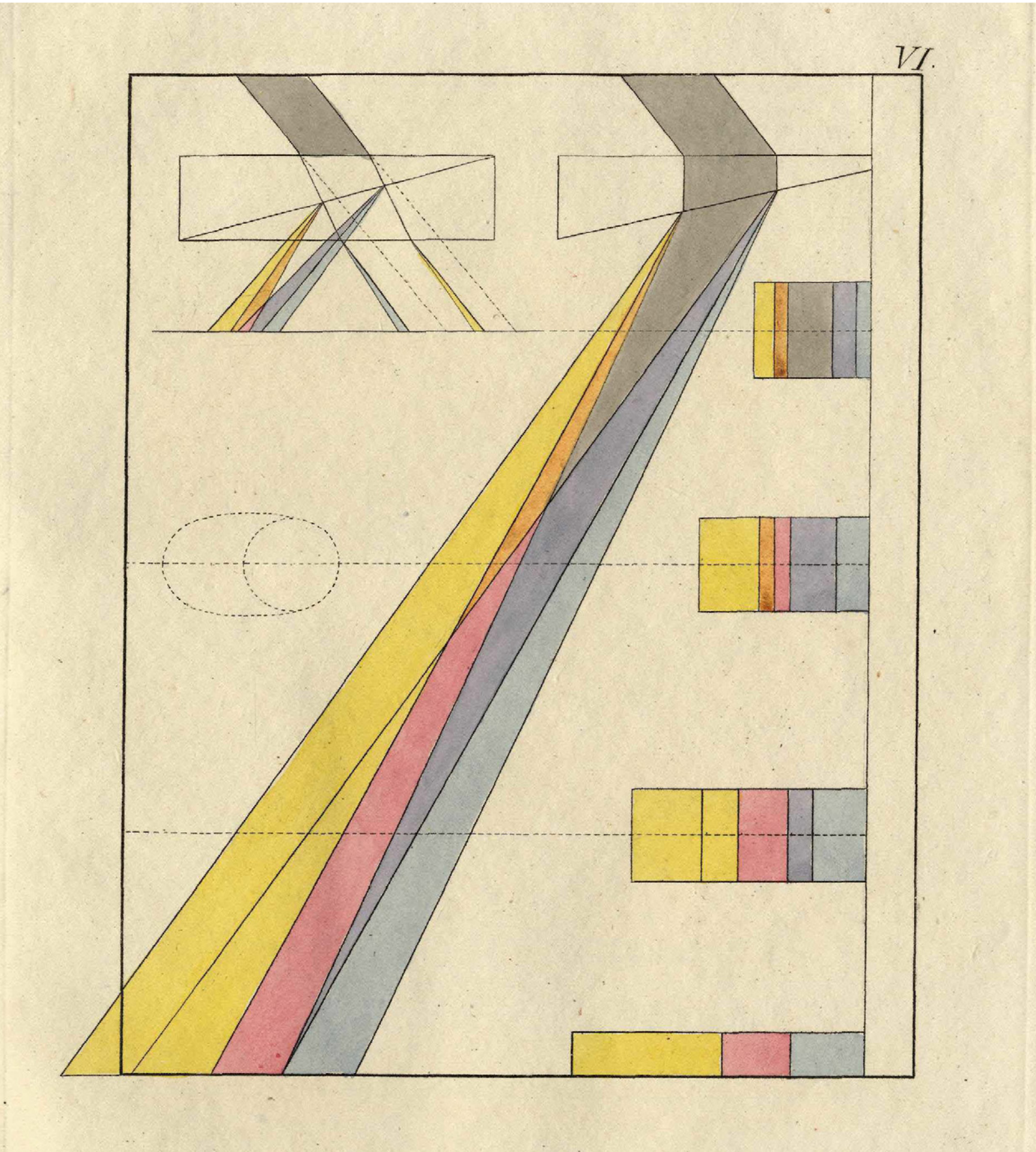
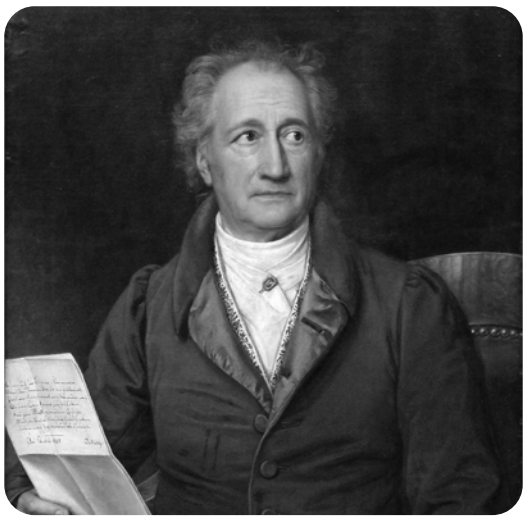
in dialogue
Journal for Holistic Science
Volume 2 | October 2022



Goethe and Whitehead

Steps to a Science of Organism

Matthew David Segall
California Institute of Integral Studies



Does not the heaven vault above?
Is the earth not firmly based down here?
And do not, friendly,
Eternal stars rise?
Do we not look into each other's eyes,
And all in you is surging
To your head and heart,
And weaves in timeless mystery,
Unseeable, yet seen, around you?
Then let it fill your heart entirely,
And when your rapture in this feeling is complete,
Call it then as you will,
Call it bliss! heart! love! God!
I do not have a name
For this.
Feeling is all;
Names are but sound and smoke
Befogging heaven's blazes.

—Goethe[1]

[Philosophy has] to rescue the facts as they are from the facts as they appear… [W]e view the sky at noon on a fine day. It is blue, flooded by the light of the sun. The direct fact of observation is the sun as the sole origin of light, and the bare heavens. Conceive the myth of Adam and Eve in the Garden on the first day of human life. They watch the sunset, the stars appear:—'And, Lo!, creation widened to man's view.' The excess of light discloses facts and also conceals them.

—Whitehead[2]

The universalist of Weimar sought truth in the world of appearance, the mathematician of Cambridge in the realm of number and ratio.

—Wolfgang Yourgrau[3]

1. Johann Wolfgang von Goethe, *Faust*, trans. Walter Kaufmann (New York: Anchor Books, 1990), 327.

2. Alfred North Whitehead, *Adventures of Ideas* (New York: The Free Press, 1967), 155. Whitehead quotes his second to last line from Joseph Blanco White's poem "To Night".

3. Wolfgang Yourgrau, "Reflections on the Natural Philosophy of Goethe", *Philosophy* 26, no. 96 (1951): 75.

Introduction

The immediately preceding epigraph is from an article on Goethe's natural philosophy wherein Wolfgang Yourgrau intended to distinguish the poet-scientist's intuitive method from the mathematical approach of his archnemesis, Newton:

> Goethe approached every natural phenomenon…with the intuition of an artist. His conception of the *cosmos* was restricted to forms, colours, sounds, thoughts, feelings and passions. But this subjective poetic world, colourful and reverberant, is unfortunately for Goethe annihilated by objective mathematical physics.[4]

The aim of the present essay is to save Goethe's poetic view of Nature from such dismissals by comparing his method and its findings to those of a more congenial Cambridge mathematician: Alfred North Whitehead. I make the case in what follows that Whitehead's later philosophical work in the other Cambridge (the location of Harvard University, where he taught from 1924 to 1937) provides cosmological context and metaphysical justification for the Goethean approach, thus strengthening its position in the debate over who is authorized to speak for—or, perhaps, *as* Nature. Whitehead's protest against scientific materialism's "bifurcation of Nature" into subjective experience and objective cause, and his reconstruction of mechanistic science on more experientially adequate *organic* grounds, provides the occasion for a reconsideration of Goethe's poetic vision of the cosmos.

First, I briefly review the literature on the resonances between Goethe and Whitehead. Then I attempt to clarify Goethe's relation to the mathematical methods of natural science, an important issue for this comparison given the mathematical inspirations guiding Whitehead's adventure in cosmology. Finally, I trace the striking parallels in their respective attempts to think Nature, with special attention paid to the way Whitehead's process-relational "organic realism" and theory of perception further clarify the metaphysical implications of Goethe's way of seeing.

A Critical Review of the Literature

While a number of scholars have noted possible resonances between Goethe and Whitehead's thought, these remarks are usually made in passing. To my knowledge the philosophical nexus between these two thinkers has yet to be elaborated in any depth. The following list is not exhaustive, but at least provides a preliminary overview.

The most sustained treatment may be in Mary Alice Wyman's book *The Lure for Feeling*, wherein she devotes a chapter to comparing the theological overlaps in Goethe, Emerson, and Whitehead.[5] Wyman reports that Whitehead had only minor acquaintance with Goethe, but this is contradicted by Whitehead's own statement as recorded by Lucien Price that he read Eckermann's *Conversations with Goethe* "forwards and back".[6] Nonetheless, it may be safely assumed that Whitehead had not studied Goethe's scientific works in any detail. Wyman notes several lines of convergence in their thinking. These include their shared en-

4. Yourgrau, "Reflections", 73.

5. Mary Alice Wyman, *The Lure for Feeling in the Creative Process* (New York: Philosophical Library, 1960).

6. Lucien Price, *Dialogues of Alfred North Whitehead* (Boston, MA: Godine, 2001), 46. Johann Peter Eckermann's *Conversations with Goethe In the Last Years of his Life*, trans. Allen Blunden (London: Penguin Books, 2022) provided the main inspiration for Price's dialogues with Whitehead (x). Also recorded by Price is Whitehead's curious remark: "It has been occurring to me of late that Goethe's thinking is too special, and that the world would be better off for the sound, sane, sensible, second-rate sentiments of Schiller. They never rise beyond a certain level but they are safe and serviceable" (122). In context it is clear that these remarks concern art and literature, rather than science; but as we will see, the need for a more generic metaphysical rendering of Goethe's special scientific insights is precisely why an integration of their respective approaches to Nature is so valuable.

thusiasm for Plato, Spinoza, and Leibniz; their attempt to grasp the interplay of permanence and flux, or eternity's participation in the creations of time; their insistence upon the profound interrelationship of all particulars with one another and with the whole; their sense that Nature as a whole and in its products must be understood as a process of development lured by an immanent divine presence; and their predilection for polarity as an organizing principle, whereby the spiritual and material, or mental and physical poles of organic process are each given their due.

In her seminal study *Goethe: Poet and Thinker*, Elizabeth Mary Wilkinson depicts Goethe as having had an instinctive, pre-philosophic grasp of the inadequacy of the bifurcation of Nature that was later so thoroughly criticized by Whitehead.[7] She notes Goethe's concern to avoid overemphasizing either the subjective or objective side of the bifurcation in an imbalanced attempt to overcome it, as idealists and materialists are apt to do. There is an ambiguity in Wilkinson's comparison that, to avoid a possible conflation, compels me to note in passing that Whitehead's account of the modern bifurcation between perception and its cause is not the same as Kant's transcendental division of phenomena from noumena. For Kant, causality is a category of understanding applicable only to the phenomenal realm; it has no legitimate use for the determination of things-in-themselves, which remain forever beyond our knowledge.[8] Whitehead's protest against the bifurcation of Nature is a critique of the more philosophically naive position of scientific materialism, which has it that a conjectured mind-independent domain of particles (or wave-potentials) serves as the causal substrate for what we in fact experience—"the greenness of the trees, the song of the birds, the warmth of the sun"—the latter thus being reduced to the status of a dream.[9] As is detailed below, Whitehead's reconstructive metaphysical program aims to provide "the all-embracing relations" by which the split between "the red glow of the sunset" and "the molecules and electric waves by which men of science would explain the phenomenon" can be reconciled as aspects of one and the same organic reality.[10]

Also focusing on Goethe and Whitehead's respective responses to Kant's transcendental idealism are Elke Weik's "Goethe and the Study of Life", and R. H. Stephenson's "'Binary Synthesis': Goethe's Aesthetic Intuition in Literature and Science". Weik's article links Goethe's "gentle empirics" to Whitehead's relational account of perception, revealing the similarity in their approaches to overcoming Kant's categorical severance of phenomena from noumena: whereas Kant only allowed for the participatory co-creation of the empirical ego with a merely apparent world, Goethe and Whitehead's more radically participatory approach grants ideas an existence within nature, not just in the human mind.[11] In his article, Stephenson goes so far as to claim that "Goethe's scientific method is…indistinguishable from the Process Philosophy articulated by Whitehead and his followers", pointing to their nearly identical prescriptions for overcoming the dualism of Kant's *Critique of Pure Reason* by way of a "Critique of the Senses" (Goethe) or "critique of pure feeling" (Whitehead).[12]

In *The Rehabilitation of Whitehead*, George R. Lucas points to Goethe, as well as the post-Kantian philosophers Schelling and Hegel, as early originators of process thought, thus

7. Elizabeth Mary Wilkinson, *Goethe: Poet and Thinker* (London: Edward Arnold, 1962), 136.

8. Immanuel Kant, *Critique of Pure Reason*, trans. Paul Guyer and Allen W. Wood (Cambridge: Cambridge University Press, 1998), Bxxvi.

9. Alfred North Whitehead, *The Concept of Nature* (Cambridge: Cambridge University Press, 1920), 30-31.

10. Whitehead, *The Concept of Nature*, 32, 29.

11. Elke Weik, "Goethe and the Study of Life: A Comparison with Husserl and Simmel", *Continental Philosophy Review* 50 (2017): 335–357.

12. R. H. Stephenson, "'Binary Synthesis': Goethe's Aesthetic Intuition in Literature and Science", *Science in Context* 18, no. 4 (2005): 553, 569.

cementing at least an indirect lineage.[13] Clark S. Muenzer's entry in the *Goethe-Lexicon of Philosophical Concepts* mentions the kinship between Whitehead's notion of "prehension" and Goethe's relational grasp of philosophical concepts (Begriffe) as elements

> [operating] within the world and not above it…[maintaining] themselves—to borrow another Whiteheadian term—by becoming 'ingredient' in the ongoing concrescence of new concepts and new perceptual objects.[14]

I return to the importance of prehension in the final section of this essay, as it is the keystone of Whitehead's categoreal scheme providing the all-embracing relations for mending the bifurcated world of materialism. In *Goethe and the Sciences: A Reappraisal*, both Jeffrey Barnouw's chapter "Goethe and Helmholtz: Science and Sensation", and Arthur Zajonc's chapter "Facts as Theory: Aspects of Goethe's Philosophy of Science" make reference to Whitehead's appeal to intuition and to his famous critique of the "fallacy of misplaced concreteness" as it relates to Goethe's rejection of hypothesized causes hidden behind appearances.[15] Maria Ilhéu and Mariana Valente's article "Delicate Empiricism and Romance in Education for Sustainability" fruitfully draws upon Goethe's method and Whitehead's pedagogical theory to reconnect the intellectual and sensual aspects of education.[16] Finally, Yourgrau cites Whitehead's *Process and Reality* in his article, but not to draw comparisons with Goethe's scientific work, and not, unfortunately, to occasion a reconsideration of his conclusion that natural science is unlikely to be reformable along Goethean or Whiteheadian lines.[17]

These scattered remarks are encouraging, as at first glance one may be tempted to distance Goethe's resolutely phenomenological approach to natural science from Whitehead's mathematically informed and, while experientially grounded, still unapologetically speculative method of philosophizing. As is unpacked later, Whitehead, like Goethe, had his own critiques of the mathematical physics and mechanistic metaphysics of his day. And upon closer examination, it would be unwise to overlook the mathematical aspects of Goethe's scientific method. It is to the latter issue that I now turn.

The Method of Mathesis

> *Philosophy is akin to poetry…In each case there is reference to form beyond the direct meaning of words. Poetry allies itself to metre, philosophy to mathematical pattern.*
>
> —Whitehead[18]

"The true method of discovery", according to Whitehead,

> is like the flight of an aeroplane. It starts from the ground of particular observation; it makes a flight in the thin air of imaginative generalization; and it again lands for renewed observation rendered acute by rational interpretation.[19]

13. George R. Lucas, *The Rehabilitation of Whitehead: An Analytic and Historical Assessment of Process Philosophy* (New York: State University of New York, 1989), 16. See also my *Physics of the World-Soul: Whitehead's Adventure in Cosmology* (SacraSage, 2021) for more on the Schelling-Whitehead nexus.

14. Clark S. Muenzer, "Begriff (Concept)", *Goethe-Lexicon of Philosophical Concepts* 1, no. 1 (2021). https://goethe-lexicon.pitt.edu/GL/article/view/34.

15. Frederick Amrine, Francis J. Zucker, and Harvey Wheeler, eds., *Goethe and the Sciences: A Reappraisal* (Dordrecht: Reidel, 1987).

16. Maria Ilhéu and Mariana Valente, "Delicate Empiricism and Romance in Education for Sustainability", in *Rehearsing Science and Art to re-connect culture and nature*, eds. Alison Neilson and José Eduardo Silva (Portugal: Teatro do Frio, 2019), 59–74.

17. Yourgrau, "Reflections", 81.

18. Alfred North Whitehead, *Modes of Thought* (New York: The Free Press, 1938/1968), 174.

19. Alfred North Whitehead, *Process and Reality: An Essay in Cosmology* (New York: The Free Press, 1978), 5.

Goethe, Whitehead, and Newton, like all modern scientific thinkers, creatively inherit the two-fold inductive-to-deductive method of investigation originally formulated by Aristotle in *Posterior Analytics*, wherein The Philosopher analogized the proper demonstration of scientific knowledge of causes to the mathematical style of reasoning from clear first principles (which Aristotle calls *archai*) to necessary conclusions.[20] Aristotle characterized the two aspects of scientific reasoning for which the human soul is constituted as follows. Induction is a movement of abstract generalization from particular perceptions to the universal principle they exemplify. Such principles are necessary to provide premises for deductions, which move from inductively derived universals to the demonstration of their logically necessary implications. In the ideal, high-altitude context of pure geometry, induction allows a mathematician to discover new truths by, e.g., observing that every triangle has angles adding up to 180 degrees. The claim remains hypothetical and does not in itself prove that all triangles necessarily have angles adding up to 180 degrees. Proof of the hypothesis requires deductive demonstration via a series of logical steps, at which point it becomes a theorem. The situation is a bit messier in the more down-to-earth context of natural scientific investigation. Unlike Newton, who Goethe argues prematurely limited experiment in order to prove pre-existing hypotheses, Goethe and Whitehead's elaboration of the proper scientific method generates an iterative and cumulative cycle of learning that forestalls the model-centrism resulting from the scientistic tendency to leap to hypothetical generalizations on too narrow an empirical basis, without proper attention having been paid to the phenomena themselves.

"The history of thought", Whitehead continues, "shows that false interpretations of observed facts enter into the records of their observation. Thus both theory, and received notions as to fact, are in doubt".[21] Whitehead's cycle of discovery, with its emphasis upon the importance of landing for renewed observation, can be understood as his way of heeding Goethe's warning about "imagination, which sweeps [one] away on its wings before he knows his feet have left the ground".[22] The point is not to avoid imaginative abstraction, which even Goethe admits is impossible, since "everything factual is already theory".[23] The point is rather to avoid rushing to prove a preconceived model with one or a few contrived experiments before the phenomena themselves have been thoroughly distilled through manifold cycles of observation and generalization.[24] Goethe laments the error so prevalent in his scientific contemporaries of leaping "immediately from the single factor to what is general".[25]

Goethe's main targets, of course, were Newton and his followers. For Newton, because the sole purpose of his experimental design was to prove a preconceived geometric model, the fastest means to arriving at the desired result was not to try "a multiple of things", but "only the Experimentum Crucis", for it is not the number of experiments, but their "weight" that is important: "where one will do, what need of many?"[26] Goethe's method, in contrast, requires the painstaking arrangement of a complete series of experiments, followed by patient contemplation of the morphological relationship between each particular instance. Gradually, the archetypal process instantiated by each particular form is perceptually distilled, bringing the general and the particular into coincidence: "the particular is the general made manifest under different conditions".[27]

---

20. Goethe also borrows aspects of his colour theory from Aristotle, who had suggested two millennia earlier that colour results from a mixing of light and dark (see *Sense and Sensibilia*, 439b20). Plato is similarly suggestive (see *Timaeus*, 67d–68d).

21. Whitehead, *Process and Reality*, 9.

22. Johann Wolfgang von Goethe, *Scientific Studies*, ed. and trans. Douglas Miller (New York: Suhrkamp, 1988), 14.

23. Johann Wolfgang von Goethe, *Maxims and Reflections,* trans. Elisabeth Stopp (London: Penguin Books, 1998), no. 575. The numbering of the maxims follows Max Hecker's 1907 edition, reprinted in *Maximen und Reflexionen* (Frankfurt am Main: Insel Verlag, 1976).

24. See Dennis Sepper, *Goethe Contra Newton: Polemics and the Project of a New Science of Color* (Cambridge: Cambridge University Press, 1988), 70.

25. Goethe, *Maxims and Reflections*, no. 1164.

26. H. W. Turnbull, ed., *The Correspondence of Isaac Newton*, vol. 2, *1676–1687* (Cambridge: Cambridge University Press, 1960), 79.

27. Goethe, *Maxims and Reflections*, no. 569.

That the Goethean method stands *opposed* to the mathematical method is a view shared even by some defenders of Goethe's contributions to natural science, most prominently Henri Bortoft.[28] Even if Goethe did not make straightforward use of arithmetic or geometry in his investigations of natural phenomena, this does not mean that he was opposed to their use in all cases. Nor does it imply that his method is non- or anti-mathematical in the original and perhaps more esoteric sense of μάθησις (*mathesis*), which need not be quantitative in its approach but is, as the ancient Pythagorean school had it, essentially an educational method—*the art of learning*—meant to dialectically lead one along a trail of proportional and analogical resonances from the sensible to the archetypal mode of perception.[29] The Spinozist philosopher Gilles Deleuze defines mathesis as an initiatory and incarnational way of knowing that overcomes dualities, whether between percept and concept, particular and universal, finite and infinite, or corporeal and spiritual.[30] Robin Mackay elaborates:

> Mathesis treats of the nature of life anterior to philosophical reflection and scientific objectivity, that is to say before the cleavage between the subject and object of thought: it returns us to 'things-in-themselves in their wild state,' the world of *concepts fauves* [bestial concepts].[31]

Of course, mathesis can sometimes make use of abstract algebraic symbols in its pedagogical pursuit of the True, the Good, and the Beautiful. While Goethe did not employ algebra in his scientific studies, as a celebrated man of letters he can hardly be said to have dispensed with the symbolic in the composition of his scientific much less his poetic works, both of which must count as expressions of his love for the rhymes and rhythms of Nature. For example, when we first hear from Faust just after the Prologue in Heaven, he, having learned all that culture has to offer, asks for spiritual help "to learn what nature has to teach". He opens the book on his desk to reveal the symbol of the microcosm: "Was it a god that made these symbols be/…And with mysterious potency/Make nature's hidden powers around me, manifest?"[32]

While Goethe's participatory, concretely phenomenological approach to the study of Nature must be distinguished from the model-centric mathematical analysis characteristic of modern physical science,[33] Bortoft goes too far in outright denying the mathematical mode of operation to Goethe.[34] While there is undoubtedly a tendency toward misplaced con-

---

28. Henri Bortoft, *Taking Appearance Seriously: The Dynamic Way of Seeing in Goethe and European Thought* (Edinburgh: Floris Books, 2012). In Dennis Sepper's terms, "Goethe is not as amathematical as people think" (*Goethe Contra Newton*, x).

29. Note that the sense of mathesis described here is not the "*mathesis universalis*" sought by Descartes and criticized by Bortoft (*Taking Appearance Seriously*, 12). Dialectical mathesis is rather the Platonic "vertex" of all scientific studies, prior to arithmetic and geometry as it is their common source (*Republic,* 534e–535a). In Michel Foucault's terms, mathesis is "the project of a general science of order" (*The Order of Things: An Archeology of the Human Sciences* (New York: Vintage, 1970), 71). In Rudolf Steiner's terms: "That is what is so significant about the mathematical conception: that a single sense formation leads out beyond itself; and it can only be for me an image of an all-embracing spiritual fact. And thus, there also exists the possibility of bringing the spiritual in this sphere into the domain of the sense perceptible" ("Mathematics and Occultism*",* trans. David Wood, *Archetype* 3, 47). For more on the Pythagorean connection, see Christopher Bamford, ed., *Homage to Pythagoras: Rediscovering Sacred Science* (New York: Lindisfarne Books, 1980).

30. Gilles Deleuze, "Mathesis, Science and Philosophy", in Robin Mackay, ed., *Collapse: Philosophical Research and Development*, vol. 3 (Falmouth: Urbanomic, 2007), 141–155.

31. Mackay, *Collapse*, 28.

32. *Goethe's Faust*, trans. Walter Kaufmann (New York: Anchor Books, 1990), 97–99. See also *Maxims and Reflections,* no. 314: "This is true symbolism, where the particular represents the general, not as dream and shadow, but as a live and immediate revelation of the unfathomable"; and Sepper's *Goethe Contra Newton*, 76: "Goethe once said of mathematical symbolization that it has the potential to become nearly identical in the highest sense with the phenomena that it represents".

33. For more on the problems with "model-centrism" in contemporary physics, see Randall Auxier and Gary Herstein *The Quantum of Explanation: Whitehead's Radical Empiricism* (Routledge, 2017), 111.

34. See Troy Vine, "Newton, Goethe and the Mathematical Style of Thinking: A Critique of Henri Bortoft's *Taking Appearances Seriously*", *In Dialogue 1* (2020): 72–73.

creteness in mechanistic approaches to physics and biology, this has less to do with mathesis as such than with scientific materialism's insistence upon bifurcating Nature into primary quantitative and secondary qualitative characteristics.

Despite the Humean decree of the logical positivists that only two kinds of meaningful propositions exist (i.e., the analytic truths of reason and the synthetic truths of fact), Kant taught us that mathematics evinces a third kind of proposition: the synthetic *a priori*.[35] Like Whitehead—who argued that positivism is "a method which, if consistently pursued, would have left science where it found it"[36]—Bortoft points out that the positivist denial of Kant's amphibious logico-intuitive form of knowing in favor of "Hume's fork" is, ironically, "hopelessly inadequate for understanding science".[37] "Twist and turn our concepts as we will", says Kant, without mathematical intuition we could not even arrive at the sum of five and seven, much less knowledge of the laws of physics.[38] While Kant insisted that we remain limited to discursive understanding when it comes to our sensory intuitions of Nature's products, mathematical construction achieves a form of *pure* intuition that partially reunites what the understanding forces us to separate. Intuitive mathesis makes it possible for us to cognize precisely the sort of necessary *internal* relations that Bortoft rightly emphasizes are so important for Goethe's holistic science of metamorphosis.[39]

Synthetic *a priori* knowledge was an essential component of Kant's new transcendental grounding of Newtonian science, as it allowed the necessary and universal truths of mathematics to be granted determinative status in our judgments of the laws of empirical Nature. However, while mathematics granted us formal knowledge of the spatiotemporal domain, Kant limited this knowledge to appearances. He held that human cognition is necessarily split into two stems: the senses, which feed us the raw material of experience filtered through the formal structures of space and time, and the understanding, by whose machinations and logical rules that material is digested and judged.[40] He denied that the understanding could reach beyond the limits of the senses to perceive essences or archetypal ideas directly. In his discussion of Kant, Bortoft does not mention the significance of Spinoza's *scientia intuitiva* for Goethe, as without the influence of Spinoza, it is conceivable that Goethe's methodological interventions into natural science may have been stymied by Kant's dichotomy between discursive and intuitive forms of understanding. Spinoza also drew upon the powerful example of mathematics, but unlike Kant, he extended the possibility of intuitive understanding beyond the mathematical domain into the natural world. In general, Spinoza and Kant would agree that an intuitive grasp of the essence or productive cause of a thing is the highest standard of truth. For example, to know the productive essence of a circle means not just being able to recognize one but being able to create it according to a rule—i.e., a circle "is a plane surface described by a line, one point of which is fixed and the other in motion".[41] But beyond the construction of mathematical objects, Kant did not allow that humans could gain intuitive knowledge of the inner archetypal core of Nature, either as a whole or in its individual products. Kant added that "we would not understand what it is even if someone [capable of such knowledge] could tell us": the idea that we might grasp such a core "is a mere fancy". Kant's denial of archetypal knowledge was less problematic in the inorganic realm, wherein it was thought that mathematically derived Newtonian laws exhaustively determined natural phenomena. But organized or living beings proved to be a striking exception, as Kant realized that organisms displayed a form of circular or whole-

35. Kant, *Critique of Pure Reason*, A10/B14.

36. Whitehead, *Process and Reality*, 5.

37. Bortoft, *Taking Appearance Seriously*, 219n56.

38. Kant, *Critique of Pure Reason*, B14–17, 144.

39. Bortoft, *Taking Appearance Seriously*, 26–27. See also Vine, "Mathematical Style of Thinking", 76ff.

40. Kant, Critique of Pure Reason, A15/B29.

41. Eckart Förster, *The Twenty-Five Years of Philosophy: A Systematic Reconstruction*, trans. Brady Bowman (Cambridge, MA: Harvard University Press, 2012), 252.

to-part *self-organizing* causality that is unlike the linear causal order of *partes extra partes* determining non-living phenomena.[42] For Kant, our discursive understanding could only build its knowledge up out of parts, thus leaving us constitutively blind to the incarnate archetypal dynamics at play in the formation of living beings. Kant's discursive method works well in the case of machines, but organisms—whose parts are each internally related to and mutually productive of one another and the whole to which they belong—could only be known by an intuitive form of cognition unavailable to divided minds like ours.

Having read Kant's *Critique of Judgment* just after completing his *Metamorphosis of Plants* (both published in 1790), Goethe realized that with his discovery of the *Urpflanze*, or archetypal plant, he was claiming precisely the sort of intuitive knowledge of organic formation that Kant had forbidden. A few years earlier, when these ideas were just taking shape, Goethe had written to Charlotte von Stein from Italy:

> The *Urpflanze* will be the most remarkable creature in the world and even nature herself will envy me for it. With this model and the key to it, an infinite variety of plants can be invented, which are consistent, that is, they are such that, even if they do not exist, they *could* exist, and thus are more than just painterly or poetic shadows and apparitions, for they possess an inner truth and necessity.[43]

Goethe's reference to the "inner truth and necessity" by which the *Urpflanze* allows one to invent new plants parallels Spinoza's intuitive understanding of a circle's productive cause, whereby we not only recognize but can generate the shape ourselves. Goethe thus extended Spinoza's *scientia intuitiva* beyond the purely geometrical realm into the study of the genesis of actual organic forms.[44] A "fortunate encounter" in 1794 with the Kantian poet Friedrich Schiller precipitated a further deepening of Goethe's self-understanding. To that point he had been proceeding mostly on the instincts of his genius and was still in search of a robust methodological justification for his findings. Goethe offered Schiller a spirited account of his observations of the archetypal plant, even sketching its form on a spare sheet of paper. Schiller listened but responded unceremoniously: "That is not an observation from experience. That is an idea." Goethe, initially frustrated, collected his wits and replied: "Then I may rejoice that I have ideas without knowing it and can even see them with my own eyes."[45]

Despite his witty reply, Goethe recognized the power of Schiller's Kantian critique. Rather than claiming an immediate intuitive insight into the holistic idea subtending many particular facts, Goethe would come to affirm the methodological importance of providing a discursive and experimental demonstration of the way these facts mutually produce one another and the whole within which they are composed. Like a good geometer, he must show his work step-by-step, despite his genius for imaginatively leaping to the solution. He thus took himself to be seeking a middle path between Spinoza and Kant "to make discursive and intuitive thinking compatible".[46] We cannot begin straight away with the essence or idea that organizes the whole, but must arrive at it in stepwise fashion by gathering together many contiguous phenomena:

> …the greatest accomplishments come from those who never tire in exploring and working out every possible aspect and modification of every bit of

42. Kant, *Critique of the Power of Judgment* (Cambridge: Cambridge University Press, 2000), 245 (5:374).

43. Letter to Charlotte von Stein from Rome on 8/9 June 1787. Johann Wolfgang von Goethe, *Briefe*, vol. 2 (München: C. H. Beck, 1988), 60. Translation from Förster, *Twenty Five Years*, 274. This passage also appears in Goethe's *Italian Journey*, trans. W. H. Auden and Elizabeth Mayer (London: Penguin Books, 1970), 305–306, which he wrote nearly three decades later based on his letters and diary entries.

44. Förster argues that, while Spinoza uses geometrical examples to illustrate intuitive science, this does not mean that the method was in principle inapplicable to particular natural processes, such as the study of plant and animal growth, or colour phenomena (*Twenty-Five Years*, 97–98).

45. Johann Wolfgang von Goethe, *Scientific Studies*, ed. and trans. Douglas Miller (New York: Suhrkamp, 1988), 20.

46. Förster, *Twenty-Five Years*, 254.

> empirical evidence, every experiment…To follow every single experiment through its variations is the real task of the scientific researcher.[47]

Goethe goes on to analogize his method of distilling the higher archetypal phenomenon out of a contiguous series of empirical phenomena to mathematical demonstration:

> [The archetypal phenomenon] shows the general formula, so to speak, that overarches an array of individual arithmetic sums. … From the mathematician we must learn the meticulous care required to connect things in unbroken succession.[48]

Eckart Förster provides a helpful analogy to the Fibonacci sequence that clarifies the Goethean method of archetypal distillation.[49] The string of numbers 1, 1, 2, 3, 5, 8, 13, 21, 34, … is analogous to the series of contiguous experimental observations. When enough numbers have been listed, or facts have been gathered, it becomes possible to intuit the rhythmic pattern of proportional transition guiding their metamorphosis. An internal relationship governs the series of numbers/phenomena through the phases of their transformation, the rules for which can be formulated in general or archetypal terms. In the case of the Fibonacci sequence, the formula is $F_n = F_{n-1} + F_{n-2}$ with $F_1 = F_2 = 1$. In the case of Goethe's observations of the phases of plant growth across a variety of species, it is the expansive and contractive movements of the *archetypal leaf*, a primal form from which all phases of plant growth are topologically derivable.[50]

Having explicated Goethe's mature understanding of his scientific method, we can affirm that while Bortoft's distinction between internal and external relations is edifying, his dichotomous characterization of the "concrete" Goethean and the "abstract" mathematical approaches to science is misleading.[51] Bortoft's treatment of Goethe's alleged divergence from the mathematical style of thinking stands opposed to Goethe's own description of his method. Troy Vine goes so far as to say that "Goethe's approach is closer to mathematics" than Newton's![52] Vine's claim is justified in that, even though Newton used geometry in his optical analysis of light, the order of the colours in his spectrum is entirely contingent, meaning that the colours are only *externally* related, their order left entirely unexplained. This despite the fact that Newton employed a clever musical analogy to determine the position of each colour on his spectrum wheel. According to Dennis Sepper, "Newton's proportions are based on an arbitrary selection of the experimental circumstances, which if chosen differently, give quite different results".[53] In contrast, in his *Farbenlehre* Goethe applies the principle of polarity (also applied in the three expansive and contractive phases of plant growth) to reveal the necessary *internal* relations among the colours of his spectrum.[54]

47. Goethe, *Scientific Studies*, 15–16.

48. Goethe, *Scientific Studies*, 16. I have inserted "archetypal phenomenon" where Goethe himself had written "empirical evidence…of a higher sort". I believe this interpretation is justified in light of Goethe's later collaboration with F. J. W. von Schelling, who in his 1799 work *First Outline of a System of the Philosophy of Nature*, trans. Keith Peterson (Albany: State University of New York Press, 2004) built on his conversations with Goethe to elaborate a form of "unconditioned empiricism" (24), claiming that philosophy of nature is precisely "empiricism extended to include unconditionedness" (22), or to include what he elsewhere calls the "absolute organism", the archetype of which all particular organisms are approximations (49). Schelling thus attempted to philosophically ground Goethe's higher empiricism in the archetypal dynamics of a self-organizing Nature, whereby a diversity of finite appearances, when taken as a metamorphic whole, are seen to converge upon an overarching ideal (50).

49. Förster, *Twenty-Five Years*, 256–257.

50. Though Förster doesn't mention it, the Golden Mean or Phi spiral found in growth patterns throughout the plant kingdom is derived from the Fibonacci sequence, so there would seem to be more than a loose analogy between it and the archetypal metamorphosis of plants.

51. Vine, "Mathematical Style of Thinking", 86.

52. Vine, "Mathematical Style of Thinking", 86.

53. Sepper, *Goethe Contra Newton*, 84.

54. Vine, "Mathematical Style of Thinking", 82ff.

Yourgrau elaborates the antithetical world views of Goethe and Newton in terms similar to Bortoft, remarking that while Goethe concentrated on "the event in its totality" (or in Planck's terms, "he would never see a detail without considering the whole"[55]), Newton sought "the mathematical pattern underlying the world of phenomena".[56] Yourgrau claims it was Goethe's intolerance of mathematical analysis that made it impossible for him to understand Newton's achievement in optics. In addition to what has already been said above, we can turn again to Goethe's own statements on the matter. In his *Farbenlehre*, Goethe admits that while he "cannot boast of any accomplishment in this field", he nonetheless viewed mathematics as "one of the most splendid of human gifts" that "has served physics well".[57] Goethe especially lauded the use of geometry in astronomy: for example, he considered "a penetrating mathematician before the starry heavens [to be] godlike".[58] In his conversations with Eckermann, he "[respects] mathematics as the most sublime and useful science", but adds that the use of geometry should not be abused by extending it indefinitely into domains ill-suited to quantitative or metrical analysis.[59] His quarrel with Newton had nothing to do with mathematics as such, but with the proper methodology for the examination of colour, a decidedly *qualitative* phenomenon. While Goethe admitted the importance of geometry for the study of optics, he argued that such a study should not be mixed up with chromatics. This is because *colour phenomena do not have an exclusively physical or geometrical origin* and so can be studied independently of optics. Here we can return again to Aristotle, who says it sometimes occurs that mathematicians, in their rush to demonstrate hidden causes, do so in ignorance of all the relevant facts:

> ...it is for the empirical scientists to know the fact and for the mathematical to know the reason why; for the latter have the demonstrations of the explanations, and often they do not know the fact, just as those who consider the universal often do not know some of the particulars thought lack of observation.[60]

Even so, Goethe admits that in his study of colour "at certain points the help of geometry would obviously have been desirable", though he regrets that the "unprejudiced mathematicians of the authors acquaintance" were otherwise occupied and so could not contribute to his study. He hopes that sensitive mathematicians unburdened by Newton's hasty reduction of chromatic phenomena to a clever optical model will take up his work in order to determine precisely where geometrical analysis may further elucidate the subject.[61] To simply reduce the experiential metamorphosis of colour to an explanation in terms of the geometrical analysis of objectified "Rays differently refrangible"[62] is not only to "unweave a rainbow",[63] it is to "murder to dissect",[64] as the living eye is uprooted from its participation in the organic circuit responsible for generating colour phenomena.

Contrary to Yourgrau, then, it is Newton's arbitrary "mathematico-technical approach" and not Goethe's holistic view that is "restricted". While Goethe also made use of the mathematical style of thinking in his scientific work, he never lost sight of our human participation

55. Max Planck, *A Survey of Physical Theory*, trans R. Jones and D. H. Williams (New York: Dover, 2003), 89–90.

56. Yourgrau, "Reflections", 73.

57. Goethe, *Scientific Studies*, 271–272.

58. Goethe, *Maxims and Reflections*, no. 606.

59. On 20 December, 1826. Eckermann, *Conversations*, 156.

60. Aristotle, *Posterior Analytics*, 79a4–7. Translation from Jonathan Barnes, ed., *The Complete Works of Aristotle*, vol. 1 (Princeton, NJ: Princeton University Press, 1984), 128.

61. Goethe, *Scientific Studies*, 272.

62. Isaac Newton, "New Theory about Light and Colors", *Philosophical Transactions of the Royal Society* (1672), 3079.

63. John Keats, "Lamia", in *The Poems of John Keats* (New York: Dodd, Mead, and Co., 1904), 161.

64. William Wordsworth and Samuel Taylor Coleridge, "The Tables Turned" in *Lyrical Ballads, with a Few Other Poems* (London: Arch, 1798), 188.

in the living phenomena of Nature. Indeed, he employed a more integral and transdisciplinary form of mathesis known to the ancients.[65] He once referred to himself as an "ethical-aesthetic mathematician"[66] because he understood his task to be not only that of distilling the dynamic forms at work in phenomena but also restoring to Nature the ethical and aesthetic values "annihilated" by the quantitative models of mechanistic physics. Whitehead took up a similar task, not only to help ameliorate the ecological catastrophe that had already resulted from the single-eyed deployment of such abstractions during the industrial revolution, but also to deepen our scientific understanding of the world-process in its concrete wholeness. Whitehead's protest against materialism was not meant to place artificial restraints upon the explanatory prowess of natural science. On the contrary, given the demolition of mechanistic materialism by the second scientific revolution of the early twentieth century, his primary motivation was to develop a new metaphysical background for and cosmological interpretation of the latest scientific discoveries. In the final section, I turn to the ways Whitehead's cosmological scheme, and in particular his theory of perception, can further explicate and lend metaphysical support to Goethe's intuitive understanding of natural phenomena.

The Philosophy of Organism and the Prehensional Account of Perception

> *Thus [nature] converses…with itself and with us through a thousand phenomena. No one who is observant will ever find nature dead or silent. It has even provided a confidant for the rigid body of the earth…No matter how diverse, enigmatic and intricate this language often seems, its elements remain forever the same.*
>
> —Goethe[67]

> *The things of heaven and earth contain such a wealth of value that only the organs of all beings jointly can encompass it.*
>
> —Goethe[68]

While cracks in the metaphysical edifice of scientific materialism continue to widen, there remains a popular scientistic orthodoxy that prides itself upon having secured objectivity by eliminating any trace of intelligent human beings or even sentient organisms from its explanations of the universe. Mind and life are treated not as the natural flowering of latent potentials in matter but as peripheral accidents ultimately explainable in terms of the mindless, lifeless mechanisms described by the equations of physics. Nature has thus been scrubbed clean of everything qualitative, value-laden, and purposive, leaving behind only what can be quantitatively measured and fed into supercomputers in search of useful predictions. A coherent account of the metamorphosis of phenomena in concrete experience has been replaced by the abstract but instrumentally powerful knowledge afforded by evermore complicated computer models.

Consider quantum and relativity theories. They remain two of the most successful scientific models in human history, where success is measured less by deeper understanding than by predictive power. Their technological applications (like microprocessors, wireless communications, and nuclear energy) have completely transformed civilization. Despite their instrumental successes, however, massive metaphysical problems remain. For starters, each model describes an entirely distinct kind of universe: quantum theory implies a cosmos of discontinuous acausal leaps, while relativity implies a causally limited spacetime continuum.

---

65. E.g., the Neoplatonist Proclus defines mathesis as "the science of learning" by means of "the recollection of ideas" (*A Commentary on the First Book of Euclid's Elements* [Princeton: 1992], 38).

66. Letter to Sulpiz Boisserée on 3 November 1826. Goethe, *Briefe*, 4:208.

67. Goethe, *Scientific Studies*, 158.

68. Letter to Jacobi on 1 June, 1813. Translation from H. J. Weigand, ed., *Goethe: Wisdom and Experience* (London: Routledge, 1949), 45-46.

While the incompatibility of these two otherwise extremely accurate mathematical models continues to puzzle physicists, the models are no less puzzling on their own. Their physical implications are typically construed as so profoundly at odds with the commonsense presuppositions of civilized life that physicists are encouraged not to ask what the equations mean. Among quantum physicists, the typical mantra is: "shut up and calculate".[69] To give a few examples of the confounding implications of these models: time is said to be a reversible, presentless, and ultimately illusory variable; space is said to bend even to the point of breaking; and material particles, now equivalent to wave-like agitations in a field, are said to exist nonlocally as clouds of probability spanning the entire universe.

From Whitehead's point of view, the situation twentieth century physics finds itself in is double-edged: on the one hand, non-Euclidean geometrical methods and more precise measuring instruments have enabled tremendous advances, while, on the other hand, despite the demolition of the old metaphysical foundations of classical physics, nothing new has been put in their place. As a result, natural science has "degenerated into a medley of ad hoc hypotheses".[70] Further, our commonsense experience has lost all touch with the utterly bizarre nature of the universe described in the latest models of theoretical physics. "The divergence of the formulae about nature from the appearance of nature", Whitehead lamented, "has robbed the formulae of any explanatory character".[71] Whitehead was dissatisfied with the instrumentalization of physical theory and frustrated by the tendency of its materialist popularizers to marshal unexamined and inadequate metaphysics in an attempt at "brilliant feats of explaining away" all those aspects of Nature (colours, sounds, feelings, purposes, etc.) deemed superfluous or epiphenomenal. In place of such a bifurcated, model-centric reductionism, he sought to assemble a more adequate metaphysical scheme in terms of which the new scientific discoveries could be understood to hang together with "the general consciousness of what in practice we experience".[72] For Whitehead, "the red glow of the sunset" that warms the hearts of poets must come to be understood as no less a part of Nature than "the molecules and electric waves by which men of science would explain the phenomenon".[73]

From Goethe's convergent perspective, the detachment of physics from human life can lead only to disaster: "experiments have been…segregated from the human factor [such] that nature is to be recognized only by the evidence of artificial instruments", which, Goethe protested, "limits what nature wants to achieve and prove".[74] Goethe here grants Nature the status of subject as well as object of science. If, as Schelling puts it, the human is "αὐτοφυὴς φιλοσοφία", or "Nature itself philosophizing" as Iain Hamilton Grant renders it,[75] then our native suite of evolved senses and contemplative powers may easily be thrown out of proportion and confused by the technological sophistication of our measuring devices and the perceptually suspect computational models they are used to calibrate. The reigning model-centric approach to natural science risks mutilation of both the human being and the world-organism for whom we serve as organs of knowing. As Randall Auxier and Gary Herstein pointedly ask:

> [W]hen experience in its *radical* fullness and connectedness is disdained in favor of clever mathematical models…*what* are we left with to *test* our

69. N. David Mermin, "What's wrong with this pillow?" *Physics Today* 42, 4, 9 (1989): 9.

70. Alfred North Whitehead, *Science and the Modern World* (New York: The Free Press, 1925/1967), 18.

71. Alfred North Whitehead, *Modes of Thought*, (New York: The Free Press, 1938/1968), 154.

72. Whitehead, *Process and Reality*, 17.

73. Whitehead, *The Concept of Nature*, 29.

74. Goethe, *Maxims and Reflections*, no. 706.

75. F. W. J. von Schelling, *Sämmtliche Werke*, division. 2, vol. 1, *Einleitung in die Philosophie der Mythologie* (Stuttgart and Augsburg: Cotta'scher Verlag, 1856), 258. Translation from Iain Hamilton Grant, *Philosophies of Nature after Schelling* (London: Continuum, 2006), 188.

> models, other than the formal and recondite cleverness of those models?… Do we achieve anything other than a preordained 'fit' with a 'reality' that bears no particular relation to experience? Do we just promiscuously add new parameters as needed and convenient? Under such assumptions, experience can offer no meaningful feedback, since it has been shut out of the process of model-centric science when it dared to challenge the models that experience would be called upon to test.[76]

Instead of defining the scientific method so as to require the total withdrawal of consciousness from phenomena (or, said otherwise, the replacement of phenomena altogether with imperceivable abstract models), Goethe and Whitehead alike encourage us to *trust our senses*: "in so far as we make use of our healthy senses", Goethe claimed, "the human being is the most powerful and exact scientific instrument possible".[77] Rather than severing the appearance of Nature from the causal nexus imagined to exist behind appearances, Goethe councils us not to "go looking for anything beyond phenomena", for "everything factual is already theory".[78] Similarly, for Whitehead, "Natural philosophy should never ask, what is in the mind and what is in nature. To do so is a confession that it has failed to express relations between things perceptively known".[79] Both thinkers sought to heal the incision hewn by modern philosophy between the perceptual and causal domains. In Goethe's terms, "theory pure and simple is no use except in that it makes us believe in the interconnection of phenomena";[80] and in Whitehead's terms, the "sole justification" for any theory is "the elucidation of immediate experience".[81] Elsewhere, Whitehead reiterates that "[t]here is no going behind actual [occasions of experience] to find anything more real".[82] Nature, for Whitehead as for Goethe, becomes simply "what we are aware of in perception".[83]

Two potential misunderstandings of this novel approach to scientific investigation must be addressed. First, trusting our senses does not mean remaining on the surface, accepting first impressions as though they granted immediate knowledge of reality. Often it happens that we do not see what Nature is trying to show us; we see, rather, our own symbolic representation of things. Our expectations shape what we perceive, so much so that habitual perception tends more to paste over the world with well-worn words instead of letting it take shape within us. Thus, as historians of science know well, "false interpretations of observed facts enter into the records of their observation".[84] Instead of naive sensory empiricism, Whitehead means to affirm our "instinctive attitude" that "by due attention, more can be found in nature than that which is observed at first sight".[85] Only the perception-dulling influence of bifurcated model-centric theorizing convinces us to accept *less* than what our senses are capable of revealing. Second, the point is not to dispense with hypothetical modeling outright, but to hold our mental models with irony, keeping in mind, as Goethe suggests, that they are like "scaffoldings erected in front of a building and then dismantled when the building is finished".[86] Models become idols when they function to obscure our living contemplation of phenomena by demoting what we are actually aware of in perception to the mere secondary effect of some imperceivable cause. Goethean philosopher Rudolf Steiner sums up the proper approach to modeling by reminding scientists that "*[o]nly* hypotheses that *can* cease

76. Auxier and Herstein, *The Quantum of Explanation*, 111.

77. Goethe, *Maxims and Reflections*, no. 706.

78. Goethe, *Maxims and Reflections*, no. 575.

79. Whitehead, *The Concept of Nature*, 30.

80. Goethe, *Maxims and Reflections*, no. 529.

81. Whitehead, *Process and Reality*, 4.

82. Whitehead, *Process and Reality*, 18.

83. Whitehead, *The Concept of Nature*, 28.

84. Whitehead, *Process and Reality*, 9.

85. Whitehead, *The Concept of Nature*, 29.

86. Goethe, *Maxims and Reflections*, no. 1222.

to be hypotheses have any justification".[87] In other words, when the archetypal phenomenon has been distilled out of a properly arranged series of experiments, then the hypothetical scaffolding that may have tentatively guided our research can be set aside, allowing the Idea itself to shine through in the form of its now purified appearances.

In light of Goethe's intuitive method and Whitehead's "organic empiricism",[88] the true task of science becomes the search for the systematic relations among the metamorphic nexus of phenomena. This phenomenal nexus displays an aesthetic spectrum ranging from the superficiality of the sensorial to the depth of the archetypal. While clearly critical of scientific materialism, Whitehead's metaphysical scheme also involves a sustained critique of Kantian modes of idealistic philosophizing which seek to balance the foundations of world order upon the "cognitive and conceptual experience" of rational subjects; instead, Whitehead converges with Goethe by rooting his cosmology in aesthetics, such that "the actual world is the outcome of the aesthetic order".[89] Rather than explaining away the qualitative appearance of Nature within our consciousness as an irrelevant "psychic addition" projected upon the real causal processes hidden beneath it, or so inflating consciousness that it becomes the sole transcendental source of Nature's intelligible order, Whitehead insists on placing perception back in the midst of things themselves, such that we come to see how "it is a fact of nature that the world so appears".[90] He continues:

> The living organ of experience is the living body as a whole…The actualities of nature must be so interpreted as to be explanatory of this fact…Human experience is an act of self-origination including the whole of nature, limited to the perspective of a focal region, located within the body.[91]

The human body is thus a microcosm, a cosmic fractal creatively repeating in unique miniature what the organism of the universe does macrocosmically. But not just the human: all actual entities function as microcosmic amplifiers of the whole of cosmogenesis. "Nature is always like itself in matters both the greatest and the smallest", says Goethe, giving voice to the ancient doctrine of correspondence. "Every dim glass pane transmits beautiful blue colour", he continues, connecting the doctrine to the findings of his *Farbenslehre*, "as also the whole atmosphere with its world-enveloping clouds".[92]

Whereas Goethe tends to turn to poetic symbol to convey the esoteric meaning of the microcosm-macrocosm resonance, Whitehead attempts to render it rationally in the form of his novel categoreal scheme, describing the perceptual process in a generic enough way that it is adequate for the interpretation of aesthetic activities at every scale of Nature, whether the vibrations of atoms, the reactions of molecules, the intuitions of poets, or the propositions of philosophers. Impatient minds rush to replace the metamorphic phenomena of Nature with names and formulas, makeshift labels to which we can affix our partiality, idolatrous explanations that only obscure true archetypal understanding. While admittedly at first imposing, Whitehead found the jargon of his metaphysical scheme to be a necessary evil to break free of tired groves of thought. His neologisms are an invitation to behold the world afresh, to look and feel again without taking habitual categories for granted. His categoreal scheme is an attempt at re-describing the flow of phenomena as nature directs. It follows from Whitehead's "refusal to bifurcate nature into individual experience and external cause"[93] that a mediating category is necessary to serve as a bridge between private feelings and public facts. How is it

87. Rudolf Steiner, *Goethean Science*, trans. William Lindeman (Spring Valley, NY: Mercury Press, 1988), 148.

88. Alfred North Whitehead, *The Harvard Lectures of Alfred North Whitehead, 1925–1927: General Metaphysical Problems of Science*, eds Brian G. Henning, Joseph Petek and George Lucas (Edinburgh University Press, 2021), 9.

89. Alfred North Whitehead, *Religion in the Making* (Cambridge: Cambridge University Press, 1927/2011), 91–92.

90. Whitehead, *Adventures of Ideas*, 214.

91. Whitehead, *Adventures of Ideas*, 225.

92. Goethe, *Maxims and Reflections*, no. 1275.

93. Alfred North Whitehead, *The Principle of Relativity* (New York: Cosimo, 2007), 66.

that external objects come to find themselves as factors related within subjective experience? Whitehead invented the concepts of "concrescence", "actual occasion" and "prehension" in order to weave together what had been torn asunder: rather than conceiving of conscious thoughts, emotions, and sensations as something separate from or beyond Nature (with Nature itself reduced to the hurrying of mute material), consciousness is reinterpreted as a vastly more complex form of feeling that, at least in germ, is pervasive throughout the physical world. In Whitehead's scheme, prehensions thread the experiential fabric that weaves the causal nexus of actual occasions together. Prehensions serve to bring the past into the present, and to give the present to the future. They are the sympathetic feelings granting the public objects of the perished past entry into the subjective immediacy of another once-occurrent living present. And they fuel the aim at future satisfaction that launches individual subjective occasions of experience beyond the privacy of the present into superjective social immortality.[94] Actual occasions of experience arise out of their prehensions of the past, enjoy themselves in the present, and perish into the future, contributing their aesthetic achievements, their memories and motives, to the formation of "historical routes" or enduring "societies": all enduring entities ranging from stars to sunflowers are examples of complex societies composed of intimately related individual occasions of experience inheriting and reproducing a shared genetic character.[95] A human being is also such a society:

> The human body is to be conceived as a complex 'amplifier'—to use the language of the technology of electromagnetism. The various actual [occasions], which compose the body, are so coordinated that the experiences of any part of the body are transmitted to one or more central occasions to be inherited with enhancements accruing upon the way, or finally added by reason of the final integration. The enduring personality is the historic route of living occasions which are severally dominant in the body at successive instants. The human body is thus achieving on a scale of concentrated efficiency a type of social organization, which with every gradation of efficiency constitutes the orderliness whereby a cosmic epoch shelters in itself intensity of satisfaction.[96]

A historical route of feeling or organized society of occasions presupposes a lineage of intimately interrelated individual experiences. As Goethe would have put it poetically, concrescing actual occasions must first die to themselves as subjects before they can become for others as superjects[97]—others who "know us better than we ourselves can".[98] In Whitehead's cosmological scheme, the subjective immediacy of self-enjoyment and the objective immortality of social purpose constitute the beating heart of Nature's creative advance, an intensifying rhythm goading evermore complex forms of organization to arise. In Goethe's terms, again, "the inner and outer spheres [are] interwoven. There is constant systole and diastole, a breathing in and a breathing out of the living organism".[99]

---

94. Whitehead, *Process and Reality*, 290.

95. Whitehead, *Process and Reality*, 108.

96. Whitehead, *Process and Reality*, 119.

97. See Goethe's poem "Ecstatic Longing" in *West-Eastern Divan* for a poetic account of what Whitehead described in terms of the process of concrescence: "Tell it to the wisest only,/For the mob will mock such learning:/I will praise the living creature/That can long for death by burning./As the candle's quiet gleaming/Cools your nights of hot surrender,/You are touched by a strange emotion,/Born again as you engender./You have passed beyond the shadows:/Snatched aloft, you shall discover/New desire and higher union:/Thrall of darkness now is over./Distance tires you not nor hinders,/On you come with fated flight/Till, poor moth, at last you perish,/In the flame, in love with light./*Die into becoming!* Grasp/This, or sad and weary/Shall your sojourn ever be/On the dark earth dreary." Johann Wolfgang von Goethe, *Selected Poetry*, trans. David Luke (London: Penguin Books, 2005), 77.

98. Goethe, *Scientific Studies*, 39.

99. Goethe, *Maxims and Reflections*, no. 278.

Goethe's gentle empiricism is often described as a form of nature phenomenology.[100] In *Taking Appearance Seriously*, Bortoft fruitfully contrasts Husserl's phenomenological method (later developed into *embodied* phenomenology by Merleau-Ponty) to the Cartesian-Kantian representationalist account of perception.[101] Rather than conscious subjectivity being construed as a "'container' closed off from the world" and only tentatively related to external objects via internal symbolic representations, Bortoft champions the phenomenological concept of "intentionality", that is, the world-directed "intrinsic openness of consciousness".[102] Whitehead is also critical of the "theory of representative perception" infecting much of modern philosophy, as the "fatal gap" it artificially inserts "between mental symbol and actuality symbolized" produces insoluble epistemological problems by solipsistically isolating the knowing subject from the objects supposedly known.[103] But on some readings, the intentionality by which a subject directs itself toward objects may overly privilege the active role of consciousness, such that the object is diminished to the status of something passively grasped by the pre-determined intention of a substantial (or, in Kant's case, a transcendental) subject. Goethe's methodological claims to an enhanced, delicate empiricism that seeks to become intimately united with its objects through the receptive cultivation of new organs of perception[104] led Bortoft to propose a hermeneutic reversal of Husserlian intentionality. After this reversal, objects can be understood as "coming-toward and constituting the subject, instead of [the subject] going-toward and constituting the object".[105] In this way, Bortoft suggests that Goethe's method is an attempt to "return us to the original meaning of 'subject' before Kant inverted it".[106] The convergence with Whitehead's account of perception could not be closer:

> …for Kant the process whereby there is experience is a process from subjectivity to apparent objectivity. The philosophy of organism inverts this analysis, and explains the process as proceeding from objectivity to subjectivity…[107]

Building on Whitehead's novel category of prehension, we could refer to Bortoft's "reverse intentionality" as the perceptual mode of "prehensionality". Whereas intentionality refers to the object-directedness of subjects, prehensionality refers to the subject-directedness of objects. As we have seen, in Whitehead's scheme, objects are understood to be perished subjects, or superjects, with aims seeking satisfaction through their growth into and achievement of a novel subjective perspective. Whitehead coins the term "concrescence" to describe the process whereby the multifaceted objectivity of the past grows together to form a new unified subjective experience in the present. Rather than a pre-existent subject internally representing external objects, prehensionality describes a perceptual process whereby new subjects, like Goethe's new organs of perception, are brought forth by objective experiential vectors streaming in from the environment. Goethe claimed that living perception requires us to "become as mobile and flexible as nature herself"[108]; he thus described his intuitive observation of Nature as a process whereby "the elements of the object, the perceptions of the object, flow into my thinking".[109] It is not just that the subject conforms to its objects,

100. See for example Fritz Heinemann, "Goethe's Phenomenological Method" *Philosophy* 9, no. 33 (1934): 67–81 and Iris Hennigfeld, "Goethe's Phenomenological Way of Thinking and the Urphänomen", *Goethe Yearbook* 22 (2015): 143–167.

101. Bortoft, *Taking Appearance Seriously*, 48–49.

102. Bortoft, *Taking Appearance Seriously*, 48.

103. Whitehead, *Process and Reality*, 54, 76.

104. Goethe, *Maxims and Reflections*, no. 565.

105. Bortoft, *Taking Appearance Seriously*, 104.

106. Bortoft, *Taking Appearance Seriously*, 104.

107. Whitehead, *Process and Reality*, 156.

108. Goethe, *Scientific Studies*, 64. Translation from Craig Holdridge, "Doing Goethean Science", *Janus Head* 8, no. 1 (2005): 36.

109. Goethe, *Scientific Studies*, 39.

it is that a completed subject cannot be said to fully pre-exist the prehensive unification of the objects which compose it. Considered from the perspective of its incomplete process of concrescence, the subject remains a "nascent creature".[110] Subjects are thus granted a partial or quasi pre-existence, since there must be at least the *premonition* or *promise* of a subjectively unified satisfaction in order to lure many mutually sensitive prehensions out of the settled past toward the one unique aim of the new occasion they are actualizing within. Like tones struck to form a chord, prehensions grow into harmony with one another guided by the emergent self-enjoyment of a newly concrescent subject, which upon experiencing the world thus harmonized, perishes into superjectivity to carry its realized value into future members of its lineage.

In Goethean fashion, Whitehead's metaphysics of perception reveals the participatory nature of knowledge, whereby the scientist and the phenomenon under investigation are co-creatively caught in mutual metamorphosis. In Goethe's terms:

> The human being knows himself only insofar as he knows the world; he perceives the world only in himself, and himself only in the world. Every new object, clearly seen, opens up a new organ of perception in us.[111]

Goethe is fond of saying that the phenomena themselves, rightly apprehended, exhibit for us their own theoretical explanation: "Everything factual is already theory: to understand this would be the greatest possible achievement".[112] Whitehead expanded his theory of prehensions to develop an account of what he called "propositional feelings", which can help us make philosophical sense of Goethe's claim. Whitehead defines a propositional feeling as the prehension of a theory.[113] In Whitehead's cosmos, only very rarely do prehensions of propositions rise to the level of conscious judgments of correctness or incorrectness. In most occasions of experience, the veracity of a proposition matters only incidentally: propositional feelings act primarily as *aesthetic lures* by bringing the given, already actualized situation into contrast with possibilities that could have been or that may yet become. Goethe's study of the *Urpflanze* or archetypal plant provides a striking illustration of what Whitehead means. The propositional feelings associated in the historical route of a developing plant work to shelter its inner archetypal satisfaction, thus expressing the established order of its kingdom, while also allowing it to adjust as needed to contingent environmental conditions. Plants express the physical purposes of their inherited archetype, but with enough propositional flexibility to adapt to changing circumstances. Goethe's archetypal plant is not a Kantian idea, but nor is it a mind-independent cause. His intuition of the archetypal dynamics at play in the growth of various plant species can be described in Whiteheadian terms as his prehension of physical purposes and propositional feelings—the "*ur-feelings*", as it were—guiding plant development. Thus, Goethe's morphological method is literally a matter of coming to perceptually resonate with and poetically describe the propositional feelings, or *theories*, shaping the organic world. The Goethean scientist thus does not invent theoretical models to explain Nature by reference to something unperceived and unperceivable, but rather, by prehensively participating in the morphogenesis of phenomena, discovers the propositional feelings—the *theories*—that Nature itself is realizing.

Conclusion

This essay has only just begun the task of integrating Goethe's poetic science with Whitehead's organic metaphysics. We have seen how the method of mathesis guides both of their investigations into the nature of Nature, replacing the still prominent pursuit of certain knowledge derived from toy models with an open-ended process of learning in relationship

110. Whitehead, *Process and Reality*, 224.

111. Goethe, *Scientific Studies*, 39.

112. Goethe, *Maxims and Reflections*, no. 575.

113. Whitehead, *Process and Reality*, 184.

to a creative, living universe. "Nature is never complete", Whitehead reminds us; "It is always passing beyond itself".[114] Thus our method must not clutch after rigid mechanical idols but remain in sensitive contact with the organic flow of phenomena. Goethe and Whitehead provide natural science with a pathway beyond the bifurcated image of the cosmos, inviting us into a re-integrated world wherein fact and value, perception and causation, and beauty and truth are each understood as co-constitutive goods ingredient in the wholeness of a reality-in-process.

Both Whitehead and Goethe inhabit a Heraclitan universe of flux, a universe wherein "None could swim that very river/Twice, so quick the changes came". Whitehead extends Heraclitus' aphorism into epistemology, remarking that "no thinker thinks twice; and, to put the matter more generally, no subject experiences twice".[115] Even a million-year-old mountain vibrates in geologic rhythm: though relative to our short human lifespans it seems static, in earth-time "Like a wave it lifts and passes,/Back to atoms on the shore". Even were it made to stand before us unchanging, we'd find ourselves still "with ever-changing eyes" unable to perceive it but in process. And yet, both thinkers also intuited an Eternal One at work within all things, a universal spirit reincarnate as each particular, an archetypal power transforming life into death, and death into rebirth.

> See in each beginning, ending,
> Double aspects of the One;
> Here, amid stampeding objects,
> Be among the first to run,
> Thankful to the muses whose favor
> Grants you one imperishable thing:
> What the heart can hold to ponder;
> What the spirit shape to sing.[116]

114. Whitehead, *Process and Reality*, 289.

115. Whitehead, *Process and Reality*, 29.

116. Goethe, "Permanence in Change" (trans. John Frederick Nims) in Christopher Middleton, ed., *Goethe: The Collected Works*, vol. 1, *Selected Poems* (Princeton University Press, 1983), 169.