THE THEORY OF GAMES AND GENETIC CRITICISM: ON THE MANUSCRIPT OF LA LOTERÍA EN BABILONIA"

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> Todo jugador, en verdad, no hace más que reincidir en bazas remotas. Su juego es una repetición de juegos pasados, vale decir, de ratos de vivires pasados. Generaciones ya invisibles de criollos están como enterradas vivas en él: son él, podemos afirmar sin metáforas. Se trasluce que el tiempo es una ficción, por ese pensar. Así, desde los laberintos de cartón pintado del truco, nos hemos acercado a la metafísica: única justificación y finalidad de todos los temas.
>
> "El truco"

In a fascinating 1995 article "From Parlor Games to Social Science: Von Neumann, Morgenstern, and the Creation of Game Theory, 1928-1944," Robert J. Leonard writes: "[Game theory] becomes part of a general shift in science which involved, broadly speaking, the abandonment of determinism, continuity, calculus, and the metaphor of the 'machine,' to allow for indeterminacy, probability, and discontinuous changes of state" (756). He also notes that when von Neumann first proposed the central Min-Max or "minimax" theorem in 1928 "there existed among Hungarian and German mathematicians something of a 'conversation' about the mathematics of games" (732). Leonard traces the evolution of game theory from von Neumann's initial work in Budapest and Berlin through his fortuitous encounter with Oskar Morgenstern in Princeton in 1940, and then their collaboration on what would become the groundbreaking book *Theory of Games and Economic Behavior* in 1944.

I wouldn't be here today if it weren't for the publication of this book, because my mother left a graduate program in mathematics at Columbia University to become Morgenstern's research associate at the Institute for Advanced Study in Princeton, where she met my father, who had come to Princeton University to work on his doctorate in economics under the direction of Morgenstern. Out of this meeting of a Jewish girl from New York and a Quaker boy from Philadelphia came a family–over the opposition of my maternal grandparents, and certainly of my father's stepmother. At the wedding my Jewish grandmother is said to have asked my Quaker grandfather if anyone had ever married outside their faith, to which he is said to have replied, "Yes, someone once married a Presbyterian." That may be legend, but we do know that in January 1949 my mother wrote her parents an anguished letter asking them to stop their opposition to the relationship, and she says there: "I do believe that there is a difference between selfishness and control over one's own fate–and that I am not being selfish in wanting to decide for myself what is best, and what I seek most in life." Even such a plea was framed in the logic of the theory of games.

What does all of this have to do with Borges, or specifically with "La lotería en Babilonia"? A crucial paragraph of the story reads:

> Naturalmente, esas "loterías" fracasaron. Su virtud moral era nula. No se dirigían a todas las facultades del hombre: únicamente a su esperanza. Ante la indiferencia pública, los mercaderes que fundaron esas loterías venales comenzaron a perder el dinero. Alguien ensayó una reforma: la interpolación de unas pocas suertes adversas en el censo de rectángulos favorables. Mediante esa reforma, los compradores de rectángulos numerados corrían el doble albur de ganar una suma y de pagar una multa a veces cuantiosa. Ese leve peligro (por cada treinta números favorables había un número aciago) despertó, como es natural, el interés del público. Los babilonios se entregaron al juego. El que no adquiría suertes era considerado un pusilánime, un apocado. Con el tiempo, ese desdén justificado se duplicó. Era despreciado el que no jugaba, pero también eran despreciados los perdedores que abonaban la multa. La Compañía (así empezó a llamársela entonces) tuvo que velar por los ganadores, que no podían cobrar los premios si faltaba en las cajas el importe casi total de las multas. Entabló una demanda a los perdedores: el juez los condenó a pagar la multa original y las costas o a unos días de cárcel. Todos optaron por la cárcel, para defraudar a la Compañía. De esa bravata de unos pocos nace el todopoder de la Compañía: su valor eclesiástico, metafísico. (*OC* 456-57)

We will return later to the manuscript of this paragraph, but it is worth noting the importance in this description of the ways in which the modification of the rules of the game affects its success, and the insistence that the whole population (or almost all of it) participated in the game. Both the importance of the ways a game is shaped by its rules and the ways in which behavior changes depending on the number of players are major themes of *Theory of Games and Economic Behavior*.

The great novelty in Borges studies of the last several years is *Borges, libros y lecturas*: Laura Rosato and Germán Álvarez of the Biblioteca Nacional in Buenos Aires did excellent work tracking down the thousand or so books that Borges donated to the library in 1973, and then transcribed and commented on his annotations to some 250 of these. Because of this monumental publication, we now know that Borges was sufficiently interested in mathematics to write these words in 1937, in the back of Egmont Colerus's *Von Pythagoras bis Hilbert: Die Epochen der Mathematik unde ihre Baumeister*:

> una sucesión se llama infinita o indefinida si consta de un número infinito de términos. una suma de infinitos términos que tiende a un número finito a medida que se toma mayor número n de sumandos, se llama serie convergente.

> una suma de infinito número de términos, tal que su valor absoluto crece indefinidamente con el número n de sumandos que se tomen, se llama serie divergente. (la progresión aritmética indefinida es siempre divergente.) (Rosato and Álvarez 90)

And of course he wrote a review of Edward Kasner and James Newman's *Mathematics and the Imagination* in *Sur* in 1940 that would be included in the second edition of *Discusión* fifteen years later, in which he states that he expects this book will join Mauthner's *Wörterbuch der Philosophie*, Liddell Hart's *History of the World War 1914-1918*, Lewes's *Biographical History of Philosophy*, Boswell's *Life of Johnson* and Gustav Spiller's *The Mind of Man* as favorite books to read and write in. He notes of the Kasner and Newman book:

> Sus cuatrocientas páginas registran con claridad los inmediatos y accesibles encantos de las matemáticas, los que hasta un mero hombre de letras puede entender, o imaginar que entiende: el incesante mapa de Brouwer, la cuarta dimensión que entrevió More y que declara intuir How-

ard Hinton, la levemente obscena tira de Moebius, los rudimentos de la teoría de los números transfinitos, las ocho paradojas de Zenón, las líneas paralelas de Desargues que en el infinito se cortan, la notación binaria que Leibniz descubrió en los diagramas del I King, la bella demostración euclidiana de la infinidad estelar de los números primos, el problema de la torre de Hanoi, el silogismo dilemático o bicornuto. (276)

It is fairly clear, then, that he was intensely interested in trying to understand some problems and paradoxes in mathematics in the period from 1937 to 1941.

Of particular importance here is the mention of L. E. J. Brouwer, whose work on endless maps is discussed in detail by Kasner and Newman for ten pages starting on page 287. *Theory of Games* notes the importance of Brouwer in von Neumann's first versions of the Min-Max problem:

> The proof of our theorem, given in the first [1928] paper, made a rather involved use of some topology and of functional calculus. The second [1937] paper contained a different proof, which was fully topological and connected the theorem with an important device of that discipline: the so-called "Fixed Point Theorem" of L. E. J. Brouwer. (154)

Though there is no discussion of game theory itself in the Kasner and Newman book, some of its underpinnings are mentioned.

"La lotería en Babilonia" was published in *Sur* in January 1941, just three months after the publication of the review of Kasner and Newman in the same magazine. I am not going to imitate Alberto Rojo and claim–as Rojo does with the anticipation of the 1957 Everett hypothesis of many worlds in the 1941 story "El jardín de senderos que se bifurcan"– that Borges anticipates by three years the central idea of a groundbreaking work in mathematical economics–maybe he did that for quantum physics but not necessarily for game theory. But it is clear, and the language of the paragraph above confirms this, that he was intensely interested in the interplay of logic and chance in the social world. Perhaps this was a way of retreating from the hellish world of 1941 (as he had suggested a translation of Browne's *Urne Buriall* could be at the end of "Tlön" in the previous year): there is a lot in "La lotería en Babilonia" that suggests a social world in disarray. I will claim, though, that what Leonard calls "something of a 'conversation' about the mathematics of games" is a useful way of thinking about "La lotería en Babilonia," with its exquisite precision about the

shifting rules of the great game that has taken over a society.[1] And here is the sentence, a bit more than halfway through the story, that clinches the case: "Por inverosímil que sea, nadie había ensayado hasta entonces una teoría general de los juegos" (459) .

Let's look now at the manuscript of the paragraph cited earlier, so we can see what Borges was concerned about as he wrote. I should explain that I am working on a book on Borges's compositional practices, using the insights and techniques of French *critique génétique* and of related kinds of scholarship elsewhere; this project, then, forms part of a much larger project on how Borges wrote, which has illuminated the relations between the references in Borges's work, his marginalia (especially what has been published in *Borges, libros y lecturas*) and his notes and manuscripts. What follows is a diplomatic transcription (that is, a transcription that shows precisely the order in which the lines were written, paying attention to alternatives and changes of direction). The manuscript, which is in the manuscript division of the New York Public Library, has this version of our paragraph:

Naturalmente, esas "loterías" fracasaron. Su virtud moral era nula. No se
      facultades   su ~~codicia.~~
dirigían a todas las ~~potencias~~ del hombre: únicamente a la esperanza. Ante
           los mercaderes que fundaron esas loterías venales,
la indiferencia pública, ~~las personas venales q. habían instituido esas loterías,~~
comenzaron a perder el   ~~{inventó~~
~~empezaron a perder su~~ dinero. Alguien ensayó una reforma: la interpolación de
      números
unas pocas suertes adversas en el censo de ~~suerte~~ favorables. Mediante
esa reforma, los compradores de rectángulos numerados corrían el doble
      a veces cuantiosa. Ese
albur de ganar una suma y de pagar una multa ~~considerable. Ese leve~~
      aciago) despertó,
leve peligro (por cada treinta números favorables había un número ~~adverso)~~
~~aumentó,~~
                  El

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1   Silvia Dapía in an article in this same issue of *Variaciones* discusses the relevance of a competing economic model from the same period to the story.

como es natural, el interés del público. Los babilonios se entregaron al juego.
~~Quienes~~
que no adquiría suertes era considerado un pusilánime, un apocado. Con el
~~no adquiría suertes eran considerados pusilánimes, apocados. Con el~~
justificado se duplicó.
tiempo, ese desdén ~~se enriqueció.~~ Era despreciado el que no jugaba, pero tam-
la multa. La Compañía
bién eran despreciados los perdedores que abonaban ~~la multa. La Compañía~~
{los ganadores, que no
(así empezó a llamársela entonces) tuvo q. velar por {el interés de los
los
~~ganadores,} q. no~~ podían cobrar ~~sus~~ premios si faltaba en las cajas
{una demanda a los perde-
el importe casi total de las multas. Entabló {~~demanda a los perde-~~
dores: el juez los condenó a pagar la multa original y las costas
o a unos días de cárcel. Todos optaron por la cárcel, para defraudar a la
bravata ~~1 nació~~ {todopoder de la
Compañía. De esa ~~decisión~~ de unos pocos 2 nace el ~~{poder actual de~~
Compañía: su valor eclesiástico, metafísico.
~~la Compañía: su {importancia teológica, metafísica.~~
~~{valor eclesiástico, metafísico.~~

In my other recent articles on Borges's compositional processes I have noted that the important and complex nodes in the manuscripts (the opening of "Hombre de la esquina rosada" or the last paragraph of "La muralla y los libros," for instance) are the ones where there is most intense rewriting. Certainly in this case Borges is interested in expressing with as much as precision as possible the evolving logic of the game, and in fact a line in the story that comes almost immediately after this paragraph is: "Nadie ignora que el pueblo de Babilonia es muy devoto de la lógica, y aún de la simetría" (457). The manuscript also confirms that he moves gently in the direction of a more mathematical description of the game: "Con el tiempo, ese desdén se enriqueció" changes to "ese desdén justificado se duplicó."

Another moment in the story where the manuscript shows significant amounts of interesting rewriting is the part about the "doctrine" of chance that rules the world of the lottery. The published version reads:

Prefirió borrajear en los escombros de una fábrica de caretas un argumento breve, que ahora figura en las escrituras sagradas. Esa pieza doctrinal observaba que la lotería es una interpolación del azar en el orden del mundo y que aceptar errores no es contradecir el azar: es corroborarlo. (458)

The manuscript shows an intense process of rewriting:

Prefirió {~~inscribir en una pirámide un~~
~~replicó~~ {borrajear en los escombros de
~~argumento breve que ahora figura en todas las antologías de carácter didác-~~
una fábrica de caretas un argumento breve, que ahora figura en las escrituras
~~tico.~~
sagradas. Esa pieza doctrinal { es una
canónicas. Esa pieza didáctica observaba que la lotería {~~no es otra cosa que~~
{es una
{errores
~~una}~~ interpolación del azar en el orden del mundo y que aceptar {~~noticias~~
corroborarlo.
~~erróneas}~~ no es contradecir el azar: es ~~confirmarlo.~~

Again we see an attention to the precise language that defines the statement of doctrine: not canon, not didacticism, not an anthology, but a "pieza doctrinal" scribbled in the ruins of a mask factory. The "game" idea is fortified here, as the central place where the importance of chance in the universe of the story is written is not chiseled words on a religious monument or some pyramid but graffiti scribbled in a place associated with carnival festivities.

Other important places in the universe of the story are some stone lions and a sacred latrine. The published text reads: "Había ciertos leones de piedra, había una letrina sagrada llamada Qaphqa" (408) . The manuscript, unsurprisingly, reads:

Había ciertos leones de piedra, había
Qaphqa,
una letrina sagrada llamada ~~Kafka,~~

The evocation of Kafka here points to the same Central European world which von Neumann fled in 1930 (returning from time to time until 1939) and Morgenstern in 1940, and of course Stanley Corngold has importantly shown the relations between Kafka's day job as an insurance lawyer (and one of the pioneers of workers' compensation law) and his writing. This quiet emendation has never fooled anyone: "Qaphqa" and "Babilonia" point to the ancient Orient, as do the mentions of the river Euphrates, the ancient sapphire mine of Taprobana and the emperor Heliogabalus, but the world of Kafka's parables (which of course also include their share of "Oriental" settings) pull in the direction of the conflicts of modernity.[2]

Theory of Games and Economic Behavior (in its original 1944 version and in the revised second edition of 1947) focuses famously on zero-sum games, including ones with many participants; these have the same number of losses and wins. In the decade following its publication there were important advances in the study of non-zero-sum games, including the famous "Prisoner's Dilemma" (first formulated in 1950). Because of the chaotic nature of the game in the Borges story, with its shifting rules and universal participation, it would seem to be a game of the latter kind, though I will leave for the moment the question of whether the rather vague terms in which its rules are described could be formulated mathematically.

In closing I would like to mention a couple of instances that show Borges's importance for mathematical economics and game theory in the years following the publication of his story. The first is a brief article that appeared in *Primera Plana* on January 5, 1971, "Primera Plana va más lejos con Herbert Simon y Jorge Luis Borges," which Alberto Rojo had the kindness to share with me. In it, a reporter for the famous Buenos Aires magazine accompanies Simon, who would win the Noble Prize in Economics in 1978 but who was already renowned in 1971 for his work in decision-making and as a pioneer in the emerging field of artificial intelligence, when he goes to visit Borges at the Biblioteca Nacional on Calle México

during a visit to Buenos Aires organized by the SADOI, the Sociedad Argentina de Organización Industrial. The conversation between Simon and Borges focuses on the former explaining to the latter that he found relevant to his work in computing and artificial intelligence Borges's use of the image of the labyrinth. "La lotería en Babilonia" is not mentioned explicitly but I hope I have showed by now its productivity for work in theory of games and decision-making.

The second instance I will mention briefly is sociologist James M. Jasper "The Dilemmas of Game Theory," which has an epigraph from "Pierre Menard, autor del Quijote." Jasper's discussion of rational choice theory and classic game theory invokes Borges, again without specifically referring to "La lotería en Babilonia."[3] Jasper's work suggests that Borges's writing is relevant to contemporary approaches to game theory, just as Nicolas Rescher (92-101, 105-06) and Alberto Rojo (*Borges e a mecânica quântica*, passim) have shown its importance for quantum physics.

The story ends with the sentence: "Babilonia no es otra cosa que un infinito juego de azares" (460), which in an earlier version of the manuscript reads: "el universo no es otra cosa que un infinito juego de azares." (The earlier version links this story explicitly to the beginning of "La biblioteca de Babel," published a few months later in *El jardín de senderos que se bifurcan*). As I explained earlier, being myself the product of an infinite game of chance that derived quite specifically from the 1944 publication of *The Theory of Games and Economic Behavior*, I cannot but feel some wonderment that Borges anticipates by three years the application of game theory–which, as Leonard explains in the article I mentioned at the beginning of this paper, von Neumann had been working out for some fifteen years before he met Morgenstern, but thinking about what Leonard calls "parlor games" like chess and poker–to the economic sphere. It is only after von Neumann teamed up with Morgenstern that they attempted to apply the mathematical structure of games to large real-world situations like

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2   I have seen photocopies of three pages of an issue of *Sur* that includes the original publication of the story and countless emendations by Borges for a rewriting of it that were never incorporated into the versions in *Ficciones* and *Obras completas*. In the case of Kafka/Qaphqa, Borges's marginal annotation here reads Qaphqha. The story was to be renamed "El babilónico azar."

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3   Jasper's chapter is on his website, and seems to be an early version of a section of his book *Getting Your Way*. The latter, however, does not make reference to Borges, though the fascinating appendix, "Rules of Strategic Action," does refer to one of Borges's favorites, Basil Henry Liddell Hart (as well as to Saul Alinsky and to Mao Tse-Tung), who made a list that governed military engagement.

economic behavior of large numbers of people (or players), precisely the sort of situation that is at the center of "La lotería en Babilonia."

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