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ESSAYS FROM PORTUGAL ON CYBERLITERATURE & INTERMEDIA

BY PEDRO BARBOSA, ANA HATHERLY, AND E.M. DE MELO E CASTRO

EDITED BY RUI TORRES AND SANDY BALDWIN

Computing Literature, the Center for Literary Computing, Morgantown, WV 26506

Published 2014 by the Center for Literary Computing.

Cover image by César Figueiredo.

ISBN-13: 978-1-938228-74-2 (pb)
978-1-938228-76-6 (elec)
978-1-938228-75-9 (pdf)

THE MACHINE OR THE INSIDE OF A VOID THOUGHT[125]

PEDRO BARBOSA

1. The electrical pulverization of the linguistic sign

The issue of the artificiality of the computer generated text, as discussed during the "International Meetings in Geneva,"[126] is a false issue, quite similar to the most recent debates sometimes rising regarding artificial intelligence. These debates are perhaps due to the general ignorance about how a computerized system works when analyzed closely and also due to the resonance of Promethean myths put forward by some science fiction. In these examples, the machine has always been regarded as an entity independent from its human creator, with the potential to replace, surpass, or even oppose him/he through war, as if the destiny of any machine (even those new cybernetic machines) could be other than to symbiotically enhance the natural limitations of the human being.

We intend to clarify some of the false pretenses behind these groundless fears, by introducing a brief consideration of the computer in its basic machine-like way of working.

Let us then ask: how does human language deposit, circulate, and be manipulated by the electronic components constituting the physical material (the hardware) of the computer?

It was mostly during the 1960's, at the time of Cybernetics and the utopian goal of Computer Assisted Translation, that the early generations of researchers focused on the possibility of simulating human thought and language through automation. They did so without fully evaluating the difficulties of treating language formally in the semantic sphere, as if the problems of meaning emerged

125 Pedro Barbosa, "A máquina ou o interior de um pensamento vazio," from A *Ciberliteratura: Criação Literária e Computador*, 1996, pp. 55-67. First published in *A literatura cibernética 1. Autopoemas gerados por computador*, 1977, Porto, Árvore. Translation by Isabel Basto.

126 The "Rencontres internationales de Genève" took place in Geneva, Switzerland, in 1965, with the topic "Le Robot, la Bête et l'Homme" ("The Robot, The Animal, and Man").

from a strictly formal modeling or as if the computer evaded these types of applications.

To simulate thought is not the same as thinking. To simulate an act of speech is not the same as talking. Hence, appearance must be parted from the phenomenon itself. It was this non-distinction that frequently presented the issue of the artificiality of computer generated text at that time produced by the so-called electronic brains.

A computer working in a self-regulating cybernetic regime—from the Greek *Kybernetiké*: the art of leading, commanding—could generate a text like the following:

ertumivakto rumissintuc

It is quite possible that earlier, some unadvised or quite naive reader would feel tempted to interpret this expression's enigmatic and sibylline tenor as deriving from a strange artificial language, an unknown code that was part of the aberrant machine language through which machines communicate in their own world. In the boundaries of fiction, such overwhelming thought would possibly end up in a fantastic meditation on the Realm of the Machine and on the advent of a new artificial intelligence. While excluding the fact that the characters employed are also human made, we could only strictly declare it artificial text in one of those cases. Yet, undecipherable as it is, what value does such a message hold for us humans?

The anthropomorphism of computers is an enduring and relentless temptation, and it is even consecrated in the linguistic habits of the very technicians dealing with them ("the computer identified an error," "the computer does not accept the software," etc.). Regarding the names used to baptize them (Calliope, Eliza, and Sophie), such attribution of human characteristics is no doubt responsible for much of the fiction surrounding them, with the added contribution of a certain sensationalist press taking metaphors literally.

Certainly, it may be unsettling that mechanisms are now able to execute a range of operations formerly considered as exclusively human and even as distinctive attributes of the human species. The use of articulate language is exactly one of those cases. However, one must keep in mind that when Pascal built his first arithmetic machine,[127] it was also considered that addition or multiplication were exclusive privileges of the human mind!

127 T.N.: known as the Pascaline.

The risk of attributing a magical character to computer activity is now renewed by the polemics surrounding Artificial Intelligence, chiefly when—as stated by Jacques Arsac—one is tempted to extrapolate from partial results and to state that all intellectual activities of man may be transferred onto machines (10). The enthusiasm even reached the point that some cyberneticists, such as Norbert Wiener, were driven to state that:

> We ordinarily think of communication and language as being directed from person to person. However, it is quite possible for a person to talk to a machine, a machine to a person, and a machine to a machine (76).

Others, such as H. R. Rapp, take a more moderate point of view: artificial systems cannot think and only humans can create meaning. Our free will defines our difference from machines. When words are devoid from their meaningful content, the machine cannot think, talk, or create in the actual sense of these terms. It cannot construe concepts, nor does it apprehend the meaning of the sentences it manipulates.[128] It merely works with the material portion of language, the signifiers: signs devoid of meaning. This standpoint is essential to the whole issue of computer generated text. As we approach it here, the meaning of a text (if any) can only be awarded by the reader. The act of reading is then, more than ever, essential.

We cannot disregard the development that computerized machines may achieve in a more or less near future; however, we can only speak as for the present state of development. And, what they offer us already deserves watchful attention. Nevertheless, the temptation of anthropomorphism and metaphysical speculation seem to vanish when dealing daily with those machines or having once entered inside them to know their technical operation at the most elementary level.

Therefore, to work at the level of literary creation with foundations stemming from the technological reality underneath, it is convenient to remind ourselves, even as a mere approximation, of the transit of the linguistic signal through the inside circuits of a computer.

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128 The AI programs, working as black box, may simulate such understanding and make the machine proceed interactively regarding the user as if it understood the meaning of natural language. However, generally, they do so by analyzing the context of the sentence, not by real apprehension of the meaning of the sentences.

It has already been stated here that computerized machines manipulate syntax but ignore semantics. Even though research in Artificial Intelligence aims to overcome such limitation through programs performing content analysis, the truth is that—from the bipolar structure of the linguistic sign—the computer only recognizes the signifier and ignores the signified. It deals with words that are reduced to strict graphic materiality (as in writing) or sound materiality (as in digital speech processing). Reduced to this level, the word is no longer word for the machine. It only becomes word to us when meaning is conferred during the act of reading.

But even this can only be declared when we place ourselves at the macroscopic level of programming (software), disregarding what happens inside of the machine. At a strictly technical level (hardware), not even this happens, for each graphic signal (letter, number) is converted in a strictly coded set of electric impulses, which are the only signals the machine recognizes. When we reach this stage—reduced to a simple flow of electronic impulses—the very linguistic signifier disappears, is pulverized, and is no longer recognizable in its linguistic nature.

Hence, once the whole text has been converted into machine-language and has entered the internal organs of any computer, it is shredded into a bundle of electromagnetic impulses (input). Only afterwards, through the inversion of the process (output), is it reconstituted and restituted by the peripheral organs (screen, printer, loudspeaker) in a form directly accessible to the human receiver. It is, therefore, only at this level of outside observation that computers may originate the feeling of mastering human language, of being able to read or write, if not hear and talk. But, if the machine imitates human language, it does so in a way that is totally mechanic and devoid of meaning.

If this is valid for the logical or syntactical operations from information dynamic processing, the same happens for the celebrated feature of memory (another anthropomorphism perpetuated by use), integrating all computers. In short (and regardless of the inevitable technical imprecision) we will now consider what occurs at this level of observation.

If the central organs of the computer only admit electronic impulses and, besides that, are only able to recognize two orders of states (positive and negative, or + and -), then any instruction to be entered into the machine must be reduced not only to a system of impulses, but also to the only logic the machine is able to accept. This is the binary logic: the yes and no, the + and -, the 1 and the 0. In this complex process of coding, the human message goes through several stages. In a first phase of human performance (programming), speech will have to be structured according to the rules (syntax) of a particular conventional language suited to the man-machine dialogue: Fortran, Algol, Cobol, APL, Pascal, Lisp, Prolog, BASIC, etc. Once the program is written, including instructions and data to supply to the machine, it will automatically code the message in order to be able to assimilate it (machine-code). Then, it will register the coded message according to a sequence of bits (0 and 1), which is the only binary system that the computer can truly manage.

Formerly, in large third-generation computers, this operation of binary coding was more perceptible to the user when one had to employ the photogenic perforated tape in order to communicate with the machine. This operation was automatically performed by perforating/tape reading machines (with keyboard and printer) that condensed instructions or data. This constitutes the program as a coded series of perforations on paper tape or small cards, where each alphanumeric character (letter or number) pressed on the keyboard by the programmer corresponded to an ordered set of perforations or non-perforations. Those rolls of perforated tape, then, became the instrument for man-machine dialogue. Through a tape, the user entered his message onto the central unit of the system, and through another tape (later on to be reconverted through the same peripherals into directly readable alphanumeric characters), the computer issued the results.

Therefore, between one tape and the other there were only electric impulses. The reading made by the computer was comprised solely of decoding and compiling the instructions on the tape, matching each hole (or absence of hole) to a certain value with positive or negative charge. Its memory was merely the record of that same value into pre-determinate cells in magnetic supports (disk or tape, ferrite plates, transistors, chips). And its intelligence, or calculation ability, was (whether numerical, logical, or algebraic) merely the processing and forwarding of such information through pre-established circuits (electronic valves, transistors, integrated circuits) that although extremely complex in structure, were quite simple in their elementary basic principles.

This way, when pressing a letter on the keyboard of a perforator ("R", for example), it would code the letter into a conventional series of holes distributed along the eight usual columns on the tape, which we will symbolize by 1 (hole) and by 0 (absence of hole): 11010010. Upon entering the machine, this series of signals would be converted into corresponding electrical states, positive or negative, and similarly the letter "R" would be stored in any cell of the computer's memory.

When observing the operation of a computational system at such close range, would it be legitimate to continue discussing, besides metaphorically, the linguistic activity of these machines?

Throughout the whole process, what happens inside any computer is a complex set of successive transmissions of signals, coding, and decoding chains. These materialize linguistic signals in the shape of electric impulses and reconvert them on the way out, reversing the process into alphabetical characters directly accessible to the human reader. That is the writing computers display: everything is performed in a pure machine-like way, with no possibility of awareness (at the material level of hardware) of the semantic content of the message. Concerning this issue, a common anecdote regards a robot to which the programmer ordered to remove from the room all round objects, and that robot ended up removing the head of the programmer himself.

The machine might never be able (or if so, not in a near future) to transcend the harsh materiality of the word, to assume language in its meaningful plenitude. Anyway, as Kondratov noted, its creative activity is limited to orders such as "take the word from cell 00101 in the memory and place it next to the word in the cell 00100" (136).[129] In other words, the computer does not deal with semantics, but it may deal with syntax (which is quite a lot). Would such a conclusion exclude any chance for the creative use of computational machines?

Yes and no. The answer depends on the level of analysis at stake. At the hardware level, the answer seems to be no; at the software level, it may be yes. It also depends on the selected approach to achieve this creative power.

If the ambition is (as the 1960's cyberneticists advocated) for the computer to fully simulate creative activity, then one must recognize that the machine is devoid of the primary magma (life experience) with which the artist makes his work. In light of this, the only possible thing to do would be to equip it with a linguistic weaponry to overcome or to simulate overcoming such handicap. However, it is not our goal to solidify the myth of the robot-poet and to place it at the pedestal of the man-artist. It matters little if the computer creates nothing on its own.

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129 O.P.: "tomar a palavra da célula 00101 da memória e colocá-la a seguir á palavra da célula 00100."

The man-machine symbiosis is what actually matters. What we intend to know is whether it is possible (and how) to use the syntactic and combinatory potential of computers in the domain of artistic creation. In other words, how can the new artist-programmer use the computer? If we are to deny all informational systems any autonomous aesthetic creation ability, this does not imply that artistic creation may not be reasonably simulated, widened, expanded, or enhanced through suitable programs. This leads to the discussion that the creative potential does not lie inside the machine itself but in the program. Hence, the artist-programmer.

2. The Computer as Amplifier of Complexity

So far, we have tried to estimate the computer's functioning in its most elementary physical structure. At this level, it may only be described in terms of electrical impulses going through a vast network of electronic materials. And, in this viewpoint, such impulses are not even able to be considered as symbols yet. Since the beginning, we have advocated that the computer is a machine for manipulating symbols.

As a matter of fact, without software or programs to define the tasks to be performed, the computer itself is merely an inert structure of electronic components, a useless tool, a bunch of junk accomplishing nothing. An informational system may only be regarded as the result of the symbiotic association between material and program, electronics and informatics, and hardware and software. We shall now discuss the more abstract level of programming, for it seems that there (to the unaware user) these machines sometimes actually perform intelligent operations.

These so-called "electronic brains" simulate operations connected to our central nervous system through the most diverse peripheral devices. They now seem to be able to read, write, think, create, see, and talk. This does not imply that there is some sort of structural resemblance between brain and computer, but merely an operational one. However, despite performing the most complex mathematical calculations and a wide range of formal operations, they cannot see, hear, speak, read, write, think, or create, in the sense that such activities have to us as conscious human beings. The machine, devoid of understanding (the ability to apprehend the meaning of the signs it works with), merely simulates. To simulate thought is not the same as to think. To simulate an act of speech is not the same as to speak.

When stating that computers may display, simulate, or model operations usually attributed to an intelligent behavior, this does not apply to a hermeneutic framework. Instead, it is restricted to a merely formal perspective and is nothing but a behavioral analogy.

Here is exactly where trenches were dug regarding the loud polemics on the so-called Artificial Intelligence,[130] whose new programming strategies (generally with heuristic methods and context analysis) aim to produce operational models of intelligent behavior. Within these modes, the machine performs as if it were able to apprehend the meaning of what it does: comprehension of natural language, automatic translation, problem solving, games, learning through attempt, error method, etc. Without getting involved with such polemics—because it is irrelevant to our goal—we will argue that informational systems are only able to develop a new sort of ability, which we shall name mechanical intelligence or instrumental reason. This construes all intellectual operations as able to be specified and materialized through signals.

Indeed, to argue that computers may perform any formal operation (actually deriving from the word form, an idea that also influences the consecrated terms information and informatics) is quite a lot: a whole new world open to collaboration between man and machine. However, we believe that this allows us to avoid inaccuracies regarding the abusive identification of human intelligence and mechanical intelligence, or even between human reason and instrumental reason. This is because, besides appearances, we believe the realm of meaning remains an exclusive dimension of the human mind—always seemingly out of reach for the machine due to its intrinsic operation mode.

Certainly, according to the most radical point of view of some informatics technicians, a cognitive machine as the computer (as complicated as it may be) is,

130 Note the books by Jacques Arsac, *Les Machines à Penser* and by Terry Winograd and Fernando Flores, *Understanding Computers and Cognition*. To frame this subject within an earlier stadium in computing, note the book by Hurbert Dreyfus: *What Computers Still Can't Do: a critique or artificial reason*. Regarding the skepticism advocated regarding the computer and the ability of Artificial Intelligence, there is an interesting debate by François Rastier, "Débat sur les limites de l'Intelligence Artificielle". On the contribution from linguistics to AI, note Inês Duarte's, *Aplicações computacionais da linguística*.

at the end of the day, nothing more than the extension of such a common utensil as the pencil.

As a matter of fact, a pencil may also be regarded as a mechanical extension (albeit an artisanal one) of our thought. It is not difficult to assess to what extent the simple possibility to fix signs on paper and work on them has already allowed the human brain to stretch its reasoning ability—infinitely more than if it were solely confined to the limited capacity of its memory.

Symbols, materialized in paper, not only help memory, but also induce new suggestions, propelling thought into operating in another dimension.

Actually, the computer can be no more than a vastly more complex and powerful device than a pencil. And it is well known that, without it, numerous scientific discoveries would not have been possible: from chemistry, to genetics, to fractals' geometry. It is also known that without its huge ability to manage data and to perform calculations in real time, the Space Age simply would not have begun!

The computer, therefore, reveals itself in its materiality as a cognitive instrument: a device used to amplify the memory and reasoning of the human mind. It also reveals itself as a powerful research instrument, which according to Heinz Pagels will open for us the doors of the "kingdom of complexity":

> Thanks to its ability to process and manage huge amounts of information in a mechanical and safe fashion, the computer as scientific research tool has already revealed to us a huge universe. This universe was not accessible before, not because it was small or distant, but for being so 'complex' that no human mind could devise it (406).[131]

Actually, we must not regard scientific instrumentation as just a set of material artifacts—such as the microscope or the telescope, which grant us access to the micro and macro-cosmos. According to Pagels, there are also cognitive instruments—or mathematical techniques. For instance, Riemannian geometry, the geometry of curved spaces, was the cognitive instrument allowing Einstein's *Theory of General Relativity*. Therefore, one may (while borrowing the fortunate expression by Adriano Duarte Rodrigues) refer to a permanent "short-circuit" between technique and science:

131 See Appendix 11 for original Portuguese.

> In this sense we may nowadays say that scientific knowledge depends increasingly more on what is possible to achieve in a Lab, on what observation and experimentation instruments allow us or stop us from knowing (86).[132]

Innovative software, based on finely elaborated logical or mathematical algorithms, has allowed scientists to solve problems previously impossible to solve or to process. Computer software, therefore, appears as the real cognitive instrument from the realm of complexity.

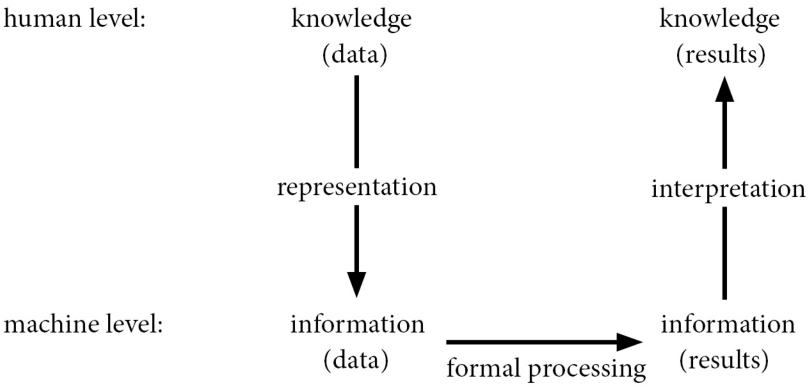
This does not consider replacing human intelligence for mechanical intelligence—the computer is a simple complexity telescope. Rather, it regards proposing the symbiosis of man/machine: if the computer amplifies our memory, its instrumental reason also improves the normal range of human intelligence.

If the microscope and the telescope were once extensions to our sensory ability in the micro and macro-cosmos domain, now the computer becomes undeniably an extension for intellectual abilities in the realm of complexity. Also in this perspective, when applied to the particular field of Art, we will consider it as a complexity extender.

It matters little if it simply manipulates characters, as considered by some more radical informatics technicians—the human mind is there to interpret, under the form of ideas, the material signals it may supply in a renewed fashion. It is not even necessary to acknowledge that the machine requires understanding images or new ideas in order to produce them. The human user will always be present at the end of the process to receive them with his intelligence and comprehension.

The machine is merely required to labor on the pure, formal level with the supplied materials (linguistic or others), so that from its manipulation through the program may result new ideas. Not for the machine, obviously, but for us! This procedure could be represented through the following scheme (Arsac 65):

132 O.P.: "É neste sentido que podemos hoje dizer que os conhecimentos científicos dependem cada vez mais daquilo que é possível realizar em laboratório, daquilo que os instrumentos de observação e de experimentação tornam possível ou impossível saber."



Computer generated literary creation is prevented from producing semantic effects (knowledge/results), not because the machine only manipulates linguistic information in its pure graphical materiality (information/data), but because the meaning of such effects are apprehended by humans, self-defined as intelligent users of devices and instruments.

Computer generated literary creation, unlike artificial intelligence (resolved the early cyberneticists' ambitions) does not require simulating the whole creative activity. It may be done (while sufficing operability as verifiable) through the simple formal manipulation of verbal language. Given that the apprehension of meaning is always performed by man, the machine is merely required to manipulate linguistic structures with literary effect!

In the scope of Computer-generated Art, there is little support to explore if the machine requires intelligence, aesthetic sensitivity, or creative power in order to generate effects with new meanings. Rather, it suffices that the algorithm for the program is able to produce these effects through the simple formal manipulation of artistic language.

The only issue legitimately remaining seems to be whether or not it is possible to use computers to run programs with creative potential. If so, computer generated artistic creation may accurately be discussed.