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Review Article

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Examination of Discrete Random Variable or "The Aberration of Mathematics" in "*Blue Tigers*" and the Limits of Language in "*The Mirror and the Mask*" by Jorge Luis Borges

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Abstract: *This paper examines Jorge Luis Borges's Blue Tigers and The Mirror and the Mask as parallel inquiries into the limits of formal systems: mathematics and language. In Blue Tigers, the chaotic numerical variation of magical stones represents an "aberration of mathematics." We propose a pedagogical intervention, applying discrete random variables and probability distributions to model the stones' behavior, demonstrating how statistical reasoning can impose order—yet also revealing its inadequacy before Borges's intentionally irrational phenomenon. The Mirror and the Mask depict a parallel failure: the court poet's odes progress from imitation to a transcendent, fatal line that shatters language in pursuit of absolute Beauty. Both narratives feature a hamartia: the logician and poet overreach the capacities of their respective systems. Their crises underscore Borges's relativistic worldview, where reality eludes full comprehension through logic or words. Ultimately, the paper argues that these stories serve as rich interdisciplinary tools, challenging readers to reflect on the boundaries of knowledge while uniting literary analysis with mathematical concepts in an educational context.*

Keywords: *Jorge Luis Borges, Blue Tigers, The Mirror and The Mask, Literary Mathematics, Limits of Language, Chaos and Order, Epistemology in Literature, Metaphysical Fiction, Relativism.*

INTRODUCTION

The complex Borgesian world, full of pantheism, labyrinths, mirrors, dreams, digressions on the infinite, reflections on chaotic reality, time, and space, continually urges us to analyze, among other things, the multiple metaphysical concepts embedded in his exquisite texts. In this article, we reflect on two of his stories: *Blue Tigers* and *The Mirror and the Mask*. Our analysis of *Blue Tigers* draws upon concepts borrowed from statistics and probability theory, specifically applying the discrete random variable in an attempt to uncover a pattern within a changing numerical reality, whose variation seems governed by chaos [1]. As for *The Mirror and the Mask*, we examine the limits of language that, in our view, this story proposes. We also perform a comparative analysis, delving into the analogy we find between the limits of

language, as postulated in *The Mirror and the Mask*, and the limitations of mathematics to explain a quantitative phenomenon, which we also see as a postulate in *Blue Tigers*.

> *Time is the substance I am made of. Time is a river that carries me away, but I am that river; it is a tiger that destroys me, but I am the tiger; it is a fire that consumes me, but I am the fire. The world, unfortunately, is real; I, unfortunately, am Borges (O.I., 256).*

Borges both marvels and transforms us [2]; he urges us to question ourselves at every step, to reflect on the world, to doubt what we consider certain, and to view reality with the eyes of both poet and philosopher. Let us begin by summarizing the plot of both stories and, after commenting on each, we will reflect on the metaphysical bridge that, in our opinion, connects them inevitably.

MATHEMATICS UNRAVELED: THE "ABERRATION" IN BLUE TIGERS

The story *Blue Tigers*, the second tale in Borges's final collection *La Memoria de Shakespeare* (1983), features Alexandre Craigie, a Scottish professor of Western logic at the University of Lahore, who spends his Sundays studying the work of Dutch philosopher Baruch Spinoza. Since childhood, Professor Craigie had been obsessed with tigers (just as Borges himself was), and in late 1904, he learned that a blue variety of tiger had been discovered in the delta of the Ganges [3]. Craigie seized the opportunity of his vacation to travel to India, to Punjab. However, Alexandre Craigie found no blue tigers in Punjab but instead heard popular stories and legends about their supposed existence. He even had the impression that the villagers revered the blue tiger as a deity. Lacking blue tigers, the professor found strange, small, smooth, circular stones of a bright blue, like the tiger in his dreams. He noticed that these blue stones, resembling small discs or tokens, randomly multiplied or decreased in number. This mysterious phenomenon, this "aberration of mathematics," caused by "stones that generate," which the villagers called "blue tigers," intrigued the professor of Western logic. Despite his academic training, Professor Craigie realized that disorder—and even the absence of logic—could exist in the universe. He tried to understand the numerical variation of the stones using statistics, after failing with the basic arithmetic operations and probability calculus. On February 10, Craigie entered the Wazil Khan mosque at the time "when light had not revealed the colors" and prayed to be absolved of "his burden." Suddenly, a blind beggar appeared and asked for alms. The professor replied that he had no coins, but the beggar responded that, on the contrary, he had many. When Craigie handed over the blue stones, the beggar said, "You keep the days and nights, the sanity, the habits, the world." Then the blind beggar vanished at dawn, as mysteriously as he had appeared.

LANGUAGE TRANSCENDED: SILENCE AND THE SUBLIME IN THE MIRROR AND THE MASK

The Mirror and the Mask, the seventh story in Borges's penultimate collection *El Libro de Arena* (1975), tells a fable set in Ireland during the early Middle Ages, immediately following the Battle of Clontarf. The Irish "High King" proposes to the court poet that he immortalize the victory over the Norwegians in an ode. A year later, *the Ollán* recites his ode from memory and presents it to the king, who accepts it and rewards the poet's effort with a silver mirror [4]. The king tells the poet that his poem will be copied sixty times by the scribes of his court and that from his masterful pen he expects an even better poem:

> *"I accept your work. It is another victory. You have assigned to each word its genuine meaning, and to each noun the epithet given by the first poets. Not a single image in this*

praise has not been used by the classics. War is the beautiful fabric of men, and the water of the sword is blood. The sea has its god, and the clouds predict the future. You have handled rhyme, alliteration, assonance, quantities, the artifices of learned rhetoric, the wise alteration of meters, with skill. If all Irish literature were to be lost—God forbid—it could be reconstructed without loss with your classical ode. Thirty scribes will transcribe it twice."

There was a silence, and the king continued:

"Everything is fine, and yet nothing has happened. The pulses no longer race with blood. The hands have not sought the bows. No one has paled. No one shouted a battle cry, no one stood against the Vikings. Within a year, we will applaud another praise, poet. As a token of our approval, take this mirror, which is made of silver ...".

A year later, the poet returned with a shorter poem, which he recited uncertainly:

"The page was strange. It was not a description of the battle; it was the battle itself. In its warlike disorder, the God who is Three and One, the pagan deities of Ireland, and those who would battle centuries later in the beginning of the Greater Age, stirred. The form was no less curious. A singular noun could govern a plural verb. Prepositions were alien to common norms. Harshness alternated with sweetness. The metaphors were arbitrary, or so they seemed ...".

The king congratulated the poet and ordered that the new poem be copied only once and kept in a chest. As a reward, the king offered the poet a golden mask and told him that from his talent, he still expected a better poem. The Ollán returned once more to the palace a year later. The king noticed the poet's physical decline; he appeared visibly worn, so much so that his eyes seemed "to look very far or had gone blind." The poet carried no manuscript and dared not recite the poem. Eventually, he did, and it was a single line heard only by the king. Intrigued by the brief poem, the king asked the poet:

"What sorcery gave this to you?"

"At dawn," said the poet, "I remembered saying words that at first I did not understand. Those words are a poem. I felt that I had committed a sin, perhaps one that the Spirit does not forgive."

"The one we now share," the King murmured, "the one of having known Beauty, which is a gift forbidden to men. Now we must atone for it. I gave you a mirror and a golden mask; here is the third gift, which will be the last."

The king placed a dagger in the poet's right hand. The poet, we know, took his own life as he left the palace; the king became a beggar wandering the roads of Ireland, his former kingdom, and he never repeated the poem.

COMPARATIVE ANALYSIS: THE FAILURE OF SYSTEMS AND THE PRICE OF HAMARTIA

The scholar Esteban Mata [5] published a lucid essay in *Filosofía*, a journal from the University of Costa Rica, analyzing *Blue Tigers* from the perspective of chaos theory.

"Therefore, and to conclude, I believe that Blue Tigers can be read as a beautiful parable symbolizing the emergence of the cosmos from chaos, a beautiful image of the indeterminate and indecipherable that is the totality, even for our boldest and most ambitious thoughts."

While we greatly appreciate Esteban Mata's analysis, our approach to the story focuses rather on the application of statistical concepts such as the discrete random variable to decipher, or at least attempt to decipher, the numerical phenomena occurring with the blue stones. We propose that it would be possible, with minimal changes to the story, to find a mathematical pattern to the numerical metamorphosis that occurs with these mythical stones. Without the variations we have made to the story, no mathematical pattern would have been discernible. One might object, perhaps Borges himself, that our changes would no longer constitute the same story.

Yet, we have made these alterations primarily because our goal is to help students understand the practical applications of statistics in daily life, while also benefiting from literary readings that expand their horizons. We have created a learning community that unites two courses through a common theme. Our theme is Borges, specifically those Borges texts where mathematical concepts abound, and for our academic project, we have combined a mathematics course with a Spanish language course.

Specifically, we will now refer to examples that we will apply in our learning community, which are only possible if we make a few brief modifications to Borges's story, as we have discussed.

For example, if we perform a random experiment with uncertain quantities, such as the small circular stones in the story *Blue Tigers*, we will have uncertain variables subject to the many contingencies of chance. These uncertain quantities are what we call random variables or stochastic variables.

In general, a random variable is, therefore, a numerical value influenced by chance [5]. That is to say, a random or stochastic variable is a function that assigns events—such as the possible outcomes of throwing or manipulating the blue stones, the stones that generate (1,1), (1,2), (1,3)—to real numbers (for example, their sum).

A random or stochastic variable is a statistical variable whose values are obtained as the result of measurements made in a random experiment. When dealing with a random variable, we cannot know exactly what value it will take; however, we can assign it a series of possible values through a probability distribution, provided that the random variable is discrete. In other words, the possible values for a random variable and their associated probabilities establish a probability distribution.

The formal definition of a random variable is represented by the following formula: Where X represents the function that assigns each element of the sample space (represented by omega) a real number (R). The set of real numbers is represented by R.

We must face infinite randomness and manage this randomness as long as we do not focus on patterns in the sense of sequences that are always exact. Therefore, we will use statistics to find a much more subtle pattern called a discrete probability distribution.

In this case, our random variable X = the number of stones produced when manipulating the generating stones. Each random variable must follow a probability distribution, which is a list of all the values of X along with their probabilities. From the probability distribution, we can find the following:

i. The arithmetic mean

ii. The variance (which is the square of the standard deviation, and this is the measure of data dispersion that is commonly used)

The mean = E[X] = sum[X * P(X)]

Variance[X] = Var[X] = $E[X^2]-(E[X])^2$

Example: Let us assume that the generating stone is manipulated eight times, as in Borges's story, and as a result of this manipulation, the following number of stones is generated (in addition to the original blue stone):

200, 7, 46, 82, 3, 102, 989, 21

i. Create a probability distribution

ii. Find E[X] and Var[X]

Sometimes, a natural phenomenon can be modeled to fit a certain type of distribution. We will examine three types of distributions here: binomial, geometric, and Poisson (named after the French physicist-mathematician Siméon-Denis Poisson, 1781-1840). In addition to this, we will make minimal modifications to *Blue Tigers*. These modifications will allow us to examine each of these distributions.

Binomial Distribution

Let us consider a minimal modification in the story *Blue Tigers*, where every time a stone is manipulated, either another stone appears or none appears at all. Let us assume that a stone appears with a probability = p, which does not change. Assuming that we manipulate the stones a fixed number of times and that each manipulation is independent of the next. In the modification we have described, the random variable X follows a binomial distribution with parameters "n" and "p". We can find E[X] using the formula n * p and Var[X] = n * p * (1−p).

Example: Let us assume that we have the blue stone from Borges's story, which produces another stone with probability = 0.6, and does not produce any stone with probability = 0.4. Let us find the expected number of stones if the stone is manipulated eight times. In this example, n = 8, p = 0.6, so E[X] = n * p = 8 * 0.6 = 4.8, and Var[X] = n * p * (1−p) = 8 * 0.6 * 0.4 = 1.96.

We could imagine another scenario with the generating stones where the binomial distribution could be used in ten trials, with the goal of obtaining a mean = 6.

Geometric Distribution

Our next modification involves a scenario where, each time the blue stones are manipulated, a new blue stone appears with probability "p" or no stone appears with probability 1-p. In this scenario, however, X—the number of manipulations until the first stone appears—follows a geometric distribution, with E[X] = 1/p and Var[X] = $(1 - p)/p^2$.

Example: We could also think of another scenario where the number of stones that appears follows a geometric distribution with a mean = 5.

Poisson Distribution

The final modification we suggest involves a scenario where, once again, each manipulation of the stones results in either no stone or a new stone. However, there is no fixed probability "p" or fixed number of manipulations. We assume that the blue stones are being manipulated following a constant rate over a given time interval. Now, X = the number of stones that appear

over a time interval. X follows the Poisson distribution, with both the mean and variance given by the mean.

Example: We can think of a situation where the number of stones that appear in one hour follows the Poisson distribution with a mean = 5/hour.

Continuous Distributions

Continuous distributions are those in which the random variable X can take an uncountable or infinite number of values. We could also think of a situation where the generating stones represent a continuous random variable. Reflecting on infinity, we imagine another way Craigie might have acted with the blue stones. One simple way would have been to use the normal distribution and create a confidence interval as follows:

i. Manipulate the stone a fixed number of times = n.

ii. Find E[X] and a standard deviation as described earlier.

iii. Find the appropriate "z" or interval.

As explained earlier, and in a simplified manner, we can see that statistics can indeed be applied to the story *Blue Tigers*. Statistics can, in the hands of Borges's characters—who are Platonic archetypes, explained generically—help alleviate their apprehensive reaction when confronted with the devastating infinity. *Blue Tigers* could, of course, as Esteban Mata has aptly done, be analyzed from the perspective of chaos theory, and it can also be commented on simply as a fantastic tale where strange phenomena occur that do not warrant or accept rational explanations. We could also interpret it as a metaphysical fantasy, which, according to Bioy Casares, is the crucial characteristic of Borges's fantasies. We could even analyze this story as a metaphor for artistic creation, specifically poetic art, or perhaps as a contradiction between the precision and exactitude of mathematics and its inability to mathematically assimilate the events that occur in the story. Our reading of the story has favored the mathematical sense because we believe that, indeed, *Blue Tigers* is one of the stories where not only mathematical concepts abound but even mathematical terms are explicitly employed in the story itself. It also seems to us that *Blue Tigers* is one of Borges's least studied stories, especially from the mathematical perspective, a discipline that, as we know, was one of the intellectual passions of our famous author Borges, so erudite.

We have argued in a previous article, where we analyzed the poem *Descartes* and the vision of geometry, space, and time that can be inferred from the poem and other Borges texts, that nothing is casual in Borges's work. It is also by no means casual that Borges decided that the protagonist of *Blue Tigers* would be a professor of Western logic, fascinated by tigers and studying Baruch Spinoza. What logical explanation could Alexander Craigie have given for the unordered and disordered numerical transformation of the fabulous stones? We agree with Jaime Alazraki [7], an expert on Borges's work [2], when he asserts that the common denominator of Borges's fictions is a relativism that influences and determines everything. It is clear that Borges presents us with a universe in which we cannot be sure of anything. In his story *Blue Tigers*, he refers to the "aberration of mathematics"—also called the "obscene miracle"—due to the impossibility of understanding the unheard-of multiplication and subtraction of the marvelous stones, which do not seem to obey any known pattern within the vast realm of mathematical laws and formulas. It is not even possible to say that 2 + 2 = 4 because in the magical universe of *Blue Tigers*, this does not happen; in fact, the opposite occurs. Using the discrete random variable, a key concept in statistics, and manipulating

Borges's story a bit, we have attempted to present a possible logical explanation for the changing and quantitative reality in *Blue Tigers*. Our intention, as we have mentioned, has been primarily to make certain mathematical concepts in statistics more manageable for university students, by thinking of concrete examples from stories, such as this one, which also allow students to expand their academic horizons through reading good literature. We will later discuss the relationship we have found between the two stories analyzed in terms of the worldview that Borges presents in them.

In *The Mirror and the Mask*, the court poet would represent all poets and, thus, the best user of language. It is very interesting that the expert in words is unable to understand all language, to convey through his art the reality or his vision of it, to express Beauty or Truth through it. In *Blue Tigers*, Professor Craigie is also an expert in Western logic and yet will not be able to understand the logic behind the numerical transformation of the blue stones. In *The Mirror and the Mask*, the King gives Ollán a mirror as a reward for his first poem, which was a mimesis of reality. The poet attempted to reflect reality and thus was not functioning in the universe ruled by "episteme" but in the realm of "doxa," of appearances, because the photographic description of reality does not exhaust or represent it entirely. The second gift from the King of Ireland was a golden mask and corresponded to the second poem, which concealed reality; it was no longer a detailed description of the battle, as in the first poem, but rather "the same battle." The poet had to fight his personal battle with language when writing the second poem, which was no longer a mere replica of reality. Ollán's third poem, the briefest yet the most intense, represents the wonder of all wonders, the aesthetic absolute. In a way, we can say that the poet has destroyed language by transcending it. The poet has broken the language by accessing the wonder with a single word or perhaps a brief, essential phrase. The King and the poet will pay for that "hamartia"—the King for witnessing the impossible, for instigating the wonder, and the poet for executing it skillfully, thus acting as if he were God, just as Alexander Craigie did in *Blue Tigers*.

Language is linear, and reality is simultaneous. Therefore, the poet in *The Mirror and the Mask* cannot, despite his attempts, apprehend reality through language, even though he is, as a poet, the best user of language. The poet is also unable to access Beauty through human language, and Beauty, with a capital B, as it appears in Borges's story, may indeed be a synonym for Truth in this multi-significant narrative [8]. Upon leaving the palace, the poet suicides with the dagger given to him by the King. For his part, the King of Ireland ceased to be a king and became a vagabond, never repeating the mysterious poem-line, or perhaps poem-word, which nevertheless contained the Wonder and Beauty. In both stories, significant and similar "hamartias" occur. Alexander Craigie manipulates sacred stones that multiply and dissipate in an inexplicable manner for human beings. His ineffable action is a costly challenge that exposes the limitations of mathematics in explaining numerical transformations. The court poet, urged by his King, dares to break language in an attempt to access Beauty = Truth through words. Alexander Craigie nearly goes mad trying to understand the incomprehensible and is saved from madness by giving the blue stones away in exchange for the return to normalcy in his life: "[...] You keep the days and the nights, with sanity, with habits, with the world."

PEDAGOGICAL REFLECTIONS: TEACHING WITH BORGES IN AN INTERDISCIPLINARY CLASSROOM

Borges presents us with a worldview impregnated with relativism in both stories. As Alazraki rightly points out, the relativism characteristic of Borges's stories encourages us to see the world as continuously shifting, invites us to transcend the "hic et nunc," and to seek all possible

dimensions of reality [9]. For Borges, the world is impenetrable, and the universe is incomprehensible to human beings. Therefore, any attempt to decipher the universe will lead to failure. In the case of the poet in *The Mirror and the Mask*, his "hamartia" led him to suicide, and the king was reduced to the condition of an outcast. In *Blue Tigers*, Alexander Craigie's "hamartia" alienated him, and he was rescued from that alienation after begging Allah to restore normalcy to his life. He is only saved when he gives the magical or diabolical stones to the mysterious blind beggar who requested them in exchange for returning his sanity and the world.

As Alazraki points out in *La Prosa Narrativa de Jorge Luis Borges* (1974):

Borges has denied the validity of metaphysics in the context of reality but has applied it to a context where it regains its relevance: literature.

CONCLUSION

We conclude by affirming that for the purposes of our learning community, Borges's mathematical texts are very useful for prompting students to think critically, expanding their literary knowledge while simultaneously advancing their statistical studies by working with examples they never would have imagined. Humanities and sciences embrace in harmony thanks to the vast and scholarly knowledge of Borges. Students in our learning community will be enriched not only academically but also from a more global and human perspective. Indeed, Borges dazzles and transforms us; he urges us to question ourselves at every step, to reflect on the world, to doubt what we consider secure, to look at reality with the eyes of both a poet and a philosopher. Who would dare say they are the same person after reading a text by Borges?

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