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The Four Corners of Our Brain

~ WAYNE ANDERSEN ~

ABSTRACT Throughout religious, scientific, and humanist literature on ideas one finds categorical subdivisions that are four in number: the four corners of the Earth, the four cardinal directions, the four proteins constituting DNA, Maxwell's four equations, Toynbee's four societies, Pythagoras' four elements of arithmetic, Pythagoras' four elements, Hayden White's four aspects of imagination. The list is endless. From where does the "four" come? Why not five, or six, eight, or nine? Andersen tracks back to the beginnings of arithmetic utilized in the architecture of conceptual thinking. He finds the answer not only in the quadration of the human body as having four sides and giving a stabilizing structure to the brain but equally in the architecture of memory. Using the slot-theory of short-term memory processing, he demonstrates how easily the four-count comes to mind and how the brain resists moving on to five.

I

The nineteenth-century Irish mathematician, Sir William Hamilton, discovered something so simple that it struck him as incredible: "If you throw a handful of marbles on the floor, you will find it difficult to look at more than five or six marbles without your eyes getting confused." A decade later, the English economist, William Stanley Jevens, meaning to or not, confirmed Hamilton's observation. He dropped a few beans into a pot, took a quick glance at them, looked away, and estimated how many beans he had seen. After a few repetitions, he found he never made a mistake with up to four beans but was sometimes wrong when there were five or six; beyond that, it was hit or miss. How strange that a mind capable of handling mathematical calculations of extraordinary magnitude and complexity would have difficulty guessing at a glance how many beans were in the pot when more than four? One recalls the pleasantry told of Albert Einstein making arithmetical mistakes in a card game, triggering one of his fellow players to cry out, "For god's sake, Albert, don't you know how to count?"

Look at your hand. When forming a hand, evolutionary biology made four fingers, not five. After four, the anatomical discourse on finger making shifted. The fifth digit became the thumb (the shift yielding four fingers plus one thumb equaling five digits, not five fingers). Now look at the "gated" method of notational counting. One counts four

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I

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units with a short vertical line for each unit, IIII, then indicates the fifth by closing the gate: **HHH**. Complexity sets in when “four ones” become verbally expressed as “five”—not as “five ones” but as “the number five.” That singular quantity stabilizes the four ones, just as the crossbar on vertical gate boards stabilizes the gate. Because the crossbar does something the four vertical lines do not do, I refer to it as a separate discourse—the same for the thumb, which belongs to the discourse of pincers, not graspers. And even though on each foot we have five toes, after counting four a shift in discourse lays emphasis on “the big toe” as performing a discrete anatomical function as the toe that works to keep the leg aligned when walking. How simple it seems! I do not agree, however, that the five-count or the ten-count came from counting one’s fingers, as if toes and fingers are at the deterministic base of arithmetic.

II

When rationalized causes first emerged from religion and philosophy everything on earth owed its origin to an interacting set of elements that already existed, most notably earth, air, fire, and water. The fifth-century BC Greek naturalist philosopher and statesman Empedocles likened those four elements to four colors on an artist’s palette that, when variably mixed, could fashion every color in the universe. With those colors, a skilled painter could create anything that existed plus things that did not yet exist. Whether Empedocles’ observation of the artist’s palette and the creative power of four colors preceded or followed his proposition that everything in the world came into existence through the mixing of earth, air, fire, and water, we cannot know for sure. But I suspect that he dwelled first on the artist’s palette before formulating his theory of everything that appears for the first time or undergoes changes. It primed his mind to expand its power of imagination to visualize Nature’s power to create and change itself without help from the gods. I suppose as well that the seventeenth-century empirical philosopher John Locke looked hard and often at marble before envisioning the mind as a block of veined marble that is indifferent to what form a sculptor gives it. And most likely Albert Einstein, when demonstrating his Special Theory of Relativity as a raven in flight alongside a railway carriage—both raven and carriage moving in a straight line with respect to the same co-ordinate system and so erasing any notion of singular velocity—had thought about that raven and carriage before he formulated his Special Theory. Were Empedocles taken to be a theoretical scientist, his formulation of a theory of everything made from just four things would seem utterly naïve: one cannot liken the creation of everything in the world to an artist mixing four pigments on a palette. Yet, using the four-color process—black, cyan, magenta, and yellow—today’s processors of imagery reproduce the appearance of any object, phenomena, or work of art.

III

This essay is confined to elementary whole numbers having status as transformational groups of ones, such as two *ones* as a weak form that becomes hardened as a pair, duo, duplex, or twins, and three *ones* as a weak form that becomes hardened as a triplet, trio, triad, or trinity. Such elementary numbers, which I deploy as *sets of ones*, usually attach to

things as a numerical count but can also be associated with things not consciously counted, such as the earth's four corners that do not exist and the four winds that cannot be isolated but only named. I will argue that the four winds and the four corners, like the four sides of a square, pre-exist their count as *four* just as heat exists before one feels hot.

My second premise upon which this essay depends is belief that, to the extent that a rupture in knowledge overrules previous knowledge, the new or modified meaning retains its previous structure. Empedocles' earth, air, fire, and water, while no longer fashioning everything in the universe, still make bricks, and the *four* that structured his grand theory still structures grand theories, even though the structures go unnoticed. Today's physicists have accumulated enough evidence to confirm that all interactions between materials and objects—the millions upon millions encountered every minute—can be reduced to combinations of *four* fundamental forces, those being the Strong, Electromagnetic, Weak, and Gravity. The weak and strong forces bind and regulate the movement of sub-atomic particles; the electromagnetic force regulates everything having an electrical charge; gravity holds the universe together. As for elements upon which these forces act, they too come down to four: the electron, electron-nutrino, up-quark, and down-quark. So, structurally speaking, with four forces of nature acting on four fundamental particles we are still in accord with Empedocles' four elements that when combined in various ways account for the substance of everything in the world. And let us not overlook that it takes only four proteins composing DNA—Adenine, Guanine, Cytosine, and Thymine—to program the form and behavior of all organisms that populate the earth. So it appears that today's most sophisticated scientists cannot escape restraints imposed by the number four, and, as we shall see, every effort to get beyond four requires a change in discourse, with each change reinforcing the integrity of four.

Four can be four of anything. But four is not a static diagram of four *ones*, or three a diagram of three *ones*. Elementary numbers are internally transformational as mental structures: the implicit *two ones*, *three ones*, and *four ones* interact both within and with each other, and therefore must be given functional considerations as more than aggregates. If expressed as a quartet, for example, the discourse on counting shifts from a count to an abstraction: the four ones become one thing made of four things. A quartet is stronger than four individuals because it bonds the four as a discrete unit of four sub-subjects, such as four musicians or singers performing in the same key, as in concert, each instrument an individual.

IV

To explicate a complex theory, one shifts downward to take a more primitive grasp on natural order that provides formats for standard and non-adventurous thought. To understand anything that is perplexingly complex, one de-differentiates the complexity by working down the scale until reaching its simplest state in banal reality (a *tabula rasa* is, in fact, blank; the raven observed by Einstein can indeed fly alongside a carriage with both it and the carriage moving at the same speed). Ironically, conjectures as to the primal creation of organisms are no closer to proven than the fashioning of Adam from clay. As if embedded in the human brain from day one, the most recent theory moving toward

an explanation of genesis for the first organic cell still looks to clay as the primal medium of creation, a clay called montmorillonite that is formed from weathered volcanic ash and familiar to many of us as cat litter.¹

In the dedifferentiating process, verbal explanations distort through reduction, yet the reduction retains everything, just as the present moment contains all time, and our genes contain imprints of every organism that gave rise to every species in the chain of evolutionary events leading to humans. Think of a theoretical reduction of data as a mine for what it conceals: any radical theory gets its subject down to the roots (radical = *radix* = root). The roots, or radicals, of any theory of natural processes are in soil, like the rooted tree of knowledge. Most sophisticated and complex theories come to mind from simple observations of simple subjects, which accounts in large part for why Claude Lévi-Strauss, the innovator of structuralism, looked to primitive cultures, why Jean Piaget looked to children, and Michel Foucault to the insane as research materials. Children not yet fully formed and people exhibiting insane behavior stand out more definably than those considered normal.

That Lévi-Strauss, Piaget, and Foucault may have misjudged the simplicity of their subjects is not a matter of which I need to take special notice. Their methodologies shared an effort to devise transformational rules for how an irrational subconscious and its idiosyncratic symbols could enter into the structure of language and become communicable as common knowledge. I differ in not believing that unconscious ingredients are irrational, or that language structures the unconscious, as Jacques Lacan proposed, other than as transformations of what is already structured. As in descriptive geometry or descriptive linguistics, what the unconscious offers to description is describable, *already* describable, just as what the brain offers to desire is *already* desirable. In short, the unconscious is not at the outset a tabula rasa but is articulated—not void and without form as was the earth before Creation.

We exist in a physically three-dimensional reality that is our reality even before articulated for our senses as having three dimensions. With time added, reality changes discourse (unlike dimensional objects, time cannot be shaped) and becomes four-dimensional. The fourth is easy enough to grasp because we perceive the three dimensions and feel the fourth, the passage or movement of time, which is a separate discourse from the dimensional three. But every effort to add a fifth dimension remains scientifically speculative and beyond our senses as perceivable or sensible. Physicists working with so-called string theory believe they have detected a fifth dimension, and for that matter, many more dimensions, but to explain their findings they must shift to an altogether different discourse as to how interactive forces define the universe. The classic four dimensions are of the macro-universe, which is external to atoms. The string theory physicist works within atoms where gravity does not figure. So, one cannot add a fifth dimension to the four insofar as current physics explained by relativity theory requires gravitational force. Every postulate of a fifth dimension meets with as much resistance as would an effort to reduce it to one—the four as aspects of one, which would require a traumatic shift in discourse: scientific into religious thinking with everything comprising the universe as aspects of one god. That shift would bring us back to the condensation of multiple gods into a single god, pantheism into monotheism, which is equivalent to modern physicists' effort to find a single formula that will explain everything and thus end physics as an inquest.

V

In that respect, modern physics has not entirely withdrawn from theology. Homer's cast of characters in ancient theogony worked just fine for establishing a broad-based lineage of gods to account for all things and incidents, but over time and in various places more sophisticated minds looked less to gods and more to natural forces. The first-century BC Titus Carus Lucretius in his *Della Natura* (*On the Nature of Things*), one of the most important books among scientifically minded Greco-Roman philosophers who drifted toward secularism, recognized the materiality of perceivable reality operating with its own forces. In the Cartesian sense of "I think, therefore I am," Lucretius may have thought, "It is, therefore it exists."

Hoping to fuse the growing trend of natural science with religion, some ancient philosophers tried postulating a single god, a covering god, but secular minds defeated their efforts. Cicero once quipped, tongue in cheek, "If everything in the world was controlled by one god, that god would be freezing in the north and baking in the south." Yet the extreme variety of natural elements could hardly be attributed any longer to a diversity of discrete gods or their number would proliferate with the appearance of new things, the god of doors generating a god of thresholds, the god of hinges needing a god of locks, the latter necessitating a god of keys and a god of key chains. Secularism led to belief that differences among things do not come about in a single relationship to an enacting god but rather to elements interacting with or against each other. The unity of Nature would not be the compatibility of its elements in peaceful harmony, as in Eden or any Garden of Earthly Delights, but in the flux of opposition and alienation. Nature would be responsible for how things came about in such enormous variety through incessant mixing, such as when two things of an opposite nature fuse to create a third thing that is different from either of the generative things, such as fire and sand creating glass. For my purposes, let us agree that the potential for becoming glass is innate in silicone sand while not in ferrous sand, just as *four* is mentally innate in the perception of a rectangle but not in that of a circle.

Stability is commensurate with squareness, or vice versa. *Four* is a secular, down-to-earth number associated with universal stability. We know the earth is a directionless sphere, but to give it stability we polarize it and speak of its four regions and four cardinal directions, thus keeping it square. The first-century BC Vitruvius speaks of a cube, such as a die, that when thrown always settles down in a stable state regardless of on which side it comes to rest.² A throw of dice is a functional example of quadratic stability demonstrating why a table with four legs is more stable than one with three. The Vitruvian Man stands foursquare within the cosmic circle, as reconfirmed by Leonardo da Vinci's famous drawing that squares the ideal body within a circle, its mid-point at the man's naval, the ancient Greek *omphalos* reduced to human scale as proof of cosmic order on every scale. In like manner, the classical Chinese heritage of cosmological themes envisions the earth as a lotus flower with a mound at the center, the mound as the earth and as well a mound of seeds signifying the fecund womb. The flower's four petals point in the earth's four cardinal directions.³ In short, whatever the context, the secular *four* is earthbound and a fundamental principle of human thought that is no more mystical than the mechanics of sensory organs and metabolism.

VI

In this essay, I move about in historical time and among cultures to erase any notion that what I have to say about “four” is bound to a specific culture or era. I will not lapse into mysticism or the alchemy of numbers, or assign the simplicity of what I have to say to simple or primitive minds. To offset that usual approach, I now cite a sequence of examples with sophisticated theoretical structures to demonstrate the autonomy of “four” as a determinate factor in theoretical structuring. To avoid physics and mathematics as the province of numbers, my first examples come from art theory (technical knowledge is not necessary for my readers to grasp the meanings of these examples other than their simple structure).

The eminent Harvard University art historian, James Ackerman, writes that the first history and criticism of art as practiced by sixteenth-century Giorgio Vasari depended for the wholeness of its conception on certain steps taken in critical sophistication, the effect of which was to formulate a more complex definition of what it meant to imitate nature. Ackerman cites four preparatory steps: (1) that of Fazio, who added interior feelings and emotions to the external appearances that had to be emulated; (2) that of Chryoloras and Alberti, who suggested that the most important ingredient of a work of art was a beautiful idea or harmony originating in the mind of the artist; (3) the postulation of *natura naturans*, which validated the inventiveness of artists on the grounds that it imitated nature in making things that did not previously exist; and (4), that of Landino, who found terms for differences among artists of the same period, thus emphasizing individuality.⁴ “Against this background of prerequisites, on accepting and emphasizing the potential divinity of an artist, Vasari also left a formidable legacy: the concept of creativity, a power previously conceded only to God, and one that could be used to glorify artists and to justify a history of art devised, like his own, in terms of the succession of works of great artists.”⁵

My second example: in 1996, Rosalind Krauss at Columbia University and Yve-Alain Bois at Harvard joined to formulate the theoretical criteria upon which they built the exhibition *L'Informe: Mode d'emploi* that took place that year at Centre Georges Pompidou.⁶ In an essay prefacing the exhibition catalogue, “The Use Value of Formless,” Bois declassified what he and Krauss call “the larger units that are the very stuff of art history,” by which they mean the conventional *four* units: style, theme, chronology, and oeuvre. Bois goes on to say that he and Krauss reclassify art history with *four* different vectors within which one finds the mark of the formless. Each division they call “an operation,” based on Georges Bataille’s notion of art making as a job (what Piaget called “a method” and Roland Barthes called “an activity”). The *four* proposed operations are horizontality, base materialism, pulse, and entropy. In an earlier publication, Krauss postulated *four* possible directions opening up for sculpture in the expanded field of postmodernist theory. In a later essay, she deployed, via Jacques Lacan, the Greimanian Square to plot the infinitely extensible generatrix of *four* formal possibilities open to art production that she diagramed as a square with figure, gestalt, ground, and grid at the corners, and figure-to-gestalt and ground-to-grid as connecting diagonals.⁷ In short, with the persistent number *four*, Bois and Krauss formalize the unformed in order to have it make sense. Their method follows on Lévy-Strauss’s principle of structuring that he previously envisioned as unformed and unconnected in primitive cultures, and follows as well on Lacan’s effort to find quadrate geometry in the work of the unconscious,

which he took to be the primitive state of the brain.⁸ From Lacan we get *The Four Fundamental Concepts of Psychoanalysis*.⁹

Why four? I propose that neither Ackerman nor Bois and Krauss determined the four-count they deployed. It was already in their heads as a structural *four* akin to how reflexively one assigns *four* directions and *four* corners to a round world, and a front, back, and two sides to one's body that is not a rectangle. Quadrangulation is so common in structuring perception and forming mental structures that it is too automatic and habitual to attract notice.

May we call it an intuitive structure? Intuition, as non- or pre-cognitive thinking, operates with structures that allow the mind to perceive or know things without conscious reasoning. By cognition, I simply mean the brain's use or handling of knowledge through generalizations, analogies, and explanations that the brain structures more or less as would other brains, so one brain can communicate with the others, each performing operations in common. Cognition depends on predictability, which is a function of thingness fused with certainty such that thought is transportable like packaged goods, whether packaged as a formula, a comprehensive explanation, or a metaphor (in Greek, a *metaphore* is a transport truck). Unless fixed by rules of discrete form, no thing or enactment can be trusted to appear the same each time it is experienced. One might say that intuitional certainties precede reasoning in the manner of the "packaging principle" of ethics, which I understand as an intuitive faculty that apprehends fundamental moral principles embedded in the human mind as essential to stabilizing individual behavior within a diverse society. Intuition binds individuals to common thought or knowledge as securely as do physical needs in an otherwise chaotic environment.

While the physical architecture and electro-chemical functions of the brain process perception, we have no insight into the process and no conscious control over it; in fact, hardly anything that takes place within our brain is open to introspection, not even a headache. Internal geometry reigns over perception while interacting with both external and internal worlds that are ever changing and have no geometry of their own. Intuition makes potential structures available to give form to knowledge, as anatomy does to give form to motility, sports, and dancing. Intuition is associated with physiology and anatomy as a sort of management team for any organism before an organism can fend for and think for itself, so to speak. For the moment, let us refer to this institutional complex as an unchanging realm lying behind changing experiences that make sense in consciousness only when fitted to pre-formed structures. It follows that formlessness can be explained only by formal diagrams, such as those deployed by Krauss and Bois. The same one must say of chaos. Chaos theory, when finally making sense, will no longer apply to chaos. If understood at all, it will take not a rational but a chaotic mind. Only an idiot can make sense of idiocy.

Abstract numbers require cognitive memory for handling numerical data. Like naming, numbering is pragmatically useful while psychologically reassuring. *Four* is the most secure number with which one can work when organizing mentally what is otherwise haphazard and so without form (*two* and *three* entail different dynamics). But is *four* a true count that follows on what is counted, or does *four* pre-exist the count, sort of like how a dozen predetermines how many randomly laid eggs go into a carton?

Why four elements, four forces, four cardinal directions? Why not five, six, or more? To deduce a sensible answer, I call upon what brain scientists refer to as short-term memory, which brings me back to Sir Hamilton counting marbles in random distribution and Jevens guessing at a glance how many beans he tossed into a pot. *Short-term memory defines a span of immediate recall as the longest sequence of data that, following a single presentation (such as a glance into the bean pot), reproduces correctly in the mind.* With a high degree of accuracy, one remembers seeing four units, while five come with errors, six with only a 50–50 chance of being correct, and beyond that number, it is anyone’s guess. If asked, “How many people were there?” it is easy to say, two people, three people, or four people. But beyond that count, one enters into declining numerical sets expressed non-arithmetically, such as “there were quite a few people in there, maybe a dozen or so, maybe more; the place was really crowded.” After “four or five,” the response shifts to an estimate, which is a different form of discourse because it expresses uncertainty as a quality of the count.

Most brain-memory researchers refer to short-term memory as “seven plus-or-minus two,” which means that, with practice, one can hold in memory between five and nine disassociated units of data. This so-called “slot theory” describes an information storeroom in the brain for short-term memory units with a fixed number of slots, each slot able to store a single unit. When data-units have filled the slots, additional incoming units must displace existing units that are obliged to move into long-term memory at a different location in the brain. This transport of memory explains why amnesia due to drugs, exhaustion, shock, or brain injury may affect either short-term memory or long-term memory only. It also explains such ubiquitous things as telephone numbers such as 1-251-7369, which can be easily memorized, while 12517369 cannot, and why US Army serial numbers are memorized as two pairs plus four: 19-25-6130 (which happens to be mine, still imprinted in my head after 50 years).

My interpretation of the number of slots that permit immediate recall allows for memory of *one to four*, or four pairs counted as two-four-six-eight. But after either four or the fourth pair, resistance sets in like a light warning of an approaching “no vacancy.” Resistance at four prompts a different character for five, a shift in discourse. Four looks back to one, so to speak, while five looks ahead. Look again at your hand. Count your “fingers.” You will find yourself resisting the fifth digit, knowing that it is not a finger but a thumb, which fits to a different discourse. As I mentioned earlier, fingers are graspers, the thumb a pincer. If that example seems too simple, try figuring out what lies behind the expression “being all thumbs.”

When structuring information, or giving form to sensory input, the limited storage-slots of short-term memory coordinate with perceptual mechanics and as well with how the brain structures cognition as to its use or handling of knowledge. The eye’s mechanics depends on reduction within the visual field in order to achieve focus, as when saying, “I can’t look at everything at once,” or, “I can’t pay attention to everyone.” The eye’s ability to discern numbers at a glance rarely exceeds four, beyond which quantities become increasingly vague as to count. To perceive any extended object or scene, the eye must direct its very narrow fovea on the retina to different places in the visual field so the same part of the eye can see different parts of an object. The rate of these shifts in focus is, interestingly, four discrete glances per second.

VII

I want to harden my stand on the power of the four-count for structuring theories and dispel any notion that quadrature is peculiar to primitive minds and pre-scientific cultures. The innate power of four transcends mathematics to affect every discipline. Here I bring in a variety of encounters with the tenacious *four*, which I am about to say is exempt from volition, a compelling structure in its own right, upon which the brain builds theories like houses built on the geometry of foundations.

Look to the ancient Greek Euclid of Alexandria whose work on geometry reigned for 2,000 years. Euclid's geometry imposed a systematic organization on the world of perception and cognition. Until the advent of non-Euclidian geometry in the nineteenth century, his books were the primary source of geometric reasoning, theorems, and methods. Known as *The Elements*, his treatise on mathematics spanned at least 13 books of which the first four deal with the basics of plane geometry. Then comes a discourse shift: the fifth book departs from the opening discourse to focus on proportions and the problem of incommensurable magnitude. The sixth book looks to applications of the fifth book to plane geometry. In other words, with the fifth book a new discourse started, the shift having been set up by the fourth book but occurring between four and five. Put the four books side by side with Euclid's four propositions: axioms, definitions, postulates, with the fourth implied by Euclid's saying that each proposition can be proved by the first three, or, if not from the three, then from the three hitched to propositions already proven. The fourth postulate, then, is conditional on the first three; that is, the fourth looks back, making it impossible to connect the fourth with a fifth proposition.

Euclid struggled to get beyond three to four postulates; like modern physicists struggled to get beyond three dimensions until convinced that time was dimensional. Recall as well that the ancients were content for centuries with three seasons as those of planting, growing, and harvesting. With winter wheat coming into production, planted at the onset of winter, the seasons became four, with winter nonetheless different from the others (think also of Empedocles' fourth element, fire, which differed remarkably from earth, air, and water, and was only added after the first three had settled into secular minds as the stuff of creation). Each of Euclid's four postulates had to do with two-dimensional analogues. He was not able to get to a fifth. Following centuries of effort by mathematicians to prove other postulates by deploying Euclid's four to yield five, the Italian mathematician Girolamo Saccheri adopted in 1733 a strategy of combining the four Euclidian postulates with the negation of a fifth postulate, hoping to show indirectly that a fifth postulate would be simply a logical consequence of the remaining four. Saccheri's efforts came to naught, however, when other mathematicians demonstrated the existence of non-Euclidian geometries in which the fifth postulate is always false.

In similar fashion, in the 1840s Sir William Hamilton, who appeared in the opening paragraph of this essay tossing marbles on the floor, spent years struggling with the algebra of ordered triples and quadruples of real numbers. He found himself stuck on how to define multiple multiplications in such a way that preserved the usual laws of multiplication. In 1845, it suddenly occurred to him that he had to sacrifice the communicative law. He then developed the first non-communicative algebra based on the *quaternion*, an element of a system of *four* dimensional vectors.¹⁰

Now, in summarizing Pythagoras' four elements as aspects of arithmetic yielding geometry, one dimension offers a directional line (road); two dimensions, a flat rectangle (field); three dimensions, an object (building); while the fourth dimension imbues a place or object with the ineffable quality of an object as more than it materially is.¹¹ While each dimension embraces a class of discourse, I will touch on the fourth dimension that resists materiality. As this fourth dimension, I suggest "fire" in Empedocles' context, the "ineffable quality of being surrounded by space" in Pythagoras' perception, and "indefinite time" in Einstein's formulations of relativity. Empedocles' covering theory was not simple but, relative to prevailing knowledge of his time, complex. What was Nature then other than earth, air, and water, with fire as the enervating, enacting force? Fire's warmth was an agent of creativity and social bonding. People gather around a fire. Chicken eggs not kept warm will not hatch. When a man gets a woman hot, she is likely to become pregnant. All naturalist theories are rooted in experienced reality. Having forsaken the gods as stabilizing agents of the world and societies, one looked to stability in Nature's material existence and predictability in its processes.

The three dimensions are essential to human perception. The four-count is as well. A three-dimensional object (including one's self) needs an enveloping space that allows all objects to have a front, back, and two sides. Anthropomorphism cannot avoid the three dimensions: height, width, and thickness that define materiality. To illustrate this assertion, look to Cubist painting (just a simple acquaintance with Cubism is all a reader needs to grasp what I am proposing). The development of twentieth-century abstract art shed the symmetry and anthropomorphism of *three* and *five* that one finds in Impressionism and its aftermath. Picasso and Braque confined their early Cubist subject matter (1911–12) largely to the portrait and table still life, both formats having a base and a terminal high point, generally centered, which retains vestiges of a vertical triangle weighted at the base. Later (1912–14), gravity gave way to imagery pasted to a flat surface rather than resting on the lower edge of the canvas, as if on one's lower eyelid. At the same time, the triad gave way to a quadrangular format. When asked about the "space" of Cubism, Picasso may have been trying to evoke a fourth dimension when referring to Cubism as non-measurable but more like perfume—the aroma all around the canvas, in front, back, and to the side. A few years later, Marcel Duchamp, when discussing his art as to two and three dimensions, suddenly broke off as if alerted to a fourth dimension, and said, "I want to grasp ideas the way the female encloses the male organ in intercourse."¹²

Whether enclosed by the scent of perfume or the vaginal casing—the perception of which can be felt but not seen—the work of art as object transcended measurable objectivity and became non-measurable subjectivity. This suggests the difference between object and meaning, or between material and immaterial, when the latter is a quality of the former, just as Euclid's fourth principle was a quality of the first three, and Empedocles' fire one might interpret as the heat of sexual passion that generates new life. That would be in keeping with his belief that changes in material elements—elements made of matter—take place through the uniting and destroying forces of love and hate, with fire providing the warmth of love.

Marcel Duchamp's *The Passage of the Virgin to the Bride* is composed of four parts that, by Duchamp's intention, deny the standard three dimensions. What would be the fourth dimension, then, other than verbalization of the vaginal grasp? Lawrence Steefel may

have been alert subconsciously to this “dimension” when describing Duchamp’s *Passage of the Virgin*: “Duchamp created a poetic equivalent of sexual pleasure by the lubricity of his abstract patterns, their fleshy color, and their pervasive texture of mucous membrane.”¹³ In short, based on Picasso’s enveloping of Cubism in perfume and Duchamp’s sentiment that his art wants to feel as if within a vagina, I call the non-perceptible essence the number four, the fourth dimension, that negates the self-materiality of a three dimensional object, akin to the nineteenth-century idea that a work of art is complete only if it embodies the unique temperament of the artist.

VIII

Counting and naming share short-term memory slots. The first four numbers in Latin (*unus, duos, tres, quatuor*) decline like other nouns, but from five (*quinque*) on the numerical terms are invariable. While the ancient Romans gave names to the first four of their sons (such as *Marcus, Servius, Appius*, and so on), numerals named subsequent sons, such as *Quintus* (the fifth), *Sixtus* (the sixth) and *Septimus* (the seventh). The first four months in the Roman calendar of Romulus had names: *Martius, Aprilis, Maius*, and *Junius*, while the fifth to the tenth were referred to by order-number: *Quintilis, Sextilis*, and so on.¹⁴ As for our modern Julio-Claudian calendar, we break up the year into four quarters and the months into four weeks, as we do also the cycle of the moon and the course of seasonal change.

The ancient Mesopotamian Aramaic script indicates a numerical progression as I, II, III, IIII, and then five signed by >, six by I >, and so on. One reads the notations not as one, two, three, four but as one, two ones, three ones, four ones. The progressive increases are grouped singulars rather than a sequence of abstractions that gives each integer a separate meaning (three is not four!). The sequence of Roman numerals I, II, III, IV is a systematic increase of ones with progress halted at IV, which signs for a decrease of V, with the subtrahend on the left hand, or feminine, non-active side (V minus I equals IV). Then the count moves on, increasing V by adding ones on the right hand side: VI, VII, VIII and so on. The fulcrum between sets is IX as “X minus I,” which looks back to the primary I, while XI as “X plus I” looks ahead.

Enter the barred fence method of counting. When enacting a numerical count by adding up “ones” after aligning them in a row, such as 111111111 *ad infinitum*, beyond 1111 it becomes increasingly difficult and soon impossible to perceive the count (recall here my examples of sophisticated minds trying to recall a count of random marbles on a floor and beans tossed in a pot). The 1111 acts like a gate threatening to impede progress, so we close that gate with a bar and call it a set five. Then one is able to count indefinitely by a series of barred gates, each with a value of five, such as **HHH, HHH, HHH, HHH**, I I adding up in this example to 22.¹⁵ The alteration from 1111 to **HHH** is a shift in discourse, as in my previous example of the shift in Roman numerals from IV to VI, with IV looking back to a finite I, and VI looking ahead to infinity.¹⁶ Such numerical discourses shift from the threat of an unstable alignment to one of stability. The barred gate halts a moving sequence, which is what historians do when holding a span of years in place between stylistic bookends, such as Impressionism bracketed between pre-Impressionism and post-Impressionism, or Modernism between pre- and post-Modernism. As if more practical,

the American five-count gate is not barred but braced: to maintain the boards as orderly, one adds a diagonal brace, yielding a stable gate, **HHH** with a value of five.

The Latin *quadratum* (a square or cube) gives us *quattuor* (four) as a structure rather than a count. The order of the quadrant affects our conception of the world. Aristotle singled out four as standing for justice because it is a product of equal numbers multiplied: $2 \times 2 = 4$. Similarly, 10 is a powerful number, for it is the sum of the first four: $1 + 2 + 3 + 4$. Pythagoras' pebble diagrams indicate 16 as the perfect square number: 4×4 . Foursomes emerge in many contexts in which they mix to create what is potentially an infinite number of interactions. *One* is lonely, *two* is company, *three* is a conflict, *four* is a party—the latter defined as a social mix that pairs individuals interchangeably so through combination and recombination four becomes many, such as 4^2 becoming 16. Augustine explained how four governs the division of Varro's *Antiquitates rerum humanarum*, and goes on to point out how 16 was the number of books comprising Varro's *Antiquitates rerum divinarum*. These titles harbor the distinction between secular and theological order. While *four* applies to *humanarum* as secular, 16 applies to *divinarum*, the divine, along the lines of the Etruscan division of the sky (the heavens) into 16 zones.

Other examples fly into mind like pigeons to tossed crumbs, many of them originating in secular ways of bringing religious beliefs into human comprehension:

- the *four* rivers of Paradise that had a common source in Eden;
- the *four* sons of Noah who initiated the *four* great urban civilizations;
- the *four* cardinal virtues;
- the *four* writers of the Gospels (the evangelists Mathew, Mark, Luke, and John);
- the *four* horsemen of the Apocalypse (lust to conquer, lust to slay, followed by famine and the silence of death).

Empedocles' hypothetical four elements was one of the first efforts known in ancient literature to extract naturalism as a "natural science" from theological rationale for the existence of everything. Increasingly, successive minds found the structure of *four* applicable to real-life situations. Here is a random sampling.

- Carl Linnaeus, the eighteenth-century Swedish botanist, listed *four* threats to health: poverty, disease, ignorance, and sin.
- The Scottish physicist James Maxwell's *four* equations explained about everything otherwise inexplicable about electromagnetism.
- Leonardo da Vinci postulated *four* mental powers: memory and intellect, desire, and covetousness.¹⁷
- Historian Arnold Toynbee proposed *four* alien societies: the Byzantine World, the Islamic World, the Hindu World, and the Far Eastern World. He also claimed that world history was a pattern of rising and falling civilizations, each undergoing *four* stages: rise, growth, breakdown, and disintegration.
- The international spokesman for the science of sexology in early-twentieth-century Berlin, Magnus Hirschfeld, declared it was unscientific to speak of only two genders: male and female. His doctrine of sexual relativity embraced *four* interstitial genders: hermaphrodites, androgynes, transvestites, and homosexuals. Hirschfeld then divided hermaphrodites into *four* subgroups: men with female organs, women with male

organs, people with both sets of organs appearing in a rudimentary state, and people possessing dual male–female organs, both functional.

- The ethologist Niko Tinbergen proposed in 1963 that the biological study of behavior pointed to *four* broad but separate problems: evolutionary history (ancestral history), individual development (how behavior is assembled), short-term controls (how behavior is controlled), and function (the use of behavior).
- In the preface to his influential *Metahistory: The Historical Imagination*, Hayden White delineates *four* aspects of imagination ranging over the space between Hegel and Benedetto Croce: metaphor, metonymy, synecdoche, and irony.¹⁸
- The landscape historian, George Henderson, broke down landscape scholarship into *four* discourses: landscape encased within a particular social formation, landscape as a human space anywhere at any time, landscape as the legible record of human practices and beliefs, and landscape as ideological expression.¹⁹
- When looking down from a hovering helicopter at his just completed earthwork, *Spiral Jetty*, Robert Smithson chanted repeatedly, “Rocks, salt crystals, mud, water”—*four* materials incorporated in the work, kith and kin to Empedocles’ earth, air, fire, and water.
- At a Jewish Seder, one drinks *four* cups of wine. Each cup represents one of *four* promises of redemption: “I will bring you from under the Egyptian yoke;” “I will deliver you from bondage;” “I will redeem you with outstretched arms;” “I will take you to be my people.”
- In science, the quadrant is of *four* kinds. In Mathematics it is a *quarter* of the circumference of a circle; in Geometry, one of *four* parts into which a place is divided by two straight lines crossing at right angles; in Anatomy, any one of *four* regions into which the abdomen is divided; and in Embryology, one of the *four* blastomeres in the *four*-cell stage of the ovum.
- In the *Book of Revelations* 6:1–8, when the seven seals open, each of the first *four* releases one of the *four* horsemen of the Apocalypse. The power of these horsemen is limited to a *quarter* of the earth. With the opening of the fifth seal comes a change in discourse: the fifth seal reveals all those who have been slain in the persecution of the church. The opening of the sixth seal reveals the day of the Lord. With the opening of the seventh seal comes another change in discourse: it reveals silence. The structure then is *four* as terrestrial and three as theological, abstracted as 4–2–1, which generates the symbol of a triangular trinity surmounting a secular square.

The above list-without-end illustrates that *four* exists in the mind before any mental input or output that it structures.

IX

How can one prove a theory if its logic or correct reasoning existed before the reasoning that imbued it with content? Is that logic *in the world* such that human thought, as to cognitive apprehension, is commensurate with the operations of the universe just as any creature’s need for nourishment matches what nature provides as nourishment? Is there a controlling system of principles in the universe that manifests how the brain logically explains the universe, thus making every logical theory that matches the world’s

principles tautological? If tautological, the match would be also aesthetic, as in “the harmony of the universe” or “the beauty of a proven theory.” The Holy Grail of physics is a formula that explains everything—a *beautiful* theory that in every way coincides with the facts, like a human body that coincides with the ideal body. Like the four-count, beauty in the mind pre-exists the perception of beauty.

Every whole thought comprising this essay depends on the belief that nothing in the universe as to formation, function, or action is random. What we tend to call randomness in nature is activity for which we have not yet discovered an order. Apprehension of predictable occurrences is innate as to receptivity even before the brain can process preemptive responses. One cannot deny the four corners of the earth with arguments that the earth is a globe. Only round people could think of themselves as fitted to an earth without corners.

NOTES

1. As reported in “Science,” *The New York Times*, November 11, 2003.
2. Vitruvius, *On Architecture*, Bk. V, pref. 4.
3. Cf. Joseph Campbell, *The Mythic Image* (Princeton, NJ: Princeton University Press, 1974), 162.
4. James S. Ackerman, *Origins, Imitation, Conventions: Representations in the Visual Arts* (Cambridge, MA: MIT Press, 2002), 19.
5. *Ibid.*
6. May 21–August 26, 1996. The text for this exhibition took the form of a book written by Yve-Alain Bois and Rosalind Krauss, *Formless: A User's Guide* (Cambridge, MA: MIT Press, 1996). Bois's essay title in this book, “The Use Value of Formless,” is adapted from Georges Bataille's “The Use-Value of D.A.F. de Sade,” which reveals intellectual pornographer Bataille's identification with the Marquis de Sade, and in turn the identification of Krauss and Bois's formulation of the formless with Bataille's thoughts on the matter.
7. Rosalind E. Kraus, *The Originality of the Avant-Garde and Other Modernist Myths* (Cambridge, MA: MIT Press, 1985), 282–83.
8. The example I have in mind appears as a diagram in Jacques Lacan, “Léonardo-en-miroir,” in *Le Séminaire de Jacques Lacan*, livre IV: “La relation de l'objet,” ed. Jacques-Alain Miller (Paris: Éditions du Seuil, 1994).
9. Jacques Lacan, *The Four Fundamental Concepts of Psychoanalysis*, ed. Jacques-Alain Miller, trans. Alan Sheridan (New York: Norton, 1984).
10. William Rowan Hamilton, *Treatise on Quaternions* (Dublin, 1853).
11. The subject of my youthful paper, “Reflections on a Polished Sphere,” delivered at the American Society for Aesthetics Conference at Sacramento State College, February 1958.
12. See Lawrence D. Stifle, “Dimension and Development in the Passage from the Virgin to the Bride,” in *Marcel Duchamp in Perspective*, ed. Joseph Masheck (New York: De Capo Press, 1975), 103 n. 32.
13. *Ibid.*, 91.
14. Cf. Georges Ifrah, *The Universal History of Numbers* (New York: John Wiley and Sons, 1999), 7.
15. For this and other examples, see *Ibid.*, 7–10.
16. While I had this worked out in greater detail when teaching my seminar on non-directional thinking at the Massachusetts Institute of Technology in the late 1960s, I found it confirmed in O. Neugebauer's excellent study, *The Exact Sciences in Antiquity*, 2nd edition (New Haven, CT: Brown University Press, 1957).
17. See *The Notebooks of Leonardo da Vinci*, comp. and ed. Jean Paul Richter (New York: Dover Publications, 1970), vol. 2, section 14: “Anatomy, Zoology, and Physiology,” para. 840.

18. Hayden White, *Metahistory: The Historical Imagination in Nineteenth-Century Europe* (Baltimore, MD: Johns Hopkins University Press, 1973), 9–11.
19. George L. Henderson, “What (Else) We Talk About When We Talk About Landscape,” in *Everyday America: Cultural Landscape Studies after J. B. Jackson*, ed. Chris Wilson and Paul Groth (Berkeley, CA: University of California Press, 2003), 182.

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