Fractal Games in "The Garden of Forking Paths" by Jorge Luis Borges

Gabriel WEISZ
Universidad Nacional Autónoma de México

The strange behavior of mazes and labyrinths opens a whole set of topological problems. Among these an interesting problem is featured by the fractal maze. The most salient attribute of fractals —considered as intricate geometrical shapes— is the ability to keep their structural information, regardless of how much the borders of the object are magnified.[1]

Once certain topological facts on these particular mazes are established, the next step will be to consider certain structural properties of fractal mazes and turn them into epistemological devices. Such devices are used in the literary text: to magnify different narrative regions and to observe how connected regions in the narrative reveal their structural complexity. We can also imagine mazes and labyrinths as visual structures that define 'textual space'.

There is a sort of holographic[2] quality to fractal objects. These entities appear self-similar, this term means that the magnified edge of a fractal object is similar to the whole object. If a holographic film, containing the image of an object, is cut in two or divided into several pieces and then is illuminated by a laser, each half or piece will contain the entire image of the object.

'Fractal' is a neologism invented by the mathematician, Benoit Mandelbrot. The word derives from the Latin adjective *fractus*. And as Mandelbrot puts it

---

[1] *Cf*. Clifford A. PICKOVER, "Mazes for the Mind", in *Mazes for the Mind: Computers and the Unexpected*. New York, St. Martin's Press, 1992.

[2] A hologram is an image produced by the bouncing, splitting and collision of a laser beam against an object, a beam splitter a mirror and a holographic plate. These events produce an interference pattern recorded on a piece of film.

"The corresponding Latin verb *frangere* means 'to break' to create irregular fragments".[3] Fractal is a concept that combines the ideas of 'fragmentation' and 'irregularity'. Mandelbrot reveals that if a piece of a fractal object is magnified to the size of the object, it looks like the whole. This explains why we mentioned self-similarity and holography.

Mazes have a double nature, on the one hand an archaic use of the word means to bewilder, to confound; but the word also signifies an intricate network of winding pathways. Both meanings unite a state of mind —bewilderment— with a spatial quality of winding pathways. Mazes constructed from fractals are peculiar objects that require magnification. Within a fractal maze one can establish a starting and finishing point, except that when the player moves through a definite path, he or she never arrive to the end because as the maze becomes magnified the player finds a new region to explore. A fractal maze expert who expects to find his or her way has to magnify different regions of the maze. Our expert will find it useful to understand certain facts about fractals. When a fractal object is subjected to magnification it shows infinite detail and infinite length. Another characteristic is that these shapes reveal self-similarity at descending scales. A spatial phenomena ensues where points fold and refold creating infinite complexity. One can visualize a labyrinth packed into a small volume. The morphology of a tree is an adequate model to understand self-similarity: "branches have smaller branches with details being repeated down to the dimension of tiny twigs".[4] Mandelbot defined 'self-similarity' as the iteration of detail at descending scales.

Other definitions of labyrinths are to be included in this analytical introduction. According to Umberto Eco, there are three types of labyrinths. The first was linear. He refers to the one built by Dedalus at Cnossus, that housed the ferocious Minotaur. When Theseus entered the labyrinth he could only reach the center. In the maze, *Imgärten* or *Irrweg* in German, we have to choose between branching paths, but if we take the wrong path it may lead to a dead end. The third type of labyrinth is a net, each point is connected to another point. This type of labyrinth is similar to a fractal maze since the 'visitor' has to sacrifice global vision in favor of local vision.

Eco compares the universe of semiosis or human culture to a labyrinth of the third type because it is manifested as *a network of interpretants*. He

---

[3] Benoit B. MANDELBROT, "Introduction", in *The Fractal Geometry of Nature*. New York, W. H. Freeman, 1983, p. 4.

[4] John BRIGGS and F. David PEAT, "On Both Sides", in *Turbulent Mirror: An Illustrated Guide to Chaos theory and the Science of Wholeness*. New York, Harper and Row, 1990, p. 105.

adds "that it is virtually *infinite* because it takes into account multiple interpretations realized by different cultures..."[5] This correlation between culture and semiosis structured over the metaphor of labyrinths, evokes the presence of visual and mental constructs. The first type of labyrinth portrays linear thinking; the second adds choice and the third represents fractal thinking.

Our next step is to implement all these analytical strategies in Borges story "The Garden of Forking Paths".[6] As the title shows we could define "The Garden..." as a maze, considering its branching structure.

During the First World War, Yu Tsun a Chineese spy, is pursued by Richard Madden, an Irishman under the orders of the English. He manages to escape Madden by hiding in a train bound to Ashgrove. The narrator's destiny is a house belonging to a certain Stephen Albert. As Yu Tsun inquires for the whereabouts of the house, a group of children forward the following indications: "You will not loose your way if you take this road to the left and at each branching of the road you turn left". The residence is already placed in a labyrinthical metaphor. Yu Tsun has to choose between branch-ing paths, so he is actually negotiating through a linear maze like structure. Yu Tsun remembers that to keep to his left was also the standard procedure to discover the central patio of certain labyrinths. Later on he recalls Ts'ui Pên, one of his ancestors, who abandoned everything in life to write a novel and build a laby-rinth. "Under English trees I meditated about the lost labyrinth: I imagined it inviolate and perfect at the top of the secret mountain, I imagined it erased by rice fields or under water, I imagined its infinitude..."

"I pictured a labyrinth of labyrinths, an increasingly sinuous labyrinth that would incorporate the past and the future and somehow implicate heavenly bodies". Such a labyrinth pulls time and space into the all encompassing structure of mind. If we are to deal with this labyrinth some kind of net system must be used. The secret mountain labyrinth would fork out to the hidden one in the rice fields and the under water labyrinth, folding into its structure the past and the present. Lost in this fractal universe, Yu Tsun, forgets time, space and his own tribulations to become what Borges calls an "abstract perceiver of the world". We could speculate that fractal thinking acts like a highly sophisticated instrument of meditation, able to dilute the present into the complexity of life. Yu Tsun remembers Ts'ui Pên's dream of building a labyrinth "The Garden of Forking Paths". This topic introduces self-similarity or a *mise*

[5] Umberto Eco, "Dictionary *vs.* Encyclopedia", in *Semiotics and the Philosophy of Language*. Bloomington, Indiana University Press, 1986, p. 83.

[6] Jorge Luis Borges, "El jardín de senderos que se bifurcan", in *Nueva antología personal*. 18a. ed. México, Siglo XXI, 1990, pp. 100-111.

en abîme, since we perceive an enclave that iterates structural similitudes and properties. From the variety of labyrinths imagined by Yu Tsun he returns to the labyrinth of labyrinths or "The Garden of Forking Paths". Two different worlds come together in Ts'ui Pên's project. His intention was to retire from the world to write a book and build a labyrinth. Both enterprises are united, as Labyrinth and novel intertwine, the visual structure of the first assimilates the texture of the second, establishing a textual space for labyrinths. It would not be idle to ask, how does textual space translate into the figure of the labyrinth? Yu Tsun explains to Stephen Albert that he once tried reading Ts'ui Pên's novel. "In the third chapter" he complains, "The hero dies, in the fourth he is alive". To which Stephen replies that the seeming confusion of the novel gave him the idea of a labyrinthine narrative. The labyrinth is a visual construct embedded into a textual media; a labyrinth packed into a novel.

In 1890 the mathematician Giuseppe Peano discovered a "space-filling curve". Peano devised a topological object that consisted in a packaged curve that filled the sheet of paper it was drawn on. A sort of string that was twisted along the surface and produced self-contacting complexity. Self-contacting complexity is another way of understanding packing procedures. The fractal maze is characterized by self-contacting complexity.

Stephen Albert describes the strategy employed to solve Ts'ui Pên's narrative labyrinth. Ts'ui Pên had suggested an infinite labyrinth and also left a letter indicating that "I leave to most future times (not all) my garden of forking paths". Stephen's first attempts to solve the enigma are based on the conventional narrative maze system or the second type described by Eco. In other words a task in which the reader can choose between different linear branching paths. And I quote: "A volume where the last page would be identical to the first, thus enabling an indefinite lengthening".

He goes on to describe another linear branching narrative device: "I also imagined a Platonic hereditary text, transmitted from father to son, in which each individual adds a chapter or corrects with pious care the page of his elders".

Stephen Albert admits that such solutions were to no avail, till he got the letter and focused on the phrase: "to most future times (not all)..." A clue that suggests a bifurcation of time, not space. Albert remarks that "In all fiction, each time a man confronts diverse alternatives, [he] selects one and discards others". This reading behavior underlines the selective system of the conventional narrative maze. However, when the bifurcation of time is added, Albert is forced to abandon the linear branching system. Only then is he able to realize that Ts'ui Pên did not select one alternative and eliminated the rest, instead he took all alternatives simultaneously, consequently creating numerous future times and diverse temporalities that proliferated and branched off.

During our own reading, it becomes clear that we are being subjected to a labyrinthine journey through Albert's reading strategies in the linear narrative maze system. This system is similar to Yu Tsun's own intricate journey to Stephen's house. Albert's reading strategies have to conform to a fractal dimension. This means that self-similarity must be included. Let us go back to the image of the tree whose "branches [had] smaller branches with details being repeated down to the dimension of tiny twigs". Iteration of details breaks linear solutions and introduces the 'self-similar' strategy of fractal mazes. In this manner all alternatives can be taken simultaneously.

Returning to Ts'ui Pên's novel we find a character called Fang. Albert explains that "Fang could have a secret; a stranger knocks at the door; Fang decides to kill him: Naturally there are several conclusions: Fang could kill the intruder, the intruder could kill Fang, both could be spared, both could die, etcetera. In Ts'ui Pên's text, all endings occur; each one is the starting point to further bifurcations".

An important feature of fractal mazes is that the player can establish the starting and finishing points, however he or she are confronted to the same complexity as the reader in Fang's story where Eco's network of *interpretants take over*. Albert plays on the bifurcation theme in Fang's story. Along this train of thought the reader participates in a nonlinear bifurcation as Albert addresses Yu Tsun: "We do not exist in the majority of times; in some you exist and not I; in others, me, and not you; in yet another, we both do".

Yu Tsun murders Albert and is taken prisoner by Richard Madden. The reason to kill Albert is to signal Berlin that an important artillery deposit is found in 'Albert' city and should be bombed. Yu Tsun is aware that the murder will appear as a news item.

To end this paper and avoid further bifurcations, we discover that spy stories share a double nature: one that equates their narrative behavior to the intricate network of winding pathways of labyrinths and fractal mazes, and another where the reader follows a conventional story.