

Borges and Data Sciences in “The Golem”

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Abstract: *This article consists of an analysis of the mathematical content in the poem “The Golem” written by the Argentinean author Jorge Luis Borges, in 1958. Our analysis takes in consideration the deep reflections on Statistics found on the book: Statistical Rethinking (2020) written by Richard McElreath. We found relevant similitudes between the mathematical content of Borges’ poem, and the innovative approach to Statistics, and in particular the explanations of Bayesian statistics, as they are presented on the book authored by McElreath.*

Keywords: Borges; Golem; McElreath; Data Sciences; Bayesian Statistics; God

Introduction

Golems have appeared in literature since the 1500’s. Perhaps the most famous version is the Golem of Prague. According to this story, the Rabbi Judah Loew, in order to protect the Jews and help them with tasks and chores, created a Golem from earth and dust. The Golem was a powerful creature who could do any task it was assigned, and could do it perfectly.

However, the Golem was an imperfect protector. Despite all of its amazing abilities, it suffered from a lack of wisdom. The golem had no wisdom; it was incapable of independent thought, and could only follow instructions as indicated. It could only perform the task it was given, and only that specific task, and it would perform it until it was told to stop. One day, the rabbi told the golem to chop down some wood, and the golem chopped down the entire forest! When the rabbi recognized the danger posed by the golem, the rabbi decommissioned his beloved golem.

As with all great stories, this one evokes many emotions, and contains several meaningful lessons. The purpose of this paper is to discuss the details of two interpretations of this story through, a poet of the early 20th century: Jorge Luis Borges, and Richard McElreath; an author of one of the most influential recent books in Statistics: *Statistical Rethinking* (2020).



This current essay is an analysis and a reflection on the important metaphysical, and mathematical elements in the fabulous poem “The Golem”, written in 1958 by Jorge Luis Borges (1899-1986). Our analysis of the poem includes, as we stated, the relevant well-written book: *Statistical Rethinking* (2020), by Richard McElreath, in which there is a complete explanation, and an understanding of nearly all Bayesian statistical concepts.

The poem “The Golem” is considered by many, -including by Borges himself, and his close friend an Argentinian writer; Adolfo Bioy Casares (1914-1999)- the most interesting, and sophisticated poem authored by our famous writer from Buenos Aires. In this fantastic poem, Borges narrates to us the story of the 16th-century rabbi of Prague; Judah Loew ben Bezalel. (Borges, *Obras Completas* (2003). He was a relevant Talmudic scholar who was versed on Jewish mysticism, and philosophy. The Rabbi of Prague decided to make a golem; a creature made of clay to defend the Jews of Prague as the Hebrew saga states. Borges’ poem has three main sources of intellectual inspiration: the platonic dialogue: Cratylus, the Hebrew legend of the golem, and the famous novel *The Golem* which was written by the Austrian writer: Gustav Meyrink (1868-1932).

The poem “The Golem” is filled with metaphysical content. On its first verse the poem refers to the platonic dialogue: Cratylus, which contains an analysis of the meaning, and origin of language. Then, the poem continues with religious references to the creation of the universe. Next comes the story of the Rabbi of Prague, who creates a golem, and teaches it to act like a human being. The poetic voice in the poem makes us think about philosophical and meaningful categories, such as time, and space. Finally, the Rabbi of Prague was saddened to realize that his golem would never be able to talk. He feels like his project to simulate God by being a creator himself was an authentic failure, and an attack on his enormous haughtiness.

Here is the amazing poem of Borges which we will analyze in depth:

Jorge Luis Borges (*Translated by James Honzik*)

If (as affirms the Greek in the Cratilo)
the name is archetype of the thing,
in the letters of "rose" is the rose,
and all the Nile flows through the word.

Made of consonants and vowels,
there is a terrible Name,
that in its essence encodes God's all,
power, guarded in letters, in hidden syllables.

Adam and the stars knew it in the Garden.
It was corroded by sin (the Cabalists say),
time erased it, and generations
have forgotten.



The artifice and candor of man go on without end.
 We know that there was a time in
 which the people of God searched for the Name
 through the ghetto's midnight hours.

But not in that manner of those others
 whose vague shades insinuate into vague history,
 his memory is still green and lives,
 Judá the Lion the rabbi of Prague.

In his thirst to know the knowledge of God
 Judá permuted the alphabet through complex variations
 and in the end
 pronounced the name that is the Key

the Door, the Echo, the Guest, and the Palace,
 over a mannequin shaped with awkward hands,
 teaching it the arcane knowledge of symbols, of Time and Space.

The simulacrum raised its sleepy eyelids,
 saw forms and colors that it did not understand,
 and confused by our babble
 made fearful movements.

Gradually it was seen to be (as we are)
 imprisoned in a reverberating net of
 Before, Later, Yesterday, While, Now, Right, Left,
 I, You, Those, Others.

The Cabalists who celebrated this mystery,
 this vast creature, named it Golem.
 (Written about by Scholem,
 in a learned passage of his volume.)

The rabbi explained the universe to him,
 "This is my foot, this yours, and this the rope,"
 but all that happened, after years,
 was that the creature swept the synagogue badly.

Perhaps there was an error in the word
 or in the articulation of the Sacred Name;
 in spite of the highest esoteric arts
 this apprentice of man did not learn to speak.

Its eyes uncanny,
 less like man than dog and much less than dog but thing
 following the rabbi through the doubtful
 shadows of the stones of its confinement.

There was something
 abnormal and coarse in the Golem,
 at its step the rabbi's cat fled in fear.
 (That cat not from Scholem but of the blind seer)

It would ape the rabbi's devotions,
 raising its hands to the sky,
 or bend over, stupidly smiling,
 into hollow Eastern salaams.

The rabbi watched it tenderly but
 with some horror. How (he said)
 could I engender this laborious son?
 Better to have done nothing, this is insanity.

Why did I give to the infinite
 series a symbol more? To the coiled skein
 on which the eternal thing is wound,
 I gave another cause, another effect, another grief.

In this hour of anguish and vague light,
 on the Golem our eyes have stopped.
 Who will say the things to us that God felt,
 at the sight of his rabbi in Prague?

Jorge Luis Borges – 1958

Borges' poem "The Golem" has in relationship to its structure, seventy- two verses which are distributed in eighteen stanzas. Where we find stanzas composed by verses of higher art, mostly hendecasyllabic verses, which have consonant and alternate rhyme with an outline of 11A 11B 11A and five quartets with an outline of 11A 11B 11A 11B.

The poem begins by invoking Socrates when mentioning the Platonic dialogue: "The Cratylus". This dialogue is a reflection on the true nature of language: the ability of using nouns to designate objects, people, places, things, etc., and really know -only by naming them- their real meaning. This dialogue is considered as an antecedent of the theory of the linguistic sign, a concept that would later be developed in depth by the Swiss linguist: Ferdinand de Saussure (1857-1913), and by the American philosopher and scientist: Charles Sanders Peirce (1839-1914). The poem continues to allude to the creation of the world, to the Bible, then it presents the story of Judah Loew, who had the intention of emulating God by creating his automaton, giving it human attributes, and then trying to teach it to speak. Then, in Borges's poem, the Rabbi of Prague is ashamed of his imperfect creation, regrets his haughtiness, for wanting to compete with God by becoming a Creator. The last two lines of the last stanza of the poem:

"Who will say the things to us that God felt,
 at the sight of his rabbi in Prague?"
 brings to memory the last stanza of the poem "Chess"



“God moves the player as he the pieces
But what god behind God plots the advent
Of dust and time and dreams and agonies?”

Also, the last stanza of “The Golem” makes us think of the last line of the short-story: “The Circular Ruins”:

“With relief, with humiliation, with terror, he understood that he also was an illusion, that someone else was dreaming him.”

In another Borges famous short-story, “The Mirror and the Mask”, there is also a reflection about the power of language and its ability to approach the truth; the meaning of life. In fact, the last poem that the poet shows to the king consists only in a word which seems to be a magical one, which was forbidden even to be pronounced; a mysterious word which converted the king into a homeless beggar, and the poet into a suicidal creator. Here the implication is that to learn the truth; the meaning of life, is neither available or allowed to humans. In the classic short-story, “The Aleph” (1949), once again, Borges invites us to reflect on the magical characteristics of language through that magnificent lyric enumeration of the wonders of the world that one can observe from the Aleph in a simultaneous trip of the imagination:

“[...] I arrive now at the ineffable core of my story. And here begins my despair as a writer. All language is a set of symbols whose use among its speakers assumes a shared past. How, then, can I translate into words the limitless Aleph, which my floundering mind can scarcely encompass? [...]”

“[...] The Aleph’s diameter was probably a little more than an inch, but all space was there, actual and undiminished. Each thing (a mirror’s face, let us say) was infinite things, since I distinctly saw it from every angle of the universe. I saw the teeming sea; I saw daybreak and nightfall; I saw the multitudes of America; I saw a silvery cobweb in the center of a black pyramid; I saw a splintered labyrinth (it was London); I saw, close up, unending eyes watching themselves in me as in a mirror; I saw all the mirrors on earth and none of them reflected me; I saw in a backyard of Soler Street the same tiles that thirty years before I’d seen in the entrance of a house in Fray Bentos; I saw bunches of grapes, snow, tobacco, lodes of metal, steam; I saw convex equatorial deserts and each one of their grains of sand; I saw a woman in Inverness whom I shall never forget; I saw her tangled hair, her tall figure, I saw the cancer in her breast; I saw a ring of baked mud in a sidewalk, where before there had been a tree; I saw a summer house in Adrogué and a copy of the first English translation of Pliny — Philemon Holland’s — and all at the same time saw each letter on each page (as a boy, I used to marvel that the letters in a closed book did not get scrambled and lost overnight); I saw a sunset in Querétaro that seemed to reflect the color of a rose in Bengal; I saw my empty bedroom; I saw in a closet in Alkmaar a terrestrial globe between two mirrors that multiplied it endlessly; I saw horses with



flowing manes on a shore of the Caspian Sea at dawn; I saw the delicate bone structure of a hand; I saw the survivors of a battle sending out picture postcards; I saw in a showcase in Mirzapur a pack of Spanish playing cards; I saw the slanting shadows of ferns on a greenhouse floor; I saw tigers, pistons, bison, tides, and armies; I saw all the ants on the planet; I saw a Persian astrolabe; I saw in the drawer of a writing table (and the handwriting made me tremble) unbelievable, obscene, detailed letters, which Beatriz had written to Carlos Argentino; I saw a monument I worshipped in the Chacarita cemetery; I saw the rotted dust and bones that had once deliciously been Beatriz Viterbo; I saw the circulation of my own dark blood; I saw the coupling of love and the modification of death; I saw the Aleph from every point and angle, and in the Aleph I saw the earth and in the earth the Aleph and in the Aleph the earth; I saw my own face and my own bowels; I saw your face; and I felt dizzy and wept, for my eyes had seen that secret and conjectured object whose name is common to all men but which no man has looked upon — the unimaginable universe.[...]"

Borges has expressed in several of his texts his concerns for the limits of language, for its inability to present the reality since the language is lineal but reality is simultaneous:

"I personally believe in the richness of Spanish but I judge that we should not keep it in lazy immobility, but multiply it ad infinitum. Any lexicon is perfectible and I am going to try it. The apparent world is a multitude of shuffled perceptions. A vision of heaven Wild, that smell as of resignation that the fields encourage, the pleasant acrimony of tobacco inflaming the throat, the long wind whipping our way, and the submissive straightness of a cane offering itself to our fingers, fit together in any conscience, at once. Language is an effective ordering of that enigmatic abundance of the world. In other words, we invent nouns into reality. We feel a reality, we see a little pile of light color at dawn, a tickle makes our mouth happy, and we lie that these three heterogeneous things are one and it is called orange. The moon itself is a fiction, outside of astronomical conventions that should not bother us here, no there is some resemblance between the yellow circle that is now clearly rising above the Recoleta wall, and the pink slice that I saw in the sky of the Plaza de Mayo many nights ago. Every noun is an abbreviation" (The Size of My Hope, pp. 45-46).

It's important to state that in Borges' poetry, in his short-stories, and especially in his essays, there is a metaphysical relativism, and profound skepticism. This philosophical posture allures us to question reality and its legitimate condition, to doubt between reality and fiction, to get confused by appearances with shadows, to challenge us to search all possible dimensions, and to walk into all plausible paths; direct, or the ones that fork, and to never accept any truth as an apodictic one. In the short-story, "The Circular Ruins" (1941), in the poem "The Chess", and in the tale: "The House of Asterion" (1947), and in our poem "The Golem", we can see that appearances distort reality. We can imply that there are different ways of interpret what we see, and perceive from what we assume is the reality. Therefore, we cannot be sure of anything as everything is possible as nobody owes her/his own destiny.



How can we know if we are not just a mere invention of a very playful minor god, as Borges suggested in his texts?

Richard McElreath mentioned in the first chapter of his seventeen-chapter book: *Statistical Rethinking* (2020), the Golem of Prague, and he discusses some crucial topics, such as casual inference, generalized linear multilevel models from a simple Bayesian perspective that builds on information theory and maximum entropy, basics of regression, advanced multilevel models, measurement error, missing data, Gaussian process models for spatial and phylogenetic confounding, the approach to causal inference, social relation models, cross-validation, importance splines, categorical predictors, instrumental variables, and Hamiltonian Monte Carlo.

It is quite relevant to point out that McElreath makes a beautiful analogy between the short-story of Borges, “The Garden of the Forking Paths”, in the second chapter of his book, in section 2.1, specifically, which he titled, “The Garden of Forking Data”. In this section, McElreath remarkably compares what Bayesian inference does with what the man of the story of Borges decides to do: explores all possible paths. In this fashion, McElreath, elegantly and cleverly, states that a Bayesian analysis is like a garden of forking data because on it “alternative sequences of events are cultivated”.

Let’s reflect now on the important connections we found between the poem, “The Golem”, and what the poetic voice is proposing on this transcendental and metaphysical poem, and what is stated on the book *Statistical Rethinking* (2020) by the German-born, and anthropologist by training, Richard McElreath. We consider that *Statistical Rethinking* (2020) is perhaps, the best book written on applied statistics, and data science because it gives a complete and clear explanation, as well as an understanding of nearly all Bayesian statistical concepts. In addition, this exposition is done without using calculus, rather computer code is more extensively used. As a testament to the thoroughness of this book, it is actually used as source material for an actuarial exam – Modern Actuarial Mathematics II, with the society of Actuaries and Casualty Actuarial Society. It is relevant to state that actuaries are the original data scientists.

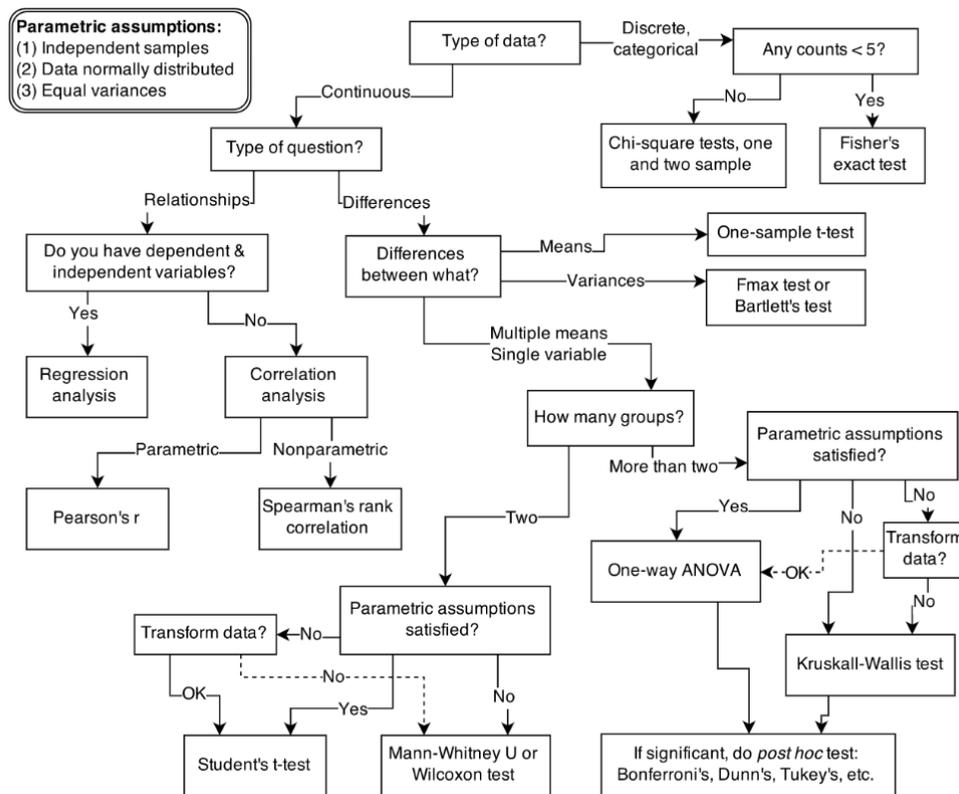
McElreath uses of the Golem of Prague in brilliant ways; he introduces the main topics of the book (Bayesian analysis, regression, etc.) by referring to the Golem of Prague, very early in the book in chapter 3. This is so he can keep referencing, and using it throughout the seventeen chapters. McElreath use of the golem focusses on a few main facts:

- i. the golem does everything perfectly every time,
- ii. The golem can only follow instructions,
- iii. The golem has no wisdom.

McElreath then use the golem of Prague as an analogy to describe the entirety of frequentist Statistics, which he sees as “golem engineering.”



A typical statistical flow chart looks as follows:



Let's embark on analyzing some relevant examples of Statistical Golems; each statistical technique is just a golem that takes inputs (told what to do) and performs the indicated procedure exactly every time (no matter how complicated), but it must be told when to stop and start. Before we talk about statistical golems, we can talk about how golems, and robots are very similar. One important similarity is their ability to perform complex tasks easily but simple tasks poorly. A robot can easily memorize π to 100 digits, but finds it nearly impossible to walk up stairs. The point is that in statistics, just as in Borges poem, the golems need guidance and supervision at all times. They are capable of many fantastic feats, but struggle to do basic things.

Below are some examples of statistical golems:

1. After gathering data, computing a confidence interval for the proportion of people who get coronavirus would be computed using one of these statistical golems called a Z test for the proportion.

2. Suppose we wished to test whether the average GPA of a student is higher than 3.0; this is just another statistical golem called a T test for the mean.
3. As a final example of a statistical golem suppose we wished to determine if grades are equally distributed by letter (20% A, 20% B, etc.). To determine this, we use a statistical test (golem) called a chi squared test.

All of these statistical golems reside in different computing devices: TI-83 calculator, Microsoft excel, etc. In fact, McElreath dubs frequentist statistics as golem engineering. Borges uses the Golem of Prague by introducing the topic of a dream; in fact, the dream like fashion in which Borges introduces his poems, much like the stories used by McElreath to introduce statistical concepts made these very easy to read.

On the surface, it would appear that Borges' poem is an entirely different take on the story. Borges poem seems to be a lament of the creation of the golem. The poem is at times hard to read. We found several crucial similarities in the interpretation of both texts. Even though McElreath never mentions Borges when using the story of the Golem of Prague (he does mention him at other times, like on chapter two) and even though the two interpretations seem to be completely different, they are not. Borges poem reads more like a lament of the creation of the golem, and a discussion of his limitations related to his makeup as a living being in a human sense. McElreath's use of the golem is also a weeping in a slightly different way. McElreath sees the golem as a non-human robot, the golem has no humanity. McElreath uses the golem to moan the fact that statistical models are just models, and models are golems. Statistics will never be free of golems. This fact tells us that statistics will always be just a model of reality and will always be limited.

Statisticians are nothing more than golem engineers who command armies of golems. There is a bit of sadness in both stories; the Golem of Prague, and the shortcomings of Statistics from a different perspective. At the end of the poem, Borges considers what the golem must have thought at the rabbi's distress (over the wretched sad condition of the golem he created). This ending fits in nicely with McElreath's position, and his problems with the shortcomings of statistics. We considered that we currently live in a world where only about 40% of statistical experiments can be successfully replicated, and most instructors do not really understand tricky concepts like confidence intervals, and hypothesis tests. In McElreath's world the ending is analogous to the founders of statistics, Neyman, Pearson, and Fisher shedding a tear as they see the way the statistics (golems) they created are abused and misused by a scientific, and teaching community who does not fully understand how to use or fully appreciate the golems.

Statistical Rethinking by Richard McElreath is, in our opinion, the best book on advanced data science and applied statistics in the last several years. This book is the official book used by the Society of Actuaries for Exam Modern Actuarial Statistics – Part II. Actuaries have often been referred to as the “original data scientists.” While Borges sees sadness in the golem, McElreath does as well; however, we have to read an entire book to truly recognize it.



Within statistics, there are two paradigms: Frequentist and Bayesian. The frequentist paradigm is easy to calculate but difficult to interpret. The Bayesian paradigm is difficult to calculate but easy to interpret. Borges sees sadness in the golem by interpreting him from a humanistic perspective.

On the other hand, McElreath views the golem as a paradigm for computations involved in the use of frequentist statistics. McElreath makes the point that each statistical procedure is just a golem (i. e. a process). From this perspective, McElreath then regards all of frequentist statistics as “golem engineering”. McElreath identifies many points about statistics, which are limitations. First, McElreath mentions the limitations of null hypothesis testing by making the point that it is a very limited paradigm; limited by observation error and ignoring confirming evidence. Most statistics courses are taught from the frequentist perspective.

McElreath makes it clear that many parts of frequentist statistics are misused and misunderstood. For example, confidence intervals are almost always incorrectly interpreted as credibility intervals. In other words, confidence intervals are almost always incorrectly interpreted. In addition, McElreath elucidates that linear regression is almost always suboptimal. McElreath explains how the line that fits the data “the best” may not always predict future outcomes “the best.” In linear regression the same line is used for both. McElreath explains well that these misused, and misunderstood concepts can easily be cleared up by taking a Bayesian perspective. This is not sad is it?

McElreath goes into great depth on many topics listed above, however, we are ultimately left with sadness as McElreath informs us that a switch a Bayesian statistic paradigm will not solve all our problems. While the Bayesian paradigm is an improvement over the frequentist paradigm in terms of interpretation, it is also limited. We will always be limited by our models, and no statistical paradigm can solve that.

As a conclusion, we can say that there are several similarities between the Borges poem ‘The Golem’, and the visionary approach of McElreath and his explanation of Bayesian statistics, on his book: *Statistical Rethinking* (2020). Also, when we compare golems and robots, one of the main similarities is based on the ability that robots have to perform easy tasks but they accomplish simple objectives in a poorly manner. For instance, as we stated, a robot can memorize from π to a 100 digits, but what they found difficult almost impossible was climbing ladders. Statistics will never be free of its cybernetic golems, and Borges will never stop astonishing us with his multiple dimensional texts which drive us to doubt about reality, to suspect the power of language, to challenge us about the meaning of life, and the categories of space and time.

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