

Mathematics in English Literature: An Interdisciplinary Exploration of Logic, Structure, Symbolism and Imagination

Mita Darbari¹, Pralay Kant²

¹Dept. of Mathematics, St. Aloysius (Autonomous) College, Jabalpur

²Dept. of English, PM College of Excellence: Govt. Mahakoshal (Autonomous) College, Jabalpur

Abstract

No knowledge can be comprehended without the two fundamental elements; namely; alphabets and numbers. Thus, Mathematics and Languages are the key component to decipher the universe. Although, Mathematics and Literature are traditionally viewed as two distinct disciplines as former is founded on logical reasoning while the other rely on imagination and emotional expression, on closer examination, we find that Mathematics has profoundly influenced English Literature in terms of structure, symbolism, narrative design, characterization and philosophical inquiry. Advances in Mathematics would have been impossible without the ingredient of imagination. Many English writers have employed mathematical concepts not merely as ornamental references but as essential devices to explore truth, infinity, order, uncertainty and human consciousness. This paper explores the role of Mathematics in selected English literary works from Renaissance to contemporary literature. Through textual analysis of works by William Shakespeare, Jonathan Swift, Lewis Carroll, Edgar Allan Poe, Jorge Luis Borges, Thomas Pynchon, Ian Stewart and others, the paper demonstrates how mathematical ideas enrich literary expression and contribute to interdisciplinary study.

Keywords: Mathematics, English Literature, William Shakespeare, Lewis Carroll, Geometry, Logic, Infinity, Symbolism, Literary Mathematics

Introduction

Mathematics and Literature are related to each other since ancient civilizations. The numerical harmony was the basis of beauty and aesthetic creation. Pythagoras, who coined the word Philosophy, had strong belief that All is Numbers and there is mathematical order in universe. This philosophical tradition continued into English literature, where mathematical ideas often appear as metaphors for harmony, proportion, certainty and paradox.

Although, Literature primarily communicates through language, it frequently adopts mathematical structures including geometry, proportion, probability, recursion, sequence and logical deduction. Conversely, mathematical thoughts often depend upon narrative and metaphor for explanation and discovery.

Mathematics and Literary Theory

Modern literary criticism increasingly recognizes mathematics as interpretative tool. These are the few ma

thematical concepts which appear in Literature: Arithmetic, Chaos Theory, Fractals, Game Theory, Geometry, Graph Theory, Infinity, Logic, Probability, Set Theory, Symmetry, etc.

Mathematics in Shakespeare

In spite of not being a mathematician, William Shakespeare often used mathematical imagery. Some examples are:

Measure for Measure: The title itself invokes mathematical measurement and justice. Here, justice is portrayed as proportional rather than absolute. The concept resembles the mathematical idea of poise.

The Merchant of Venice:

The numerical precision is the key to the famous bond between Shylock and Antonio. Concepts like interest, contracts, valuation and risk involve mathematical reasoning. The courtroom argument of Portia transforms strict calculation into moral interpretation.

King Lear

The problems associated with partition and proportion is very well depicted in the division of kingdom. The violation of mathematical fairness by irrational human decisions is illustrated in the tragedy of King Lear.

Satirical Mathematics in Jonathan Swift's Gulliver's Travels

Jonathan Swift satirizes mathematicians in Gulliver's Travels, especially in the voyage to Laputa. The citizens of Laputa were fascinated with abstract calculations, astronomy and geometry, but still, they failed in pragmatic governance.

The Mathematician Novelist: Charles Lutwidge Dodgson- Lewis Carroll

Lewis Carroll was an Oxford teacher of mathematics whose literary works has many mathematical puzzles. Some Examples are:

Alice's Adventures in Wonderland (1865)

Nonsensical Multiplication: Alice claims, "4 times 5 is 12, and 4 times 6 is 13...". Scholars noted that if you continue this progression up to 4×12 , the answers work perfectly if you alter the number base (Base-18, Base-21, etc.), failing exactly at 20 because the system breaks down.

The Mad Hatter's Tea Party: This scene acts as a critique of **quaternions**—a new 19th-century number system involving four terms (x, y, z spatial dimensions plus time) where multiplication is non-commutative. When Time deserts the party, the three remaining characters (Hatter, Hare, Dormouse) are trapped rotating around a table forever.

The Cheshire Cat: The cat's body disappears, leaving only its grin. This represents the rise of abstract mathematics, where relationships and structures exist independently of physical reality.

Changing Proportions: Alice growing and shrinking symbolizes changing geometric scales while maintaining her "temper" (proportions).

Through the Looking-Glass (1871): The sequel where Alice steps through a mirror into a giant, living chess game. Thus, the novel resembles a chess game in which each chapter corresponds to moves on a chessboard. The characters in the novel move according to mathematical constraints. The entire narrative is dominated by Logic.

A Tangled Tale (1880-1885)

A Tangled Tale is a collection of ten humorous stories, which Lewis called "Knots". They cleverly conceal serious mathematical and logical problems inside whimsical Victorian narratives.

Core Mathematical Themes

- **Speed, Time, and Distance:** Opening with travellers walking up and down hills at varying rates to calculate precise arrival times.
- **Probability and Logic:** Puzzles tackling conditional probability, deceptive averages, and infinite regress.
- **Algebraic Distribution:** Whimsical scenarios involving items like pigs in sties, - evaluating shared assets, or tracking changing quantities.

Sylvie and Bruno (1889 and 1893)

A two-part fairy tale novel weaves mathematical, logical, and geometric concepts into whimsical conversations, absurd proofs, and philosophical musings on infinity.

Mathematical Puns and Geometry

- **The Bumble-Bee Paradox:** Carroll mocks Euclidean line division through young Bruno. When the Other Professor draws a line A-B with a midpoint C and asks what happens if A-B is divided at C, Bruno nonsensically claims "the bumble-bee" would be drowned and sink in the sea.
- **Straight-Line Logic:** Dialogue frequently reduces complex literary or dramatic ideas (like Shakespeare's "to be or not to be") into literal geometric line-drawings and triangle formations on a blackboard.

Philosophical Infinity and Curves

- **Exhaustion of Curves:** In Sylvie and Bruno Concluded, characters like the Earl discuss pure mathematics in the context of eternity.
- **Progressive Degrees:** The text ponders how a person in an afterlife could systematically work through the properties of circles and ellipses (curves of the second degree) before moving on to curves of the third degree, treating math as an infinite intellectual journey.

Logic and Satire

- **Adult vs. Child Logic:** Unlike the pure nonsense of the Alice books, Sylvie and Bruno embeds mathematics alongside heavy doses of theology, political satire, and moral philosophy, reflecting Dodgson's academic transition toward formal symbolic logic.

Edgar Allan Poe and Mathematical Logic

Edgar Allan Poe integrated mathematical concepts, analytical reasoning, and formal logic deeply into his works. Far from just a writer of gothic horror, Poe studied mathematics at West Point, viewed poetry and composition as structured problems, and invented the modern detective story using strict logical deduction.

Critique of Pure Math: In stories like The Purloined Letter, Poe distinguished between abstract logic and routine calculation, cautioning that a mind trained only in narrow mathematical formulas (like differential calculus) is not automatically poetic or broadly rational.

Probability and Axioms: He frequently critiqued the calculus of probabilities and famously challenged traditional geometric axioms in his cosmological prose poem Eureka.

Logic in Detective Fiction (Ratiocination)

- **C. Auguste Dupin:** Poe's pioneering detective tales (The Murders in the Rue Morgue, The Mystery of Marie Rogêt, and The Purloined Letter) rely entirely on analytical problem-solving and observational logic.

Calculus of Probabilities: Dupin explicitly uses probability, calculation and analytical deduction to unravel crimes that mystify the conventional police force.

Cryptography: In The Gold-Bug, Poe turned cipher-solving and numerical frequency analysis into a plot device, inviting readers to engage with the mechanics of cryptanalysis.

The Mechanics of Composition

- **Rigid Consequence:** In The Philosophy of Composition, Poe claimed he wrote The Raven with the exactness of a mathematical problem, arguing that artistic creation relies on step-by-step logic rather than blind luck or sudden inspiration.
- **Verse as Mathematics:** He maintained in The Rationale of Verse that the vast majority of poetic structure is fundamentally mathematical rather than purely emotional.

Infinity and Geometry: Jorge Luis Borges

Borges' fiction is deeply mathematical. Some examples are:

The Library of Babel

The story anticipates modern computational mathematics. The Library represents: Infinite combinatorics, Permutations, Information Theory and Possibility of existence of every book.

The Garden of Forking Paths

The narrative resembles branching trees studied in Graph Theory. Each decision generates multiple future possibilities.

Modern Mathematics and Thomas Pynchon

The novels of Thomas Pynchon integrate mathematical topics like Entropy, Statistics, Probability and Information Theory. In Gravity's Rainbow, political uncertainty is reflected by mathematical uncertainty. Scientific models become literary metaphors.

Mathematical Structure in Poetry

Mathematical structure in poetry relies on precise numerical patterns, constraints, and formulas. Traditional meter, syllable counts, and complex forms like the sestina use permutations, counting, and symmetry just like mathematical proofs.

Classic and Modern Mathematical Forms

Haiku: Uses a strict 5-7-5 syllable count, totalling 17 syllables.

Sestina: A 39-line form where the final six words of the first stanza repeat in a specific spiralling, permutational order across six subsequent stanzas.

Fib (Fibonacci Poem): Line lengths follow the Fibonacci sequence (1, 1, 2, 3, 5, 8, ...) by counting syllables or words per line.

Pilish: A constrained writing style where word lengths correspond sequentially to the digits of Pi (3.14159...)

Combinatorial Poetry: Pioneered by groups like the Oulipo, creating frameworks where lines or stanzas can be mathematically rearranged to yield trillions of variations from a single book.

Shared Elements of Verse and Mathematics

- **Symmetry and Rhythm:** Meter relies on predictable grids of stressed and unstressed beats, mirroring mathematical periodicity.
- **Constraints as Catalysts:** Just as axioms define the boundaries of a mathematical space, formal constraints spark creative expression rather than hinder it.
- **Visual and Equational Layouts:** Some modern works use explicit geometric shapes, formulas, or computer code structures as the literal body of the poem.

Mathematical Symbolism

Numbers possess symbolic significance. Some examples are as follows:

Number	Literary Meaning
1	Unity
2	Duality
3	Trinity
4	Stability
7	Perfection
12	Cosmic Order
∞	Infinity

These numbers appear throughout English literature.

Mathematics as Metaphor

Literary authors employ mathematics metaphorically. Examples include: Infinite love, Geometric perfection, Calculated revenge, Probability of fate, Balance of justice, Equation of life, etc. Mathematics becomes a language for expressing abstract human experiences.

Contemporary Literature

Modern writers increasingly incorporate mathematics. Examples include:

Apostolos Doxiadis: *Uncle Petros and Goldbach's Conjecture*, explores mathematical obsession.

Ian Stewart: Combines fiction with mathematical exposition.

Simon Singh: Although primarily non-fiction, his works influence literary appreciation of mathematics.

Yoko Ogawa: *The Housekeeper and the Professor* presents mathematics as a language of compassion.

Mathematics and Narrative Structure

Many narratives resemble mathematical systems. Such structures create coherence and aesthetic balance. These include: Recursive storytelling, Fractal narratives, Network structures, Cyclic time, Fibonacci patterns, Golden Ratio

Educational Significance

Studying mathematics in literature benefits both disciplines. The integration of mathematics and literature supports STEAM education by connecting scientific reasoning with the humanities.

Students learn:

- Logical reasoning
- Critical thinking
- Symbolic interpretation
- Pattern recognition
- Interdisciplinary analysis

Conclusion

Mathematics is not merely an occasional reference in English literature but a foundational element shaping narrative structures, symbolism, and philosophical inquiry. From Shakespeare's proportional justice to Lewis Carroll's logical puzzles and Borges' infinite libraries, mathematical concepts deepen literary meaning and expand readers' intellectual engagement. The interdisciplinary study of mathematics and literature challenges the conventional separation between the sciences and the humanities, revealing that both disciplines seek patterns, order, beauty, and truth. Future research may explore computational literary analysis, digital humanities, and mathematical models of narrative complexity, further strengthening the dialogue between these two enduring fields of knowledge.

References

1. Borges, Jorge Luis. *Labyrinths: Selected Stories and Other Writings*. New Directions, 2007.
2. Carroll, Lewis. *Alice's Adventures in Wonderland and Through the Looking-Glass*. Penguin Classics, 2009.
3. Doxiadis, Apostolos. *Uncle Petros and Goldbach's Conjecture*. Faber & Faber, 2001.
4. Eco, Umberto. *The Infinity of Lists*. Rizzoli, 2009.
5. Gleick, James. *Chaos: Making a New Science*. Penguin Books, 2008.
6. Hayles, N. Katherine. *Chaos Bound: Orderly Disorder in Contemporary Literature and Science*. Cornell University Press, 1990.
7. Ogawa, Yoko. *The Housekeeper and the Professor*. Picador, 2009.
8. Poe, Edgar Allan. *The Complete Tales and Poems*. Modern Library, 1992.
9. Pynchon, Thomas. *Gravity's Rainbow*. Penguin Books, 2006.
10. Shakespeare, William. *The Complete Works of William Shakespeare*. Arden Shakespeare, latest edition.
11. Stewart, Ian. *Letters to a Young Mathematician*. Basic Books, 2006.
12. Swift, Jonathan. *Gulliver's Travels*. Oxford University Press, 2008.