

Knowing the Unknown: Metaphor and Science in Aristotle, Kant and Hanson

Gonzalo Martin

Universidad de Valladolid

Martin Heredero

Universidad de Valladolid

Alfredo Marcos

amarcos@uva.es

Universidad de Valladolid

Research Article

Keywords: Metaphor, Philosophy of Science, Scientific Observation, Theory-Ladenness, Scientific Discovery

Posted Date: August 31st, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10613336/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.
[Read Full License](#)

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at Global Philosophy on October 8th, 2026.
See the published version at <https://doi.org/10.1007/s10516-026-09800-w>.

Abstract

The relationship between metaphor and science is commonly understood as one of opposition: whereas scientific knowledge aspires to literal precision, metaphor is often regarded as a merely rhetorical or pedagogical device. This paper challenges that assumption by arguing that metaphor performs a constitutive epistemic function whenever scientific inquiry confronts phenomena that exceed the available conceptual framework. Rather than serving only to communicate established knowledge, metaphor enables the exploration of the unknown by providing new ways of organizing experience and guiding observation. To defend this thesis, the paper develops a systematic—rather than historical—dialogue between Kant, Norwood Russell Hanson, and Aristotle. Kant's account of symbolic hypotyposis shows how metaphorical thinking becomes necessary when mechanistic explanation reaches its limits. Hanson's theory-ladenness of observation explains how such metaphorical frameworks reorganize perception itself, making possible new modes of seeing. Finally, Aristotle's theory of metaphor reveals the cognitive mechanism underlying both accounts by conceiving metaphor as the recognition of objective similarities capable of extending knowledge. Despite their different philosophical commitments, all three thinkers converge on the idea that metaphor is not external to scientific rationality but one of the conditions that make scientific discovery possible.

1. Introduction

The relationship between science and metaphor is often framed in terms of an apparently irreconcilable opposition. Whereas science is commonly understood to aspire to a precise, univocal, and literal language, metaphor is relegated to the domains of literature, rhetoric, or, at best, popular science communication. On this view, science neither speaks in metaphors nor has any need of them, since its aim is the formulation of rigorous and unambiguous concepts rather than evocative images. Yet both the history of philosophy and an examination of scientific practice reveal a far more complex picture. Whenever knowledge encounters phenomena that remain insufficiently understood, thought repeatedly turns to images, analogies, and metaphors that make it possible to guide inquiry before fully developed concepts are available. In large part, a deep change in the valuation of metaphor in science was due to the seminal works of authors such as Mary Hesse (1965) -influenced by the original contributions of Norman R. Campbell- and Rom Harré (Martin Soskice and Harré, 1995).

Along these lines, the present paper argues that metaphor is not an ornamental, secondary, or dispensable feature of scientific discourse, but rather an indispensable epistemic instrument for the exploration of the unknown. Its function is therefore not limited to the communication of already established knowledge. Instead, it makes the discovery of what is still unknown possible by providing new hermeneutical frameworks through which experience can be organized and understood.

To defend this thesis, the paper examines three particularly significant philosophical moments. First, it analyzes Kant's conception of symbolic hypotyposis and the role that metaphorical thought plays in the investigation of phenomena—such as living organisms—that resist mechanistic explanation. Second, it

turns to Norwood Russell Hanson's notion of the theory-ladenness of observation, showing that all scientific perception depends upon prior conceptual frameworks and that metaphor can become the means by which experience is reorganized, making visible what had previously remained hidden. Finally, it examines Aristotle's theory of metaphor, understood not merely as a rhetorical device but as a cognitive procedure capable of extending knowledge through the discovery of relevant similarities.

Although Kant, Hanson, and Aristotle begin from profoundly different philosophical assumptions, the analysis will reveal a significant point of convergence: in all three cases, it is the very reality of scientific practice that demands recourse to metaphor whenever literal knowledge reaches its limits. Furthermore, given the objectives of this article, it is highly useful to focus the discussion on three figures so diverse in era and approach, yet all so influential, and at the same time so convergent in their assessment of the role of metaphor in science. The overall view we gain strongly supports the idea of the epistemic value of metaphor.

The sequence adopted here—from Kant to Hanson to Aristotle—is systematic rather than historical. The discussion begins with Kant because he formulates the problem of thinking what exceeds our concepts, proceeds to Hanson because he relocates that question within scientific observation, and concludes with Aristotle because his theory of metaphor provides the conceptual framework that illuminates the epistemic structure underlying both accounts.

2. Kant and Metaphor in Scientific Practice

Much of Kant's rhetorical power derives from his ability to evoke images that are at once simple and deeply provocative. Beyond the cathedral-like architecture of the *Critiques*, there lies at the very heart of his philosophy a symbolic force that animates—indeed, in the etymological sense of the word, gives life to—his thought. It is no coincidence that the philosopher of Königsberg repeatedly appeals to the evocative power of images in order to articulate the central insights of critical philosophy: from the threat to the legitimacy of the reign of metaphysics in the Preface to the first edition of the *Kritik der reinen Vernunft* (AA, KrV: A IX–X), to his legal metaphors, which David Taber has regarded as the most important in his philosophy (1968). Indeed, the very essence of the *KrV* is itself presented at the close of the “Transcendental Analytic” through yet another powerful metaphor: that of the territory of truth conceived as an island enclosed within immutable boundaries.

We have now surveyed the territory of the pure understanding. We have not only traversed it and carefully examined each of its parts, but have also measured it and assigned to everything within it its proper place. This territory, however, is an island enclosed by nature itself within unalterable boundaries. It is the land of truth (a seductive name), surrounded by a vast and stormy ocean, the true seat of illusion, where many a fog bank and many an iceberg, soon to melt away, appear to be new lands, and by constantly deceiving the navigator eager for discovery with empty hopes, entangle him in adventures from which he can never desist, yet which he can never bring to completion. (*KrV*, A 235-6; B 295-6)

Kant's use of metaphor is by no means incidental. In § 59 of the *Kritik der Urteilskraft*, he makes a significant contribution to our understanding of the role of metaphor within his philosophical system. Whenever a concept that can only be thought by reason requires sensible presentation, what comes into play is a hypotyposis—a process of sensible exhibition (*Versinnlichung*)—which may be either schematic, when the intuition corresponding to the concept is given *a priori*, or symbolic, when the concept is one that reason alone can think and to which no sensible intuition can correspond (AA V, KU 351). Kant illustrates symbolic representation with two examples: the monarchical state represented as an animated body (*beseelter Körper*), governed by the internal laws of the people, and the absolutist state represented as a machine or a hand mill (AA V, KU 352). As Hans Blumenberg observes, this conception “corresponds quite closely to the use of metaphor still employed today, as is clearly evident from Kant's own paradigms” (1996, p. 289). In other words, when reason is confronted with a concept for which no sensible intuition is available, thought does not come to a halt. Rather, it generates images, metaphors, and symbols in order to continue inquiry.

This is why, as Kant himself argues, although there is no resemblance between the terms involved in symbolic hypotyposis—as in the case of the hand mill and the despotic state—there nevertheless exists an analogy “in the rule of reflecting on both and on their causality” (AA V, KU 352). This claim is fundamental for understanding that Kant's account of metaphor—or, more precisely, of symbolic representation—is not confined to the context in which it is introduced, namely the discussion of beauty as the symbol of morality. Rather, it becomes one of the cornerstones of the second part of the *Kritik der Urteilskraft*, namely the “Antinomy of Teleological Judgment”. Ultimately, in this latter part of the *KU*, Kant critically revisits concerns that had already occupied him during his pre-critical period: the limits of mechanistic explanation and the possibility of investigating nature.

Indeed, Kant had repeatedly identified the philosophical and scientific problem arising from the fact that our understanding—which can operate only through mechanistic causal explanation, that is, by conceiving the motion of matter as something always externally determined (AA IV, pp. 543 ff.)—is incapable of accounting for certain phenomena of nature, namely organisms or the products of organic nature. Thus, already in the *Allgemeine Naturgeschichte und Theorie des Himmels* (1755), Kant acknowledged the limitations of the understanding in grasping the true inner nature and complexity of living beings (AA I, p. 230). Along similar lines, in *Der einzig mögliche Beweisgrund zu einer Demonstration des Daseyns Gottes* (1763), he argues that it would be incoherent to explain the origin of a plant or an animal solely in terms of mechanical laws (AA II, p. 114). It is, however, in *Träume eines Geistersehers, erläutert durch Träume der Metaphysik* that the philosopher of Königsberg appears to anticipate essential themes of the *Kritik der Urteilskraft*, maintaining that the principle of life—spiritual nature—cannot be known, but only presupposed (AA II, pp. 351–352). This ultimately leads Kant to his celebrated claim that it would be futile to expect that some future Newton could ever explain even a single blade of grass (AA V, KU 400).

The limits of explanation through mechanistic causality thus leave a residue at the heart of scientific practice: how are we to approach those natural phenomena whose very existence seems to require a

mode of explanation other than mechanical causality—that is, other than the descending analysis of causes and effects through which the understanding ordinarily operates (KrV, A211/B256). Such descending causality appears ill-suited to organisms, to organized and self-organizing beings (AA V, KU 374), that is, to beings whose organization arises from themselves rather than from something external. Instead, the internal structure of organisms seems to exhibit a relation in which the parts exist for the sake of the whole while simultaneously producing one another (AA V, KU 373). It is for this reason that Kant maintains that, strictly speaking, “there is no analogy with any of the causalities known to us” (AA V, KU 375).

Nevertheless, despite the absence of any analogy with the forms of causality familiar to us, Kant returns at this point to the metaphors he had previously employed in his discussion of symbolic hypotyposis, namely those associated with the two possible forms of the state: the organism and the machine. The significance of the contrast Kant develops between organism and mechanism lies not so much in what distinguishes them as in what they share. As Hannah Ginsborg has argued (2006, pp. 462 ff.), artifacts, no less than organisms, also appear to resist a purely mechanistic explanation, since their production seems to presuppose an efficient and final cause irreducible to the forces of attraction and repulsion—the artisan in the case of watches, and a divine understanding in the case of organisms.

Through this symbolic device, Kant is able to show that, since the human faculty of understanding is “not merely very limited, but also clearly de-limited” (AA V, KU 417), we may employ regulative rather than constitutive principles and maintain that certain products of nature cannot be judged solely according to mechanical laws. Instead, judgment requires an altogether different principle of causality: that of final causation (AA V, KU 386–387). This, however, implies that, given the limited character of the understanding, we may think of organisms as *if* they were the products of a divine understanding, and thus as *if* they possessed an efficient and final cause irreducible to mechanistic explanation. Ultimately, in his treatment of organisms and mechanisms, Kant is drawing upon the philosophical resources of metaphor, or symbolic hypotyposis. Although there is no resemblance between them—for, in the case of organisms, “there is no analogy with any of the causalities known to us”—there is nevertheless an analogy “in the rules according to which we reflect upon both and their causality” (AA V, KU 352).

The reality of scientific practice thus leads Kant not only to argue that we may think natural products—and indeed nature as a whole—through a regulative principle that operates with the same necessity as if it were an objective principle (AA V, KU 404), but also to maintain that metaphorical thinking is both possible and advisable whenever the scientist encounters a form of causality that exceeds the capacities of the understanding. By conceiving natural products as *if* they were the products of a divine understanding, Kant is able to reflect upon their governing principles and upon a mode of causality that, while not identical to that of mechanisms, nevertheless shares essential features with it, such as efficient and final causation. In this sense, metaphor—or symbolic hypotyposis—becomes one of the cornerstones of scientific practice. Whenever inquiry reaches the limits of the understanding, it is metaphor that allows, to return to the image of the *Critique of Pure Reason*, the navigator eager for discovery to embark upon a second voyage, navigating safely across the vast and stormy ocean of

reality, without thereby falling into the naïveté of the dove that believed it could dispense with the air in order to fly higher, to use another famous metaphor of Kant (KrV, B9).

3. Theory-Ladenness of Observation and Metaphor

The foregoing discussion shows that metaphorical thought does not arise from arbitrary imagination, but rather responds to the challenge posed by phenomena that exceed the conceptual frameworks available for inquiry. If Kantian symbolization enables us to think that for which no immediate intuition is available, then the issue ceases to be exclusively transcendental. It can also be formulated from the standpoint of scientific practice: how do scientists come to see that for which they do not yet possess concepts? Plotinus offers a suggestive point of departure for addressing this question: “No eye would ever have seen the sun had it not become sun-like” (*Enn.* I.6.9.32–36). How can the scientist render the understanding akin to an object that remains unknown and yet is sought as an object of knowledge? As we have already suggested, metaphor is what makes the unknown intelligible by relating it to what is already known. From this perspective, scientific practice finds in metaphor an irreducible epistemic function, for it enables us to confront the fundamental challenge of coming to know the unknown.

The question thus ceases to concern only how we think that which exceeds our concepts; it also becomes a question of how we come to see it. It is precisely this shift from symbolization to observation that leads to the problem of the theory-ladenness of scientific experience. The inadequacy of mechanistic explanation examined in the previous section provides a valuable example for understanding how the observation of a particular domain of nature—such as living organisms—requires a new way of seeing. This compels us to examine two issues. First, we must clarify what it means to see that something is a certain kind of thing; that is, we shall analyse the concept of experience underlying scientific observation. Second, we shall argue that the notion of observation developed Norwood Russell Hanson’s work enables us to understand scientific practice as being interwoven with metaphorical frameworks that make observation itself possible.

The mere fact that two observers stand before the same organism does not mean that they actually see the same thing. If observer A approaches the nature of lilies from a mechanistic perspective, whereas observer B regards them as *if* they possessed both an efficient and a final cause, it is evident that their descriptions of the mode of being of the lily will not be identical. The flower before them is the same, yet A and B are not making the same observation. Were observer A to transform his way of thinking about lilies in light of B’s account, he might eventually find himself saying something like: “It has not changed; and yet I see it differently” (Wittgenstein, 1971, p. 307).

This example implicitly raises the following question: do two observers see the same thing when confronted with the same reality? If we were to adopt something like a neopositivist criterion for the evaluation of scientific observations, the question would have to be reformulated. We would then ask instead: is what is immediately given in experience identical for both observers? Such a formulation faithfully reflects the position expressed by the members of the Vienna Circle in their manifesto (Carnap

et al., 1929). The answer to this reformulated question appears to be an unequivocal yes. Observers A and B seem to receive the same immediate experiential data when looking at a lily. Yet it is equally evident that they are not seeing the same thing if one conceives of the organism mechanistically while the other approaches it teleologically. This suggests that knowledge cannot be understood solely in terms of the immediate data of experience.

We must begin by asking whether there is, in fact, such a thing as raw empirical information, unmediated by any prior theoretical framework. Hanson's answer is unequivocally negative, and it is this position that will guide the discussion that follows. Hanson takes the practice of scientific inquiry as his point of departure. When a scientist observes, what takes place is an experience, one that far exceeds the mere registration of sense data. As Hanson puts it, "seeing is an experience. A retinal reaction is only a physical state—a photochemical excitation" (1958, p. 6). The implications of this claim are of central importance for the present argument. First, it suggests that no one-to-one correspondence can be established between the physical states of the sensory organs and perceptual experience. Nor does such a correspondence obtain between the observer's sensory stimulus and the experience itself.

We may return once again to the example introduced above. When we think teleologically, we do not first perceive a series of physical sensations corresponding to the lily and only subsequently attribute to it an efficient and final causality appropriate to living organisms. If this were the case, observing a lily would involve two distinct cognitive processes. Admittedly, in the previous example we described observer B as regarding the lily as *if* it possessed such a teleological causality. This formulation might suggest that the adoption of this regulative principle occurs only after the perception of the lily has already taken place, as though a theoretical assumption were subsequently added to an otherwise complete perceptual experience. Although these two moments can be distinguished for the purposes of analysis, the practice of observation tells a different story: when we observe, we perform a single cognitive act. There is no clearly distinguishable physical component followed by a separate interpretive one. Accordingly, observers A and B do not merely interpret the same object from different theoretical standpoints; rather, they see different things. As Hanson puts it: "Theories and interpretations are 'there' in the seeing from the outset" (1958, p. 87).

In the example under consideration, the visual field does not exhaust what the understanding apprehends when we undergo a perceptual experience. The difference in experience therefore lies in different ways of organizing and understanding what we see; what changes is, in Hanson's words, "the organization of what one sees" (1958, p. 12). When, following Kant, we suggested that organisms may be thought as *if* they were the products of a divine understanding, we introduced a formulation that can now be contrasted with Hanson's account. Hanson distinguishes between "seeing... as..." and "seeing that" (1958, pp. 19–24). This distinction is not intended as a psychological analysis, as though vision consisted of separable components, but rather as a theoretical description of perceptual experience. *Seeing... as...* consists in perceiving an object as belonging to a particular classificatory framework. For Hanson, analyzing the logic of *seeing... as...* helps to clarify the very concept of seeing. Yet important

aspects of perceptual experience remain beyond the scope of this form of vision. For instance, seeing a motorcycle cannot be reduced to seeing a collection of metal and other materials as a motorcycle.

It is in *seeing that* that the theoretical commitments shaping experience become most clearly manifest. To see an object is to see *that* it behaves as objects of that kind are expected to behave. If the object were to behave differently from what we anticipated, our perception of it would likewise change. It is precisely here that the cognitive power of metaphor becomes most apparent. By providing a new framework for organizing experience, metaphor makes possible a new mode of *seeing that*.

This allows us to radicalize Kant's claim. The point is not merely that organisms—or nature as a whole—may be thought as *if* they exceeded mechanistic explanation. Rather, it is a matter of *seeing that* the organism is not a mechanism because it does not behave as a mechanism would be expected to behave. If the life of organisms could be explained mechanistically, there would be no need for the symbolic hypotyposis that enables us to see *that* they are not mechanisms. This new way of seeing, made possible by the metaphor that allows us to understand differently what we perceive, is accompanied by what Hanson calls the “finding of new entities” (1958, p. 18). This is because there is no neutral observational basis from which entities are simply given. Every act of observation involves a mode of organization inseparable from the observer's knowledge and beliefs. This is precisely what Hanson means when he argues that perception is “theory-laden” (1958, p. 19).

This thesis implies that scientific practice is far removed from the mere discovery and cataloguing of new facts awaiting subsequent interpretation. The point is not that there must exist facts that are simply unknown to us. Rather, it is that the very facts we already know may be conceived differently, thought in new ways, and, ultimately, perceived in previously unimaginable ways. If observation is inseparable from its theoretical commitments, then it is precisely through new modes of *seeing that* that previously unnoticed aspects of reality come to be discovered. Scientific observation, understood in this way, is aptly captured by the words with which Hanson concludes the opening chapter of *Patterns of Discovery*: “The paradigm observer is not the man who sees and reports what all normal observers see and report, but the man who sees in familiar objects what no one else has seen before” (Hanson, 1958, p. 30).

One essential problem inherent in Hanson's account still remains to be addressed: how can we discover new ways of seeing when an object exceeds all our existing modes of *seeing that* it is this or that kind of thing? Put differently, what can we do when an observation leaves us at a loss for words? Here we encounter that which, precisely because it is unknown, belongs to the realm of the inexplicable. Faced with the question, “What is that?”, when the object fails to behave as our knowledge and beliefs lead us to expect, our only possible answer is: “I do not know.” What is therefore required is a radically new way of seeing. It is precisely here, we contend, that metaphor finds its fundamental epistemic role within the practice of science.

A historical example may help to clarify the issue (Marcos, 2014). Galileo Galilei's and Thomas Harriot's observations of the Moon through a telescope provide an illuminating case in which metaphor occupies the very center of the logic of discovery. Although both men placed their eyes before the telescope's lens

and directed them toward the same celestial body, they did not see the same thing. Galileo perceived the Moon's topography, whereas Harriot did not organize the elements of his experience as topographical relief. The well-known drawings produced by each observer clearly illustrate this difference.

Implicitly, Galileo's artistic training enabled him to interpret his observations through a conceptual framework borrowed from pictorial art. The patterns of light and shadow revealed by the telescope could thus be understood in terms of the techniques of drawing and chiaroscuro. Artistic knowledge made it possible to see *that* the shadows on the Moon behaved as one would expect of a body possessing physical relief. Harriot was able to perceive them in this way only after becoming acquainted with Galileo's drawings. A familiar object could thus be seen with new eyes through a framework of meaning—borrowed from the pictorial arts—that made it possible to bring what had previously been unknown within the horizon of intelligible knowledge.

Admittedly, one might argue that the example under discussion merely illustrates a case of structural analogy between the patterns of light and shadow that reveal topographical relief and the artistic technique of chiaroscuro. Yet analogy is itself one of the four kinds of metaphor distinguished by Aristotle (*Rh.* 1411a), and it may indeed constitute “the general mode of operation of metaphor” (Montuschi, 1993, p. 31). Galileo's observation is therefore articulated within a metaphorical framework derived from pictorial practice, one that makes analogical thought possible.

The theory-ladenness of observation reminds us that what observes is not an eye but a person, deploying the entirety of his or her knowledge. When a given phenomenon calls into question the very framework through which it has hitherto been understood, we are confronted with the need to discover new explanatory frameworks capable of conceptually grasping what has been observed. Metaphor—which here functions not merely as a linguistic device but also as an epistemic procedure—effectively enables us to imagine new ways of organizing what we observe within a framework of meaning in which what had previously remained hidden can become visible. What was once unknown—and therefore inexpressible—can be seen by means of metaphor and subsequently articulated in a scientific language that is itself necessarily metaphorical, for “discursive thought and speech have the same logic” (Hanson, 1958, p. 33).

4. Aristotle and the Epistemic Function of Metaphor

The preceding discussion has shown that, despite their profoundly different philosophical frameworks and without any direct dependence on one another, Kant and Hanson converge in assigning metaphor—or, more precisely, the perceptual reorganization that metaphor makes possible—an active role in extending our knowledge of the unknown. Kant appeals to symbolic hypotyposis in order to think that for which no sensible intuition is available, doing so, significantly, with reference to the very domain that will occupy the remainder of this section: living beings and their resistance to purely mechanistic explanation (AA V, KU, pp. 373–375). Hanson, for his part, argues that seeing is not a neutral act but one already permeated by theory, so that a new interpretative framework makes possible a new mode of *seeing that*

(Hanson, 1958, pp. 19–24). It is now worth turning to a much earlier precursor of this same insight—one that is, in certain respects, even more comprehensive: Aristotle's theory of metaphor. As Eduardo Bustos has observed, Aristotle was the first philosopher to recognize metaphor's importance “in the constitution and extension of knowledge” (Bustos, 1992, p. 21).

In the *Poetics*, Aristotle defines metaphor as the transfer of the name of one thing to another to which it does not conventionally belong (*Poet.* 1457a7), and distinguishes four kinds of such transfer: from genus to species, from species to genus, from one species to another, and by analogy (*Poet.* 1457b6–9). Of these four, proportional analogy—in which the second term stands to the first as the fourth stands to the third—is accorded the highest value (*Poet.* 1457b16; *Rh.* 1410b36), since it enables information from a familiar domain to be transferred in a controlled manner to one that is unfamiliar, without collapsing into a mere accumulation of accidental similarities.

This transfer is designated in Greek by the revealing technical term *epiphora*, which signifies not only a displacement but also, in its ordinary usage, an increase or augmentation. This ambiguity is no accident, but an integral part of Aristotle's theory itself. Every metaphorical transfer does more than relocate an already established meaning: it expands that meaning and makes it available for new applications. In much the same way, within the scientific practice examined by Kant, thinking metaphorically about an otherwise unintelligible domain is not a merely ornamental exercise but the only available means of carrying inquiry forward.

For Aristotle, then, metaphor is not a dispensable rhetorical ornament but an instrument of learning. In a well-known passage of the *Rhetoric*, he argues that learning with ease is pleasurable for everyone, and that metaphor, more than any other rhetorical device, best facilitates such learning. When old age is described as “stubble,” for instance, the hearer acquires knowledge through the mediation of the genus, since both realities have already lost their vitality (*Rh.* 1410b10–19). Such a transfer of meaning, however, is legitimate only when the metaphor is appropriate—that is, when it is grounded in a genuine rather than an arbitrary similarity.

To this cognitive dimension Aristotle adds, seamlessly, both an aesthetic and a perceptual one that may be read, *avant la lettre*, in a Hansonian key. He maintains that metaphor, more than any other resource, lends clarity to discourse (*Rh.* 1405a8), and that certain metaphorical expressions make reality “spring before the eyes,” presenting it as something vividly present rather than merely described (*Rh.* 1411a28; 1411b25–26). This formulation is far from incidental. For Aristotle, the understanding is compared to the eye of the soul (*Eth. Nic.* 1096b29), the soul never thinks without an image (*De an.* 431a14–17; *Parv. Nat.* 450a1), and among all the senses, sight is the one human beings prize most because it yields the greatest knowledge (*Metaph.* A1, 980a21). If, for Hanson, seeing is already a matter of *seeing that*—that is, organizing perception in accordance with theoretical expectations—then in Aristotle metaphor operates in a structurally analogous way: it does not add a further layer of meaning to an already complete perception, but reorganizes perception itself, bringing into view a configuration that would otherwise have remained invisible.

One problem nevertheless remains, and Eleonora Montuschi has identified it with particular acuity: a successful metaphor is at once unpredictable—no one could have anticipated it—and, once expressed, so self-evident that it almost acquires the status of a convention (1993, p. 26). Aristotle himself provides the elements needed to resolve this apparent paradox. To perceive the similarity between distant terms, as the ingenious thinker does, is the one capacity that cannot be learned from another and is therefore a mark of natural talent (*Rh.* 1412a12); indeed, to produce good metaphors consists precisely in perceiving similarities (*Poet.* 1459a5–8). Similarity, then, is not imposed upon a passive mind but requires an act of conjectural insight.

Theodor Scaltsas has argued that, for Aristotle, similarity does not simply reside simultaneously in two substances, but rather in what a knowing subject is able to abstract from them both (Scaltsas, 1994, pp. 197–198). Similarity thus possesses an objective yet merely potential basis, one that is actualized only through the intervention of the person who discerns and formulates it. In her interpretation of poetic metaphor, M. C. Haley has accordingly characterized this operation as an act of creative discovery (Haley, 1988), mediating between the traditional view—which emphasizes only the element of discovery, as though the mind were a passive mirror reflecting pre-existing similarities—and a purely interactionist account, which reduces metaphor to arbitrary invention. Neither the mechanical accumulation of what is already given nor unrestricted construction, metaphor is the discovery of real possibilities that become actual only through the activity of an intelligence capable of discerning them.

Mutatis mutandis, the same description applies both to Hanson's *seeing that*—which is neither pure discovery nor pure invention—and to Kant's symbolic hypotyposis, whose employment, as we have seen, is demanded by the very reality of scientific practice rather than by a merely theoretical preference. A passage from the *Parva Naturalia*, apparently unrelated to Aristotle's theory of metaphor, reinforces this interpretation from the standpoint of perception. The best interpreter of dreams, Aristotle writes, is the one most capable of recognizing similarities between the confused dream images—distorted by the movements of the sleeping body—and the figures, whether of a human being or a horse, that those images imperfectly resemble (*Parv. nat.* 464b5). Neither the interpretation of dreams nor that of metaphors is accomplished through an effortless intuition. Both require the same capacity to recognize, beneath the apparent disorder of the image, a configuration that points toward something already known.

One point of tension nevertheless remains and should not be overlooked. In the *Posterior Analytics*, Aristotle excludes metaphorical terms from scientific definitions, on the grounds that they introduce the ambiguity characteristic of dialectical discourse (*An. post.* 97b37–39). In our view, however, this passage should not be read as a general rejection of metaphor—which, as we have seen, pervades without hesitation the *Rhetoric*, the *Poetics*, and Aristotle's own biological writings—but rather as a demand for precision confined to the highly specific context of apodictic demonstration. Here, almost exactly, we encounter the same discrepancy that emerged in Kant between theoretical requirements and the reality of scientific practice. It is not the methodological ideal of the *Posterior Analytics*, but the actual practice

of biological investigation, that compels Aristotle to make constant use of metaphors, comparisons, and analogies precisely where demonstrative reasoning can no longer operate.

One may even suggest a path toward reconciliation that Aristotle's own practical philosophy appears to invite. Alongside theoretical truth, which concerns what exists independently of human action, Aristotle recognizes a practical truth, proper to the understanding directed toward action and measured by its accordance with right desire (*Eth. Nic.* 1139a26); a truth that is not possessed in advance but attained through the very exercise of activity (*Eth. Nic.* 1103a31). Read in this light, the demand for univocity in the *Posterior Analytics* may be understood not as a descriptive claim about Aristotelian epistemology, but as a regulative norm governing good scientific practice—a function not altogether unlike that performed in Kant by regulative principles, which, as we have seen, always remain subordinate to the demands of actual scientific inquiry (cf. Marcos, 1995, pp. 90–91).

Aristotle, Kant, and Hanson therefore begin from philosophical assumptions that are difficult to reconcile with one another. Yet they converge on what, at this stage of the argument, has emerged as a structural insight: in all three cases, it is the actual practice of inquiry—not a theoretical preference nor a merely stylistic ornament—that necessitates recourse to metaphor whenever literal knowledge reaches its limits. If Kant required the metaphor of the island and the navigator to describe the very limits of literal knowledge, and if it was only the reality of scientific practice that enabled him to recommend metaphorical thinking beyond those limits, it should come as no surprise that Aristotle had already recognized, more than two millennia earlier, that it is metaphor, rather than literal discourse, which first allows us to catch sight of the shores of the still unknown.

5. Conclusions

The foregoing analysis supports the claim that metaphor plays a constitutive role in scientific practice, one that is far removed from the traditional view that reduces it to a merely expressive device. In Kant, Hanson, and Aristotle alike, metaphorical thought emerges precisely where knowledge encounters phenomena that cannot be adequately understood through the conceptual frameworks already available. Metaphor does not replace scientific knowledge; rather, it enables its expansion by providing new ways of organizing experience and guiding inquiry.

In Kant, this function is manifested in symbolic hypotyposis, which makes it possible to think regulatively about that for which no adequate sensible intuition is available. Hanson, for his part, argues that scientific observation is never neutral, but always depends upon the theoretical frameworks through which experience is organized. Within this context, metaphor makes possible new modes of *seeing that* and, with them, the discovery of aspects of reality that had previously remained invisible. Finally, Aristotle understands metaphor as the creative recognition of objective similarities, emphasizing its capacity both to generate knowledge and to bring things before our eyes.

The convergence of these three thinkers is especially significant because it cannot be explained either by a shared philosophical tradition or by doctrinal dependence. On the contrary, their differences reveal that

it is the very dynamics of scientific inquiry that require recourse to metaphorical thought whenever literal explanation proves insufficient. Metaphor thus emerges as a rational procedure that enables the exploration of domains that remain unknown without thereby abandoning the standards proper to scientific knowledge.

From this perspective, the opposition between scientific language and metaphorical language loses much of its force. Metaphor does not mark the limit of rationality; rather, it constitutes one of the conditions that make its development possible. It is precisely where established concepts cease to be sufficient for understanding reality that metaphorical thought opens new avenues of inquiry and makes scientific discovery possible.

Declarations

Author Contribution

The general conception and idea of the article arose collaboratively among the three authors (G.M., M.H., and A.M.). A.M. contributed the background on the state of the art, as well as the ideas from the Aristotelian tradition. G.M. connected the group's research on metaphor in science with I. Kant's ideas on the subject, while M.H. undertook a similar task with regard to N. R. Hanson's thought. G.M. drafted the text jointly, and M.H. carried out subsequent revisions for its refinement and adjustment.

References

1. Aristotle (1974) *Poética* (V. García Yebra, Trans). Gredos, Madrid
2. Aristotle (1978) *Acerca del alma* (T. Calvo Martínez, Trans). Gredos, Madrid
3. Aristotle (1988) *Tratados de lógica* (Órganon) II [*Analíticos Posteriores* included] (M. Candel Sanmartín, Trans). Gredos, Madrid
4. Aristotle (1990) *Retórica* (Q. Racionero, Trans). Gredos, Madrid
5. Aristotle (1993) *Parva Naturalia* (J. A. Serrano, Trans). Alianza, Madrid
6. Aristotle (1994) *Metafísica* (T. Calvo Martínez, Trans). Gredos, Madrid
7. Aristotle (1995) *Ética a Nicómaco* (J. Pallí Bonet, Trans). Gredos, Madrid
8. Blumenberg H (1996) : Paradigmen zu einer Metaphorologie, in Carnap, R., Hahn, H., & Neurath, O. (1929): *Wissenschaftliche Weltauffassung. Der Wiener Kreis*. Arthur Wolf Verlag
9. Bustos E (1992) : La teoría aristotélica sobre la metáfora, in D. Sánchez y J. Domínguez, J. (eds.), *Historia de la relación filosofía-literatura en sus textos* (Suplementos de Anthropos, n.º 32). Anthropos, Barcelona
10. Ginsborg H (2006) Kant's Biological Teleology and its Philosophical Significance. In: Bird G (ed) *A Companion to Kant*. Wiley-Blackwell, Oxford, pp 455–469
11. Haley MC (1988) *The Semiosis of Poetic Metaphor*. Indiana University Press, Bloomington

12. Hanson NR (1958) *Patterns of Discovery. An Inquiry into the Conceptual Foundations of Science*. Cambridge University Press
13. Haverkamp A (ed) (1996) *Theorie der Metapher*. WBG, Darmstadt, pp 285–315
14. Hesse M (1965) *Models and Analogies in Science*. Nôtre Dame University, Nôtre Dame
15. Kant I (1900) : *Kants gesammelte Schriften*. Preußische Akademie der Wissenschaften (eds.), 29 vols., De Gruyter, Berlín
16. Plotinus (1982) : *Enéadas I-II* (J. Igal, Trans.). Gredos
17. Marcos A (1995) Biología, realismo y metáfora. *Ágora Papeles de Filosofía* 14(1):77–97
18. Marcos A (1996) Aristóteles y otros animales. Una lectura filosófica de la biología aristotélica. P.P.U., Barcelona
19. Marcos A (1997) The Tension between Aristotle's Theories and Uses of Metaphor. *Stud Hist Philos Sci* 28/1:123–139
20. Marcos A (2014) El pulso de la ciencia. In: Villar A, Ezcurra, Sánchez A, Orantos (eds) *Una ciencia humana. Libro homenaje a Camino Cañón Loyes*. UPCO, pp 169–182
21. Montuschi E (1993) *Le Metafore Scientifiche*. FrancoAngeli, Milán
22. Scaltsas T (1994) *Substances and Universals in Aristotle's Metaphysics*. Cornell University Press, Ithaca, NY
23. Martin Soskice J, Harré R (1995) : Metaphor in Science, in Z. Radman (ed.), *From a Metaphoric Point of View*. De Gruyter, Berlín, pp. 289–307
24. Tarbet D (1968) : The Fabric of Metaphor in Kant's Critic of Pure Reason, *Journal of the History of Philosophy*, 6, 1968, pp. 257–260

Footnotes

1. From this point forward, references to Kant's works will follow the Akademie-Ausgabe (AA) of the *Gesammelte Schriften*.
2. All translations from the original are ours, unless otherwise indicated in the references.
3. It is worth noting that the very conceptual apparatus through which Aristotle constructs definitions and demonstrations—genus, species, and analogy—itself belongs to the repertoire of resources examined here. What the methodological norm demands, therefore, is not the absence of such resources, but rather their stabilization as conventionalized concepts within that particular discursive context.