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**ATEMPORAL LABYRINTHS IN TIME:
J. L. BORGES AND THE NEW PHYSICISTS**

MODERN PHYSICS HAS MADE IT plainly evident that the constituents of microphysical systems operate in a manner that contradicts the accepted patterns and relationships of space and time that originated from Newton's classical mechanics. The following familiar words from Borges's "Avatars of the Tortoise" convey this very point; it indicates the inability of the old scientific paradigm to rationalize reality as it is conceived by the new physics:

We have dreamed it [the world] strong, mysterious, visible, ubiquitous in space and secure in time; but we have allowed tenuous, eternal interstices of injustice in its structure so we may know it is false (OI 115).¹

Borges is, of course, referring to Newton's idea that to any and every event in the universe there correspond absolute coordinates of space and time. According to the traditional view, it was possible for any object or event to be seen at the same instant in the same place by each and every observer. In other words, time functioned as a gigantic clock that marked off seconds with absolute precision in all corners of the universe; it "flowed" at a uniform rate regardless of the position of the viewer. For Borges, however, "each fraction of time does not fill all of space simultaneously" (OI 185). This is likewise the case for physicists, and as we will soon see, they will lead us to an awareness of space and time which deviates so far from the familiar path of logic that its effect is unnerving.

Time in particular has this effect on Borges, and that is why he devotes a great amount of attention to it relative to other universal themes such as love, life, death, etc. He appears to be preoccupied, or perhaps feels a certain uneasiness with time, which he expresses in the essay, "Historia de a eternidad":

El tiempo es un problema para nosotros, un tembloroso y exigente problema, acaso el más vital de la metafísica, la eternidad un juego o una fatigada esperanza. (OC 353)

During an interview with B. E. Koremlit, Borges reveals an even more intimate attitude toward time:

hay algo que siempre me interesó y aún me aterró desde que yo era niño. Ese algo es, como ya lo sabe quien haya hojeado mis libros, el problema del tiempo, la perplejidad del tiempo, el infinito remolino del tiempo. (Ferrer 39)

Like the new physicists, Borges's approach to time is twofold. First, he exposes the fallacies behind the rationalistic approach of the Newtonian/Laplacean model. Then, he uses a technique that could be described as a predilection for experimentation; he complements the new physics by investigating the strange nature of time's characteristics that lie hidden from our normal perception. These characteristics can be classified into three categories: the flexibility of time, the concept of the "Eternal Now," and space-time.

Since Plato, time has been seen as an "arrow" that travels forward in space. To this day, we accept the notion that time is a steady, continuous phenomenon. However, physics and mathematics—including Galileo's laws of motion and Newton's laws of mechanics—actually contradict the notion of time being strictly irreversible; they cannot disprove that deviations from the "normal" pattern are impossible. Roger Penrose's comments support this reversal concept:

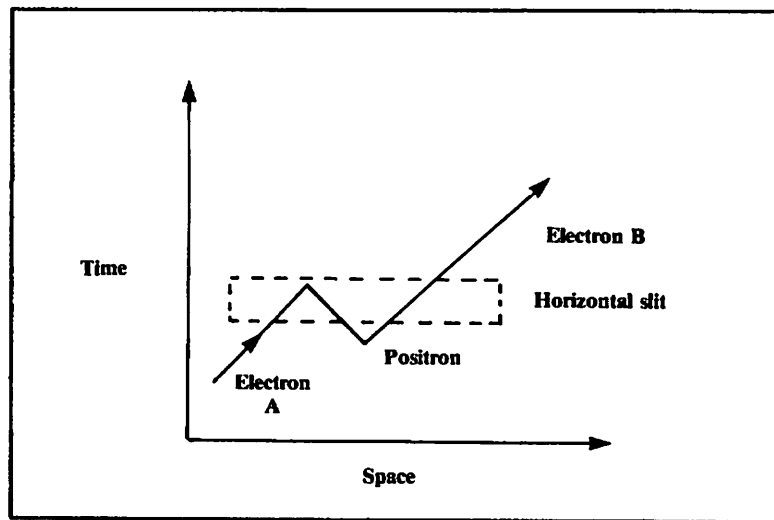
All the successful equations of physics are symmetrical in time. They can be used equally well in one direction in time as in the other. The future and the past seem physically to be on a completely equal footing. (302)

The fact that we always see a glass of water falling off a table and emptying its contents on the floor does not mean that the reverse process is excluded from the realm of possibilities. For modern physics, both events are identical. Adolf Grünbaum explains that when processes are mirror images of each other they exhibit "isotropic time," or they are called "time-symmetric" (152). In more common language, time is said to be "flexible."

In his essay, "Historia de la eternidad," Borges comments on this aspect of time and we see that he is in full agreement with the laws of physics:

Una de las oscuridades, no la más ardua pero no la menos hermosa, es la que nos impide precisar la dirección del tiempo. Que fluye del pasado hacia el porvenir es la creencia común, pero no es más lógica la contraria, la fijada en verso español por Miguel de Unamuno: "Nocturno el río de las horas fluye / desde su manantial que es el mañana / eterno. . . . Ambos son igualmente verosímiles—e igualmente inverificables. (OC 353)

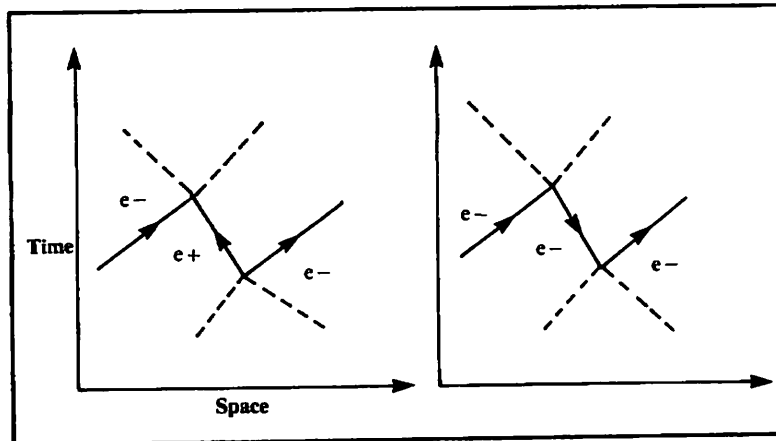
In 1948, the physicist Richard Feynman showed that temporal symmetry exists in particle/antiparticle trajectories. He proved that an antiparticle moving forward in time is the mathematical equivalent of a particle that moves backward in time. To explain this, we imagine that we perceive only a small portion of the total reality that is spread out before us as if it were a landscape. By analogy, this total reality is covered with an opaque sheet of paper and our perception is a horizontal slit cut into it through which we are permitted a partial view. This is shown below in a diagram that follows the world lines of three subatomic particles (Gardner 106):



Because time moves forward for us, our perception (the horizontal slit) moves up the page, allowing us to eventually see all three particles (Electron A, Positron, and Electron B). Electron A moves forward and collides with a positron and both mutually annihilate each other. The energy produced creates an Electron B, which moves off to the right.

If the opaque sheet were removed, we would be able to view the whole landscape of reality all at once. Here we would judge that there is but one particle: an electron that moves forward, then backward, and then forward once more. The main difference between these two views of reality is that in the full view (without the opaque sheet) one particle, by changing its temporal direction, is able "to trace out" an identical trajectory to that made by the three particles (with the opaque sheet) which never

changed their forward direction in time. Below are two space-time diagrams that depict the particle landscape described above, first with, and then without, the opaque sheet:



The modification of the past—which can also be interpreted as the creation of diverse pasts—is another consequence that isotropic time permits. The “delayed-choice” experiment, conceived by John A. Wheeler, deals with the ability of the present to transcend its temporal boundary and influence the past. As was already known from the results of previous experimentation, photons (light particles) can manifest themselves as waves if they pass through a partition with two slits open, or as particles when only one is left open. If the photons are particle-like, they all hit a light-sensitive screen and form a solid pattern. If they are wave-like, interference occurs which allows only some of the photons to reach the screen, and this shows up as a concentric ring pattern.

Wheeler added a temporal dimension to this experiment by enabling the light-sensitive screen to open and close after the photons have gone through the slitted partition. Detectors are placed behind the screen in alignment with each slit to record the final position of each photon released. When the screen was closed they behaved as waves and therefore the detectors would register only a portion of the photons. With the screen open, however, one of the two detectors always registered a “click” indicating that the photons had passed through both the slitted and the light-sensitive screens. The fascinating point is that the photons have already “chosen” to act either as waves or as particles by the time they reach the slitted screen; they are forced to make a decision before the light-sensitive screen’s position is fixed. In other words, the present

(the decision to leave the screen open or closed) is influencing the past (the photon's manifestation as a wave or particle). Wheeler states: "we decide, after the photon has passed through the screen, whether it shall have passed through only one slit or both" (1980, 357).

In several of his texts, Borges treats the theme of diverse pasts as a possibility. In "The Secret Miracle," he makes a reference to the first volume of Hladik's work, *Vindication of Eternity*, which "is a history of the diverse eternities devised by man, from the immutable Being of Parmenides to the alterable past of Hinton . . ." (F 145). The idea also appears in "Tlön, Uqbar, Orbis Tertius." The discovery of hrönir, that is, artefacts which have replaced original, lost objects and which are produced solely through a mental process, "has allowed them [the archeologists] to question and even modify the past, which nowadays is no less malleable or obedient than the future" (F 30). The essay, "Kafka and His Precursors," brings to our attention that it is not necessarily the past that changes, but rather how we perceive it: "the fact is that every writer creates his own precursors. His work modifies our conception of the past, as it will the future" (L 201). Perhaps the most striking example of the link between perception and the past is found in "The Other Death." Pedro Damián, the protagonist, handles himself like a coward during the battle of Masoller in 1904. In his shame he resolves to redeem his character, and in 1946 he projects his consciousness back in time to relive the battle as a brave soldier. Subsequently, all those who participated at Masoller remember him in this way. Damián has converted his cowardly past into a heroic present. These stories, as well as the work carried out by Feynman and Wheeler, demonstrate that the past can be affected by subsequent events, that it is not totally separate from the present.

The concept of the "Eternal Now" takes a major position in both Borges's writings and the new physics. It presents us, however, with the difficult task of demolishing some long-standing notions of time. The first of these, briefly mentioned in the previous section, is that time, as a unidirectional flow from past to future, ceases to exist. Olivier Costa de Beauregard compares this new view of time with the old:

In Newtonian kinematics the separation between past and future was determined by a single instant of universal time, the present. This is no longer true in relativistic kinematics. . . . Therefore there can no longer be any objective and essential (that is not arbitrary) division of space-time between "events which have already occurred" and "events which have not yet occurred" (429)

Borges speaks of this notion in "New Refutation of Time": "the chronological determination of an event, of any event on earth, is alien

and exterior to the event" (OI 184-185). For him "every instant is autonomous," and he defines the present as that which "lasts between several seconds and a tiny fraction of a second; that is how long the history of the universe lasts. Or rather, there is no such history, as there is no life of a man, nor even one of his nights; each moment we live exists, not its imaginary aggregate (OI 177)." Along this same line of thought, Grünbaum speaks of a "transient Now" that "shifts" and forms a string of "Now-contents" (154). The past, present, and future, therefore, are wholly disconnected from the flow of time. In his book, *Star Wave*, Fred A. Wolf begins to define what is meant by time as an Eternal Now: "Everything that is, is, was, and will be. It remains "out there" forever. Things do not pass away in time. Every moment remains lifeless, motionless and frozen forever (20)." In "The Garden of Forking Paths," Borges expresses Wolf's idea through his protagonist Yu Tsun: "Then I reflected that all things happen, happen to one, precisely now. Century follows century, and things happen only in the present" (F 90).

Probably the best example in all of Borges's fictions that encompasses the implications of the Eternal Now is "Funes, the Memorious." As Juan Nuño correctly interprets the story, Ireneo Funes atomizes time to an ultimate extreme (107) by perceiving reality as a series of autonomous "Now-contents," to use Grünbaum's terminology. The analogy that comes to mind is that of cutting up a reel of film into individual frames, and then splicing them together in random order. Funes's universe becomes a mental cacophony, a tangled circuitry of memories that could be compared to a huge computer-like storage facility for millions of bits of information. His mind, then, functions like time; it is a chaotic jumble of past and future moments that has no net movement in either direction, and where all events are eternally present. For Ramón Xirau this "proceso mental hecho de átomos incomunicados, cesa de ser tiempo" (7).

Another way that Funes's life could be considered an eternal present is the fact that he keeps himself enclosed in a dark room "without lighting the candle" (F 110) and "at sunset he allowed himself to be brought to the window" (F 109). Because we perceive the passage of time as a transition from day to night, Ireneo attempts to deny the flow of time by living in perpetual darkness, and this action would simulate an Eternal Now.

In "The Secret Miracle," Jaromir Hladik is granted an extra year of time by God at the moment of his execution by a Nazi firing squad. This freezing of physical time by divine intervention allows Hladik to bring his literary work to a completion. Superficially, critics have labeled this as a cessation of time, but we have already seen that time cannot be arrested, that "reality is continuous and constant" (Ouspensky 26). Like Ireneo Funes, Hladik is paralyzed in the physical sense but his "being-

time" remains intact and active. From the soldier's frame of reference, time is proceeding normally; the command to fire is called out, and perhaps a second transpires before the actual discharge of the rifles occurs. From Hladik's standpoint, however, the time interval between these two events (the command and the discharge) lasts for one year. In other words, Hladik and the soldiers represent two distinct frames of reference. Under these conditions, relativity theory predicts that they will perceive the same events differently. This brings us to the concept of Einstein's space-time which is part of both Borges's thought and the new physics.

From the discussion thus far, it has been argued that there is no universal moment that can be called "now." In fact, an infinite number of different "nows" are possible, all of which are contingent upon the motion and distance of the observer relative to the event. In daily life, we naturally assume that our observation and the occurrence of a given event are simultaneous, because we do not encounter the velocities nor the distances that even remotely approach the levels necessary for such discrepancies to be noticeable. In the astronomical world, however, this is a fallacy, for we know that light has a finite speed. To travel from the sun, for example, light needs about 500 seconds to reach the earth, and from Pluto, it needs five to six hours. We are not seeing their images in the present, but as they were; their past is our present "now." A powerful telescope focused on one side of our galaxy would produce a "now" image that occurred thousands of years after the "now" image on the closer side; for the telescope operator, however, they are the same "nows" (Sagan 276). For a remote quasar, a "now" could display an elasticity of billions of years.

"The Other" by Borges is an imaginative story that exemplifies the space-time distortions that occur between two observers who are moving in different frames of reference. A young Borges meets another man on a park bench who turns out to be an older version of himself. The two Borgeses have a disagreement: the former believes that the encounter takes place in Geneva in 1918, while the latter experiences it in Cambridge in 1969. The discrepancy of their respective "nows" involves 51 years and some 3,000 miles.

Time, then, is just as labyrinthine as space; it twists, turns, moves forward and backward, etc. It can therefore be considered a fourth dimension, forming an inseparable continuum with space known as space-time. Herman Minkowski was one of the first individuals to acknowledge this relationship:

The views of space and time which I wish to lay before you have sprung from the soil of experimental physics, and therein lies their

strength. They are radical. Henceforth, space by itself, and time by itself, are doomed to fade away into mere shadows, and only a union of the two will preserve an independent reality. (Gardner 93)

Wolf reasons that because time can only be deduced through the movement of objects, it is dependent on an observer. He continues by saying that "Space without time is unobservable because there is no observer. Time without space is also unobservable because there is nothing to observe" (24).

In the prologue to *Historia de la eternidad*, we see that Borges shares the views of Minkowski and Wolf:

El movimiento, ocupación de sitios distintos en instantes distintos, es inconcebible sin tiempo; asimismo lo es la inmovilidad, ocupación de un mismo lugar en distintos puntos de tiempo. (PC I, 313)

As a result of the intimate and obligatory union of space and time, the terms "temporalization of space" and "spatialization of time" have surfaced in scientific, philosophical, and literary studies. The first implies that consciousness is "out there" in the universe and that our total experience is reduced to the what is called "being-time." To help us understand this expression, Wolf uses equivalents like "hereness" and "our sense of presence" (20).

Borges touches upon the temporalization of space in an essay entitled "La penúltima versión de la realidad," in which he devalues the exaggerated importance that modern society places on space:

el espacio no es sino una de las formas que integran la cargada fluencia del tiempo. Es uno de los episodios del tiempo, y contrariamente al consenso natural de los ametafísicos, está situado en él, y no viceversa. (OC 200)

At the end of the essay, Borges imagines a world devoid of space and the three senses that depend on it: taste, sight, and touch. The result, as he sees it, would be an existence as "apasionada y precisa como la nuestra" (OC 201).

In "Utopia of a Tired Man," Eudoro Acevedo travels thousands of years into the future to find a world whose inhabitants have spatialized (or have tried to spatialize) time. During Acevedo's visit, his futuristic host tells him: "We live in time, which is successive, but we try to live *sub specie aeternitatis*" (BS 91). Borges addresses this process in a section of *Discusión* entitled "Notas": "Uspenski profetiza que nuestras mentes prescindirán del tiempo lineal, sucesivo, y que intuirán el universo de un modo angélico: *sub specie aeternitatis*" (PC I, 229). If existence is "*sub specie aeternitatis*," then time is like an eternal now. It is not limited to

forward linear motion; we conceive it as going back and forth like space. Time, in other words, is spatialized. Returning to the story, Acevedo asks his acquaintance about "time-space travel" and he replies, "It's centuries ago now that those travels were given up. . . . Besides all travel is spatial. To go from one planet to another is like going to the farm across the way" (BS 94). We also know that there is no chronology or history in this futuristic society, and that people try to forget all traces of the past. Time is gradually being eliminated while its inhabitants concern themselves only with the spatial aspects of existence.

In "Time and J. W. Dunne," Borges reviews Dunne's version of the spatialization of time, which again converts time into another spatial coordinate that serves as a fourth dimension:

He postulates that the future already exists and that we must move to it, but that postulate suffices to convert it into space and to require a second time (which is also conceived in spatial form, in the form of a line or a river) and then a third and a millionth. Not one of Dunne's four books fails to propose infinite dimensions of time, but those dimensions are spatial. (OI 20)

Alberto J. Pérez maintains, for example, that many of Borges's characters are portrayed in terms of space and time (13). Noteworthy examples are Ireneo Funes, first as a chronometer and then as a paralytic, and Juan Dahlmann who, while on a train heading south, senses that he is also moving toward the past. Space-time metaphors appear with great frequency in Borges's texts, especially in his poetry. Ana Mariá Barrenechea calls this an "asociación espacio-temporal" (28). Here are some examples: "siete siglos de distancia" (OC 371), "la inmortalidad de su andanza" (OC 47), "tiempo de anchura de alma" (OC 43), "inmortales distancias" (OC 17), "años cargados de ciudades" (OC 365), "altas horas" (OC 88), "ayer profundo" (OC 1098), "el tamaño del porvenir" (TE 49), and "los ágiles días" (OP 89).

In summary, the very essence of time in Borges is paradoxical. On the one hand, it is argued, time does not flow: it is static and laid out "en bloc," where past, present, and future exist simultaneously. On the other hand, it appears to be dynamic, a series of ephemeral instants that shift around and succeed one another without causal connection. Some experiments of modern physics have shown time as having certain qualities, but then they also yield other results that refute the original findings. The Feynman diagrams lead us to the realization that the subatomic stage conceals what goes on "behind the scenes." Its actors appear to move forward through their parts, when in fact they may be moving backward. The delayed-choice experiment demonstrated that there is no fixed past,

that a given history metamorphoses into an amalgam of possibilities only one of which is elected by the observer. Therefore, according to Wolf, it is our experience that induces this paradox and comes to the realization that time is "timeless":

What is past is literally gone, dead, vanished, and never to be seen again. What is future is also not here, not experienced except as a hope, or a dread. Both past and future are not here! Our experience seemingly is reduced to now, but that too is an illusion, for how now is now? (20)

This statement closely coincides with Borges's assessment of time in *El idioma de los argentinos*:

El tiempo, si podemos intuir francamente esa identidad, es una delusión: la indisolubilidad de un momento de su aparente ayer y otro de su aparente hoy, basta para desordenarlo. (IdA 150)

Perhaps John Wheeler offers us the only reasonable conclusion that we can draw at this point:

These considerations reveal that the concepts of spacetime and time itself are not primary but secondary ideas in the structure of physical theory. . . . Then one has to forego that the view of nature in which every event, past, present, or future, occupies its preordained position in a grand catalog called "spacetime." There is no spacetime, there is no time, there is no before, there is no after. The question what happens "next" is without meaning. (1968, 253)

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1. All references to Borges's texts will carry the following abbreviations: *Other Inquisitions* (OI), *Obras Completas* (OC), *Ficciones* (F), *Labyrinths* (L), *Jorge Luis Borges: Prosa Completa* (PC), *The Book of Sand* (BS), *Obra Poética* (OP), *El tamaño de mi esperanza* (TE), *El idioma de los argentinos* (IdA).

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