6. Johannes Kepler: Poetic Inspiration and Scientific Discovery

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Welches Genie das grösste wohl sei? Das grösste ist dieses,
Welches, umstrickt von der Kunst, bleibt auf der Spur der Natur.¹

The emergence of a “New Historicism” in literary studies in the past years has generated anxiety of a kind that comes with paradigm shifts.² One of the causes of anxiety is the fundamental, ordinarily implicit thrust of that trend, to question the claim of empirical rationalism as the foundation of serious literary studies and to assert the role of imagination as a basic critical function. Even less explicit because more deeply hidden in the motor forces of this trend is the assumption that events in human affairs, and even physical reality itself, possess, beyond the surface appearance of unpredictability, a poetic deep-structure that betrays a planning and ordering consciousness operating both as artist and engineer, in a way that the empirical disciplines do not willingly credit as “scientific.” The “new historical” study of literature proceeds from the assumption of literary structures in reality and human experience. That assumption is explicit in the idea of a “poetics of culture” (which Greenblatt prefers to “New Historicism”). This idea sets an agenda of humanistic study, a broadly comparative enterprise to infer from all forms of representation—including social, political, artistic—an underlying “poetics.” Within this enterprise, literature is a particularly rich bearer of congruences that mirror that external work of art, reality. This conception of a general aesthetic of representation makes literary interpretation something quite different from the quasi-scientific text study grounded on the twin pillars of philology and “Literaturwissenschaft,” different also from the new critical enterprise of severing the text from anything outside of it, and akin to but beyond the late romantic, deconstructionist project of textualizing reality.

The primacy of the imagination does not necessarily diminish the rigor of literary studies and the general validity of its insights. Still, its claim of a place in the methodological premises of criticism is a cause
of deep skepticism to a generation that feels the anchor of its discipline cut away and literary studies left adrift in the tides of arbitrariness.

The idea that empirical rationalism has privileged access to the truth and that its discoveries are more firmly grounded than those of the critical imagination has a life cycle; it represents a historical phase of Western thought. The two alternate in their domination of inquiry, as Aristotelianism alternates with Platonism. Occasionally they cooperate. Literary studies in America are at present in a phase where, after radical questioning of their rationalistic premises, they are moving toward a conception that gives the imagination priority over scientific or quasi-scientific method as the basic faculty of critical commentary.

This trend coincides with a strain in current theory of science, which sees the poetic imagination as a force in the construction of nature. The aesthetic sense is not only at work in the perception and interpretation of reality, but in the making of it. It follows from this assumption that the imagination must have a high value for the research scientist in reconstructing its laws. The recent book by Robert Pollack, Signs of Life, to take only one example, analyzes the structure of DNA using a linguistic model. The author speaks of the grammar and syntax of molecules, and suggests that DNA strands represent a kind of natural poetry.3

If the universe is poetically constructed, then scientists and literary scholars have a lot to talk about. This kind of dialogue has received strong stimulus from the side of literary studies in the writings of Katherine Hayles and in the recent collection of essays she edited, Chaos and Order: Complex Dynamics in Literature and Science.4

The conception of nature and significant human experience as works of art has a long history, which has yet to be written. The last decades of the twentieth century will have some modest claim to attention in such a study when it is written. It will certainly include a renewed interest in the writings of Johannes Kepler in this period.5 Kepler was an astronomer and mathematician who seemed in his conceptualizing of science barely to distinguish between an empirical and a poetic/musical mode. He regarded the cosmos as a decidedly musical, architectonic composition, and made his discoveries about its structure in a mode that looks to modern viewers like musical/poetical inspiration. This study looks at the context of discovery in Kepler. He is a model case of a scientist in whom the assumption of the “poetic structure of the world” and the poetical mode of the investigator’s mind produced results of immense importance of empirical, rational science.6

Fortunately Kepler liked to talk about his work. The later division of the scientist’s life into private searcher and public discoverer (Newton)7 did not exist for him. He published his discoveries imbedded in narratives of the process that led to them.
As a young man he thought he had discovered the secret of the architecture of the heavens. He described his approach to the discovery in the preface of his book, *The Cosmographic Mystery* (1596; 2d ed., 1621). As a student at the University of Tübingen he was introduced to the Copernican universe in the lectures of his mathematics professor, Michael Mástlin. He began to gather arguments for the superiority of the Copernican model over the Ptolemaic. This phase continued over a number of years, and he compared the task with that of Sisyphus. Finally he was able to take some time from his post as teacher of mathematics at the Protestant school in Graz to devote himself entirely to his studies. His conviction that the heavenly bodies at rest—sun, fixed stars, and intermediate space—were patterned on the Trinity led him to pursue Trinitarian models as an explanation for the number, the size, and the motions of the planets. After long study and many fruitless thought experiments, he turned to God and swore to the maker of the universe with many vows and oaths that, if he revealed to him the workings of the universe, he, Kepler, would defend the truth of the Copernican system. Finally one day, as he was in the middle of a lecture on planetary motion, the answer came to him: geometrical figures hold the key to the size, number, and spacing of the planets. He experimented with triangles, squares, and pentagons, placing them as spacers in intervals that corresponded to the presumed distance between the planets. He realized the approach was wrong, but it brought him to the final question prior to plenary discovery: why use plane figures when dealing with a three-dimensional system? He began to experiment with solid geometrical bodies, and these unlocked to him the mystery of cosmic architecture. The five so-called regular solids are the key.

Ancient philosophers and mathematicians had puzzled over the fact that there are only five regular solids, that is, figures constructed of plane polygons (the cube, for instance, constructed of squares) in which each surface is identical with every other, and the whole fits together in perfect symmetry with no gaps, can be inscribed in a sphere such that each of its corners touches the surface of the sphere, and can circumscribe a sphere such that the sphere touches each of its surfaces exactly in the middle.

The model of the five solids is the key, and once the plans for the construction of the universe are revealed to him in brilliant illumination, he explains them to the reader "in the very words in which it was conceived at that moment." He imagines a demiurge-God sitting in his workshop planning out the universal building with the regular solids on his worktable. When God ran out of regular solids, he stopped making planets; when he reached the bounds of inner and outer circle in
any one of the figures, he stepped out of his workshop and set the planet in place in a size and distance from the previous that reproduced the very proportions determined by the network of solids and superscribed spheres. It almost seemed to Kepler as if God himself had learned his art of universe building from human architects. He promises to reveal in his work “how God, like one of our own architects, approached the task of constructing the universe with order and pattern, and laid out the individual parts accordingly, as if it were not art which imitated Nature, but God himself had looked to the mode of building of Man.”

This glimpse into the workshop of the demiurge was granted him not by persistent reasoning induction but by divine grace. In the dedicatory letter to the 1621 edition of Mysterium, he cautions the reader not to take the book as a contrivance of his own intellect, but rather “just as if it had been dictated to my pen, an oracle fallen from heaven, every chapter of the little book was recognized at once, by those who understood it, as important and quite true (as manifest works of God usually are).” Kepler himself just meditated; he “touched the seven-stringed psaltery of Creative Wisdom” and gave voice to the writings in the book of Nature, putting into words the glory of God as proclaimed by the heavens themselves.

We see Kepler here caught between the megalomania and humility of the man who takes himself to be the mouthpiece of a god, often the dilemma of discoverers who understand their ideas as a completely extrapersonal merit, a gift from some outside source. In his later work, Harmonices Mundi (1619), he again explains the circumstances surrounding his perception of world harmony, and he again resorts to the idea of inspiration: God himself had implanted in him, he relates, an “enormous desire” to investigate the heavenly harmonies, and he “inspired his mind” (mentem inspiraverat). Here Kepler places himself in a line of descent from physicists whom God had elected personally to receive his revelation: fifteen hundred years earlier he had chosen Ptolemy as his vessel (who also had written a book on the heavenly harmony). Now he has chosen Kepler as the successor of the famous Egyptian astronomer: “Nature itself wanted to reveal itself to men in various centuries as its interpreters,” and it can only be God’s finger that pointed two astronomers independently (Kepler read Ptolemy only after writing most of his Harmonics) to the insight into the musical nature of cosmic composition. Now Kepler depicts himself standing at the very threshold of the final revelation: eighteen months previous he had glimpsed the first light, three months before the bright day, and a few days prior to writing, “the full sun of a most wonderful vision”: 
“nothing restrains me any longer. I am free to indulge in sacred raving [sacer furor], free to fling into the face of mortal men the open confession that I have stolen the golden vessels of the Egyptians to set up for my God a tabernacle far from the borders of Egypt. . . . The die is cast, the book is written, whether for the present generation or for posterity, it is no matter. Let it wait one hundred years for its reader; God himself waited six thousand years for his!” 11

Kepler’s discoveries came to him in a torrent of emotion. The insight into the musical harmony of the world came in a state of “sacred raving.” The moment of discovery has this ecstatic character, as he is glad to point out. The mystery of the five solids caused him a delight that he “will never be able to express in words.” 12 He wrote to Michael Mästlin, on August 1, 1595, telling him of the discovery. It came to him, he says, so powerfully that he “shed profuse tears.” 13 And again writing to Mästlin on October 3 of the same year: “Behold how close I come to the truth. And doubt not that as often as something like this comes to me, I shed tears abundantly.” 14 In the Epitome of Copernican Astronomy he speaks of the “unbelievable delight” that fills him when he recognizes and contemplates the beauty of his idea. 15

There are fewer clearer insights into Kepler’s self-conception as a scientist than the hieratic atmosphere he builds around the experience of discovery: his scientific work is a quest after the ideas of the creator; and if he receives insight into them, it is by special grace that God grants to Kepler as his elect astronomer. He investigates with a sense of religious mission, part of which is to mediate between God’s mysteries and mankind. Truth comes in the divine rage (sacer furor) of Platonic inspiration. He is the new Moses. He is the interpreter of the book of nature, chosen personally by God on high for the task. Kepler imagines God first selecting Ptolemy as the chosen one to receive the insight into world harmonics, and then patiently biding his time until the second coming of an elect astronomer, Kepler. He describes this sense of election in a striking passage from the Astronomia Nova (1609): “There is . . . a certain determination of destiny that works in secret, leads particular men up to the various arts and sciences, and lends them a sense of certainty that they, while a part of the work of creation, still participate in divine providence.” 16

“Participation in divine providence” is a bold formulation. It points to a strain in Kepler’s thinking that he has in common with both inspired geniuses and inspired madmen: absolute certainty of the truth of his insights. His confidence in his thoughts is absolute because they are not his; he is just following a path that has been cleared before him and opened to him by a much greater mind. In the epigram that intro-
roduces the *Mysterium Cosmographicum* he quotes verses that he ascribes to Ptolemy: "I know that I am mortal and ephemeral. But when I search for the close-knit encompassing convolutions of the stars, my feet no longer touch the earth, but in the presence of Zeus himself I take my fill of ambrosia which the gods produce." The hieratic tone of Kepler’s thinking shows again in the priest’s role in which he regularly cast himself. He and other elect astronomers are “priests of the highest God” whose sacred book is Nature itself. His sanctuary and realm of worship are the mystery of nature. He imagines his book, *Cosmographic Mystery*, as “standing guard at the gates of the temple where Copernicus performs the sacred rites at the high altar.” He leads his generation to the cosmic mysteries through new astronomies, as Moses led the Jews out of Egyptian captivity. His book on celestial harmony, following the Egyptian Ptolemy, is “gold from Egypt” to adorn the temple of Jehovah.

The god of astronomers is everywhere at work in Kepler’s life. Any coincidence that favored his work is explained as divine intervention and the furthering of a higher plan. He knows that Tycho Brahe’s observations on planetary motion are vital to his work, but he fears the trip to Denmark. Lo and behold, Brahe plans a trip to Prague, and Kepler takes this for an act of “divine guidance.” They meet just at the time when Brahe is preoccupied with the motions of Mars, the same problem on which Kepler has just reached an impasse. Again, divine guidance is at work. God has sent him the required help at the critical moment.

It is possible to see this hieratic overlay as the reassertion in astronomy of his earlier sense of a religious calling. Kepler’s first ambition as a student was to become a Protestant minister, and when he gave it up to become a mathematics teacher, he had written to Mastlin: “I wished to become a theologian: it was long a source of torment to me. Behold now how God is glorified by my work in astronomy.”

But also Kepler had a strong sense of identification with pagan philosophers. He sees himself in a line of descent from Pythagoras, Plato, and Euclid, though his role is far more modest. He, Galileo, Copernicus, the moderns, are placed in the world in order to correct some minor errors of the great ancients, which they made for lack of good data.

Kepler wrote poetry, and his poems are a part of this complex of a priesthood of ancient and modern astronomers. Many of his poems are hymnic praises of the creator. His models were the psalms of David. In his dedicatory letter to the first edition of the *Mysterium*, he explains the whole enterprise as parallel to that of the psalmist, the main theme
of both being the glory of God visible in the heavens. The heavens proclaim God's glory, but without a voice. Kepler's task is to provide them with one. 24

Kepler's conception of his activity as searcher and finder of divine mysteries fits a widespread model of inspiration and discovery. Nietzsche's description of the experience resonates clearly with Kepler's:

[Inspiration consists in] ... the sense of being merely an incarnation, merely a mouthpiece, merely a mediator of higher forces. The notion of Revelation—in the sense that all at once, with ineffable certainty and subtlety, something becomes visible, audible, something that shatters and overthrows the very depths of your being—this is an objective description of a factual state of affairs. One listens without searching; one receives without asking the identity of the giver; like a flash of lightning a thought lights up, with necessity, in the right form and no hesitating—I never had any choice. An ecstasy whose enormous tensions discharge themselves in a stream of tears. In its grip your pace is now hectic, now serene—always out of your control: you are beside yourself, only partially, you are intensely aware of shudders and gooseflesh down to the tips of your toes. . . . Every thought presents itself as the most exact, the most correct, the simplest expression. 25

The experience is common to artists and scientists. The comparison of Kepler and Goethe on inspiration and the role of poetic design in nature is also useful. The poet-scientist and the astronomer-mathematician-poet share a conception of nature as musically composed, at the same time concealing and revealing the inner laws of its construction. Both men explicitly locate their inspiration in this conception of nature: a world constructed on principles of harmony, proportion, according to a grand design conceived by a master artist. Discovery then becomes a process of reconstituting in the human mind the poetry of nature. 26 That process is no more open to arbitrariness than any other mode of investigation, perhaps less so, since the assumption of chaos or indeterminacy, given a poetic structure of nature, represents an error every bit as great as the converse.

Kepler also described this process in detail, and Hallyn has offered a wide-ranging reading of it:

An inner conception precedes and governs the Creation of the material world. It determines the form of the world and . . . in the second half of the sixteenth century art theoreticians insistently transposed this conception of the divine Creator to their realm. The
concrete work of art, the \textit{disegno esterno} . . . is seen as dependent on the \textit{disegno interno} . . . which is its inner and prior conception, its model and source . . . corresponds to the \textit{a priori} apprehension of a beautiful form, and constitutes an act of production rather than reproduction. \( ^{27} \)

We can observe Kepler's conception of the world as a work of art and the scientist as a kind of critic by looking briefly at his ideas of cognition. They are laid out in a passage on a priori knowledge in the \textit{Harmonices Mundi}:

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to \text{ know is to compare external things perceived by the senses with the internal ideas and to judge that the one corresponds to the other. . . . How then did these notions make their way into the mind? I respond that the ideas or relationships of the harmonies in their entirety are . . . present in those who enjoy that faculty of cognition, but they cannot by any means be received inwardly through discursive reasoning; rather they arise from a natural instinct and are inborn in them [i.e., in men gifted with cognition], as in plant-forms the number of petals is inborn in the flower and of seed cells in the apple.}^{28} \]

An interesting Keplerian variation to this Neoplatonist scheme is the idea that implanted knowledge is instinctual. Such instincts link humans with animal and plant forms. The chicken has a fear of the hawk that is activated just by the sight of its enemy; it requires no lessons or training in recognizing hawks. The instincts are a purely animalistic or vegetative faculty. As the chicken recognizes the hawk a priori, men—at least some men—possess the sense of number, musical harmony, and geometrical relationships. \( ^{29} \) These implanted instincts show the functioning of what Kepler calls a "creative force" (\textit{vis creatrix}), a power informing every living creature and driving it toward a characteristic and predetermined telos. Its strict and inalienable working is evident, for instance, in the six-cornered shape of every snow flake; it is visible in the invariably symmetrical cells of the beehive. \( ^{30} \) Cognition in humans is as passive and automatic as the building of cells for the bee or the developing of petals for the flower.

But one function of the \textit{vis creatrix} is reserved exclusively for the human species and distinguishes it from lower forms: artistic expression. Human beings can themselves form harmonies, symmetries, and shapes in imitation of the ideas within. They can compose music and make their bodies perform pleasing and harmonious gestures in accord with the implanted harmony. \( ^{31} \) And insofar as this willed creation of
order imitates higher order and harmonies, it must make use of those intellectually present archetypes. Men can also write verse, in which the expression of harmony is carried by the rhythm and sounds of the words. The composition of poetry calls on the ideas inborn in the soul, which send forth refractions of harmony and thus mediate between heavenly and earthly harmonies.

Human cognition, then, is identical with animal and vegetable in terms of its dynamics, but it is of a higher order. Instincts serve only self-preservation in the chicken, but they permit humans to converse with God in poetry and music. The vision of harmony brings them joy by reminding them of the eternal principles of the universe; they rejoice to feel the presence of harmony, beauty, simplicity in their minds: "we share this brand of cognition with God, at least insofar as we perceive something of these things in earthly life. It is foolish to fear that we make man into God by saying so, since the counsels of God may be incomprehensible, but His visible works are not." Human cognition imitates divine. Mathematics is the prime example: "Geometry is unique and eternal, and it shines in the mind of God. The share of it which has been granted to man is one of the reasons why he is the image of God."

In this notion of human imitating divine cognition, we have, I believe, the core of what earlier studies called "Kepler's mysticism." But at the same time it is the core of his rationalism. The phrase "mysticism" in this case only has content and meaning if the world is rational and comprehensible. If Kepler was a "mystic" for believing in the regularity of the universe, then so were Newton, Goethe, and Einstein. Goethe also noticed the individual and artist-like will to form implanted in everything living, and described man's ability to perceive the secret law hidden behind the veil of variety. Einstein's much-quoted comment that "the eternal mystery of the world is its comprehensibility" restates the same "mystical" insight into the rationality of the universe.

Now, of course, Kepler's inspired discovery, the five regular solids as the key to the "cosmographic mystery," an idea that he never completely abandoned, was out and out wrong. The hypothesis would eventually have faced falsification on the grandest scale: the discovery of more planets is crushing refutation. God only made five perfect solids, and he would have run out of them before he ran out of planets.

The immensity of Kepler's error, viewed against the immensity of faith in it, suggests that the whole tissue of ideas leading to his "sacred raving" was really a tissue of error, as fallible as prophecies made in asylum-variety raving. But in his case, precisely the tissue of error...
was the matrix of discovery. Kepler’s three laws of planetary motion emerged from this matrix, which we could at the least generous call a highly productive, fruitful error. The five-solids hypothesis yielded, for the first time, “a universal physical law based on terrestrial mechanics to comprehend the whole universe in its quantitative details.” 38 The result is “a breathtaking conception of unity . . . perhaps even more striking than Newton’s for the simple reason that Kepler had no predecessor.” 39 His hypothesis harmonized an impressive array of ideas: a whole line of thought since Pythagoras fell into place and made sense: the mystical importance of numbers, the secret of the five geometrical solids, the music of the spheres and the general conception of a harmonic cosmos, the heliocentric theory.

We have a puzzling situation in which a man committed to scrupulous testing of theory clings to inspired ideas that turn out to be preposterous. This underscores the point that inspiration is indifferent to the truth. The experience is common to geniuses and maniacs. Kepler’s inspiration was a response to grand visions of order. The idea of the five solids reduced an enormously varied set of phenomena to simplicity. It satisfied his criteria for the thoughts of God: mathematical perfection made visible. Whatever the ontological value of the idea of an ordered and designed universe, it had an immense heuristic value, and created the circumstances under which poetic inspiration could produce scientific discovery. Wrong though the “cosmographic mystery” was, it ordered the vast machinery of the heavens according to simple and beautiful principles, and beautiful principles had for Kepler the quality of the thoughts of God.

The productive cooperation of a poetic and an empirical-scientific mode of thought in Kepler supplies a parallel to the current search for a “poetics” of science, history, and culture, and it suggests the firm grounding of that trend. The comparison tends to legitimize a mode of thought that can find aesthetics in the structure of nature, of history, and of culture, and that can envision, conversely, an empirical grounding of poetry, art, and narrative. The contrary, rationalist idea that the composition of poetry and the discovery of scientific laws are essentially different processes of the mind deserves a critical view. Kepler is a model case of their essential similarity.

Notes


3. Robert Pollack, *Signs of Life: The Language and Meanings of DNA* (Boston: Houghton Mifflin, 1994). This trend was featured in a newspaper article recently: "Academic Disciplines Increasingly Entwine, Recasting Scholarship," *New York Times*, March 23, 1994, p. A-19. The trend is criticized in its relation to "postmodernist" cultural studies by William Clark in an ironic review ("Poetics for Scientists") of F. Hallyn's *The Poetic Structure of the World: Copernicus and Kepler*, in *Studies in History and Philosophy of Science* 23 (1992): 181–92; his review is about "the project of a 'poetics' of science" (p. 182); "Hallyn may be placed in a broad 'postmodern' project to restore the postmodern status of poetics in the economy of knowledge. . . . Such a poetics might even hubristically subvert the Modern Era's notion of science, efface the borders between science and literature, make science fiction" (p. 182); "'Poetics of . . .' has become part of the postmodern mantra, and thus, eo ipso, possessed of equivocal sense" (p. 183). His treatment of Hallyn as "eruditio à la mode," and as a member of "the California school," casts him smugly and unfairly as a kind of new-age flake, forcing knowledge into eccentric, archaic classifications. Hallyn, however, is a fairly sober observer of Kepler's presuppositions of investigation. If anyone is a new-age flake, it is surely Johannes Kepler himself.


13. To Mästlin, August 1, 1595, GW 13:28.
22. In a long dissertation on the superiority of the pagans to the moderns he places himself at the end of their line: “the prodigies will naturally be Pythagoras, Plato and Euclid. . . . Trailing far behind the ancients will be Kepler.” Kepler’s Conversation with Galileo’s Sidereal Messenger, trans. Edward Rosen, Sources of Science, 5 (reprint, New York: Johnson, 1965), pp. 37–38.
23. This ranking predominates in Kepler’s definition of moderns against the ancients. It did not prevent him from correcting the ancients, but without a sense of superiority (in contrast to the texts cited by Grafton arguing Kepler’s sense of superiority to the ancients, in “Humanism and Science,” pp. 39–42).
24. Cf. also the poem that ends the Mysterium. It is a hymn of praise to the creator written distinctly in the style of the psalms. Mysterium, trans. Duncan, pp. 224–25; GW 1:80.
26. An important statement of this conception in Goethe’s essay, “Erfinden und Entdecken,” GA 17:752: “Everything we call ‘invention’ or ‘discovery’ in a higher sense is the decisive exercise or activation of a primal sense of truth
which, developed unconsciously over a long period of time, leads in an unex-
pected flash to fruitful insight. It is a revelation developing from within and
confirming itself externally. It lets man glimpse his god-like nature. It is a syn-
thesis of world and mind, which gives the most blissful assurance of the eter-
nal harmony of existence.” He developed his ideas on inspiration in poetry
and science in a conversation with his friend Eckermann, from March 11,
1828, GA 24:678–79: “Any productivity of the highest kind, every significant
insight, every invention, every great thought that bears fruit and produces
consequences, stands in no one’s power and is elevated above any human
force. . . . In such cases man is often to be regarded as a tool of a higher world
order, as a vessel found worthy of receiving the divine influence.” Goethe en-
visioned a single principle unifying all creation. Like Kepler, he found a pure
expression of that unity in the laws of musical harmony. In a letter from 1810
he expressed the hope that he could join theory of musical composition with
his own ideas on nature to create a kind of Grand Unified Theory (to Georg
Sartorius, July 19, 1810, GA 19:610): “Zelter is here at the moment, and no
doubt his presence will favor my old urge to tie harmonics to my own inter-
ests, so that it can be synthesized with the rest of physical phenomena and
with the theory of colors. If a few great formulas can be worked out success-
fully, then everything will be One, unfold from One, and return to One.”

34. Conversations with Galileo’s Sidereal Messenger, p. 43.
35. Cf. R. S. Westman, “Kepler’s Theory of Hypothesis and the ‘Realist Di-
lemma,’” Vistas in Astronomy 18 (1975): 717–18: “[Kepler’s] enthusiastic pro-
mulgation of the polyhedral hypothesis, frequently misunderstood by histori-
ans who relegate it to the ‘mystical’ side of Kepler’s personality, was, in fact,
a rational attempt to show that the Copernican ordering and spacing of the
planets was no accident; that it literally reflected the decision of a purposeful,
architectonic God who could only have embodied his goodness and perfec-
tion in the most beautiful of all possible geometrical forms, the five Platonic
solids.”
36. “Metamorphose der Tiere,” GA 1:519–20 [all members are formed after
eternal laws, and the most exotic form preserves secretly the archetype]:
“Freue dich, höchstes Geschöpf der Natur, du fühlst dich fähig, / Ihr den
höchsten Gedanken, zu dem sie schaffend sich aufschwang, / Nachzudenken.
Hier stehe nun still und wende die Blicke / Rückwärts, prüfe, vergleiche, und
nimm vom Munde der Muse, / Dass du schauest, nicht schwärmst, die lieb-
lliche, volle Gewissheit.” The sentiments could come straight from Kepler.
37. Albert Einstein, “Physics and Reality,” in his Ideas and Opinions (New
York: Bonanza, 1954), p. 292. This is close to Goethe's idea that everything factual reveals unchanging laws: "Do not seek anything behind phenomena. They themselves are the theory." ("Beobachten und Denken," GA 17:723).

39. Ibid., p. 72.