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A Geometric Model of Self-Organization and Its Significance to Societal Dysfunction

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Abstract

A toy geometric model applies the general principles of self-organization and stationary action principles in a Cartesian two-dimensional framework to represent an infinitely contained universal state. The geometry purposefully incorporates inconsistency, representing paradoxical structure, and receives validation by accurately predicting the experimental outcomes in key quantum experiments. The model also conjectures its dynamic format beyond the two-dimensional limit of the geometry. The second part of the paper adapts the model's framework to discuss human social structure. The conjecture is that in the first order, the statements claiming universal truth devolve into a dualism of perspectives paradoxically conjoined. The framework of paradoxical inconsistency found in formal arguments of logic and mathematics applies in all spheres, from the structure of Nature to human rationalism, when attempting to conclude absolute truth. Therein lies a primary causative source of dysfunction in the logic and beliefs adopted as absolute truths in human society. The argument extends that, analogous to quantum entanglement, the relationship between rationalism and belief is entangled in the search for absolute universal truth.

Keywords

Infinity, Paradox, Rationalism, Logic, Hardy's Paradox, Bell's Inequality, Social Dysfunction, Self-Organization, Geometry

1. Introduction

This study claims through a geometric model applied to experiments in quantum structure that rationalism has a limit falling short in the formal representation of universal states. By definition, a universal state will contain all the elements of its property within a boundary as an infinity. However, numerous

theorems in logic and mathematics prove it is not possible to represent infinity in a formally consistent argument (Wikipedia, 2023i, "Infinity"). The argument of this and its companion papers is that although rationalism, within its limit, is responsible for the significant advances in science and technology, it is a human construct not native to the Universe.

Gill argues that "the fundamental distinction between us as humans and other living creatures is that we have an advanced form of intellect, allowing the creation of theoretical principles". It is a particular category of sentience involved in the development of meaning from the theoretical aspects of logic, mathematics, and science to our value judgments and sense of morality for each person.

For these diverse forms of reasoning, is there a limit to the function of rationalism? The only source of information is from observation of the Universe in all its immensity. Our curiosity and discoveries have led to the belief that greater understanding is always possible. However, suppose the Universe has a fundamental, inconsistent, paradoxical structure at its core. In that case, absolute limits to rationalism fall short of ultimate truth and certainty. If so, all our judgments on the absolute [will mirror the structure of the Universe and contain, at their core, a framework of inconsistent nonresolvable cycle in the search for absolute truth] (Gill, 2023b: p. 594).

2. The Geometric Model

This section presents the background for the structure of the geometric model applied in the companion papers to analyze Russell's paradox, Hardy's paradox, Bell's inequality, and the mathematical structure of the Moebius band, among other topics. The starting point in the argument focuses on the significant failure of the theoretical calculations in the formalism of quantum mechanics to predict the data obtained in the experimental demonstration of Hardy's paradox. To this point, the geometric model's calculations match the experimental data with an error of less than 2 percent.

The geometric model incorporates a format of structural relationships inconsistent in formal mathematics yet obtains the correct values for the data in the experiment. The question arises whether the theoretical basis of quantum formalism contains a fundamental flaw in its application to Hardy's paradox. This paper conjectures that although quantum formalism has unquestioned accuracy within a definable limit, Hardy's paradox is a particular category of phenomenon not previously considered in which a universal state is bound absolutely as an infinity (see **Appendix**).

The second part of this study discusses the structure of statements claiming to represent absolute truths in the social context of rationalism. The conjecture is that the same limitation identified in the geometric model, discussing empirical structures, applies to rationalism in general. Rationalism in all formats has a limit that falls short of certainty for understanding absolute truth, and in social structures, that limit becomes a potential source of dysfunction.

The geometric model is based on a thought experiment using the general concepts of emergent self-organization and stationary action principles (Wikipedia, 2023a, "Thought Experiment"; Wikipedia, 2023c, "Self-organization"; Wikipedia, 2023d, "Stationary action principle")… From an initial null state (see **Appendix**), segments develop across dimensional boundaries, and each segment is an infinity bound within its upper and lower limits… [The] claim is that the geometry describes the root structure in which a universal state develops complexity.

Because the circumference of the geometry encloses segments that each form infinities, it is a self-contained infinity of infinities. Classical states are always open within a larger framework, and instead, the circumference forms an infinitely closed space that cannot, theoretically, be considered a classical location. Neither can its interior be considered observable [as a rational construction]".

The geometric figure has an inner and outer circumference and a superposition of the right triangle within. The sides to the right triangle cross dimensional boundaries established by the inner and outer circumferences.

The structure of the geometric model illustrated in **Figure 1** and **Figure 2** has no special significance for the claim that its two-dimensional framework contains dimensional infinities. The justification developed in the companion papers, and further discussed in the following sections, is that the segments to the right triangle counterintuitively entangle linear [magnitudes] as unitary object identities. The segments are each assigned the object identity (1) despite having different linear values (Gill, 2023c: pp. 789-790).

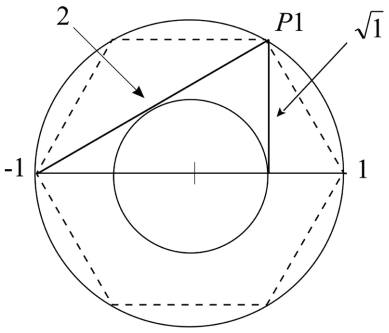

Figure 1. Cosine squared identity for the 60-degree angle.

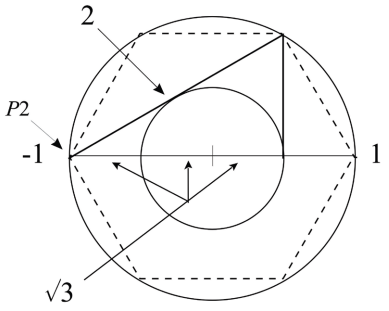

Figure 2. Cosine squared identity for the 30-degree angle.

The entanglement of linear values and object identities has the effect of compacting two separate dimensional frameworks. The Cartesian plane's classical two-dimensional [surface] is transformed downward into a one-dimensional structure, and the square root function is applied to each segment. The hypotenuse consists of two segments beginning and ending on the same dimensional level, and the square root cancels. The geometry counterintuitively (paradoxically) opens dimensional boundaries in an inconsistent framework to formal mathematical representation. The agreement of the two formats for calculating the cosine squared identity strongly validates the rationale in the geometric model.

The Right Triangle Side and Angle Calculator computes the linear values for the adjacent sides to the right triangle on the Cartesian plane (Pamuła, 2023). The diameter of the geometry for the outer circumference is assigned the value 4, and the portion that applies in the geometry is 3. The sides of the 30-60-90 right triangle are: for cos (30): 3, for cos (60): 1.732, for the hypotenuse: 1.732 (Gill, 2023c: p. 791).

2.1. Calculation Using Linear Values in the Geometry

$$P1 — \cos^2(60) = (1.732/3.464)^2 = 0.25 \tag{1}$$

$$P2 — \cos^2(30) = (3/3.464)^2 = 0.75 \tag{2}$$

2.2. Calculation Using Entangled Identities in the Geometry

$$P1 — \cos^2(60) = \left(\sqrt{1}/2\right)^2 = 0.25 \tag{3}$$

$$P2 — \cos^2(30) = \left(\sqrt{3}/2\right)^2 = 0.75 \tag{4}$$

The nonclassical feature of entangling linear values and object identities is quantum-like. However, it differs in that the boundaries of each segment and the composite structure containing it are infinities. Therefore, their basis is inconsistent with formal mathematical and geometric representation, wherein it is not possible to represent infinity as a structurally closed observable state. The term applied is that the geometry has a sub-classical framework (see **Appendix**). The structure is a two-dimensional static representation. However, by self-organization, the dimensional complexity of the model is not limited to a two-dimensional basis. It contains hidden complexity both within and outside of its two-dimensional format.

3. Hardy's Paradox and Bell's Inequality

Gill (2003a: p. 791) demonstrates in the paper "The Mechanism of Paradox in the Structures of Logic, Mathematics, and Physics" that the geometric model successfully explains the wavefunction rotations in Bell's inequality and the experimental outcome in Hardy's paradox. For both structures, the cosine squared identity calculates the probability attribute of correlated entangled particles and "… is an elementary exercise in quantum theory" (Herbert, 1985: p. 224).

3.1. Hardy's Paradox (Wikipedia, 2023b, "Hardy's Paradox")

Hardy's paradox is a thought experiment proposed by Lucien Hardy in which a particle and its antiparticle may interact without annihilating each other. Aharonov et al. (2002) calculated the quantum-level probabilities, and Lundeen and Steinberg performed an experimental demonstration, "Experimental joint weak measurement on a photon pair as a probe of Hardy's paradox" (Lundeen & Steinberg, 2008).

Hardy's paradox analyzes the quantum cohabitation of a particle and its anti-particle on four possible paths when they exit simultaneously at dark ports in the structure. The geometric model considers the particle and anti-particle data when both cohabitate on the inner or outer paths. In the modified experiment by Lundeen and Steinberg, entangled photons replace the particle and anti-particle framework.

Probability values calculated by Aharonov et al.:

- For cohabitation on the inner paths, 0.
- For cohabitation on the outer paths, –1.

Experimental values (Lundeen & Steinberg, 2008: p. 3):

- For cohabitation on the inner paths, 0.245.
- For cohabitation on the outer paths, –0.759.

Probability values based on the geometric model (Gill, 2023b: p. 594):

- For cohabitation on the inner paths, 0.25.
- For cohabitation on the outer paths, 0.75 (the negative value in the experimental results is justified below).

The divergence between the theoretical calculations and the experimental results is significant and suggests that something else is not accounted for in the formal mathematical framework. The geometric model resolves the issue and receives validation by predicting the experiment data.

Hardy's paradox consists of two particles interfering with each other and not one particle displaying the interference of a single waveform as in a double-slit experiment (Wikipedia, 2023e, "Double-slit experiment"). This elevates the structure to two waveforms with entangled interference across them.

Framework ($F1$)—the particle/waveforms take both inner paths, formal value (0) and experimentally (0.25).

Framework ($F2$)—the particle/waveforms take both outer paths, formal value (–1) and experimentally (–0.75).

The conjecture is that although the calculated values for ($F1$) and ($F2$) are formally correct, that method does not account for interference across ($F1$) and ($F2$) simultaneously. Instead, using the geometric interpretation, (F1) and (F2) form an entangled state in a framework of uncertainty between their pure values. The two arms of the right triangle to the hypotenuse at each incident location on the circumference down-convert and combine ($F1$) and ($F2$) as a single unitary structure such that neither experimental data point is a pure value.

The shorter arm represented in ($F1$) receives weighting from the longer arm

represented in ($F2$) and shifts ($F1$) from its pure value (0) to (0.25). Conversely, the longer arm represented in ($F2$) receives weighting from the shorter arm represented in ($F1$) and shifts from its pure value (−1) to (−0.75). Of note, the circumference that centers the right-angle in the triangle for the cosine squared function in both calculations is not shown and is not the circumference of the geometric model.

3.2. Bell's Inequality (Wikipedia 2023g, "Bell's Theorem")

(Herbert, 1985: pp. 215-227) [explains that] the basis of classical relativity theory is that all locations in the universe are local and distinct, in which the speed of light limits the connection between them. Bell's theorem tests this hypothesis by analyzing the polarization attribute between two entangled particles at separated locations in classical space.

Under the misalignment of each particle by 30 degrees, the error rate between them is more strongly correlated than predicted by classical probability and is a single, unmediated, mixed-phase waveform. The experiment indirectly proves that despite the unquestioned accuracy of relativity theory in its realm, classical relativity can never explain any system that obeys the laws of quantum mechanics.

Applying the cosine square identity in the geometric model successfully predicts the experimental results:

For polarity misalignment of one crystal by 30 degrees, the misses are 1 out of 4, (0.25).

For polarity misalignment of two crystals by 60 degrees, the misses are 3 out of 4, (0.75).

The experimental datum point in Hardy's paradox of (–0.75) is negative because both particles are entangled in a one-dimensional quantum structure, wherein negative probabilities occur (Wikipedia 2023h, "Negative probability"). Contrarily, in Bell's inequality, the particles are entangled across a classical space in a two-dimensional framework, and negative probabilities do not exist. The inconsistency in the probability structure between the two experiments highlights the significance of the paradoxical relationship that conjoins the one-dimensional framework of entangled particles in Hardy's paradox and two-dimensional framework of entangled particles in Bell's inequality.

The validity of applying the right triangle and the cosine squared identity to the experimental results in Hardy's paradox and Bell's inequality does not directly rely on the nonclassical rationale of the geometric model. The results are valid by applying the cosine squared identity in a classical format. However, the model's feature that counter-rationally entangles a linear magnitude as an object matches a similar format of entanglement found in the quantum structures. The conjecture is that the geometric model identifies the deeper connection for applying the cosine squared identity that incorporates paradoxical inconsistency as a valid basis and methodology.

4. Formal Representation of Dimensional Structure versus the Framework in the Geometric Model

Gill (2023c) comments that dimensional structure is placed on a consistent basis for mathematical operations using the power function. Dimensions can then be grouped and interpreted as having a real relationship between them. However, [under the geometric model], this hides the root framework in the generation of complex structures across dimensional levels that incorporate an infinity at each level.

The boundaries that conjoin segments in a universal structure incorporate a paradoxical relationship. The same feature will apply between structures that are each universal. In other words, a universal structure also takes its reference in two paradoxical frameworks: that it is contained and not contained to itself. This is the theoretical conundrum arising in Russell's paradox. Such entanglement, in a dynamic state, would generate tension, as a force, between the two paradoxical frameworks. Finally, the force itself would display [correlated] frameworks of attraction and repulsion.

5. The Role Paradox Plays in Human Reasoning in the Search for Universal Truth

The above sections outline the basis of the geometric model and its application in Hardy's paradox and Bell's inequality. They are crucial in laying down the model's foundation, strength, and significance. The key element of the model is that it paradoxically entangles object identity and linear magnitude in each geometric segment for calculating the value of the cosine squared function.

The framework of entanglement in the geometry is generically analogous to the mechanism of entanglement found in quantum structures, and the claim can be made that paradox is not an anomaly in our rational interpretation of the Universe. Instead, it is the hidden basis of the connection between correlated elements that, on the surface, appear paradoxical for sharing a common property but do share property in a hidden state that allows both as members.

This is where the argument can be extended in nonformal terms to the application of rationalism in human societal frameworks when claims are made intended as universal, absolute truths but hide as a minimum, a second framework of argument that is paradoxically conjoined but equally valid for conclusion.

The argument's justification cannot be "hand waving," Hand waving is the term that best describes an argument not based on a concrete logical structure. The best way to avoid the trap is through mathematical theory verified by experiment. That is precisely the strength of the geometric model.

Having confirmed the above, moving the argument from the sphere of mathematics and experimental proof to the realm of human social interaction still requires a leap of logic. The argument is that demonstrating the limitation of rationalism in determining universal truth applies to all forms of statements having a claim to represent absolute truth.

There are two sides to the argument on the limitation:

1) The internal structure of universal statements that claim to be absolute for truth categorically contain correlated parts with paradoxically conjoined properties. The resulting argument is whether the universal truth is true or false accounting for its internal inconsistency. The argument is circular and unresolvable. This framework is found in Russell's paradox (Wikipedia, 2023f, "Russell's paradox").

2) There is a sliding scale of uncertainty between the dualism of extremes claiming universal truth, and each extreme hides the validity of the other.

The limitation of rationalism is that there is no such thing as absolute truth that does not reference the role of paradox and the element of uncertainty attached. The failure to understand the prohibition to absolute truth and its sliding scale of uncertainty contributes to dysfunction in the human realm of social interaction.

As humans, we want finality for truth to be a guide, and the only way to achieve that is to arbitrarily stop what is not resolvable. The problem with that approach is that it contains a systemic error of judgment. Understanding is then locked down and arbitrary in a smaller space than in the larger framework of reality. This can have negative consequences on two levels. Not understanding the process and what exists beyond any given understanding can lead to intolerance of what is unknown in its locked-down perspective. In the second and worst incarnation, it is the pattern of ignorance, bias, and hatred. What is outside that view of reality is then seen as an untruth. The term for that is bigotry (Gill, 2023b: p. 595).

Dimensional Boundaries is a novel written from an artistic perspective to capture the concepts in this and its companion papers. A term the protagonist, Jack Bennett, who is a physicist, uses to describe the Universe is that it is immaculately nonordered (Gill, 2023d). He distinguishes this nonorder from disorder with no internal, hidden structure other than randomness. It is not rationally possible to have direct and infinite access to the rule of a Universe with the property of immaculate nonorder. However, an order to the structure can be observed in which elements are paradoxically conjoined. Paradox is the mechanism and limit that allows a dualism of elements to have a relationship as ordered; however, it is a paradoxical order. Paradox creates an order that is one level removed from absolute certainty for observation. Additionally, the property of immaculate nonorder can be observed as the process of change that is not statically resolvable.

The fracture of universal truth has significance for what we decide as true and false. Any truth constructed and considered universal is false within a larger framework than directly observable. The element of uncertainty is a necessary component of framing any absolute truth. Beyond the fracture in the study of dualism, the complexity of arguments grows but not with resolution. The structure of the Universe points to a principle that there are no final answers when attempting to form single principles that are fundamental and absolute.

The role of paradox in the Universe cannot be argued for proof by deductive

logic. Deductive proofs prohibit paradox from the outset. However, inductive reasoning does not have that restriction. Then, proof relies on the absence of a counterexample, and that is the situation we find based on the collection of supporting examples in this and its companion papers (Gill, 2023c: p. 587).

6. Conclusion

The mathematics of the geometric model is applied to quantum theory and experimentation and opens the framework of a hidden partition that conjoins elements having a paradoxical relationship. In the exclusive perspective, from one side of the partition, the other side is hidden. The case has been made that the same framework applies in the human sphere of social interaction when concluding the nature of absolute truth.

From purely formal theory to everyday observations and conclusions, the structure of rationalism hides the root framework of inconsistency that has as its basis the development of complexity across dimensional boundaries. The paradoxes found in diverse theoretical and empirical examples are discounted because the default rule of rationalism is that counter-rational structure is ruled invalid. Truth is proven false if an argument has inconsistency. Nevertheless, mathematics provides a key understanding of how paradox is a valid mechanism in [all aspects of rationalism].

One of Richard Feynman's last thoughts, as he lay dying on his hospital bed, was, "I don't have to know an answer. I don't feel frightened by not knowing things, by being lost in a mysterious universe without any purpose, which is the way it really is, as far as I can tell. It doesn't frighten me" (Gleick, 1993: p. 438). Feynman's insights are legendary, and his last statement hints at the role of paradox in all universal structures (Gill, 2023c: p. 587).

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix

Definitions

Classical: Classical mechanics refers to the period of mathematical understanding in physics before discovering the basis of quantum phenomena. Classical mechanics is the domain of Newton's laws of motion and Einstein's General and Special Relativity theories. Classical structure describes the basis of our observable universe.

Immaculate Nonorder: Immaculate nonorder is distinguished from disorder, the random mixing of an ordered state's elements such that the original structure's framework is lost. Immaculate nonorder does not come from an antecedent higher-ordered structure. Instead, it is the basis of building order by the cyclical subsummation of complexity from its origin, which is a null state. The term immaculate nonorder is adopted from the novel *Dimensional Boundaries* (Gill, 2023c).

Null State: A null state is without internal form and is not a location within a larger structure.

Quantum: The fundamental mathematical component of quantum theory is the square root of minus one. The term imaginary is used because, in classical mathematics, the antecedents $(+1)^2$ and $(-1)^2$ both produce the product $(+1)$. The reverse operation taking the square root is only in the form $(+1)$ and not (-1), which is found in quantum structure and is paradoxical to the format of classical mathematics.

Sub-classical: Sub-classical is a new term applied in the geometric model. The power function cannot be used in formally representing the dimensional structure that applies. This is because each segment is a self-contained infinity, and therefore, dimensions cannot be grouped in a consistent mathematical framework.

In the geometric model, each unique sub-classical component is subsumed as the complexity of the structure builds across its dimensional boundaries to the circumference that wraps them into a universal state.

Universal State: A universal state is one whose boundary contains all the structural components it defines. There are two fundamental formats. In the first format, the parts have a logical-not structure. Observation of their normalized membership in the parent state is prohibited. In the second format, internal components are observationally distinct and normalized. The difficulty in conceptualizing the framework of universal structure is that all frameworks of observation have a circular complexity both within and to the outside by the mechanism of paradox. At a minimum, half of the framework is necessarily left out in any view taken on the composition of a universal state.