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## **BORGES' LIBRARIAN IN THE LIBRARY OF BABEL AS A *TURING MACHINE* AN *UNREASONABLE NOTE***

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In his *paen* to Bloch's sustained, almost lyrical, mathematical rendering of *The Library of Babel* (*LoB*)<sup>1</sup>, the extraordinary magic realistic essay by Borges, formally written as a book review, Dan King (2010, p. 418), perceptively observed:

“In more uncharted terrain, Bloch closes his mathematical analysis of *LoB* by weaving connections to the works of Turing and Gödel. He argues that the combined lives of the librarians endlessly searching the volumes of the Library can, in a sense, be regarded as homomorphic to the operations of a Turing Machine.”

Bloch's characterization of the activities of a single librarian<sup>2</sup> - there are, obviously, a *countable infinity* of them, since there are *at least* a countable infinity of hexagons and, according to *LoB* (footnote 1, p. 54), ‘there was a [librarian] for every three hexagons’<sup>3</sup> – as those of the computation by a Turing Machine are persuasively described (*ibid*, p.124, last paragraph). The characterization is schematized as a formal (symbolic) computational procedure by a Turing Machine, with a defined halting state – i.e., death (‘by suicide and pulmonary diseases’!).

However, the Turing Machine interpretation of the life and times of a Borgesian Librarian, in *LoB*, remains *incomplete* (sic!) without the addition of the following ‘Lemma’:

Lemma: It is (algorithmically) undecidable when (and *whether*) any particular librarian will expire.

Proof: Due to the *undecidability*<sup>4</sup> of the *halting problem for Turing Machines*.

I should add one ‘surreal’ (*pace* Knuth, 1974) mathematical note to substantiate some of the implicit mathematical assumptions in the notes above. The existence of a *countable infinity* of hexagons, in finite space, is easily formalized within one or another form of nonstandard analysis<sup>5</sup>, as clearly indicated by Bloch (see, in particular, pp. 53-4, *ibid*).

Two other, distinctly *non-surreal*, notes refer to possible *non-consistencies*<sup>6</sup> in Borges. One, when he refers to the books in the *LoB* having been composed using only *twenty-five orthographical symbols*

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<sup>1</sup> I am using James Irby's translation of this gem, in Borges (1964).

<sup>2</sup> I do not think, contrary to King's interpretation of Bloch, that this characterization is about ‘the *combined lives* of the librarians’, but that of *one* arbitrary librarian.

<sup>3</sup> Although Borges adds the caveat (*loc.cit*): ‘Suicide and pulmonary diseases have destroyed that proportion’, this does *not* mean the existence of *any less than* a countable infinity of librarians, since only the ‘proportions’ are ‘destroyed’, not annihilated.

<sup>4</sup> I add this ‘lemma’, invoking also the use of the words ‘incomplete’ and ‘undecidable’ to substantiate Bloch's otherwise seemingly unnecessary reference to Gödel (*ibid*, p. 121).

<sup>5</sup> My own preference in this regard, particularly for reasons of easy mathematical compatibility with the computability requirements above, would be via ‘*Smooth*’ *Infinitesimal Analysis*, with its underpinning in both intuitionistic logic and category theory (cf., for eg., Bell,1998).

<sup>6</sup> I choose this word, avoiding the more familiar ‘inconsistency’ because, in the spirit of Bloch's lyricism and King's *paen*, I do not want to imagine Borges being subject to ordinary strictures, mathematical or otherwise.

(*ibid*, p, 53), ruling out the use of ‘digits or capital letters in the original manuscripts’. Yet, on the same page he observes:

“One [book] which my father saw in a hexagon on circuit fifteen ninety-four was made up of the letters MCV, perversely repeated from the first line to the last.”

The second possible non-consistency is when he claims that the number of books, since they are ‘made up of the same elements: the space, the period, the comma, the twenty-two letters of the alphabet’, are ‘not infinite’ (*ibid*, p. 54). However, this has to be an *impossible* conclusion, given the premises! An elementary enumeration, even constructively enabled, would convince a reader, in particular, of Borges and Bloch, that the *listable* combinations of the ‘twenty-odd orthographical symbols’ is, in fact, countably infinite.

These non-consistencies are absolute trivialities in Bloch’s lyrical rendering of **The Unimaginable Mathematics of Borges’ Library of Babel**.

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