with literary elements. Cavendish employs fictional characters and dialogues to integrate scientific ideas into her literary narrative, creating a multifaceted and dynamic exchange of perspectives. In contrast, Kepler utilizes a monologic structure with clear-cut framed narratives, presenting his core scientific discourse in a more rigid and separate manner from the fictional framework. By analyzing Cavendish's use of fictional characters and dialogues to convey scientific ideas and contrasting it with Kepler's reliance on monologic discourse and framed narratives, the essay explores how the authors' professional backgrounds, personal interests, and the compositional history of the works influence their narrative choices and shape the readers' perceptions. The study employs a Venn diagram model to illustrate the varying degrees of overlap between science and literature in these texts, emphasizing Cavendish's predominantly literary approach and Kepler's primarily scientific focus. By exploring the interplay between scientific discourse and literary imagination, the essay aims to deepen our understanding of the intricate relationship between science and literature during the early modern period.

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Key words: Margaret Cavendish, *The Blazing World*, Johannes Kepler, *Somnium*, science and literature

> "And this is the reason, why I added this piece of fancy [i.e. *The Blazing World*] to my philosophical observations [i.e. *Observations upon Experimental Philosophy*], and joined them as two worlds at the ends of their poles; both for my own sake, to divert my studious thoughts, which I employed in the contemplation thereof, and to delight the reader with variety, which is always pleasing."
>
> —Margaret Cavendish, "To the Reader," *The Blazing World* (no pagination)

Introduction

As a prolific female natural philosopher in seventeenth-century England, Margaret Cavendish (1623-73) published many scientific treatises on natural philosophy, in addition to poetry, drama, letters, biography and prose fiction. She frequently infused her scientific concepts and deliberations into her literary oeuvre, demonstrating a distinctive ability to intertwine the disciplines of science and literature.

Cavendish's prose fiction *The Blazing World* was published in the same volume with her scientific treatise *Observations upon Experimental Philosophy* (1666).[1] The phrase "two worlds joined at their poles" in my title draws from a note in Susan James's edited book of Cavendish's political writings, which comments on Cavendish's preface to *The Blazing World* (*Political Writings* 5n2). In this preface, the "two worlds" refer to the realm of natural philosophy, grounded in "reason," and the realm of literary imagination, based on "fancy." James highlights Cavendish's focus on the "interconnections" between reason and fancy, encouraging readers to "move between philosophy and fiction" (*Political Writings* 5n2). Cavendish's decision to publish her prose fiction alongside her scientific treatise symbolizes the real-world convergence of these two fields, a convergence physically manifested in the book that unites the two distinct works in a single volume. This material union reflects deeper connections

[1] My quotations of this work come from Cavendish's 1666 edition accessed via *EEBO*, cited hereafter as *Observations*.

within Cavendish's textual universe, as evidenced by the integration of her scientific discussions into her literary work.[2]

When analyzing elements of (proto-)science fiction in Margaret Cavendish's *The Blazing World* in an earlier essay, I argue that Cavendish provides scientific and astronomical explanations to make her creation of the alternative Blazing World plausible. The scientific explanations, though presented as digressions, are "organically integrated" into the utopian narrative (Su 160). Whereas Johannes Kepler's *Somnium* (1634) features "clear-cut" layers of framed narratives, Cavendish's work intricately combines different genres, demonstrating the novel's potential to "cannibalize" and consume diverse literary modes (Su 161).

Using this argument as a starting point, this essay examines in greater details the narrative strategies of Cavendish's *The Blazing World* in contrast to Kepler's *Somnium*, to explore how both authors, writing during the Scientific Revolution, blend elements of science and literature in their science fictional works.[3] By contrasting their approaches, the analysis highlights how Kepler's monologic discourse, conveyed through a single narrator, readily aligns with the author's perspective, whereas Cavendish's dialogic discourse, featuring multiple narrators, complicates the identification of the author's stance amid the interplay of varied voices. This investigation of the interplay between scientific discourse and literary forms in Cavendish's *The Blazing World* and Kepler's *Somnium* seeks to

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[2] Cavendish's decision to publish *Observations* and *The Blazing World* in the same volume, just like "two worlds joined at the ends of their poles," entails her view of the close connection between these two works. Cavendish describes *The Blazing World* as a "Piece of Fancy" intended both to divert her from her intensive contemplations and to "delight the reader with variety, which is always pleasing" ("To the Reader," *Blazing World*, no pagination). As Hutton indicates, by asserting "a serious purpose of her book," Cavendish aligns with Francis Bacon's perspective on the utility of fiction in advancing new concepts ("Science and Satire" 167). Cavendish believes that reason sometimes benefits from the assistance of fancy "to recreate the Mind, and withdraw it from its more serious Contemplations" (*Blazing World*, no pagination).

[3] I do not intend to claim that these two works by Kepler and Cavendish are "science fiction" in its narrow sense. Instead, my analysis in this essay focuses on the science fictional elements in the two works.

deepen our understanding of the intricate relationship between science and literature during the early modern period.

The Relationship between Science and Literature

The relationship between science and literature in the early modern period was far more intertwined than is commonly assumed. Stephen Jay Gould challenges the perceived dichotomy between the sciences and humanities, arguing that both fields adopted complementary approaches to knowledge during the seventeenth and eighteenth centuries (84-85). He highlights how many prominent naturalists and empiricists in the Scientific Revolution were well-versed in and revered the ancient woks in Latin and Greek. Similarly, William Powell Jones and Thomas L. Hankins note that during this era, natural philosophy (the study of nature) was integrated with literature. Although Enlightenment scholars continued to hold literature in high regard, it was not until the nineteenth century that the separation between science and literature was done (Powell 8-9). In other words, the relationship between science and literature was much more closely connected than commonly assumed at least through the eras of the Scientific Revolution and the Enlightenment.

Tita Chico emphasizes that natural philosophy embedded literary qualities, allowing authors to explore new definitions of evidence and authority (134). She shows how works like Thomas Sprat's *The History of the Royal Society*, Margaret Cavendish's *The Blazing World* and Jonathan Swift's *Gulliver's Travels* used literary forms to express and critique scientific ideas, demonstrating the capacity of literariness to shape and express complex societal visions (14).

The close relationship between science and literature during the seventeenth century, particularly during the Scientific Revolution, reflects a time when natural philosophy was regarded as an integral part of the humanities. To illustrate various aspects of this relationship, I propose a Venn diagram model, as illustrated in Figure 1a, Figure 1b, and Figure 1c below.

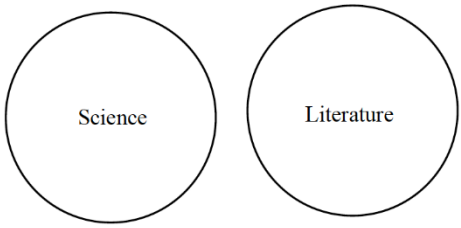

Figure 1a: No overlapping between science and literature

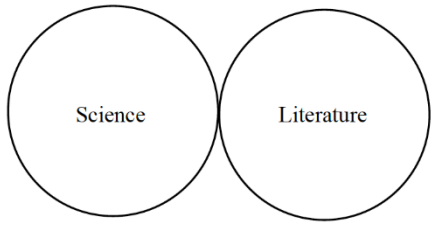

Figure 1b: Minimal connection between science and literature

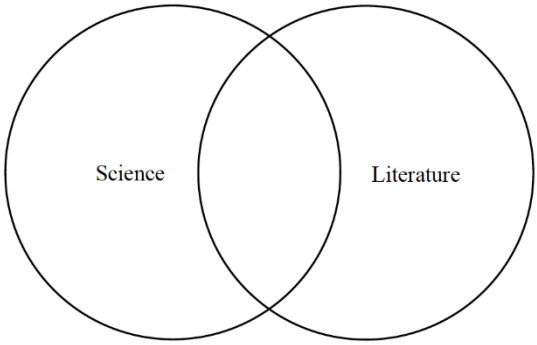

Figure 1c: Overlapping between science and literature

The Venn diagrams illustrate the varying degrees of connection between science and literature within a work. In Figure 1a, the circles representing science and literature do not overlap, indicating no connection between the two fields in the work. Figure 1b shows a minimal connection at a single point, suggesting that the work is predominantly literary or scientific and incorporates only a slight element of the other field. Figure 1c, with significant overlap, indicates a work where science and literature are deeply intertwined.

The extent of overlap between science and literature can vary, leading to larger or smaller areas of intersection. A literary work may incorporate scientific elements, and a scientific work may contain literary elements.

The genre classification of a work often depends on the proportions of these two fields. For instance, a predominantly literary work with minor scientific discussions is usually categorized as a literary work (fiction), whereas a work with a strong scientific approach is generally recognized as science (nonfiction). The greater the imbalance between the two fields, the more straightforward it is to classify the work; the closer the balance, the more challenging and potentially perplexing it becomes for the reader.

The integration of literary and scientific discourses within a work can be heavily influenced by the author's background, professional training, personal interests, and the compositional history of the work. A scientist with expertise in natural philosophy, mathematics, geometry, astronomy, anatomy, or medicine is more likely to infuse their works with scientific principles and scholarly discussions. This explains why numerous renowned natural philosophers and scientists, such as Johannes Kepler, Margaret Cavendish, H.G. Wells, Julian Huxley, and Naomi Mitchison and Arthur C. Clarke,[4] have all contributed to the genre of science fiction that bridges science and literature, despite their varied motivations and strategies for melding scientific and literary components.

Science fiction typically represents a significant overlap between the fields of science and literature. M. H. Abrams notes that science fiction actively endeavors "to render plausible the fictional world by reference to known or imagined scientific principles, or to a projected advance in technology, or to a drastic change in the organization of society" (279). By definition, science fiction draws upon established or hypothetical scientific principles to construct and rationalize the narrative framework. However, literary works that explore scientific themes may also incorporate elements beyond science fiction, such as satire, utopia, travel narrative, allegory, poetry, and romance, depending on the author's creative choices and narrative objectives. To view this from the other side, scientists discussing their innovations and theories might resort to literary devices to articulate their findings, although these might be less perceptible to readers, if the bulk of the content is presented in the format of the scientific treatise.

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[4] The later four writers are suggested by Patrick Parrinder in his 1990 essay "Scientists in Science Fiction: Enlightenment and After" (60-72), to which I add Kepler and Cavendish.

This essay will explore the contrasting narrative strategies used by Cavendish and Kepler to navigate the intersection of science and literature in their works. As prominent scientists—natural philosopher and astronomer respectively, both Cavendish and Kepler produced scientific treatises and literary works during the seventeenth-century Scientific Revolution. Their works are exemplary in demonstrating the intricate connections between science and literature, making them ideal subjects for examining how science fiction can serve as a conduit for scientific and imaginative exploration and how the writers' professional backgrounds influence their narrative choices and themes.

Cavendish and Scientific Debates about the Plurality of Worlds

Margaret Cavendish's integration of scientific discourse into *The Blazing World* is deeply rooted in her engagement with the natural philosophical debates of her time. As a prominent natural philosopher, Cavendish actively participated in discussions surrounding topics such as atomism, vitalism, and the plurality of worlds, which served as a foundation for her imaginative exploration of alternative realms. Critics have widely acknowledged her contributions to seventeenth-century scientific discourse. Jay Stevenson and Judith Moore examine how Cavendish incorporates her natural philosophical ideas, such as atomism and vitalism, into her literary works.[5] Frédérique Aït-Touati argues that her blending of fiction and scientific treatise represents a significant shift from Baconian "imitation" to an inventive, novelistic approach, challenging the boundaries between knowledge and fiction (490-91).

Cavendish's work exemplifies how her professional background shaped her ability to navigate and integrate scientific concepts within a literary framework. Unlike many of her contemporaries, Cavendish rejected rigid philosophical systems, critiquing them as artificial constructs. She regarded all theories as provisional and argued that philosophical systems often resembled fictional narratives more than empirical explanations (Aït-Touati 497). This perspective allowed her to explore scientific ideas with a creative fluidity that blurred the distinctions

[5] In addition to her scientific treatises, Stevenson analyzes Cavendish's early literary works *Poems and Fancies* and *The World's Olio*. Moore focuses on her *Poems and Fancies* and *Philosophical Fancies*.

between fact and fiction, reflecting her broader materialist and vitalist worldview.

Research exploring the connections between *The Blazing World* and early modern science typically concentrates on Cavendish's parodic and satirical critique of the experimental philosophy practiced by members of the Royal Society (Chico 112-16; Mittag 135-36; Azcárate 110; Lascano 161). Feminist scholars like Eve Keller, Lisa T. Sarasohn, López-Varela Azcárate, and Martina Mittag view these critiques as part of her challenge to the gender biases prevalent in male-exclusive early modern scientific communities.[6] In this section, I will investigate how Cavendish articulates and manifests her natural philosophical ideas through her literary writings. Rather than focusing solely on issues of gender, my analysis aims to transcend gender binarism and highlight Cavendish's innovative integration of scientific discourse within her literary creation.

During the Scientific Revolution, new technologies such as telescopes and microscopes were revolutionizing the study of nature and sparking debates about the innovative models of the universe,[7] including the possibility of the "plurality of worlds" (Stevenson 1996; Moore 2002). To elucidate the potential scientific backdrop against which Cavendish conceptualizes the alternative worlds in *The Blazing World*, it is helpful to discuss two relevant models of the universe composed of infinite worlds, one proposed by Giordano Bruno (1548-1600), and the other by René Descartes (1596-1650).

Influenced by the Copernican heliocentric theory, the Italian scholar

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[6] Emma Wilkins contends that the male scientists in the Royal Society were more diverse than commonly perceived, and thus, Cavendish's criticism of these male scientists should not be oversimplified as solely based on gender ("Margaret Cavendish and the Royal Society" 245).

[7] The most influential is Nicholas Copernicus's 1543 scientific treatise *De Revolutionibus Orbium Coelestitum* (*On the Revolutions of the Heavenly Spheres*). Copernican heliocentrism influenced numerous later scholars, including Giordano Bruno (1548-1600), Galileo Galilei (1564-1642), Johannes Kepler (1571-1630), and René Descartes (1596-1650), among others. For more detailed analysis of the debates and controversies about astronomical models, see Robert S. Westman's *The Copernican Question* (2011).

Giordano Bruno believed in a boundless universe filled with innumerable celestial bodies like the earth, each representing a center of motion in its own world (Dick 65-69; Campbell 116-20; Connes 179-204). The following Figure 2 shows a diagram from Giordano Bruno's *De immense et innumerabilibus* (*On the Immense and Innumerable*) (1591) (Dick 68):[8]

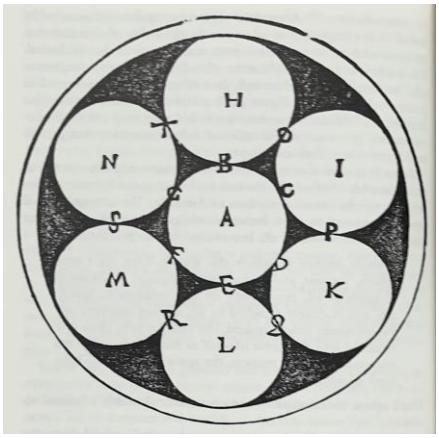

Figure 2: Giordano Bruno's diagram of the universe in *De immense et innumerabilibus* (1591) (Dick 68)

This diagram illustrates that "A part of world *H* placed at *B* cannot and ought not to drive toward the center *A* of another system, but toward the center of its own system" (Dick 68). Bruno's descriptions further elaborate, "There are then innumerable Suns, and an infinite number of Earths revolve around these Suns, just as the seven we can observe revolve around this Sun which is close to us . . . around [the stars] revolve Earths both larger and smaller than our own" (*De l'Infinito* 304-6; qtd. in Connes 194).

[8] A simplified version can be found in Bruno's earlier work *De l'Infinito universo e mondi* (*On the Infinite Universe and Worlds*), published in 1584 (Dick 68).

Although Bruno's model does not depict celestial bodies in contact with one another as shown in Figure 2, this radical cosmological concept of infinite worlds resonates within Cavendish's scientific treatises and forms the foundational worldview for *The Blazing World*.[9]

René Descartes also proposed a model of the universe incorporating the concept of a plurality of worlds. During Cavendish's exile in France (1646-48) with her husband, William Cavendish, Marquess of Newcastle, Descartes was among the leading intellectuals who frequented the Newcastles' residence (Whitaker 84-106). As the hostess of these gatherings, Cavendish likely became acquainted with the visitors' theories and research.[10] Her perspective on the plurality of worlds could have been influenced by Descartes' model of the universe in *Principia philosophia* (*Principles of Philosophy*) (1644), as shown in Figure 3 below (from Dick 110): [11]

[9] In his book addressing the themes of the plurality of worlds and extraterrestrial life since the ancient time, Steven J. Dick only mentions Cavendish in a single note, stating that she adopts the "ancient atomist doctrine of the formation of infinite worlds through the random coalescence of atoms, and viewed the stars as suns with their own planets" (Dick 199n18).

[10] Specifically, through conversations with Sir Charles, her husband's younger brother, Cavendish was introduced to the ideas of both ancient and contemporary philosophers, including Seneca, Lucretius, Descartes, Gassendi, and Hobbes (Whitaker 119).

[11] *Principia philosophia* was first published in Latin in 1644; a French version *Les Principes de la Philosophie* came out in 1647.

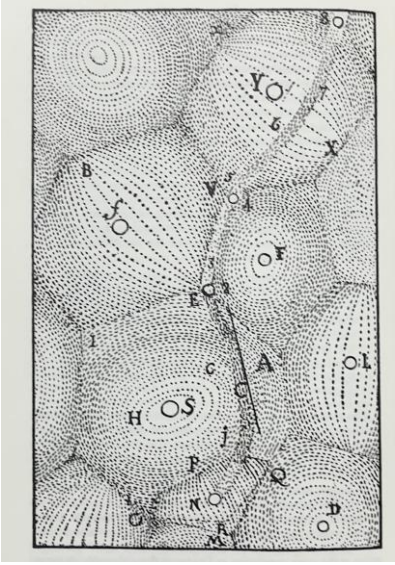

Figure 3: Descartes' vortex cosmology in *Principia philosophia* (1644) (Dick 110)

Descartes constructs a three-dimensional model to illustrate the distribution of stars across the universe. He envisions the space as partitioned into polyhedral cells centered on stars, just like "a conglomerate of soap bubbles"; the cells are of unequal sizes but of "comparable magnitudes" (Connes 296). Unlike stationary bubbles, each cell exhibits a dynamic whirling motion of "particles of subtle matter" resembling a vortex (represented as lines of cluttering dots in Descartes's diagram), with each star situated at the vortex's center (indicated by small circles) (Connes 296). Descartes further explains that the "poles of some of these vortices touch the parts farthest from the poles of some others," ensuring no two vortices share the same polarity, which prevents vortices with opposing poles from merging with each other (Connes 297).

As a devoted natural philosopher, Cavendish was interested in ancient

atomism and constructed her unique system of vitalistic materialism.[12] Her belief in the plurality of worlds articulated in *Philosophical and Physical Opinions* (1655) and other treatises, exemplifies her imaginative and scientific synthesis.[13] She argues that Nature may repeatedly make the same creature by using the same matter with the same motions, but "motion delights in variety," allowing for infinite particular worlds with infinite variety. She envisioned nature as capable of infinite variations, creating countless worlds filled with diverse creatures:

> …motion may make *infinite particular worlds*, as infinite particular Animals, Vegetables, Minerals, and *those infinite worlds may differ*, as those kindes of Creaturs; for worlds may differ from other worlds, not onely as man from man, but as man from beast, beasts from birds, birds from fish, . . . so there may be *infinite worlds*, and *infinite variety of worlds* . . . (*Philosophical and Physical Opinions* 38-39; italics added)

This belief aligns with her vitalistic materialistic view of Nature and is reflected in her conception of a multitude of distinct worlds populated with "infinite kinds of creatures" that surpass human imagination, akin to the extraordinary hybrid beings she creates in *The Blazing World*.

In *The Blazing World*, Cavendish depicts a human girl who accidentally intrudes into an alternative world connected to Earth at the North Pole. She provides scientific explanations for the existence of other worlds linked to ours, including the feasible means of entering this other realm (*Blazing World*, Part I, 3-4). Cavendish speculates that different worlds could be connected at their poles, with multiple suns visible near the poles, each illuminating its respective world. She envisions an underwater passage linking these worlds, challenging to traverse but not impossible, and makes efforts to explain the scientific principles that render such a journey credible.

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[12] For relevant studies, see Sarah Hutton (1997, 2003), Susan James (1999), Lisa T. Sarasohn (2009, 2010), Lisa Walters (2014), Emma Wilkins (2014, 2016), Brandie and Sarasohn (2016), and Deborah A. Boyle (2018).

[13] For example, Cavendish imagines other worlds smaller than a coin and endless worlds shone by their suns which we earth-dwellers see as stars (*Poems, and Fancies* 36 and 44).

López-Varela Azcárate associates Cavendish's descriptions of several suns with the belief in "Hollow Earth" and "inner suns in this subterranean world" in the mythologies of ancient civilizations (115). According to the astronomer Edmond Halley's theory, the earth could be "a hollow shell . . . with two concentric inner shells, each with their own atmospheres and magnetic poles, luminous inside" (Azcárate 115). However, if this were true, the suns would be blocked by the shells separating these "concentric" world, making it impossible for people in any of the worlds in Cavendish's story to see the suns of other alternative worlds.

The passage depicting the possible existence of multiple worlds quoted above is highly reminiscent of Bruno's visual representation of a vast universe filled with an infinite number of worlds, as shown in Figure 2. Cavendish's descriptions appear to diverge from the Cartesian model of vortices (Figure 3), where vortices cannot merge at their poles. Nevertheless, removing the aspect of the vortices' whirling motion from Descartes's theory, the depiction of tightly interconnected cells of small worlds provides a visual clue to how these worlds are joined in the cosmological perspective presented in *The Blazing World*.

Integration of Scientific Discourse within the Imaginative Narrative of *The Blazing World*

Delilah Bermudez Brataas argues that in *Sociable Letters* and *The Blazing World*, Cavendish skillfully combines science fiction, fantasy, and philosophy to create a unique utopian narrative. A central theme is the use of "hybridity," both in genre and content, as the work blends fantastical components with serious philosophical discussions (Brataas 37). Cavendish also explores the concept of multiple worlds, reflecting contemporary scientific debates about their potential existence. Brataas emphasizes that the fusion of the fantastical and the rational defines her innovative approach to genre and establishes her as a pioneer in early science fiction and utopian literature.

Brataas's analysis underscores the "fluidity" and interconnectedness of various forms of knowledge and existence in Cavendish's broader literary and scientific vision (41). I will delve deeper to investigate how Cavendish achieves such "fluidity" between scientific discourse and literary imagination in *The Blazing World* through two primary narrative strategies. First, she creates fictional characters, such as various animal-men and the "Immaterial Spirits," to experiment with her natural

philosophical theories. Second, she uses dialogues among characters to present different scientific viewpoints, enriching the narrative with dynamic exchanges of ideas.

In *The Blazing World*, Cavendish invents a diverse array of animal-men,[14] reflecting her speculations on creatures in nature. This inventive taxonomy is not merely fantastical; it aligns with Cavendish's natural philosophical views in *Observations upon Experimental Philosophy*, where she suggests that quadrupeds could "easily and safely go upright like men," although they would be unable to "imitate the actions of man" fully (31-32). Cavendish brings her theoretical musings to life with remarkable consistency in *The Blazing World*. When the unnamed heroine first encounters the Bear-men and Fox-men in this alternative Blazing World, she describes them as "strange Creatures" "walking in an upright shape" like men (*Blazing World*, Part I, 4-5). In contrast to the limitations outlined in *Observations*, Cavendish's narrative in *The Blazing World* not only allows these four-legged animals to walk upright but also to engage in distinctly human behaviors. They communicate in languages, partake in eating, worshipping, and showing the heroine "all civility and kindness imaginable" (*Blazing World*, Part I, 5), thus blurring the lines between human and animal, scientific fact and imaginary fiction.

Cavendish extends this anthropomorphic transformation beyond quadrupeds to include avian, aquatic, and vermiform creatures in this fantastic blazing world. These beings, while engaging in human-like activities, also retain their species-specific abilities such as swimming or flying. For instance, the Bird-men are depicted with features reminiscent of wild geese, including "heads, beaks, and feathers," yet they adopt an upright posture (*Blazing World*, Part I, 5). This concept parallels her *Observations*, where she posits that "Flying is but swimming in the Air" (31) and theorizes that certain animals, if they possessed limbs with a similar form and function, might "perhaps flie as Birds do, nay, without the help of Feathers" (31). In *The Blazing World*, Bird-men embody Cavendish's speculative fusion of human and avian traits by transporting the Empress "upon their backs into the Air" (*Blazing World*, Part II, 21), illustrating Cavendish's innovative integration of scientific theories with imaginative

[14] These include Bear-men, Fox-men, Bird-men, Fish-men, Worm-men, Ape-men, Spider-men, Lice-men, Magpie-men, Parrot-men, Jackdaw-men, among others.

narrative.

Cavendish also introduces "Immaterial Spirits" to further her scientific exploration. These spirits, described as "cloath'd in some sort or other of Material Garments . . . of Air" (*Blazing World*, Part I, 64), engage in dialogues with the Empress, revealing their nature and capabilities.[15] This portrayal aligns with Cavendish's unique version of vitalistic materialism, as outlined in her scientific treatise *Observations*. Susan James labels Cavendish "an extremely unusual vitalist" among seventeenth-century English thinkers, envisioning nature as composed of self-moving, thinking matter, and advocating for a material world endowed with life and knowledge ("The Philosophical Innovations of Margaret Cavendish" 219, 226). Emma Wilkins supports this view, highlighting Cavendish's criticism of incorporeal substances and the deficiencies of both mechanical philosophy and traditional vitalism. By engaging closely with contemporaries like Thomas Hobbes, Johannes Baptista van Helmont, and Henry Power, Cavendish promotes a comprehensive materialistic explanation for all natural phenomena, including spirits (Wilkins "'Exploding' Immaterial Substances" 861).

In *Philosophical Letters* (1664), her scientific discourse in the epistolary form, Cavendish discusses her views on "Immaterial Spirits" across various sections, asserting that immaterial entities like spirits, angels, devils, and the human soul are supernatural and not part of the natural, material world (227). She contends that everything in nature must be material. When discussing "the Immortality of the Divine Soul," Cavendish muses that "if Nature had shewed [her] some of her secret and hidden effects, or if [she] had seen an Immaterial Spirit," it would be like a

[15] Cavendish describes that these spirits inhabit "living bodies" which are the source of motion, countering the preconceived notion that the spirits animate their corporeal vehicles or give them motion (*Blazing World*, Part I, 71). These vehicles vary in composition, ranging from "gross and dense" to "more pure, rare, and subtil," reflecting a spectrum of materiality (*Blazing World*, Part I, 71). These spirits are incapable of writing without utilizing human arms to transcribe their thoughts into words, underscoring their dependence on physical bodies for certain types of interaction within the natural world. Communication and sensory perception for these spirits are contingent upon having bodily organs, so without a physical body, they cannot "have bodily sense, but onely knowledg" (*Blazing World*, Part I, 70).

"Miracle" to her (*Philosophical Letters* 220). In the natural world, Cavendish may not meet with an immaterial spirit though she frequently discusses about them in her scientific treatises; nevertheless, by exercising her imagination, Cavendish can create those supernatural beings and conduct fictional conversations with them in her science fiction, making the "Miracle" happen. Her science fiction becomes a creative platform where she can conjure and interact with these supernatural beings. Exercising fancy or imagination is then indispensable to the "serious contemplations" of scientific studies and may even facilitate the rational mind to generate new ideas after the light-hearted diversion or distraction.

Besides the imaginary characters of the animal-men and the immaterial spirits, Cavendish also integrates scientific discourse into the imaginative narrative through dialogues between the Empress and the virtuosi of the societies. Sarah Hutton highlights the breadth and content of the Empress's dialogues which reflect Cavendish's engagement with "the intellectual revolution of the seventeenth century," invoking contemporary scientific and philosophical discussions ("Science and Satire" 166). These conversations are interspersed with insights derived from Cavendish's own natural philosophical work.

These conversations reflect Cavendish's engagement with contemporary scientific debates. For instance, discussions on the movements of celestial bodies and the limitations of telescopic observations mirror Cavendish's skepticism towards artificial instruments, as expressed in her scientific treatises. When the Empress instructs the Bear-men to observe the celestial bodies using their telescopes, their observations lead to a diversity of opinions. Some Bear-men deduce that the sun remains stationary while the earth orbits around it; others argue that both celestial bodies are in motion; while another group contends that the earth remains still and the sun revolves around it (*Blazing World*, part 1, 26).

Additionally, debates arise over the moon's physical features: some propose that the lunar world is like that on earth, with its spots representing "Hills and Vallies," whereas others argue that these spots are "the Terrestrial parts, and the smooth and gloossie parts, the Sea" (*Blazing World*, part 1, 26).[16]

In *Philosophical and Physical Opinions* (1655), Cavendish discusses the prevailing astronomical theories of her time, stating "I Will not dispute, according to *Copernicus,* that the earth goes about, & the Sun stands stil, upon which ground *Galleleo* saith, the reason of the ebbing and flowing of the sea, is the jogging of the earth, the old opinion is, that the moon is the cause of it, which I can hardly beleeve" (86). In this scientific treatise, Cavendish specifically references the opinions of notable figures such as Copernicus and Galileo. In *Observations*, Cavendish further elaborates on her views of celestial observations:

> For put the case, the Moon, or any other of the Planets, were inhabited by animal Creatures, which could see as much of this terrestrial Globe, as we see of the Moon, although they would perceive perhaps the progressive motion of the whole figure of this terrestrial Globe, in the same manner as we do perceive the motion of the Moon, yet they would never be able to discern the particular parts thereof, viz. Trees, Animals, Stones, Water, Earth, &c. much less their particular changes and alterations, generations and dissolutions. (147-48)[17]

Here Cavendish is using a premise of imagining how living creatures inhabiting the moon may perceive the situation on earth to illustrate her point that the celestial bodies of the universe including stars and planets, all undergo constant transformations similar to those on earth. However,

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[16] These descriptions/debates about the moon echo Kepler's interpretations of the spots on the Moon. It would be interesting to explore whether Cavendish obtains such ideas from reading Kepler's or other astronomers' works on this issue.

[17] Cavendish's observations align closely with Kepler's fundamental argument in his seminal work on lunar astronomy, *Somnium*. Kepler posits that "Levania [the Moon] seems to its inhabitants to remain just as motionless among the moving stars as does our earth to us humans" (*Somnium* 17). Through adopting a perspective based on the moon, Kepler aims to support the Copernican heliocentrism.

these changes remain imperceptible to human eyes because of the immense distance separating the earth from these celestial bodies.

In *The Blazing World*, the Empress engages the Bear-men in a discussion to uncover the "truth of the Phaenomena's of Celestial bodies" (*Blazing World*, Part I, 27). The Bear-men's disagreements over their telescopic observations lead to the Empress expressing her "displeasure concerning their Telescopes," stressing that the natural eye is superior for observing the movements of celestial bodies than through "Artificial Glasses" and consequently commands them to break their telescopes (*Blazing World*, Part I, 28). Through the interactions between the Empress and the Bear-men, Cavendish presents various perspectives on the motion of the sun, moon and earth, many of which are in conflict with one another as shown in the dispute among the Bear-men.

In *Observations*, Cavendish questions the practical value and accuracy of the telescope, pondering, "if it be true, that Telescopes make appear the spots in the Sun and Moon, or discover some new Stars, what benefit is that to us?" (no pagination). Within *The Blazing World*, the Empress serves as Cavendish's mouthpiece, voicing her skepticism towards telescopic observations and the discord they generate among observers. Through this narrative strategy, adopting dialogues among different fictional characters, Cavendish not only critiques the reliance on telescopes by experimental philosophers, but also advocates for the primacy of human reason and direct observation over artificial means of exploration.

In *The Blazing World*, Cavendish creates imaginative characters to explore her natural philosophical theories in scientific writings. Through dialogues and character portrayals, she intertwines a diverse array of scientific ideas with her narrative, effectively merging scientific discourse with literary imagination.

The Compositional History and Clear-Cut Framed Narratives of Kepler's *Somnium*

The creation and publication of Kepler's *Somnium* were marked by a complex and lengthy process that spanned more than four decades throughout his turbulent career (1571-1630).[18] Initially drafted as a lunar astronomy thesis by Kepler as a student at the University of Tübingen in 1593, the work was shelved after it was denied to be heard by the faculty of the institution.[19] Sixteen years later in 1609, he took it out again and added a dream framework surrounding the core lunar astronomy. The circulation of the manuscript at this stage sparked controversy, leading to the unfortunate legal prosecution of Kepler's mother for witchcraft (initiated in 1615, acquitted in 1621). This incident prompted Kepler to further expand the manuscript with extensive notes between 1621 and 1630;[20] the work was eventually published posthumously in 1634.

Kepler's *Somnium* is structured in layered frame narratives like nested Chinese boxes. At the outermost layer, the narrator "I" recounts falling asleep and dreaming about reading a book acquired at a fair, and then starts to depict the content of the book, which forms the second narrative layer. This layer is an autobiographical account from Duracotus, detailing his early life, his mother Fiolxhilde, his journey to Denmark and back, and his mother's secret arts of acquiring knowledge from the "Daemon from Levania [i.e. the Moon]" (15). The invocation of a daemon by Duracotus's mother unfolds the third narrative layer, with the daemon's speech based on Kepler's student dissertation on lunar astronomy, now mixed with science fiction elements such as lunar voyages and extraterrestrial life on the moon. In the middle of the daemon's speech, the first narrative "I"

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[18] My quotations of Kepler's *Somnium* come from Edward Rosen's translated volume, *Kepler's Somnium: The Dream or Posthumous Work on Lunar Astronomy of Johannes Kepler, Late Imperial Mathematician* (University of Wisconsin Press, 1967), hereafter referred to as *Somnium*.

[19] Professor Veit Müller, who took charge of students' disputations, strongly opposed the Copernican astronomy Kepler's dissertation entails, and therefore refused to allow Kepler to defend it (Rosen, "Appendix C" 207-8; Dick 70 and 203n27).

[20] In the midst of this period, in 1623, Kepler added the "Geographical, or If You Prefer, Selenographical Appendix" to *Somnium*, with notes for this appendix completed in 1628.

suddenly wakes up from his dream, abruptly ending the entire narrative. Appended to the main text of the story are 223 explanatory notes, where Kepler elucidates certain ludic points of his work and delves into extensive astronomical discussions. These notes amount to almost six times the length of the main narrative (18 pages of main text versus 118 pages of appended notes).

In his "Notes" appended to *Somnium*, Kepler presents a series of counterarguments and clarifications, employing a scholarly style reminiscent of scientific treatises, characterized by the use of technical language and structures typical of scientific discourse. For example, in the lengthy Note 154, Kepler addresses the issues of interpreting the dark spots on the moon based on optical theories concerning colors (*Somnium* 108-13). The language of this note is distinctly academic, aligning with that of a scientific treatise rather than a literary narrative. It meticulously cites sources, providing specific references to books and page numbers where the arguments are discussed.

In Kepler's *Somnium*, clear-cut boundaries exist between the scientific discourse and the science fiction narrative. First, the core lunar astronomy, presented as the speech by the "Daemon from Levania," can be taken out of the work to stand alone as an independent scientific treatise. Second, discussions of astronomical debates are placed in the extensive notes appended to the work, external to the science fictional narrative. When Kepler decided to frame his lunar astronomy within a dream vision in 1609, he did not choose to incorporate serious astronomical debates into the fictional narrative. While composing the notes between 1621 and 1630, Kepler chose not to incorporate the scientific discussions *within* the lunar astronomical dissertation or the overarching dream framework, instead presenting them separately *outside* the whole work in the form of appended endnotes. These narrative choices form a sharp contrast with Cavendish's method of blending scientific discourse into her imaginative narrative through creating fantastical characters and dialogues.

Monologic Discourse in Kepler's *Somnium* Versus Dialogic Discourse in Cavendish's *The Blazing World*

In this section, I will contrast the monologic discourse in Kepler's *Somnium* and the dialogic discourse in Cavendish's *The Blazing World* to illustrate their different effects in conflating scientific discussions and literary imagination. Elizabeth A. Spiller's analysis of Kepler's *Somnium* and

Cavendish's *The Blazing World* highlights both authors' exploration of the limitations inherent in scientific observation and reading. She argues that Kepler, through his imaginary lunar world, and Cavendish, in her critique of experimental philosophy, challenge the barriers to understanding scientific truths. Spiller also notes their use of frame narratives to create a distance between the reader and the utopian visions presented, serving "both a means of access to an imagined ideal and a barrier to ever realizing it" ("Sighing Utopia" 150).[21] However, structurally the two works are still written in very disparate forms: Kepler's *Somnium* presents disconnected, multi-layered narratives, whereas Cavendish's *The Blazing World* incorporates closely intertwined generic forms of romance, utopia, satire, allegory, science fiction, and scientific treatise, which moves closer to the form of the novel to be fully developed in the eighteenth century and beyond.

The daemon's speech, which contains Kepler's core lunar astronomy, is overwhelmingly monologic.[22] The reader hears only the daemon's observations and perspectives. The listeners in the narrative, Duracotus and his mother, become silent and virtually vanish from the story once the daemon begins to speak. This narrative choice emphasizes the daemon's speech as a focal point for conveying Kepler's astronomical insights, leaving no room for interaction or response within the fictional context.

Unlike Kepler's *Somnium* with clear-cut boundaries between the monologic lunar astronomy and the layered fictional narratives, in *The Blazing World* Cavendish intertwines diverse perspectives on natural philosophy *within* her fictional narrative through character portrayals and dialogues among characters. Scientific discussions are presented through the Empress's dialogues with the virtuosi of her founded societies that comprise inquiries and elaborate responses. Cavendish embeds her

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[21] Spiller revisits her argument in a later article (2000), examining how Cavendish, alongside Galileo, critiques the experimental philosophy reliant on visually distorting artificial technologies, thus hindering readers' engagement in the creation of new scientific knowledge ("Reading through Galileo's Telescope" 216, 211).

[22] When the daemon begins her speech, she immediately goes into the main topic without even addressing the human listeners: "Fifty thousand German miles up in the ether lies the island of Levania. The road to it from here or form it to the earth is seldom open. . ." (*Somnium* 15).

natural philosophical viewpoints primarily through the Empress and, to a lesser extent, through certain animal-men like Bird-men, Worm-men, and Fish-men. Conversely, viewpoints or methodologies that Cavendish critiques are often portrayed satirically in order to expose their absurdity and ineffectiveness, as seen with characters like Bear-men, Parrot-men, and Jackdaw-men.

A notable distinction between Cavendish's *The Blazing World* and Kepler's *Somnium* lies in their approach to incorporating different views within their works. Cavendish employs dialogues and conversations *within* her narrative, presenting the various opinions as anonymous, sometimes distorting them beyond recognition as typical of satire (Hutton "Science and Satire," 168). In contrast, Kepler presents different opinions in the authorial notes *outside* the fictional narrative of *Somnium*, which would demand scientific accuracy and evidence, including precise citations of authors, books, and page numbers.[23] Unlike Cavendish's approach of anonymous or casually cited opinions, Kepler indisputably attributed these differing opinions to identifiable scholars, including himself, indicated as "I" in the notes. Cavendish's method of anonymizing and distorting debates highlights the key features of the dialogic discourse, where different perspectives are voiced by various fictional characters, rather than direct references to real-world individuals.

Both Kepler and Cavendish draw inspiration from Lucian's work—probably Lucian's *A True Story*, known for its satirical narratives of voyages to alternative worlds. In the prefatory letter preceding *Observations upon Experimental Philosophy*, Cavendish alludes to "*Lucian*'s, or the *Frenchmans* Art, with Bottles, Bladders, *&c.* or like the mans that would scrue

[23] For example, in Note 154 Kepler indicates that "In favor of the correct opinion, which holds that the spotted parts are like seas and lakes, whereas the bright parts are like a dry continent or islands, you have completely convincing arguments in Galileo's *Sidereal Messenger*, in my *Conversation* with him, page 16, in my *Copernican Astronomy*, Book VI, page 81, and in Note 147, above" (*Somnium* 112-13). Another notable example is Note 223, in which Kepler presents lengthy discussions of "a disputation presided over by Mästlin and published in the year 1600 under the title *The Phenomena of the Planets*" (*Somnium* 135-47).

himself up into the Moon,"[24] though she emphasizes that her work is "a World of [her] own Creating" (no pagination). Hutton notes the appeal of Lucian and Cyrano, emphasizing their role in satirizing "contemporary philosophical and scientific ideas" ("Science and Satire" 171), highlighting the capacity of "Lucianic dialogues" to convey "novel, heterodox, and even dangerous ideas" through entertaining narratives ("Science and Satire" 171).

While Kepler adopts the concept of a Lucianic moon voyage, he diverges from the use of Lucianic dialogues, opting instead for a dream vision framework, possibly as a precaution against hostile attack at his Copernican stance. In contrast, Cavendish embraces both the Lucianic voyage to an alternative world by boat and the use of Lucianic dialogues when presenting different views on scientific debates.

In particular, Hutton points out "a Lucianic feature" called "the elusiveness of the authorial voice," whereby Lucian "constructs one or more persona for the author that makes it difficult to attribute to him the views expressed in the narrative" ("Science and Satire" 173). Cavendish disperses her personal perspectives not only through the Empress and the Duchess, but also among some of the virtuosi in *The Blazing World* ("Science and Satire" 173). Consequently, readers may find it challenging to discern which opinions within the fictional narrative accurately reflect Cavendish's own beliefs. In a different way, in Kepler's notes appended to *Somnium*, the delineation of views, particularly on lunar astronomy, is clear and straightforward, allowing readers to easily distinguish between Kepler's insights and those of other cited scholars. Despite Kepler's employment of a dream narrative, the monologic delivery of the daemon's speech further makes it easier to identify the author's viewpoint as clearly represented by the daemon. This contrast underscores a fundamental distinction between the monologic and dialogic discourses: monologic discourse, often through a single narrator, more readily lends itself to being

[24] For these allusions Eileen O'Neill identify Savinien de Cyrano de Bergerac's *Histoire comique contenant les etats et empires de la lune* [Comic Story Containing the States and Empires of the Moon] (Paris, 1657) and John Wilkins's *The Discovery of a New World; or, A Discourse Tending to Prove, That (It Is Probable) There May Be Another Habitable World in the Moon* . . . (London, 1638). See also Sarah Hutton (2003), p. 171.

associated with the author's perspective, whereas dialogic discourse, with its multiple narrators, creates a complex interplay of voices that obscures the author's stance.

The dialogic structure in a narrative discussing scientific ideas enhances the integration of scientific discourse into imaginative literary work by creating a dynamic interplay between characters and ideas. This approach allows for multiple perspectives and voices to engage in conversation, mirroring the natural process of scientific inquiry and debate within a fictional context. Through dialogue, Cavendish interweaves factual scientific information with imaginative scenarios, blending reality and fiction in a cohesive manner. Dialogues can also propel the narrative forward by creating tension, conflict, and resolution around scientific ideas. This narrative momentum ensures that scientific discourse is not an isolated element but integrated into the story's progression. By employing a dialogic structure, Cavendish creates a vibrant, interactive narrative environment where scientific and imaginative elements are intricately connected.

Kepler's *Somnium* notably lacks such an element of dynamic interplay in its main fictional narrative. The scientific discussions pertaining to lunar astronomy are encapsulated within the predominantly monologic speech delivered by the daemon from the moon, which Fernand Hallyn characterizes as a "didactic speech" (262). In this speech, dialogue between characters is absent; Duracotus and his mother are merely silent listeners, offering no interjections or responses. Instead, Kepler opts to add a semblance of "dialogue" through the appended notes, modeled on those found in the scientific treatises to present different perspectives on the issue at hand. In such a monologic structure, different perspectives on certain scientific issues in scientific discourse are presented in separate, listed notes, appearing disjointed and isolated from the overall narrative progression.

In monologic discourse, the narrative primarily conveys the narrator's perspective, relegating alternative viewpoints to being indirectly voiced through the narrator, sometimes even incorporating direct quotations from the opponents. However, this format does not facilitate the opponents' direct rebuttals or spontaneous exchanges within the same textual space, often resulting in a one-sided conversation, as illustrated in Kepler's *Somnium*. In contrast, dialogic discourse presents a diversity of

perspectives, allowing characters to express different views through direct interactions, as seen in Cavendish's *The Blazing World*. This setup enables readers to witness the characters' immediate reactions to each other's statements within the same dialogue, leaving them to judge or evaluate the validity of the competing arguments. In such dialogic narratives, authors may employ various literary modes, including satire, irony, lampoon, and rhetoric, to influence readers' evaluation of these varied perspectives. This engagement with dialogism renders the narrative more dynamic and effective in presenting competing viewpoints.

Conclusion

Margareth Hagen, Randi Koppen, and Margery Vibe Skagen observe that classic dichotomies—such as "subjective versus objective," or values versus facts—no longer suffice to delineate science from literature. They note "Intuition and imagination, the use of metaphors and rhetoric, are the prerogative of the creative scientist as much as the poet" (12). They further argue that as reason is segmented into different disciplines, and specialization intensifies across all areas of knowledge, any interaction between literature and science beyond "separation" often involves "popularisation" (24).[25] Scientists might therefore opt to adopt literary forms such as science fiction and utopia to popularize their scientific discoveries. For instance, in her preface to the 1668 edition of *The Blazing World*, Cavendish targets "all Noble and Worthy Ladies" who "take no delight in Philosophical Arguments" and typically eschew the hard, serious works on natural philosophical debates. This suggests her intent to popularize scientific concepts among female readers outside the scientific community. Cavendish's approach exemplifies how literature can be at the service of science, facilitating the dissemination of new scientific discoveries through literary forms such as science fiction, utopia, allegory, metaphor, and romance.

By applying my Venn diagram model to illustrate the overlap between science and literature in Kepler's *Somnium* and Cavendish's *The Blazing World*, we obtain Figure 1d and Figure 1e. In these figures, the gray area represents each of the works:

[25] The literary historian Erica Harth similarly describes Cyrano de Bergeerac's *Autre Monde* as a work of "scientific popularization" (Campbell 12, n21).

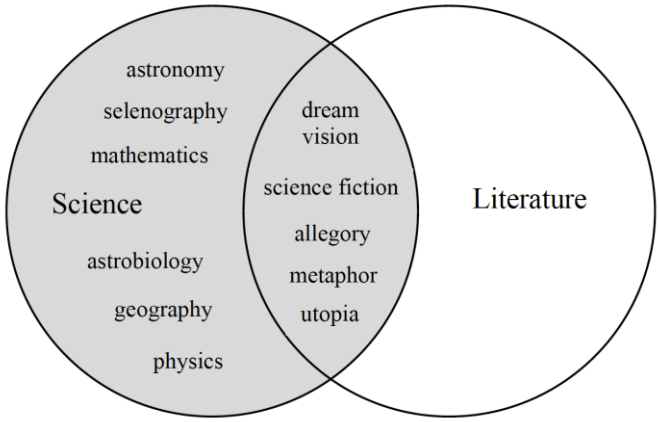

Figure 1d: *Somnium*'s overlapping between science and literature

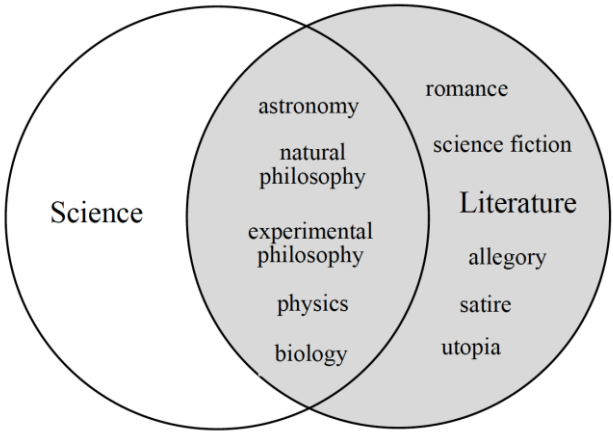

Figure 1e: *The Blazing World*'s overlapping between science and literature

The two Venn diagrams provide a visual representation of the integration of scientific and literary elements in Kepler's *Somnium* and Cavendish's

The Blazing World, emphasizing the predominant focus of each work. While both texts blend scientific and literary elements, *Somnium* is primarily scientific, whereas *The Blazing World* is predominantly literary.

In my analysis, Kepler, as an astronomer, predominantly positions *Somnium* as a scientific endeavor rather than a literary one. In the diagram for *Somnium (Figure 1d)*, the left circle lists scientific disciplines such as astronomy, selenography (the study of the moon), mathematics, astrobiology, geography, and physics. These fields reflect the scientific foundation of Kepler's work, emphasizing its basis in empirical and observational sciences. The smaller, overlapping area includes dream vision, science fiction, allegory, metaphor, and utopia. This overlap demonstrates how Kepler combines his scientific knowledge with literary techniques to create a work that serves as a scientific hypothesis. The use of dream vision, for instance, allows Kepler to explore complex scientific ideas within a narrative framework, making them more accessible and engaging. By integrating these literary elements, Kepler contextualizes his scientific hypotheses, but the core of the work remains deeply rooted in scientific exploration and empirical inquiry.

In contrast, Cavendish, with her background in natural philosophy, composes *The Blazing World* primarily as a literary work, embedded with various generic forms including science fiction, utopia, allegory, satire, and romance. The diagram for *The Blazing World* (Figure 1e) shows a different balance, emphasizing its literary elements. The right circle encompasses a rich array of literary genres such as romance, science fiction, allegory, satire, and utopia. The smaller, overlapping area lists astronomy, natural philosophy, and experimental philosophy, reflecting Cavendish's engagement with contemporary scientific debates and her interest in the natural world. Despite its fantastical, science fiction façade rooted in imagination, Cavendish intricately incorporates her natural philosophical theories, including critiques of experimental philosophy, into her literary narrative. These two cases demonstrate how a writer's professional background and personal inclinations influence their approach to blending literature and science, shaping the balance between the two in their works.

This model of Venn diagram serves as a flexible tool for evaluating and visualizing the proportions of scientific and literary elements within a work. It is particularly helpful for analyzing science fictional works like *Somnium* and *The Blazing World*, illustrating how the authors bring the

two worlds of science and literature together in their works in unique ways. The overlap in Kepler's work focuses on how he uses literary techniques to present scientific ideas, reflecting his background as an astronomer engaged with empirical observations of the heavenly bodies. On the other hand, *The Blazing World* shows how Cavendish employs a broader range of literary genres to explore and communicate scientific ideas, which allows her to explore scientific ideas in a more multifaceted and critical manner.

This comparative analysis underscores the complexity and richness of early modern (proto-)science fiction. Using this Venn diagram model to analyze these works provides a clear and concise way to visualize the interdisciplinary nature of these texts, revealing the intricate ways in which early modern writers blended these elements to navigate and contribute to the intellectual currents of their time. This approach not only enhances our understanding of individual texts but also provides a richer perspective on the dynamic interplay between science and literature in early modern cultural and intellectual history.

Traditionally, science is seen as a domain of facts, while literature is viewed as a realm of values (Hagen et. al., "Introduction" 12). However, this dualistic, dichotomous perspective becomes untenable in the case of Kepler's *Somnium* and Cavendish's *The Blazing World*. Kepler wraps his lunar astronomical disputation with a dream vision of interplanetary voyage and extraterrestrial inhabitants, turning it into a science fictional work. Cavendish presents scientific facts with literary devices, notably through adopting the dialogic discourse to integrate scientific discussions into her science fiction narrative. These two cases confirm the views by Gould, Jones, and Hankins on the relationship between science and literature, illustrating how early modern works obscure the distinction between science and literature.

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