MATHEMATICS AND SPIRITUAL INTERPRETATION: A BRIDGE TO GENUINE INTERDISCIPLINARITY

by Ronald Glasberg

Abstract. This article is a spiritual interpretation of Leonhard Euler's famous equation linking the most important entities in mathematics: e (the base of natural logarithms), π (the ratio of the diameter to the circumference of a circle), i ($\sqrt{-1}$), 1, and 0. The equation itself ($e^{\pi i} + 1 = 0$) can be understood in terms of a traditional mathematical proof, but that does not give one a sense of what it might mean. While one might intuit, given the significance of the elements of the equation, that there is a deeper meaning, one is not in a position to get at that meaning within the discipline of mathematics itself. It is only by going outside of mathematics and adopting the perspective of theology that any kind of understanding of the equation might be gained, the significant implication here being that the whole mathematical field might be a vast treasure house of insights into the mind of God.

In this regard, the article is a response to the monograph by George Lakoff and Rafael Núñez, *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being* (2000), which attempts to approach mathematics in general and the Euler equation in particular in terms of some basic principles of cognitive psychology. It is my position that while there may be an external basis for understanding mathematics, the results are somewhat disappointing and fail to reveal the full measure of meaning buried within that equation.

Keywords: Leonhard Euler; hermeneutics; mathematics; spirituality; transcendental numbers.

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How does C. P. Snow's famous two-cultures argument (1963) relate to the forging of new interdisciplinary paradigms? The famous essay was written before interdisciplinarity came to the forefront in a variety of academic contexts, but it continues to pose a serious challenge to interdisciplinarity as a form of knowing—a challenge that this essay addresses after an introductory clarification of the issue.

One may begin by asking if academics in the humanities and social sciences harbor a secret suspicion that they are second-class citizens in the world of learning—a world that appears to be hierarchically structured in favor of the sciences, with the "hardest" (hard in the sense of rigorous) sciences at the very top of the heap. Here we may note that the two cultures are not just estranged in terms of fundamental interests, but they are also marked by a curious asymmetry that goes beyond the technological-materialist orientation of Western civilization. Thus, while a mathematician, physicist, or chemist could wander into the average history class and not be totally lost, the same would not be the case for the humanist visiting a class taught by his or her science colleagues. Unless historians, philosophers, and anthropologists spent a good deal of time training themselves, they would be hard-pressed to follow the arguments put forth in even elementary science or math classes. It is precisely this asymmetry that tends to cast a shadow on interdisciplinary work. Of course, one can import scientists or mathematicians into some interdisciplinary project developed and managed by humanists and social scientists, and much in the way of understanding different perspectives may be achieved in the process; but that would do little to alleviate the general level of intellectual alienation experienced by the vast majority of the population with respect to the hard sciences and mathematics. Indeed, such alienation is almost taken for granted, and a deep fissure in our culture, if not any culture, is allowed to continue. How many humanists are even embarrassed by this situation? Given that so much of our technologically oriented culture is based on the application of scientific principles, it would almost be salutary for the humanist to cultivate a sense of embarrassment as a springboard to action—to seeking a way of dealing with the aforementioned asymmetry of understanding.

Yet ignorance of science and mathematics is only one side of the asymmetry problem. The other side is what I would call an antispiritual perspective. While humanists and social scientists may not be able to handle the more abstract forms of rational understanding (as embodied in the hard sciences), there is a general acceptance of the way of reason as such; and that means a profound suspicion of what might be termed the mystical, which lies at the heart of the spiritual approach to the world and which is not always amenable to rational treatment. How often are those claiming to have spiritual or mystical experiences dismissed as gullible at best or mentally ill at worst, despite the question-begging quality of the latter

ascription? How often in courses associated with the study of religion are students encouraged to meditate, take drugs, or partake in other "spiritual" practices so that they may directly experience an aspect of reality to which their sacred texts often refer? How often are mystics asked to participate in interdisciplinary projects? Although I myself have not had mystical experiences, I have met many intelligent, self-aware, and obviously sane individuals who have had such experiences. Moreover, there exist a vast number of texts from all cultures that accept the existence of a level of reality associated with the Divine, or God. If it seems unlikely that all these instances of a relationship with a reality beyond the grasp of scientific reason are examples of delusion, then the mystical "purchase" on reality must be brought into some kind of connection with the one of science. Thus, we may speak of "three cultures" instead of the two highlighted by Snow: the scientific, the humanist, and the mystical (with the social science culture being a kind of interface between the first two).

These two issues (i.e., alienation from the hard sciences on the part of humanists and alienation from the spiritual approach to reality on the part of all who deny the validity of mystical experiences) characterize a kind of crisis in the world of knowledge and a challenge to interdisciplinarity as a way of integrating radically different methods of knowing the world. In this context, the present essay endeavors to develop a way of interpreting mathematical abstractions in such a way that humanists might have access and at the same time integrate the spiritual approach to reality. Thus, after a discussion of what such a hermeneutic might be like, an exemplary equation ($e^{\pi i} = -1$) will be interpreted in order to see how spiritual truths might exist in heretofore unsuspected areas. I conclude by discussing the implications of these results for the future of interdisciplinarity as well as of knowledge in general.

METHODOLOGY

A principle of interpretation relying on reason exclusively would tend to look at all phenomena in terms of what is externally verifiable. The internal or the sphere of consciousness would be deemed suspect along with any speculations derived from that sphere. In this regard one cannot seek to justify an "internalist" hermeneutic by appealing to external criteria, because they are different in principle. Thus, an internalist hermeneutic—one that is based on the primacy of the contents of consciousness as opposed to what is external to it in the "outside world"—must do its work and be known by the taste of its fruits. That is, does it allow one to understand what could not be understood before, especially via an approach rooted in an externally based scientific objectivity? In this regard, the paradoxes of quantum mechanics seem to indicate some kind of limit to intelligibility in the area of physics. Mathematical formalization allows one to

make predictions with respect to subatomic phenomena, but it does not allow one to picture what is going on at this fundamental level of reality. If an internalist hermeneutic gave one a sense of insight into these otherwise unintelligible aspects of physical reality (e.g., wave-particle duality), then it has performed a valuable service. Not only has some kind of understanding been achieved, but that understanding would be available to those not specifically trained in the hard sciences. Moreover, if that understanding took into account—and was indeed made possible by—the metaphors associated with spirituality or mysticism, then the estrangement of the spiritual perspective from the rationalist one might be overcome to some extent.

It is important to understand at this point that an internalist hermeneutic does not intend to dispense with rationalism, which is essential if a common language for discourse is to be maintained. What it seeks to do is to supplement reason with an intuitively based speculation informed by the most taken-for-granted principles of spirituality. While some mathematicians and physicists would, no doubt, find such speculations unintelligible when applied to their fields of study, others might gain access to what would otherwise be a forbidden garden. But, with the aforementioned proviso, we must still ask just what an internalist hermeneutic is. Here, internality refers to the common space of consciousness, where we are most at one with our awareness in all of its manifestations. Put another way, we are inside of it in the manner of being inside a room. In contrast, we do not necessarily share a common space with the awareness of others or with what we often term the outer (or external) physical world. In that sense an internalist hermeneutic interprets phenomena from the point of view of an inner awareness, but that can mean reconsidering the phenomena in question as manifestations of consciousness so that a basic commonality can be explored.

What are some of these manifestations? Focality (e.g., concentration, working on a problem), flow (e.g., a train of thought), creativity, spontaneity, emotionality—the list could go on; but the main point is that when one is confronted with some phenomenon, the introspectively available phenomena of internality are successfully applied to enhance intelligibility. Obviously, the intelligibility of the phenomenon of a billiard ball hitting another and causing it move would hardly be enhanced by such a hermeneutic, because while psychic automatism, in the context of André Breton's understanding of surrealism (1978), is usually a manifestation of freedom, deterministic automatism (e.g., it is automatically determined that the other billiard ball will move when hit) is not, and an externalist hermeneutic is accordingly in order.

With respect to a spiritualist internalism, this discussion endeavors to develop the hermeneutic in terms of a divine consciousness, the main qualities of which would be infinitude, growth, creativity, unity, love, and perfection. While these terms point toward states of awareness that are not

easily accessible, they are nonetheless, as states of consciousness, open to us even if only as limit concepts. Moreover, they might be particularly appropriate to the interpretation of mathematical phenomena since these are often associated with infinity, unity, growth, and perfection. In this regard, the Pythagorean tradition, as articulated in such texts as *The Theology of Arithmetic* (1988, attributed to Iamblichus), probably made such connections between divinity and mathematical truth; but as the discipline advanced in the context of a materialist science, such links would have become ever more problematic and ultimately ruled out of court as the dregs of prerational superstition. At the same time, the increasing level of abstraction in contemporary mathematics has made the insights articulated within that subject inaccessible to all but the cognoscenti. Thus, the possibilities of increasing access, while at the same time exploring new levels of meaning by way of a spiritual hermeneutic, should not be ignored.

APPLICATION TO EULER'S EQUATION

There are two reasons the application of our spiritual internalist hermeneutic will be directed to Leonhard Euler's famous equation: $e^{\pi i} = -1$. First of all, the equation has within it the most fundamental numbers of mathematics: e is the base of natural logarithms, π is the ratio of the diameter to the circumference of the circle, i is the square root of -1, and 1 (as derived from its negative by making the equation zero) is the first of the natural numbers, on which all others are based. The fact that two of the numbers in the equation (e and π) are transcendental and thus cannot be expressed by a ratio of integers means that these numbers are expressible as decimals, the expansion of which has no repetitive pattern and is for that reason infinite. Consequently, the idea of putting these numbers in the relation of base to exponent (one as the power of another) and involving the imaginary number i (the square root of -1) to boot seems extremely counterintuitive. Even more shocking is the fact that this expression (involving a combination of nonrepeating decimals as well as an imaginary number) has been proved to be equivalent to a simple quantity, that is, -1. Given the significance of the numbers constituting the equation and its inherently mysterious nature, a successful application of a spiritual internalist hermeneutic would shed some light on the nature of mathematical reality—a light that might be of interest to mathematicians as well as to those individuals who are based in the humanities and would probably have no other means of access to the meaning of the equation.

The second reason for focusing on this equation pertains to the recent work of George Lakoff and Rafael E. Núñez entitled *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being* (2000). This rich text takes an approach that is at once similar yet opposite to my own. It is similar in that it seeks to unpack some of the mystery of mathematics and relate it to metaphors that are, strictly speaking, outside the

realm of mathematics proper. But because these metaphors are rooted in certain areas of cognitive psychology and therefore in the sphere of externalist science, the hermeneutic utilized by these researchers is directly opposed to the internalist hermeneutic that I employ. Lakoff and Núñez also focus on Euler's equation (2000, 383–451) and seek to explicate the mathematical principles behind the proof by relating them to concepts that have significance in everyday life—change, acceleration, recurrence, and self-regulation (p. 450). The problem here is that after the aforementioned connections are made, the reader is left hanging. While Euler's equation brings all of these concepts into some kind of relationship, it is unclear just what this relationship is. The authors feel they have done enough by making interesting connections between the elements of the equation and the themes of change, acceleration, and so on, and that satisfaction might come from the possibility that they have gone as far as an externalist hermeneutic might take them. Contrary to this, an internalist spiritual hermeneutic has different standards of meaningfulness in the sense that the themes associated with spirituality are rooted in and embody the great myths of all cultures—myths that link the principles of human destiny to some divine order or purpose. The concepts of change, acceleration, recurrence, and self-regulation are not in themselves alien to such "mythic" reinterpretation, but, without an internalist approach that views phenomena from the perspective of consciousness as the ultimate reality, the full significance of the concepts elucidated by Lakoff and Núñez is not likely to come forth.

The course I follow, then, is to interpret each element of the equation from an internalist spiritual perspective and then give an overall summary. Outlining the proof in mathematical terms, as Lakoff and Núñez do, is beyond the scope of this essay. I deconstruct the equation itself as if it were a highly concentrated text that requires considerable elaboration. However, that should not imply that the procedure of carrying out proofs is without significance for an internalist spiritual hermeneutic. If mathematics is to be taken as some kind of embodiment of a divine consciousness, the activity as well as the results must be considered as being relevant to the hermeneutic enterprise. This study should, in this context, be taken as a testing of the waters. But the stakes are high. Should such a hermeneutic quest prove unfeasible, then the "three cultures" of the sciences, the humanities, and spirituality will remain isolated to their mutual impoverishment.

We begin with the transcendental number e, the value of which is 2.718281828459045. . . . In the Euler equation it is functioning as the base of an exponent defined as πi, and it is normally understood as the base of natural logarithms, where logarithms entail a procedure whereby products are mapped onto sums and back again so that difficult mathematical operations may be simplified. However, in the context of the equation e is not functioning as a logarithmic base but is mapping sums onto products, where πi is being taken as a sum, that is, one of many such

on a number line comprising all the real numbers, and transformed by being the power of *e* into some value normally represented on a different line. Because the transformation is in the context of a power (i.e., a form of product), we have a mapping of the simple onto the complex, although paradoxically the result of the mapping is itself simple, since the value of $e^{\pi i}$ has been proven to be -1.

Clearly *e* is complicating something, but the complicating is not just by way of any quantity, for the quantity represented by *e* has two special qualities: (1) the number is transcendental, that is, it can be presented as an infinite series of nonrepeating digits, and (2) the number is also associated with growth in a unique way. If the derivative is taken of any function with *e* as its base, then the value of the derivative at any point in the function is exactly equal to the value of *e* at that point. In other words, the derivative of any function based on *e* is equal to itself. Because derivative means the rate of change at any given instant and because on a curve defined by *e* the rate is always changing, the increase in the rate of change is directly proportional to the increasing value of the function (on which the rate is being defined at any given instant).

The first special quality (that of the infinitude of *e*) can easily be associated with the infinitude of the Divine. But the second is harder to interpret in terms of an internalist spiritual hermeneutic. Clearly, if the second quality of *e* is associated with growth, we must begin to understand divine consciousness as somehow growing, but growing in a way that is different from that of human consciousness. While it might seem odd to think of divine consciousness in its infinitude as growing, mathematicians such as Georg Cantor have shown that there are many levels of the infinite (see Aczel 2000). Thus, the idea of growth of the infinite is not without some basis. More important, however, is the idea of the rate of growth or change being in harmony with the amount of growth or change (i.e., this amount being the changing value of the function). This could be interpreted as any particular moment of growth being an expression of the whole pattern of growth up to that moment. In terms of internality or consciousness as a growing entity, the divine mind is in harmony with itself in a way that contrasts sharply with a human mind. Whereas the latter would have a growth experience involving dissonance between any moment of change and some overall pattern of change, the former (i.e., a divine consciousness) would experience ever greater degrees of unity until at the point of absolute unity the moment of change would be one with the whole process up to that moment.

The dissonance is not difficult to understand because it is such a common human experience. For example, growth in consciousness usually involves some shock, where what had heretofore been hidden rises to the surface, in the manner of Oedipus learning something about himself that he had in one way or another suppressed. The shock of learning that he

had murdered his father and married his mother was not seen as part of a larger pattern, although the tragic hero does later develop prophetic abilities or an awareness of a larger pattern through the experience of intense suffering. Extrapolating from this dissonance with respect to human growth in awareness, we can begin to see the logic of a divine consciousness that would not experience such dissonance to the extent that growth in awareness would always be in harmony with any given moment of that awareness. Is such an extrapolation warranted? The fact that the number e exists as a transcendental with the aforementioned quality pertaining to "self-derivation" would seem to suggest that a divine consciousness might not be a fantasy and that certain mathematical expressions are a manifestation of that mind.

In an effort to reduce further the level of abstraction still associated with a growth in consciousness, I suggest that increasing complexity be adopted as a possible criterion for such growth. The fact that e (in the context of the equation) is mapping sums onto products (i.e., the inverse of logarithmic procedures) would indicate a movement from simplicity to complexity, and in the context of consciousness this might mean an awareness of more aspects of reality and of more connections between these aspects. Given the idea of harmony between any moment of growth and the whole process in itself, growth as increasing complexity would mean that the level of complexity is such that it would allow one to gain insight into the whole pattern. If the level were too great or too small, then any particular consciousness would have greater difficulty in relating to the overall pattern of growth. In this context, the Oedipus myth (as articulated by Sophocles) comes to mind. When the hero answered the riddle of the Sphinx by reducing the pattern of growth to childhood, youth, and old age (i.e., the answer to the riddle of what walks on four legs in the morning, two legs at noon, and three legs in the evening), this simplistic answer was not enough to bring his level of consciousness into harmony with the larger pattern that was ensnaring him. When Oedipus developed prophetic powers, the level of complexity was too great in that it failed to bring him peace of mind or reintegrate him into the society that treated him as an exile. Thus, what e seems to be suggesting as the base of an exponent mapping the simple onto the complex is a kind of Aristotelian golden mean between growth in consciousness that at any given moment is either too simple or too complex to be in harmony with itself.

This takes us to the second element in the equation—namely, that which is being mapped, the quantity πi, which is taken as a power of e. At first, this "powering" of e seems highly problematic. How can e be multiplied by itself πi times? It is bad enough that e and π are both transcendental, but the addition of i to the mix seems to add incomprehensible insult to unintelligible injury. Yet again the internalist aspect of our hermeneutic can come to our rescue by considering multiplication in general and pow-

ering in particular as aspects of self-consciousness. Consciousness can grow but not necessarily be aware of its growth. The growth might be in some kind of harmony with an overall pattern, but again that need not entail awareness of that harmonization. How might multiplication be associated with self-consciousness—a consciousness that is aware of itself as a consciousness and not just of a set of contents of consciousness?

Speaking metaphorically, any two numbers that are multiplied together engender a space that is common to both. Since a common space is a reflection of internality, there seems to be a metaphorical link between consciousness and multiplication where consciousness needs to be explored as relationship to itself and not just to some of its contents. The best way to proceed in this unfamiliar territory of mathematical metaphors is to begin with the more familiar territory of self-consciousness as human beings might understand it. When are we, as conscious beings, most self-aware in the sense of being conscious of ourselves as conscious beings? We can enter into that common space with ourselves when we are not obsessing with the external world as an arena for our survival. Paradoxically, that means a relationship with some other that is not only safe but loving, where a love relationship allowing for absolute vulnerability might be taken as the safest of all spaces. Because we are freed from the pressures of the external, we can enter into the internal. Moreover, because that freedom is in the context of some other individual (i.e, the object of our love who makes us the object of his or her affections), our self-exploration involves the perspective of that other and vice versa. In other words, love creates an appropriate space for self-consciousness (as opposed to an externally oriented consciousness) through an intimate relation with a loving other, where one explores oneself from the safe perspective of that other. That means that one knows oneself better by seeing that self through the eyes of the other, and, concomitantly, one knows the world from another perspective by identifying with the perspective of the loved one. Love makes such identification not only possible but desirable. Paradoxically, then, one cannot help but become more self-aware by getting out of oneself so that one can return back to oneself.

Such a common space with oneself can be seen as existing on a spectrum, where mutual love with another lies in between a more casual relationship of friendship or short-term support and a more intense relationship with oneself where one's self-consciousness manifests itself as an awareness of one's trajectory or path of personal growth. Thus, a less-than-love relationship can still engender a common space, but it is not as rich or powerful. Consider the two mathematical expressions: 6 + 7 = 13, and 6 x 7 = 42. The first of these would be considered as a weaker common space (13) compared to the second (42) insofar as the second number is greater than the first. In both cases two figures (6 and 7) are being brought into a relationship. But in the additive relationship 6 is not being explored from

the perspective of 7 or vice versa. To speak metaphorically, 6 is in a richer common space in the multiplicative relationship than in the additive one. 6 knows itself in terms of 7 just as 7 knows itself in terms of 6; 6 explores itself 7 times, and 7 explores itself 6 times, and the result of that exploration is the rich common space of 42. It is as if 6 and 7 have entered a relationship of love, and each number explores itself from the perspective of the other. The additive relationship is not so rich. Just as in a nonloving friendship an individual can know him- or herself as a unique self capable of relationship to other unique selves (as opposed to a reactive isolated self, whose sense of self-awareness is seriously compromised by an overemphasis on externals), the additive relationship brings numbers into a common space where identity is clarified in terms of another but not explored deeply in terms of that relationship. In other words, in the additive relationship, 6 does not adopt the perspective of 7, and the common space engendered is diminished as a result.

Toward the other end of the spectrum we have one number taken to the power of another (e.g., $6^7 = 46,656$; $7^6 = 117,159$). Here we have what might be called a greater degree of internality or self-consciousness, because the number has entered into a common space with itself in that it is being multiplied by itself. The self-multiplication factor may differ, and that difference is not without significance since it suggests various growth potentials inherent in the number—potentials defined by the value of the power. While common space with one's own consciousness might be confused with a narrow selfishness, selfishness is not normally associated with greater self-awareness. Indeed, the opposite is more likely to be the case insofar as the selfish individual is usually defensive, oriented toward externals, and as a result has minimal self-awareness. Self-consciousness that is beyond the level of awareness associated with love of another (i.e., the multiplicative relationship) would have to entail love of something within that is greater than any other. If the divine consciousness exists within each individual consciousness to some degree and if one of its manifestations is a power of growth in our self-awareness, then an exploratory and loving relationship with that aspect of our inner being is far from selfishness. To put this in other terms, I am suggesting that the power relationship in mathematics be taken as a metaphor for self-awareness based on an intimate relationship with our inner "power" of developing self-consciousness—a power that may be taken as manifestation of the divine consciousness within each of us. In this respect, one of the key choices we have in this life is that of deciding whether to develop all, part, or none of that potential for expanding our self-awareness. Individuals who have in some way chosen the path of minimal or no self-awareness are dangerous, because, in being focused exclusively on externals, their need to control or dominate becomes paramount. Contrariwise, those individuals whose level of self-consciousness is highly evolved and who can accordingly relate to

the consciousness of others (since their own has grown to include the per-spectives of others) will tend to embody empathic relations with others, and the need to dominate will be slight or even nonexistent.

In view of the foregoing discussion of the meaning of the power rela-tionship, we can return to *e* as an embodiment of growth, each moment of which is in harmony with an evolving overall pattern. The fact that it is being put into some kind of relationship with itself through the power function would suggest an element of self-consciousness in this harmoni-ous growth, and it only remains for us to explicate the full nature of this self-consciousness in terms of the value of the power, that is, πi.

To begin, just as *e* is a transcendental number, so is π—a quality that entails an immediate association with divine consciousness, because the value expressed by this ratio (i.e., of diameter to circumference of a circle) is an ongoing, nonrepeating, and in that sense infinite decimal. Now, circularity is associated with at least two things: perfection and recurrence (or return to the beginning). The perfection, from the perspective of an internalist spiritual hermeneutic, suggests that the manifestations of di-vine consciousness are always a constant distance from some center, which may be thought of as some origin. As consciousness grows or expands away from the origin by developing a variety of aspects, even those aspects that appear to be farthest from each other (i.e., the distance defined by the diameter of the expanding circle of consciousness) are related by a con-stant factor associated with the distance from the origin. Thus, no matter how consciousness expands from an origin, the multifarious aspects of the divine mind are always interrelated in such a way that the most disparate (i.e., opposite) are always a constant distance from each other, that is, the diameter or twice the radius of the growing circle. This perfect interrela-tionship between all elements of the divine mind stands in sharp contrast to human consciousness as it expands. Here, one element is often devel-oped at the expense of another, and an obvious example may be linked to the very subject of this essay: the asymmetry between the sciences and the humanities, not to mention the disciplines associated with spirituality. Currently within Western civilization (if not world civilization) science is strongly supported, the humanities are often underfunded, and spiritual-ity has little or no place in the academy. In medieval times theology was overemphasized vis-à-vis science. Thus, it would be well worth studying cultural manifestations of consciousness to see how this imbalance plays itself out.

The second theme pertaining to the circle is recurrence, and in terms of our internalist spiritual hermeneutic we can understand the expanding yet perfectly interrelated elements of divine consciousness as a trajectory that is always returning to its origin, where any given point on the circle of consciousness could be taken as both a beginning and an end point of a journey. Thus, the elements of consciousness can also be thought of as a

series, where each element is intimately connected to the next one in such a way that, as one goes along the trajectory defined by the series, one ultimately returns to where one started. The point is that in a divine consciousness, which is by definition infinite, one must always return to where one started, because the divine mind is all there is. By contrast, a finite human consciousness in its trajectory of growth never returns exactly to its origin but advances to a higher or lower level (as in some forms of reincarnation)—a level where there appears to be a sense of some new beginning as if consciousness were at the threshold of a new cycle of growth. In other words, in finite consciousness there appears to be more of a spiral than a pure circle.

Why must a trajectory of consciousness be circular in any sense? Why not linear? As consciousness evolves in a balanced way, consciousness must link awareness of an Other (or Others) with awareness of self as knowing that Other (or Others), and that link defines the circularity of the trajectory. In this respect, self-consciousness has a different quality than what might be termed "other-consciousness." Both are forms of awareness; but while the former is reflexive—that is, involved with the process of knowing as such or with its deeper foundations in some spiritual reality—the latter is not. Other-consciousness is more focused on externals. Yet each form of consciousness would oscillate toward the other and back again because one leads naturally to the other and thus defines a circle. For example, other-consciousness in quantum physics is being led back to self-consciousness as it attempts to grapple with the paradoxes of that discipline—a point made by Amit Goswami in *The Self-Aware Universe—How Consciousness Creates the Material World* (1995). Self-consciousness, as a mystical involvement with the foundations of its existence in a divine consciousness, begins to experience an alienation from the world that leads to a reinvolvement with externals (i.e., other-consciousness) as a way of overcoming that alienation. David E. Cooper articulates such a position in his *World Philosophy* (1996) when he views the mystical strain in late medieval philosophy as generating a reaction in the form of more "externalistic" Renaissance humanism (p. 193). Thus, the circle exists because *self* and *other* mutually entail each other in the sphere of consciousness, and in the sphere of divine consciousness one can illustrate this circular principle by turning to the Hegelian "myth" of spirit losing itself in matter (a form of self-alienation) to know itself, at the end of a historical trajectory, as freedom in a rational state (Cooper 1996, 316–19).

In any case, given this interpretation of π as (1) a representation of a perfect relationship between all elements of a divine consciousness and (2) a circular alternation between self-consciousness and other-consciousness, let us recall that π is also functioning as a power of e, where that quantity represents a principle of growth in perfect harmony with itself. Because we have interpreted "powering" as a mathematical equivalent of being in a

common, intimate or loving space with an inner power of developing self-consciousness, we can begin to understand the meaning behind e^{π} as harmonious growth that is consciousness of its divinity as perfection and as a circular alternation between self-consciousness and other-consciousness. In other words, as the divine consciousness grows harmoniously, so that at any given moment it is always in perfect harmony with the whole evolving pattern, it is also aware that all of its aspects are in perfect balance with each other and that the very consciousness of this whole process shifts between self-consciousness and other-consciousness in a perfectly circular manner. One might better understand this shift as involving an alternation between infinitude and finitude, where the former can be associated with God's full self-consciousness (God's consciousness of God's infinite consciousness) and the latter can be associated with God's ability to transcend divine infinitude by a kind of negation that generates the only alternative to infinitude—namely, finitude, or other-consciousness, which is consciousness "limited" by a focus on externals or others. Nonetheless, because this shift is being interpreted as an embodiment of circularity, that limitation of consciousness is perfectly integrated into the full self-consciousness of divine infinitude—an integration that is well beyond the power of human consciousness.

Where does i fit into all this? Recalling that i is the square root of -1 ($\sqrt{-1}$), we can begin by noting the obvious connection between 1 as unity and the unity of divine consciousness, but here the unity has been negated and the square root taken as well. What could this mean in terms of divine consciousness? Unity negated suggests that the unity is not complete but is an eternally evolving potential, where all the elements of consciousness are part of a greater whole but also manage to maintain their independence. Unity negated, however, is not unity abolished, for the elements constituting the divine consciousness are still interlinked in a multitude of ways. Yet, taking the square root of this potential unity points to a particular organizing principle, that of duality, since a square root (as opposed to a cube root or other factor) is equivalent to a value that when multiplied by itself constitutes the value of what the square root is being extracted from. Thus, $\sqrt{-1}$, or i, can be understood as an infinite series of dualities that constitute an emerging unity—dualities such as good and evil, love and hate, positive and negative, infinite and finite, life and death, male and female. However, this dualism does have a unique quality that is inherent in the root concept. Because taking the root of a number involves obtaining a value that has to be multiplied by itself to realize the original number, the duality or dualities have to be apparent or relative rather than real or absolute. From the perspective of a divine consciousness, good and evil, positive and negative, and so on are embodiments of a deeper unity, and it is only from the perspective of a human consciousness that they would seem to cancel each other out rather than constitute an emerging

unity by entering into a common space (i.e., squaring or self-multiplication). But even humans can have some sense of this unity by realizing that each element of a fundamental duality is inconceivable without the other. Thus, i may be interpreted as a principle of "equivalent dualities" entering into a common space with themselves. Of course, in this connection duality has associations of creativity (e.g., male and female as "opposites" in a sexually procreative relationship); but inasmuch as what is created seems to embody unity (e.g., the offspring as a complex set of unities), there is reason to think of the dualities as being more apparent than real.

There is, no doubt, something inconceivable about i. Hence, the designation "imaginary." While the number is as necessary as π and e, in that it has numerous practical applications (for i the key area being in electrical engineering), i is somehow at the boundary of the conceivable, because one can hardly imagine, given certain basic rules of computation, how a number can be multiplied by itself and generate i. Yet, from the perspective of an internalist spiritual hermeneutic, one can go some way toward demystifying the term. Indeed, its very inconceivability already has associations with a divine mind that is by definition inconceivable at the same time that it plays an important role in our lives.

More to the point, however, we might consider the nature of number itself from a divine perspective and interpret number as a principle of unique identity in relation to an infinite continuum of other such identities, with all of these having an infinitude of potential relations with each other. Thus, mathematics might be viewed as the discipline that articulates these relations. If i has a unique identity, we must get at it by asking if there is some way of understanding how a number when multiplied by itself can yield a -1. Here we can make headway by expanding the concept of number beyond that of discrete identity to an idea of "blended aspects." The question, then, would be, If such a blended number were brought into a multiplicative relationship with itself (i.e., squared), would a negative unity (-1) ensue?

To answer this, let us develop an analogy based on the phenomenon of personal or individual identity as experienced by human beings. By simple introspection it would appear that our identities are only apparently discrete. In fact, they are quite diffuse, in that each of us exists within a complex network of shifting identity blends. But if we enter into a common space with ourselves, we are moving toward self-consciousness in a manner similar to two different numbers existing in a multiplicative relationship with each other, except in this case the number would be entering into such a relationship with itself (the equivalent of squaring a number). By way of this act of self-awareness, we are forcing the blended elements of our identities to become less diffuse and more concentrated. If this could not be done, if the blends could not be forced into some relatively stable pattern at least for a moment, self-consciousness could not be attainable,

and we would remain in our usual unselfconscious drift of shifting person-
ality blends. In short, the identity blend that constitutes our identity is
squeezed, constricted, forced into some degree of focus via an act of self-
reflection, but it is never abolished. Moreover, as might be suspected, to
the extent that these blendings are squeezed into some relatively stable
forms, our personalities or senses of self become more coherent or unified.
The unity can never be total (unless we were divine) and in that sense is
always emergent. Thus, by analogy, we can consider the concept of blended
numbers as numerical identity blends. When forced into a common space
by squaring, they should also tend to unity, but only an emergent or nega-
tive unity, that is, -1. Of course, all this hinges on the possibility of such
new numbers existing. But then, mathematics is a field for intellectual
creativity, and if these new entities allow us to clarify the heretofore incon-
ceivable *i,* the creation may prove valuable. Certainly, the "equivalent du-
alities" described here may gain some deeper mathematical grounding.

   In the context of the equation $e^{\pi i}$ = -1, we can now modify our interpre-
tation of the left side in two ways. (1) The self-consciousness of the har-
monious growth in divine consciousness is not just in terms of a balance of
elements and an alternation between self- and other-consciousness. It is
also in terms of an awareness of itself as an ever-emerging unity consti-
tuted by an infinite series of paradoxically equivalent, albeit creativity-in-
spiring, dualities. (2) Because *i* (as an imaginary number) is often
understood as a value on a number-line axis that is rotated 90 degrees from
the nonimaginary axis, it may be interpreted as a facet of self-conscious-
ness that is in another dimension from that in which exist the "non-unity"
aspects of divine consciousness. In other words, divine self-consciousness
must always be stepping into another dimension (metaphorically speak-
ing, a transverse axis) in order to gain awareness of its evolution as an
emergent unity.

   Finally, when a square root is not being taken of -1 and the number is
allowed to stand on its own as that to which the right side of the equation
is equivalent, we can understand negative unity in a simpler way. Without
the dualistic aspect (linked to taking the square root), -1 can be taken as a
symbol of emergent unity; but inasmuch as it is no longer functioning as a
power on the right side of the equation, -1 is no longer part of the self-
conscious of the divine mind as harmonious growth. Instead, emergent
unity may be understood as a unity that is reflected everywhere. It is always
in the process of being discovered by scientists, but also by philosophers,
theologians, and theorists in many other disciplines. It may also be in the
process of always being created by a divine consciousness. Yet, as Euler's
equation seems to suggest, this emergent unity has a structure—a struc-
ture articulated throughout the course of this discussion: (a) harmonious
growth of divine consciousness as (b) conscious of its own perfect balance
and (c) of its inner alternation between self- and other-consciousness as

well as (d) of its dualist aspects with respect to an emergent and transcendent unity. How should all of the foregoing come together in what can be interpreted as a nondualist emergent unity? Or why should a combination of these be one with or equivalent to an emergent unity (i.e., -1)?

First of all, growth in itself (i.e., e) as change, development, and so on is by definition emergent (i.e., the negative aspect of -1). It may be perfect in its embodiment of divinity, where any moment of that growth is reflective of the whole pattern, but in its ongoing emergence it is not necessarily unified unless it monitors itself in that direction. Such self-monitoring or self-consciousness is what shifts the ongoing emergence in the direction of unity.

Second, because "powering" is the mathematical analog to entering into a relationship with oneself, the monitoring self-consciousness exists in the form of e functioning as the base of exponents π and i. Thus, π and i are the factors of self-consciousness as it pertains to the growth of divine consciousness, and they must in some way shift that growth in the direction of unity.

Third, the foregoing analysis suggests that the divine consciousness monitors itself in such a way that growth becomes an expression of unity rather than something else. If another power were chosen, the universe as we know it would be different. Thus, in a universe characterized in terms of an emergent unity, God had to make the choice God did. In another universe God would presumably have made a different choice.

Fourth, self-consciousness directs growth toward an emergent unity because its factors (those associated with self-consciousness) are circularity (π) and creativity-inspiring equivalent dualities (i). Circularity is linked to unity in two ways: (1) all the diverse aspects of divine consciousness are in a constant or singular relationship (i.e., the radius) to their origin (i.e., the center of the circle); (2) the trajectory of consciousness from self- to other-consciousness is endlessly recurring and, consequently, embodies a kind of temporal unity. The principle of equivalent dualities is also unity-engendering to the extent that the dualist (i.e., square) root of emergent unity must be in a common space with itself—meaning that all dualities are apparent inasmuch as they mutually entail each other and through their interaction create specific areas of unity.

It is no wonder, then, that when these two principles of self-consciousness monitor or control the growth of divine consciousness, an emergent unity is the result. As an equation that can be proven mathematically without any reference to the Divine, $e^{\pi i} = -1$ tends to be opaque and express the properties of mathematics as such. But with our internalist spiritual hermeneutic, the equation overflows with meaning. The fact that two of its elements (e and π) are associated with the infinite in their transcendental nature is indicative of the need for a spiritual hermeneutic, where infinitude, as a quality of the Divine, can naturally inform the act of interpreta-

tion. The lesson of all this might be that mathematics needs a metaphor to bridge the gap between the three cultures. The metaphor utilized herein with respect to Euler's equation is that of mathematics being an expression of a divine consciousness. It is something available not only to humanists, who are aware of consciousness in its numerous manifestations (history, psychology, and so on), but also to those in the "third culture" of spirituality, where mystical insights are the stock-in-trade of understanding.

CONCLUSION

One of the interesting implications of this hermeneutic exercise pertains to the peculiar fit of mathematics to physical reality. Why should the world be open to the most subtle mathematical formalization? From the point of view of this discussion, if mathematics is an embodiment of a divine consciousness and that consciousness underlies all things as the source of their existence as well as being constitutive of their basic nature (e.g., quantum reality having qualities similar to those of consciousness), then it would be only natural for mathematics to be the most appropriate expression of reality. Remembering that consciousness entails a sense of common space, mathematics and reality as embodiments of consciousness would share space in the divine mind and thus mutually entail each other.

Apart from the application of mathematics to reality, the theme of emergent unity (-1) suggests the possibility of complete unity or an emergence that has been fully realized. This seems impossible, because $e^{\pi i}$ is a fixed quantity. But what if i is a "wild card"? While it might seem to have a stable value, recall that, according to the interpretation given above, it is constituted by blended numbers being "squeezed" into a relative stability, which is a kind of emergent unity. Should the condensation reach a point where the unity is realized, the equation would shift, and from a phenomenological perspective, $e^{\pi i}$ would equal 1 instead of -1. Thus, divine consciousness would have completed its cycle of growth and be ready for a new birth at zero. In the Euler equation, emergent unity is in a common additive space with completed unity (i.e., $e^{\pi i} + 1 = 0$), which from the perspective of a timeless divine mind makes sense. The common space is defined as a void from which all things are engendered (Seife 2000, 208–9, 215). In this context it would seem that the divine consciousness integrates emergent and realized (or absolute) unity to create afresh. There is more of a balance in the additive relationship than in the multiplicative one (emphasizing a more intense common space), and we may interpret this as God's balancing an ideal of absolute unity against differing emergent ones—an infinitude of infinite creations always in process in a realm beyond humanly conceivable time and space.

In any case, when we consider one of the key problems of interdisciplinarity—namely, the asymmetry with respect to the relationship between

the sciences and the humanities—it would appear that understanding might be facilitated to the extent that the insights of spirituality were brought into the mix. Of course, this is something that is not likely to happen any time soon, given the current intellectual milieu where spiritual issues are often relegated to "New Age nonsense." Yet spiritual knowledge did not begin with the New Age; it has a long tradition, and to the extent that this tradition can shed light on the mysteries of mathematics and physics, these abstract children of reason not only will be open to more seekers of understanding but might also be understood at a deeper level. Thus, instead of our accepting a mathematically formalizable paradox as the best that can be achieved in our understanding of nature, those paradoxes might become the royal road to our understanding the world as an expression of the mind of God.

I mentioned Oedipus earlier, and I conclude by noting that Oedipus found disaster by taking the wrong road—a road that led him to murder his father. According to legend, there were three roads from which Oedipus had to choose. From my point of view, there is danger in going down any one road and avoiding the others. In the physical world we might have to choose one. In our journey to truth, however, we must choose all three roads—the sciences, the humanities, and the spirit. Naturally, one needs a mind map for this kind of undertaking, and the present discussion may be thought of as sketching out the first few strokes of what should prove to be a great atlas.

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