diplomatic status, are by definition exiles. Their willingness to help Manuel and Maria at considerable risk to themselves affirms their identification with suffering humanity; refusal on their part to come to the lovers' aid would have exiled them, in a much deeper sense, from human beings in danger of their lives.

Another theme much treated in Bazin's fiction is the wayward, unlikely but imperative nature of love, which need not necessarily be either sexual love or between a man and a woman, as is shown, for example, in *Lève-toi et marche* (1952) and *Au nom du fils* (1960). Love is envisaged by Bazin as the one human emotion capable of dispersing the sense of alienation, of mitigating the effects of exile. It also involves—and in this sense Bazin's novels are political, though non-partisan, statements—a passionate affirmation of individual freedom, freedom from constraint and convention, from the chains of family, society and belief, a motif studied with the most powerful effect in *La Mort du petit cheval* and *Qui j'ose aimer* (1956). In *Un Feu dévore un autre feu* the love of Manuel and Maria transcends upbringing, family, and ideology and even, given the political circumstances of the novel, common sense, but it confers existential meaning upon their lives and vindicates their last days together.

Un Feu dévore un autre feu belongs to the form of the short novel to which the French genius has made major contributions (e.g. *Manon Lescaut, Adolphe, La Symphonie pastorale*). The writing is spare and concentrated in a manner not always characteristic of Bazin's earlier work. The novel excludes all superfluous detail and yet gives the impression of density of texture, so that the reader is left with a sense of a controlled and structured form created as a framework for the delineation of strong, passionate, and believable characters. The tightness of the writing, the deftly-drawn background, only too typical of the twentieth century, the subtle interplay of personal and political themes make of this novel a worthy addition to an already substantial achievement.

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Mathematics in the *Ficciones* of Jorge Luis Borges

This paper is a comment on the rather explicit use of mathematical concepts in three of Borges's *Ficciones:* "Tlön, Uqbar, Orbis Tertius," "An Examination of the Work of Herbert Quain," and "The Library of Babel."

The mathematics in "Tlön" is at first only subtly suggested. The first mention of it is in connection with the recollection of one Herbert Ashe who has "a mathematics textbook in his hand."[1] Ashe and the narrator discuss the duodecimal system (in which twelve is written 10), and Ashe states that he is transcribing some duodecimal tables into sexagesimals (in which sixty is written 10). Nothing

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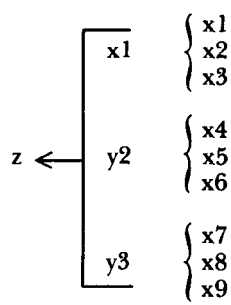[1] Jorge Luis Borges, *Ficciones* (New York: Grove Press, 1962), p. 20.

more is said of these number systems until considerably later when in a seemingly irrelevant footnote it is mentioned that in the duodecimal system a century signifies a period of one hundred forty-four years. This is correct because duodecimal means base 12. Hence, $100 = 1 \times 12^2 + 0 \times 12^1 + 0 \times 12^0 = 144 + 0 + 0 = 144$. In the same way, 12 is written 10 because $10 = 1 \times 12^1 + 0 \times 12^0 = 12 + 0 = 12$. Sexagesimal means base 60, so that in this system, $10 = 1 \times 60^1 + 0 \times 60^0 = 60$, as quoted above.

One might be led to think that perhaps the arithmetic of Tlön is duodecimal. This does not seem to be the case, however, since it is stated a little later that "The arithmetical system is based on the idea of indefinite numbers" (p. 28). The concepts of greater than and lesser than, for which, incidently, Borges uses the proper mathematical symbols ($>$ and $<$), are of primary importance in this system. It is interesting that quite recently there has been a development in mathematics referred to as "interval arithmetic." This originated through some work in computer science, and it replaces numbers by entire intervals or ranges of values—indefinite numbers!

We are told that Tlön has two different systems of geometry, a visual one, and a tactile one. The latter corresponds to our geometry, but in the former man's own motion alters the forms which surround him. One cannot help but be reminded of Einstein's theory of general relativity in which the presence of masses alter the curvature of space-time.

The final bit of mathematics in "Tlön" has to do with the discussion of who invented Tlön. On page 22 one finds the following sentence: "We conjecture that this 'Brave New World' was the work of a secret society of astronomers, biologists, engineers, metaphysicians, poets, chemists, mathematicians, moralists, painters and geometricians, all under the supervision of an unknown genius." It is further stated that the plan for constructing Tlön "is so vast that each individual contribution to it is infinitesimal." This could be a sophisticated way of indicating something infinite. (Borges's preoccupation with the infinite will be seen more clearly in our comments on "The Library of Babel.")

In "Quain" the use of mathematics is remarkably explicit. In describing the work "April March," which consists of nine novels each containing three long chapters, the diagram below is actually displayed to make clear the structure of the work. The first chapter (z) is common to all nine novels. There are three second chapters, y1, y2, y3, each of which gives rise to three third chapters for a total of thirteen chapters.

$$
z \leftarrow
\begin{cases}
x1 & \begin{cases} x1 \\ x2 \\ x3 \end{cases} \\
y2 & \begin{cases} x4 \\ x5 \\ x6 \end{cases} \\
y3 & \begin{cases} x7 \\ x8 \\ x9 \end{cases}
\end{cases}
$$

Not only do we have mathematical notation here, but a slight modification will turn Borges's picture into a standard mathematical illustration known as a tree diagram:
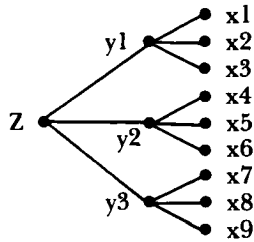
The number of points (dots) is the number of chapters, and the number of novels equals the number of paths from z to an end point.

This same type of diagram is used a second time when it is stated, "Quain regretted the ternary order and predicted that whoever would imitate him would choose the binary arrangement

$$
z \begin{cases} y1 & \begin{cases} x1 \\ x2 \end{cases} \\ y2 & \begin{cases} x3 \\ x4 \end{cases} \end{cases}
$$
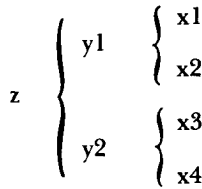
If put in tree form, it will look like this:
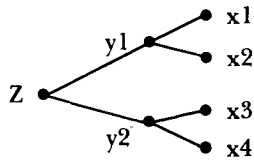
The most profound use of mathematical thinking, bordering on the philosophical, is to be found in "Babel." A library (or is it the universe) is described; it consists of an "indefinite, perhaps infinite" number of hexagonal galleries. These are stacked one upon the other so that many floors exist, and are also attached one to the other so that the configuration is spread out horizontally as well as vertically. Throughout this work, there is a lingering preoccupation with the question of whether or not this library-universe is infinite. It is interesting that the galleries are hexagonal, but even more interesting that the narrator tells us that "idealists argue that the hexagonal halls are a necessary form of absolute space" (p. 80). "They contend that a triangular or pentagonal hall is inconceivable" (p. 80). As a matter of fact, if one wishes to cover a flat surface with regular geometric patterns, one cannot do it with pentagons, but *only* with hexagons, triangles, or squares. These are known as the three regular "tesselations" of the plane.[2]

A sophisticated expression of the infinitude of the library is found in the sentence, "The library is a sphere whose consummate center is any hexagon, and whose circumference is inaccessible" (p. 80). Here, "circumference" should be read "surface". Thus the outside surface is not reachable. Furthermore, the idea of *any* hexagon being the center indicates that no location interior to the sphere is any closer to its surface than any other one.

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[2]H.S.M. Coxeter, *Regular Polytopes* (New York: Macmillan, 1963), p. 58.

The infinity issue becomes confused, and some mathematical contraditions appear towards the end of the work. It all begins with the relating of the discovery of a certain book dealing with combinatorial analysis. This, incidentally, is an important and difficult branch of mathematics which is enjoying a very active period of research at present. It is specifically mentioned that the book contains "examples of variations with unlimited repetition" (p. 82). From the information in this volume, a librarian of genius deduced that the library is *total,* comprising all books with no duplication. Oddly enough, the idea is expressed at this time that the total number of possible combinations of the twenty-odd orthographic symbols is vast, but not infinite. This number, however, is surely infinite since one is allowing unlimited repetition. The notion of the number of books being limited is brought forth at the conclusion when the narrator explicitly states (finally) that the library is infinite. The two notions are reconciled by the closing statement that the library is *limitless* and *periodic* so that "If an eternal voyager were to traverse it in any direction, he would find, after many centuries, that the same volumes are repeated" (p. 87). This, of course, is in direct contradiction to the earlier conclusion that no book is duplicated!

These are perplexing developments. But, in fact, an aura of the absurd is present throughout this work. From its very title, the reader is warned of impending confusion. As a structure is being erected, it is simultaneously being eroded. As man probes the secrets of the universe, other, more formidable, secrets appear. The mathematically inconsistent conclusion could be an expression of the hopelessness of our quest for understanding.

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The British and the Anglo-Indian Encounter in Malgonkar's *Combat of Shadows*

In *Combat of Shadows** Manohar Malgonkar demonstrates how interracial relationships involving sex, love, and marriage have little chance of success. The races under treatment are the white British and the not-so-white Anglo-Indian. Passions of fear, suspicion, pride, desire, and aversion, aroused and strengthened by racial and cultural prejudices, scuttle the efforts of the members of the two groups from forging lasting and durable relationships. The efforts are shown to lead mostly to frustration, misery, and death.

Henry Winton, a British plantation manager, appoints Ruby Miranda, a beautiful Anglo-Indian girl, as a teacher in the plantation school, and uses her as a mistress to break the loneliness and monotony of his plantation life in a remote corner of north-eastern Assam. Being rootless, unwanted, and despised in India, Ruby Miranda desperately tries to become Henry's wife and escape from the brown world to the white. When Eddie Trevor, Ruby's lover, applies