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► **To cite this version:**

Jean-Gaël Barbara. THE CONSTITUTION OF SCIENTIFIC IMAGINATION: THE CYBERNETIC IMAGINARY WORLD OF JEAN PERDRIZET (1907-1975). *L'imagination dans les sciences*, In press. hal-04297612v2

HAL Id: hal-04297612

<https://hal.science/hal-04297612v2>

Submitted on 26 Mar 2024

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Author's translated version of : J.G. Barbara, 2024. "La constitution des imaginaires scientifiques: L'imaginaire cybernétique de Jean Perdrizet (1907-1975)", in C. Chérici (ed.), volume on imagination forthcoming.

THE CONSTITUTION
OF SCIENTIFIC IMAGINATION
THE CYBERNETIC IMAGINARY WORLD
OF JEAN PERDRIZET (1907-1975)



Jean PERDRIZET in 1927.

BY

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INTRODUCTION

The new history of science studies on imagination are mainly devoted to historical investigations of the conceptions on imagination as a psychological faculty. The long-standing question of its role in science is much less debated. However, this latter theme regularly reappears in a sometimes conventional manner, generally through the study of one or a few author(s), with little overall vision of the theme, and often paying lip service to a very incomplete version of Gaston Bachelard's conceptions of the subject¹.

A paradoxical common feature of these texts, whether recent or written over the last two centuries, is the adoption of the term "imagination" in the titles and the concomitant paucity of its occurrences in the developments. Imagination is most often taken to be a *term*, rather than a *concept*, which redefines another – sometimes attempting to make the latter a concept – such as intuition, scientific creation, the construction of mental images and representations, or any a priori knowledge independent or partially detached from experimental practice. For all these reasons, this field of research remains relatively unstructured.

The theme of the role of imagination in science developed in the scholarly world, particularly in the second half of the 19th century. As early as 1859, the physiologist and surgeon Sir Benjamin Collins Brodie (1783-1862), then President of the *Royal Society*, gave a speech in which he famously referred to the role of imagination in physics². It became a classic quotation, notably by the Irish physicist

¹ Bachelard developed a veritable theory of the imagination if we consider his entire body of work, and not just the works of the 1930s. He defines the role of imagination in science as a faculty of abstraction through the deformation of images, regulated by scientific rationalism. See in particular Edward K. Kaplan. Gaston Bachelard's philosophy of imagination: An introduction, *Philosophy and Phenomenological Research*, 33, 1972, 1-24 and Sandrine Idlas, *Bachelard: l'objectivité scientifique d'un point de vue constructiviste, entre imagination et raison*, Södertön University, School of Culture and Communication, thesis. This underestimated dimension of Bachelard's work has been somewhat forgotten today; yet it was noted very early on, with a simultaneous awareness of the opposition and ambiguous complementarity between science and dream, scientific creation and poetics. See in particular Jean Hyppolite. Gaston Bachelard ou le romantisme de l'intelligence, *Revue Philosophique de la France et de l'Étranger*, 144, 1954, 85-96.

² Brodie writes: "Lastly, physical investigation more than anything else helps to teach us the actual value and right use of the Imagination – of that wondrous faculty, which, left to ramble uncontrolled, leads us astray into a wilderness of perplexities and errors, a land of mists and shadows; but which properly controlled by experience and reflection, becomes the noblest attribute of man [...] the instrument of discovery in Science [...]". Quoted in John Tyndall, *The scientific use of the imagination. Discourse delivered before the British Association of Liverpool on Friday evening, 16th September, 1870*, second edition. London, Longmans, Green and Co. 1871. The quotation from

John Tyndall (1820-1893) in a lecture on imagination³. Tyndall describes it as a psychic faculty, little cultivated in his view among aristocrats, whose role he demonstrates in certain discoveries in physics, showing that it is necessary for constructing the images that give meaning to the mathematical expressions of physical phenomena⁴. This conception of the imagination makes it an elective power of abstraction that can be interrogated, according to Tyndall, to gain insight into the outcome of thought experiments in microscopic physics.

From a historical point of view, while there are far more essays on the imagination in general in the 19th century than in the following century, Tyndall's kind of analysis becomes classic in the English-language corpus between 1860 and 1940⁵. And this tradition endures to this day in dotted lines, tending to become a theme developed not only by important players in science, but also by historians and philosophers.

I. Imagination and the constitution of scientific imaginary worlds

1. From the study of imagination in the sciences to the concept of scientific imagination

In the wake of Tyndall's much-commented essay, the demonstration of the value of imagination in science became almost a circumstantial discourse in the scholarly world⁶, opposing a concept of scientific imagination entirely restrained by reason⁷ and defending the speculative mode of thought. This discourse found its way into

Sir Benjamin Collins Brodie is missing from the first edition and therefore probably from the original 1870 speech.

³ John Tyndall returned to this issue in a lecture given to the British Association for the Advancement of Science in Liverpool on September 16, 1870. John Tyndall, 1871, *op. cit.*

⁴ John Tyndall, 1871, *op. cit.*

⁵ Take, for example, the evolution of occurrences of the expression *scientific imagination* (Ngram viewer).

⁶ For example, John M. Tyler, The Culture of the Imagination in the Study of Science, *The School Review*, 6, 1898, 716-724.

⁷ In positivist philosophy, taken up by Claude Bernard in his *Introduction à l'étude de la médecine...*, scientific knowledge proceeds from sensation, but in a way guided by reason, and above all by the control of experience. In the 1930s, Gaston Bachelard would again defend the idea that the scientific imagination (the ability to rationally transform images) must be controlled entirely by experience and reason. The primordial role of experience was developed in the context of natural philosophy in a way defended by Descartes.

the philosophical sphere⁸, and also became an incentive for writers to bring science and literature closer together⁹. However, in 1920, the English physicist and philosopher of science, Norman Robert Campbell (1880-1949), criticized in accord with our view both philosophy for having underestimated the role of imagination in scientific discovery in the 19th century, and scientists, whose discourse on imagination he deemed disastrous¹⁰!

In addition to these texts, which are not very interesting indeed, it would be possible to sketch a history of the role of imagination in science, as Michel Paty did in a few stimulating lines¹¹, noting that the rise of psychophysiology and experimental psychology have favored what he calls the "epistemological loosening between the conceptual and the empirical"¹² and which he studies for the lineage between Helmholtz, Mach, Poincaré and Einstein.

In this article, Michel Paty notes the persistent scarcity of historical studies on the role of imagination in science; but he cites the works of Gerard Holton (b. 1922) and Arthur I. Miller (b. 1940), which were highly innovative when they appeared in 1978 and 1984 respectively¹³. These two works, which are not independent because of their links within the Harvard University's Physics and History of Science Departments, address two different aspects. The most recent, Miller's, is devoted to paradoxically older perspectives, with a cognitive psychology dimension that Gerald Holton had encouraged in Miller's work¹⁴ and that Holton

⁸ William A. Gerhard, Natural Science and the Imagination, *The Thomist*, 16, 1953, 190-216. William A. Gerhard (1915-1964) was then Professor of Philosophy at *Brooklyn College* (New York).

⁹ Thomas Sergeant Perry, Science and the Imagination, *The North American Review*, 1883, 137, 49-56. The author develops the idea that science will influence the style of literature, and that the precision of its knowledge will develop rather than destroy writers' imaginations.

¹⁰ Norman Robert Campbell, *Physics: the Elements*, London, University Cambridge Press, 1920, chap. 8.

¹¹ From Descartes, Locke, Condillac, Berkeley, Diderot, d'Alembert, Hume and Kant, to Ampère, Helmholtz, Mach, Pierce, James, Poincaré and Einstein. See Michel Paty, « La création scientifique selon Poincaré et Einstein » in Serfati, Michel, ed, *La recherche de la vérité*, ACL – éditions du Kangourou, p. 241-280, 1999.

¹² *Ibid.* p. 6. This is the pagination of the *hal* version of the article (halshs-00167297).

¹³ *Ibid.* p. 10, note 34. Gerald Holton, *The Scientific Imagination. Case Studies*, Cambridge University Press, 1978; Arthur Miller, *Imagery in scientific Thought. Creating 20th Physics*, Birkhauser, Boston, 1984.

¹⁴ Arthur Miller, 1984, *op. cit.*, *Acknowledgements*, unpaginated. Miller notes that this perspective had previously been suggested by Jacques Hadamard (1954), Gerald Holton (1973), Thomas S. Kuhn (1962), Peter Medawar (1969), Jean Piaget (1970), and Max Wertheimer (1959). See Arthur Miller, 1984, *op. cit.* p. 4. Holton made this the subject of an article on Einstein's genius: Gerald Holton, On Trying to Understand Scientific Genius, *The American Scholar*, 1971-1972, 41, 95-110. Despite this, Miller's work was the subject of numerous highly critical reviews (J.-P. Mathieu, Makepeace Tsao, John Blackmore, William R. Shea).

had touched on a little earlier¹⁵. Miller deals with the epistemologies of Hertz, Poincaré, Einstein and Boltzman to show the essential dimension of image formation for scientific thought and creation, without citing either Tyndall or the work of Bachelard. However, he joins them in considering that images are not secondary objects of thought, since in modern physics, thought in images, necessary for understanding phenomena, evolves to construct a microscopic world, beyond the reach of the senses and in interaction with the mathematical thought of scientific theories.

For his part, Gerald Holton had distanced himself from such issues by the early 1970s, no doubt because he considered them of little interest in understanding scientific discovery¹⁶. Through two books¹⁷, Holton defends the idea that scientists construct science according to stable and diffuse *themata*, which, according to him and some of his readers, are implicit beliefs, regulatory ideas, speculative criteria, prior interpretations, untested hypotheses, presuppositions, philosophical positions, epistemic values, key insights, scientific statements, preconceptions, viewpoints or, more broadly, or cultural roots.

For Holton, this is the basis for better interpretations of the genesis of scientific creation in case studies, and the underlying concept of imagination seems to us to be backed up by two more precise ones, which we define as, on the one hand, the concept of the set of philosophical, scientific and epistemic norms and values and, on the other, the concept of a set of scientific, philosophical and, more broadly, cultural values and representations, which refer to a *scientific imaginary world* that lies outside science. In fact, many of the approaches that preceded Holton's work had already dealt in one way or another with this type of consideration in the fields of philosophy, the history of science and psychology. In 1961, over a thousand recent and older references appear in a bibliographical survey of the field¹⁸.

¹⁵ Gerald Holton, 1971-1972, *op. cit.*

¹⁶ See Holton's quotation in Arthur Miller, 1984, *op. cit.* p. 4-5. However, Holton considered the concept of visual imagination again in a 1993 study, but from a strictly history of science perspective; G. Holton, On the art of scientific imagination, *Daedalus*, 125, 1996, 183-208.

¹⁷ G. Holton, *Thematic Origins of Scientific Thought. Kepler to Einstein*, Cambridge, Massachusetts, University Harvard Press, 1973 and Gerald Holton, 1978, *op. cit.*

¹⁸ Mildred Brenton, *Creativity and invention in the physical sciences: An annotated Bibliography*, Washington: U.S. Naval Research Laboratory, 1961. References include R.D. Carmichael, *The Logic of Discovery*, Chicago: Open Court Pub. And Co., 1930 (on certain modes of scientific creation by the imagination that are not part of a logic of discovery); Egon Stephen Merton, *Science and Imagination in Sir Thomas Browne*, New York: King's Crown Press; London: Geoffrey Cumberlege, 1949; M. I. Stein, Creativity and Culture, *J. Psych.*, 1953, 36, 311-322; O.T. Benfey, The role of imagination in science. Van't Hoff "s inaugural address, *J. Chem. Ed.*, 37, 1960, 467-470. This review overlooks Marjorie Hope Nicolson's (1894-1981) *Science and Imagination*, Great Seal Books / Cornell University Press, 1956.

2. A concept of scientific imagination

Holton's ideas have prompted some historians of science to take imaginary worlds into account in scientific creation, but more often than not this concept has been little explicated. At first glance, for an individual, an imaginary world is a psychological function, as with G. Bachelard or G. Simondon, for example¹⁹. If imagination is seen as a creative psychic process, an imaginary world is, according to Bachelard, what produces the "value of images", their "halo", which can be considered as the set of emotions with positive or negative valences attached to representations, and their interdependent relationships that make them resonate with each other in the mind to a greater or lesser extent.

The imaginary world thus accounts for the forms of sensibility in the association of representations, their modes of genesis, and enables the imagination, as a dynamic creative process of imaginary worlds, to be "open" and "evasive". If we adopt the concept of the imaginary world as a set of representations associated evasively according to a certain sensibility and creating fictitious worlds, it is then possible to consider the imagination as a creative mode of functioning and constitutive of this imaginary world, but also a mode of intelligence to the world partly detached from reality, whose essential property is its free dynamism that blossoms between memorized representations, new sensations and creation of new representations.

It is therefore possible to define the imaginary world of an individual, in relation to certain scientific themes, as the totality of their representations, which are most often first structured unconsciously as fiction, in a narrative that can take on the dimension of a personal myth, partially detached from reality, which structures this imaginary world and gives it meaning in relation to the history of the individual. This myth often functions as an a posteriori system of rationalization for an individual seeking to redefine his or her relationship with the world. This is true of everyone, but more dramatically so of a creator of *art brut* whose fiction is a necessity of life. This is how we can speak of Jean Perdrizet's cybernetic imaginary world, a scientific imaginary that takes the form of a cybernetic utopia of communication with the dead, the function of which was for him to become the engineer he was unable to be in reality, but only for himself and those close to him who were not fooled by it²⁰.

¹⁹ Gilbert Simondon. Imagination and invention. *Bulletin de psychologie*, 19, 1965, 230-237, 395-414; 19, 1966, 916-929, 1074-1095, 1184-1205.

²⁰ J.G. Barbara, *Art brut et science: l'utopie cybernétique de Jean Perdrizet (1907-1975)*, Paris, Hermann, 2021.

More generally, a collective scientific imaginary world can be defined as a set of shared representations referring to technical objects and projects, scientific actors, theories, and the vision of a future envisaged as the fiction of technical, scientific and humanistic progress. These scientific imaginary worlds can be studied on the basis of any material produced by a society: newspapers, literary works, magazines, films, and productions of *art brut*, etc. Like the individual imaginary world²¹, the collective imaginary is not a simple assemblage of representations, for it always draws in fiction a certain vision of the world in its present and future states, so that the study of all these imaginaries can be of interest to the historian of science in order to understand their role in scientific creation and reveal how science in turn produces its own.

3. What is a cybernetic imaginary?

A cybernetic imaginary, whether individual or collective, is an imaginary relating to the science produced by the cybernetics scientific movement of the 1940s and 1950s. These imaginary worlds are built around the scientific and technological elements that spread throughout society, in the form of themes taken up in science fiction or popular science articles, for example. These themes revolve around the central idea of cybernetics: the control and regulation of complex living and artificial systems through the manipulation and transfer of information. The resulting imaginary worlds are therefore essentially centered on the concept of the machine (calculating machines, robots) and that of communication (between man and machine, between machines), in a way that recycles the pre-cybernetic imaginaries of calculating machines and the myth of the communicating robot, from the 1920s and 1930s.

In an unpublished thesis defended in 1999, Sheryl Hamilton²² proposed to define the concept of "cybernetic imaginary" as both a *discursive formation* and a *sensibility*²³. Michel Foucault's concept of discursive formation can in fact be declined in multiple forms²⁴, and in our case, to characterize an imaginary by a set

²¹ For Simon Bréan, the elements of the imaginary "are not limited to themselves; they outline the laws of the world of which they are a part, whether from a strictly physical point of view or in terms of the human uses they provide an opportunity to observe"; Simon Bréan, « Considérations sur l'imaginaire scientifique : le cas de Rudyard Kipling », *Somnium*, Rudyard Kipling et l'enchantement de la technique, 2009, 139-149, halshs-03358202.

²² Sheryl N. Hamilton is *Canada Research Professor and Associate Professor in the School of Journalism & Communication and the Department of Law & Legal Studies at Carleton university.*

²³ Sheryl N. Hamilton, *Interrogating the Cybernetic Imaginary: Or Control and Communication in the Human and the Machine*, thesis of the department of communication studies, Concordia university, Montreal, 1999.

²⁴ For the use of the concept of *discursive formation* in the history of science, see for example J.G. Barbara, *La naissance du neurone*, Paris, Hermann, 2010, p. 229-230.

of representations that depend on the same conditions of existence and the same modes of constitution that guarantee their unity. A cybernetic imaginary can therefore be defined as the set of shared conceptions concerning artificial machines and man-machine communication. It can also reflect a *sensibility*, insofar as the conditions of formation of these representations bear witness to deep-seated specific interests – sensibilities – in machines, in their capacities for regulating, thinking and communicating with man, but also in their mechanisms, seen as possible models of human cognitive faculties.

In a Foucauldian perspective, Hamilton adds a necessary social dimension to these conceptions of the cybernetic imaginary, referring to this concept as a "cultural formation" to reflect the fact that its constitution depends on social relations, especially between scientists, journalists, writers and the general public, and that it itself in turn possesses a certain social power²⁵.

With his object thus defined, Hamilton was able to describe the phases in the constitution of an American cybernetic imaginary as essentially constituted around the concept of thinking artificial machines, enriched by its collusion with the concept of the computer, capable of computation and artificial intelligence, from a perspective reinforced by the concept of the game algorithm²⁶. This parallel between the thinking machine and human thought is established both in science and in its imaginary, through functional equivalences in terms of capabilities, but also through research into equivalence of structures of artificial systems in the human brain. Such a sensibility to this kind of rapprochement enables us to envisage communication between man and machine in a new way, transforming the future into a field of knowledge like any other, in which the concept of communication has a central place and enables us to make legitimate claims to representations of a dreamed future that carries a political and religious utopian dimension.

This development then joins what is referred to as the *cybernetic imaginary*, i.e. the realm of science fiction that envisages complex scenarios of future relations between man and robot as life on earth evolves, against a backdrop of an apocalyptic vision of its final demise, and with the utopian escape featuring self-

²⁵ For example, in the definition of standards linked to the aptitudes of complex artificial systems, suggesting that the autonomous machine would be more effective than human regulation, as was recently the case with NASA's *Dart* mission in the final phase of the automation-optimized approach of a spacecraft destined to crash on the asteroid Dimorphose on Monday September 26, 2022, with a view to diverting it from its trajectory.

²⁶ Like the electronic chess sets of the 1970s and before.

replicating robots invading space from earth, capable of transporting the souls of departed humans²⁷.

4. Modes of constitution of cybernetic imaginaries

Recently in 2017, Sheryl Hamilton returned to the research theme of the American cybernetic imaginary, indicating that the study of its constitution was still neglected even though a number of authors had focused on the relationship between cybernetics and American society²⁸.

Hamilton does not go back over the arguments of her thesis, but she does develop two new ideas: that the development of the cybernetic imaginary was not accidental, although not necessarily inevitable, and that this development owed much to the central figure of Norbert Wiener and his representations as a scientist in society²⁹.

In fact, it is common to consider that cybernetics itself, but also from our point of view the constitution of its imaginaries, were determined by a conjunction of scientific evolutions in non-accidental interactions around the concepts of the calculating machine and the computer, and by the rise of the respective imaginaries of these evolutions before and after the development of cybernetics. So, while Norbert Wiener certainly played a central role in the spread of cybernetics in society, concomitant with the blossoming of its imaginaries, the latter depended just as much on sensibilities and modes of constituting representations that actually pre-existed cybernetics and Wiener himself. The cybernetic imaginary is thus also constructed on the basis of broad representational social constructs, some of which predate cybernetics. Indeed, society should not be seen as a passive magma receptive to the novelties of science, which would degrade them into popular imaginaries, but rather as the origin of old and present imaginaries that sometimes anticipate, if not science itself, at least its new imaginaries.

²⁷ See, for example, Patricia S. Warrick, *The Cybernetic Imagination in Science Fiction*. Cambridge: The MIT Press, 1980. See also, in connection with Jean Perdrizet's work, J.G. Barbara, 2021, *op. cit.* p. 278-288.

²⁸ Sheryl N. Hamilton, The Charismatic Cultural Life of Cybernetics: Reading Norbert Wiener as Visible Scientist, *Canadian Journal of Communication*, 42, 2017, 407-429.

²⁹ Hamilton considers this idea by studying the figure of N. Wiener through the prism of the *visible scientist* concept. Hamilton, 2017, *op. cit.* Other authors also consider representations of Wiener: Pierre Cassou-Noguès, Norbert Wiener dans la presse américaine : une figure du bon savant fou, in Hélène Machinal (ed.), *Le savant fou*, Rennes, Presses universitaires de Rennes, 2013, p. 389-406.

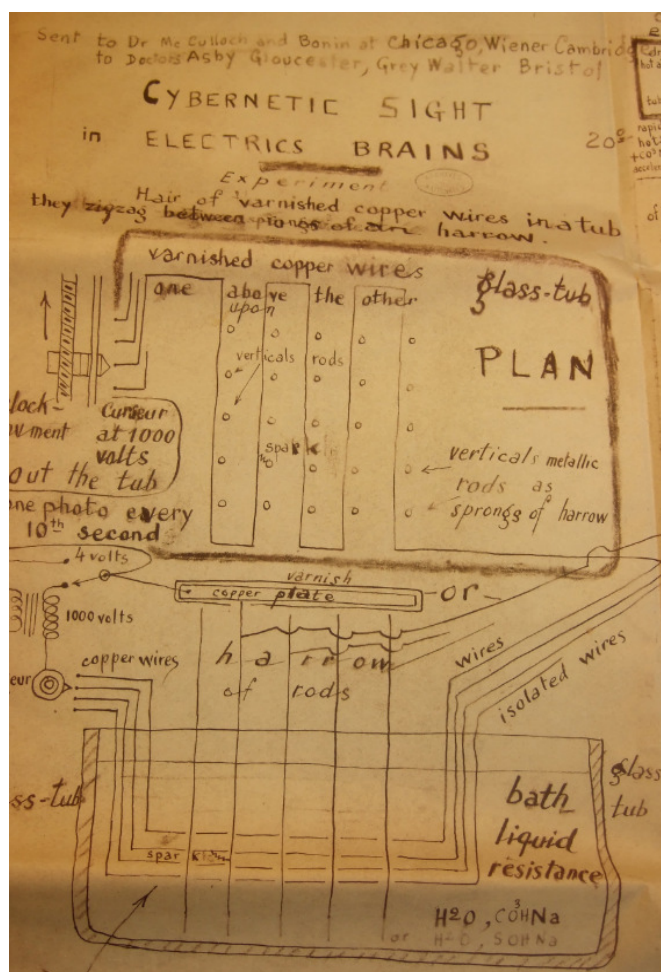


Figure 1. Drawing “cybernetic sight in electric brains” which is the English translation of *Parapsychologie cybernétique – résonateur lecteur – cerveau électrolyte – robots astronautes auto-reproducteurs* (Archives nationales). The drawing mentions at the top : “Sent to Dr [W.S.] McCulloch and Bonin at Chicago, [N.] Wiener Cambridge, to Doctors Asby [W.R. Ashby] Gloucester, [W.] Grey Walter Bristol”.

This is certainly the exact lesson that is reinforced by the analysis of the work of *art brut* creator Jean Perdrizet (1907-1975)³⁰, as it reveals how his imaginary gradually resonates with the collective cybernetic imaginary and anticipates it through conjunctions of earlier imaginaries from the 1930s, also at work in cybernetic imaginaries (Figure 1). These include the imaginary of the

³⁰ J.G. Barbara, *op. cit.*, 2021.

thinking machine (the calculating machine of the 1920s and 1930s), the imaginary of the intelligent, imaginative robot (the robot myth of the 1920s), the imaginary of life after death and universal communication between human or artificial spirits (collusion between spiritualism, T.S.F.³¹ and electroencephalography in the 1930s).

The central idea of cybernetics and its imaginaries therefore do not originate entirely in science, but also derive to a very large extent from immediately anterior, synchronous and posterior imaginaries located outside science, and presenting in their collusions a dynamic of their own that blends scientific, technological, spiritual and metaphysical aspects.

II. Jean Perdrizet's "cybernetic imaginary *before* cybernetics

1. Reconstructing the scientific imagination of Jean Perdrizet (1907-1975)

The *art brut* work of Jean Perdrizet (1907-1975), an assistant engineer of the *Ponts et Chaussées* civil engineering department, reveals the forty-year development of a cybernetic imaginary rooted in certain scientific themes of the 1930s, the dynamics of which can be reconstructed through a chronological analysis of the work³².

The chronology we have established for this work, by examining the biographical background of its author, by dating the works and by analyzing the scientific and spiritual interests at stake, is the fruit of our ten years' work. This work involved cross-referencing several sources of information and, above all, meticulously analyzing the large-scale drawings, teeming with interesting details, as well as the correspondence on the backs of these drawings. Inspection of the handwriting was necessary to reconstruct the chronology of the various parts of the drawings, which were annotated several times, sometimes more than ten years apart.

These drawings are actually copies of unpreserved originals, assembled in large formats in the 1950s-1960s and sometimes undated. This complex chronology makes it possible to follow the evolution of scientific themes developed in a singular way by Jean Perdrizet (electrical thought, universal languages, electrical communication between minds, the robot), according to a cybernetic sensibility and

³¹ Wireless telegraphy using Morse code to receive and transmit radio signals.

³² For a complete analysis of this work, see J.G. Barbara, 2021, *op. cit.*

modes of constitution that gradually merge with those of the collective American cybernetic imaginary analyzed in a global way by Sheryl Hamilton.

2. The pre-Cybernetic imaginary of the electric mind by Jean Perdrizet

Jean Perdrizet was the eldest son of two schoolteachers; at the age of fifty, his father became a tax collector through a competitive examination, which testifies to a certain ambition found in other members of his family and in Jean himself. His background was characterized by a seemingly conformist atmosphere, but with a Freemason father and a whole family very interested in religion and spiritualism, in a favorable socio-cultural context. Jean became a gifted pupil, with an even greater interest in science and technology, and an interest in flying machines, initially in the tradition of Leonardo da Vinci, building a plan for a human-powered helicopter³³ as early as 1923, at the age of sixteen (Figure 2.).

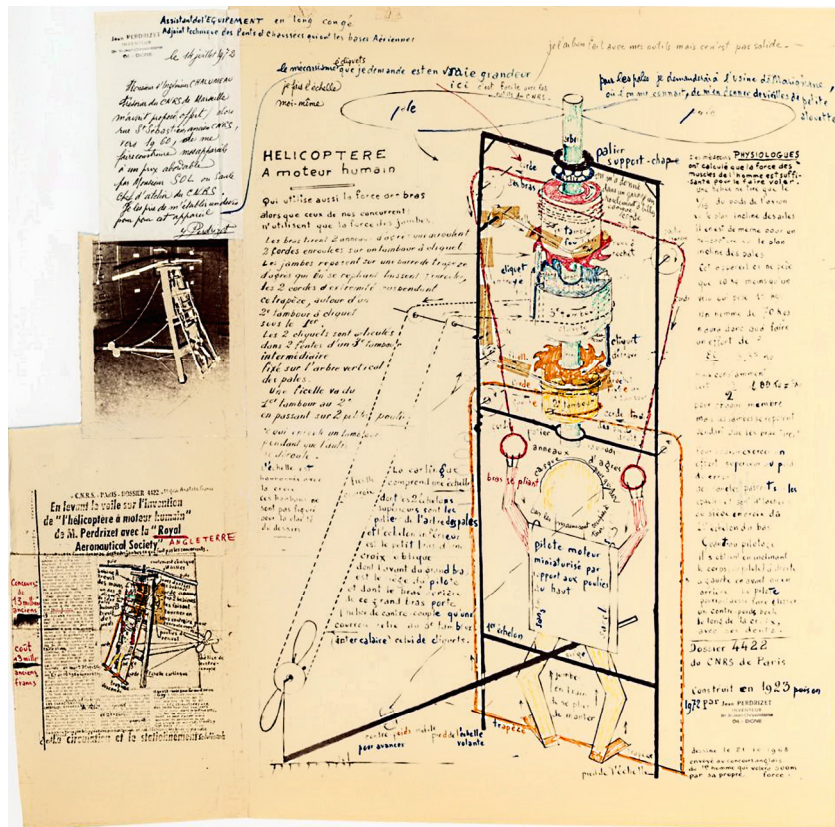


Figure 2. Drawing *Hélicoptère à moteur humain* , 95 × 75 cm, 1968, musée de Lille, LaM.

³³ Drawing *Hélicoptère à moteur humain* (Helicopter with human engine), 95 × 75 cm, 1968, Musée de Lille, LaM, bearing the inscription "Built in 1923".

In 1931, Jean became an assistant engineer at the *Ponts et Chaussées*, where he worked at the drawing board and began his professional life on construction sites in 1934. At the same time, Jean began his personal drawings as soon as he received his diploma, and his fragile personality was already evident in the contradiction between, on the one hand, his dream of becoming an engineer at all costs, thwarted by the difficulty of the competitive examination, which finally led him to opt for the easier assistant engineer competition, and, on the other hand, his refusal, linked to his attachment to his family, to enter the corps of engineers he was offered in 1931 on condition that he agreed to go and work in the French colony of Madagascar.

Between 1932 and 1935, Jean Perdrizet developed the first part of his work in two main directions: the creation of machines capable of "electric thought" with supposed cognitive capacities, and the constitution of a universal language. For the time being, the two projects appear to be separate, although they are later consubstantially associated in Jean's imagination of man-machine communication through a specific language he himself designed. But these projects were already being developed in such parallel fashion in the 1930s that it may be legitimate to think that Jean already had in mind the collusion of these themes to imagine forms of universal communication to the point of enabling that between man and machine, in the future perspective of cybernetics.

The drawing montage most emblematic of the electric thought project is the drawing for the Christian Berst gallery entitled "Véritable cerveau photo-électrique"³⁴ (Figure 3). It consists of eight sheets assembled linearly. The first addresses the theme of a digital camera using photoelectric cells as an artificial eye to film the hammering motion of a forge hammer. For Perdrizet, the transformation of the image into a matrix of photocell intensity values is interpreted in the second sheet as the "transmission of coordinates to 4-dimensional films" and paralleled, by a later annotation from 1971, with the "principle of the punched card"³⁵.

³⁴ « Véritable cerveau photo-électrique » 31,5 × 167,4 cm, galerie Christian Berst. This drawing is among the first of Jean Perdrizet's and is part of the scientific section of his personal project of a Ph.D. thesis. Several written mentions allude to the years 1934-1935 for this project : « Please find very old drawings I made in 1935 » (Letter dated November 30th 1971 to José Argémi, on the back of the drawing « Véritable cerveau photo-électrique ») ; « Principe de l'exploration en 1934 de la chambre noire » (first sheet of the drawing « Intégraphe automatique »). For other mentions see J.G. Barbara, *op. cit.*, 2021.

³⁵ For Jean, the digital image becomes the programming that reactivates the real image in the mind, making it a memory or representation for a thinking machine.

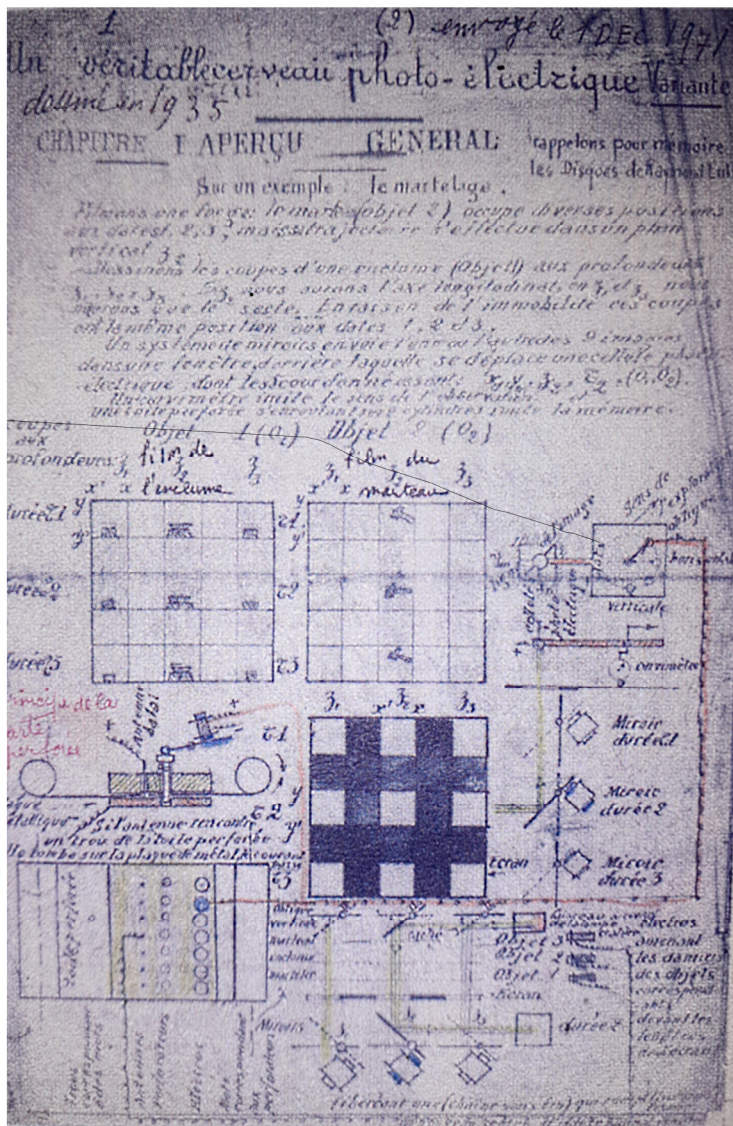


Figure 3. Drawing entitled *Véritable cerveau photo-électrique*, 31.5 × 167.4 cm, Galerie Christian Berst. On the back of the drawing is a letter dated November 30th 1971 to José Argémi: "Voici de très vieux plans que je dessinais en 1935" (Please find those very old plans I drew in 1935). This drawing is claimed by Perdrizet to contain plans drawn in 1935, like the one entitled "Rotation", with a letter dated 14 November 1971 to Argémi. This drawing, *Véritable cerveau photo-électrique*, contains a reference to "Chapter I", in neat Indian ink, in full and loose strokes. This is the original title of the drawing on this first sheet, the full version of which is "Chapter I – General Overview", with the words "True photo-electric brain" added below. This drawing concerns a filming process using photoelectric cells. The subject of the film being made in this drawing is the hammering process, with the repeated movements of a hammer being recorded. This drawing appears to be a starting point for this thesis, directly related to the work of the 1930s on photoelectric cells, such as that of Professor Jausseran.

There is also a direct link with the first trials of mechanical television, a television process using photoelectric cells to record images, the TSF to transmit them, and a mechanical wheel to play them back on film. From this starting point, Jean immediately envisaged a cognitive problem, namely that of creating, from the film of an object, other images of that same object, but after a translation or rotation of the film, according to a cognitive neuroscience theme. For Jean, these image transformations have two implicit interests. Firstly, they are a way for a robot, or artificial thought, to imagine an object during a fictitious movement. Secondly, it provides a mechanism for recognizing a known object, whose image is stored, but in any position. We hypothesize that the scientific part of Jean's thesis, which he is secretly imagining, includes both assemblies of drawings from the 1950s and drawings from the 1930s and 1940s featuring such electro-mechanical devices.

The third sheet is devoted in part to parallels between this artificial device and human thought in a cybernetic way. According to Jean Perdrizet, in such a machine with an artificial eye with photoelectric cells, "images would float like Epicurus' atoms in an inner space, coming together, associating with each other (associationist theory) [sic] cf. Bergson [sic]. In retrograde amnesia, memories that disappear from consciousness are preserved on the extreme planes of memory", which undeniably testifies to the same rationality in thinking about the human mind and the machine.

In the following pages, Jean Perdrizet considers certain cognitive aspects of his machine, whose "eye" is in fact an "explorer star" that enables a form of thought capable of grasping, memorizing and transforming images. For Bachelard, this capacity for transformation was the very faculty of imagination, and for us that of forging a dynamic representation that enables us to imagine and recognize – for example – an object from different angles of view³⁶. Perdrizet envisages creating this artificial capacity by finding mathematical equations capable of rendering the view of an object from one angle from another. Furthermore, in a cybernetic spirit, Jean interprets certain capacities of the human brain in the same terms as those used for his machine, when he writes that "the brain is a natural analytic geometry apparatus" that enables the "transformation of polar coordinates into Cartesian coordinates [...]". Finally, in a 1970 annotation to the same drawing, Perdrizet graphically recapitulates what he had already conceived as early as 1935: "In our mind, if we reverse a u, it becomes a c and then an n without maths, like grains hanging together spinning in the sewer".

But Jean Perdrizet does not envisage an artificial thinking device with an electric eye exploring its environment by simply taking random shots in all directions. For Jean, artificial thought must be capable of directed attention as it explores its environment, just as we do with ocular saccades. By 1934, Jean had invented what he calls a "principle of exploration" by means of an "explorer disk [with] rules of prehension from which will flow [sic] lust, desire, will, the search for means, the act finally, success or failure, joy or pain" and resulting in the generation of an "image store"³⁷. From the subsequent genealogy of Jean's mechanical principles of visual exploration, we can say that this principle of exploration is for him an active, conscious mechanism, involving an attentional process of the gaze, as a faculty shared between the artificial "ame [sic]" and the human mind.

³⁶ From the perspective of cognitive neuroscience. See, for example, for early studies on this subject: Shepard S, Metzler D. Mental rotations of three-dimensional objects, *Science*, 1971, 171, 701-703; Shepard S, Metzler D. Mental rotation: effects of dimensionality of objects and type of task, *J Exp Psychol Hum Percept Perform*, 1988, 14, 3-11.

³⁷ Drawing "Intégraphe automatique", 40.5 x 69 cm, Galerie Christian Berst, presenting Perdrizet's principle of visual exploration devised in 1934.

Jean developed yet another electrical thinking machine in 1935, based on a "rheographic tank" in his *Rétine électrolytique* drawing in the Musée Gassendi in Digne (Figure 4). This is a device currently used for practical physics work at school, comprising a rectangular glass tank filled with a copper sulfate solution and bordered on two sides by electrodes the width of the tank. The cuvette is placed on a piece of graph paper to provide a reference point for mapping the potential at all points of the solution in the cuvette, by dipping an electrode which is moved to each point. If a metal object is placed in the tank, the field lines are modified, revealing the shape of the object. This rudimentary technical process was used in the 1930s in the field of electron optics, and in particular for the development of the electron microscope. Jean used it to devise an alternative to photoelectric cells, with a view to building an "electric" artificial eye, which he saw as the organ of a thinking, imaginative robot capable of modifying images.

3. Jean Perdrizet's pre-Cybernetic imaginary of communication

During the same years, 1934 and 1935, Jean Perdrizet developed the project of a universal language in a way that was both classical and modern, i.e. by adopting Descartes' ancient project of a pasigraphy³⁸, while at the same time developing a language of his own with a view to making it easier for artificial thought to learn it, to recognize words and phrases and modify them to form new ones, to achieve a form of intelligence by developing the ability to create syllogisms.

Jean developed several languages between the 1930s and the 1970s. He created a first form of Esperanto, and then developed the idea of Estonian linguist Jacob Linzbach (1874-1953) of giving the value of a hieroglyph to simple characters, as in his "t language" of the 1940s. With regard to the 1930s period, Perdrizet's work has long been examined to see if there was an intermediate work between his first Esperanto of 1934 and his "Esperanto" of 1946³⁹. We recently found a page on the back of a sheet in the Christian Berst gallery, entitled "Formule de la clothoïde" (Clothoid Formula), written in pen and Indian ink, suggesting that it is a text from the 1930s (Figure 5). In this text, Jean describes an early form of universal writing based on hieroglyphics: for example, the word "house" is written with two parallel vertical lines and a thick circumflex accent for the roof.

³⁸ Marc Lebon, *Contra Automata: orgueil et préjugés?*, 2022, halshs-03555988v2.

³⁹ In other words, the "t language" with its 92 characters.

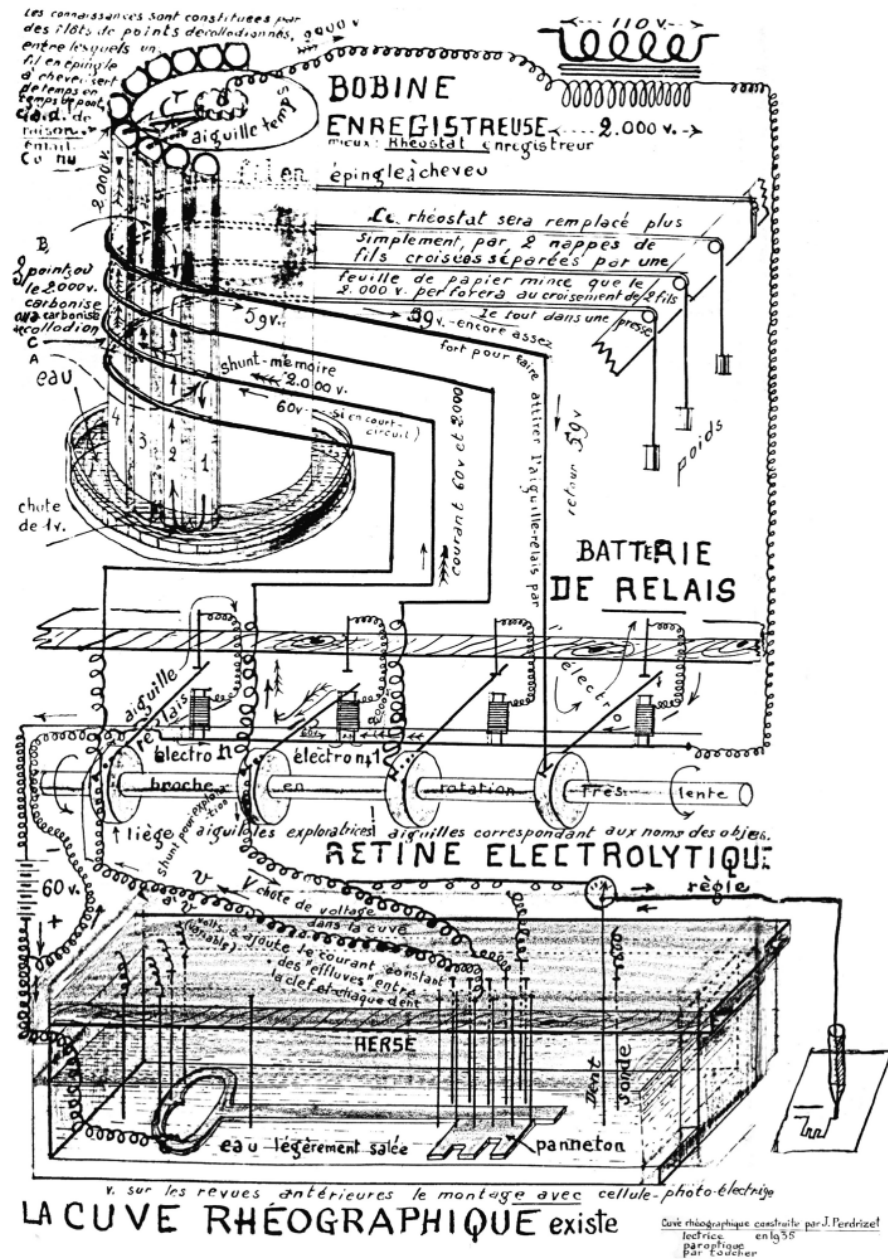
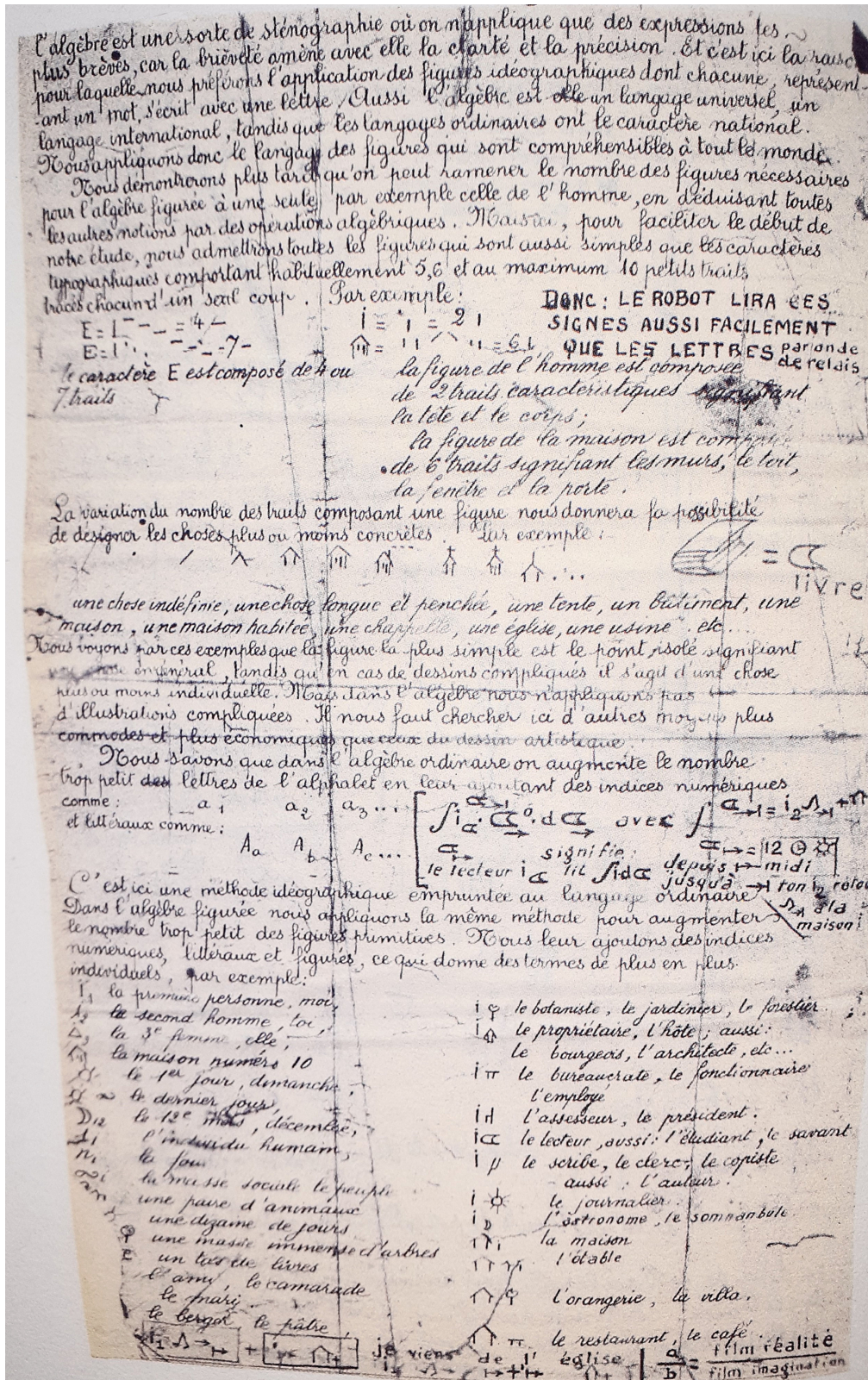


Figure 4. Jean Perdrizet's "rheographic tank" in his *Rétine électrolytique* (36,5 × 94,5 cm, 1959-1975, musée Gassendi) which he built when he was 28 years old in 1935 and which he considered the retina of a thinking robot. The complete drawing is made of four sheets: « rétine électrolytique », « batterie de relais explorateurs », le « couplage des relais avec la rétine » and « bobine enregistreuse ».

In this drawing, Jean explains his project: "Algebra is a kind of shorthand where only the briefest expressions are applied, because brevity brings with it clarity and precision, and this is why we prefer the application of ideographic figures, each of which represents a word, written with a letter. Algebra is a universal language, an international language, whereas ordinary languages have a national character. So we apply the language of figures that everyone can understand. Later, we'll demonstrate that the number of figures required for figurative algebra can be reduced to a single one, such as that of man, by deducing all other notions through algebraic operations. But here, to facilitate the beginning of our study, we'll admit all figures that are as simple as typographic characters usually comprising 5, 6 and at most 10 small lines each drawn in a single stroke"⁴⁰.

Figure 5 (next page). « Formule de la clothoïde », 30,5 × 19,2 cm, galerie Christian Berst. The text is : « L'algèbre est une sorte de sténographie où on n'applique que des expressions les plus brèves, car la brièveté amène avec elle la clarté et la précision et c'est ici la raison pour laquelle nous préférons l'application des figures idéographiques dont chacune représente un mot, s'écrit avec une lettre. Aussi l'algèbre est-elle un langage universel, un langage international, tandis que les langues ordinaires ont le caractère national. Nous appliquons donc le langage des figures qui sont compréhensibles à tout le monde. Nous démontrerons plus tard qu'on peut ramener le nombre des figures nécessaires pour l'algèbre figurée à une seule, par exemple celle de l'homme, en déduisant toutes les autres notions par des opérations algébriques. Mais ici, pour faciliter le début de notre étude, nous admettons toutes les figures qui sont aussi simples que les caractères typographiques comportant habituellement 5, 6 et au maximum 10 petits traits tracés chacun d'un seul coup. » "Algebra is a kind of shorthand where only the briefest expressions are used, because brevity brings with it clarity and precision, and this is why we prefer to use ideographic figures, each of which represents a word, written with one letter. Algebra is a universal language, an international language, whereas ordinary languages have a national character. So we apply the language of figures that everyone can understand. Later we will show that we can reduce the number of figures needed for figurative algebra to just one, for example that of man, by deducing all the other notions by algebraic operations. But here, to facilitate the beginning of our study, we will admit all the figures which are as simple as the typographic characters usually comprising 5, 6 and at most 10 small lines each drawn in a single stroke."

⁴⁰ This appears to be Jean Perdrizet's earliest text, explaining his approach to creating a universal script from the strokes of a figure, using a new system of composition and decomposition, in the manner of the numbers 0 to 9, which can be written as diodes or liquid crystals on old calculators, with a selection of the seven strokes all present in the number 8". Jean would imagine several systems for decomposing and recomposing characters with segments or arcs of circles throughout his work



Since 1934, Jean has been interested in Esperanto and what are now more widely known as international auxiliary languages. On the back of the drawing "Myographe" in the Christian Berst gallery, Jean mentions in his letter of July 9, 1971, sent to his friend José Argémi, that "a Russian, an esthonian [sic] of Rigal, Jacob Linzbach, in Paris in 1934 [and] 1940, had sent me his tongue, i = man because the dot is his head, [and the i without a dot] his foot [...]". On the same sheet, Jean suggests that he had already created the beginnings of his own Esperanto as early as 1934: "another [Russian] Wesivolov Tchestikin, former judge of the Tsars in Nizhny Novgorod [Gorky] had sent my Esperanto to Moscow to a museum where the books that are not printed are kept, in 1934 [...]". We also read: "A Czech at Prague University, Alexander Batek, sent me his language in 1935".

Jean Perdrizet's interest in universal languages is also rooted in the spiritualist sphere. As noted by Diane Zorzi⁴¹, Jean was familiar with the Martian hieroglyphic language of the famous medium Hélène Smith⁴². These interests explain Jean's pre-Cybernetic sensibility that a universal language must enable communication between man and non-human forms of intelligence, into which he almost indiscriminately lumps extraterrestrials, terrestrial robots and robots that man will send into space to reproduce autonomously.

Jean Perdrizet's work on language and communication in the 1930s enabled him to imagine communication between an artificial mind modeled on the human brain, and a human mind whose capacities were envisaged as arising from information processing comparable to those used in machines, in a way that anticipated the central idea of cybernetics and its imaginary world.

4. The pre-Cybernetic imaginary of *electrical* communication between minds

In 1936, Jean Perdrizet developed a new approach to artificial thinking, in the form of drawing (Figure 6) and an associated patent entitled *La pensée électrique*, registered with the Office national des recherches et inventions⁴³. Between Jean's earlier research and this one, the medical-scientific world was transformed by the

⁴¹ Diane Zorzi, in J.G. Barbara, 2021, *op. cit.*

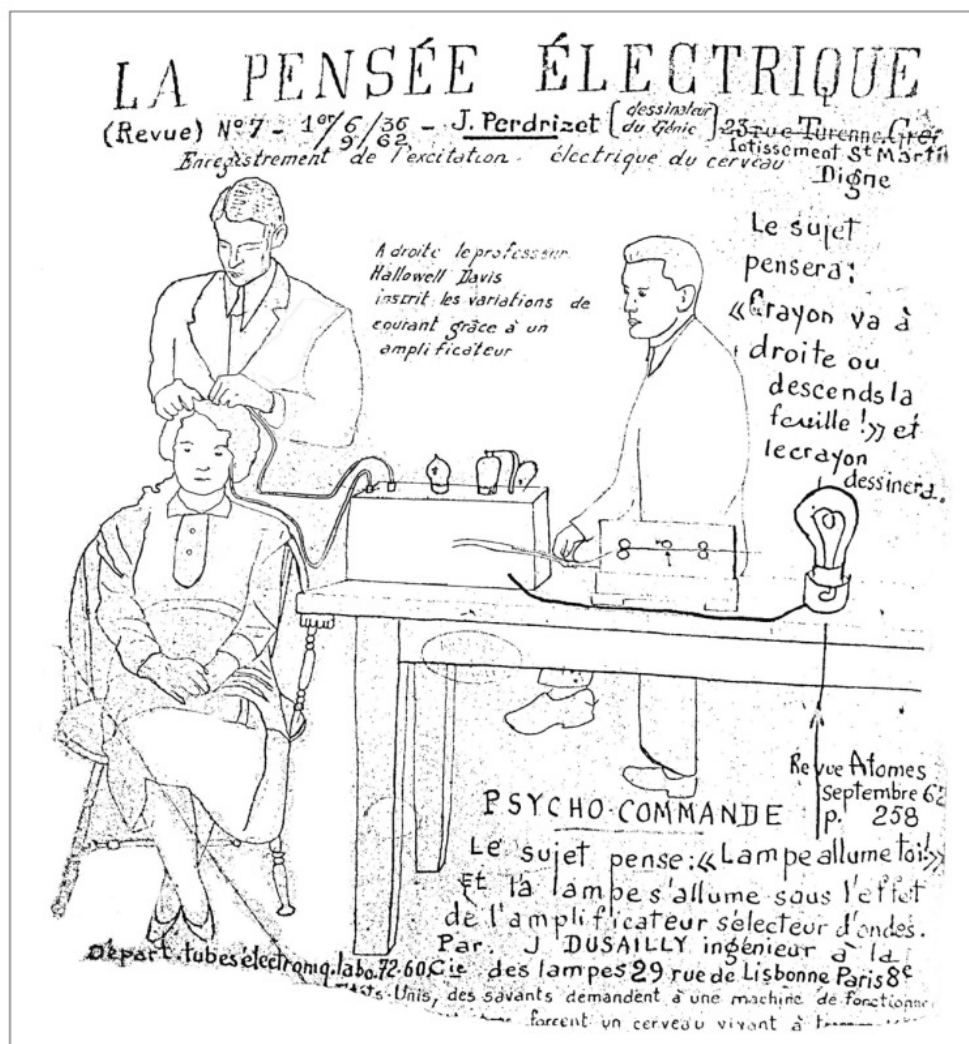
⁴² This is the language that Swiss psychologist Théodore Flournoy transcribed in 1900 in his book *Des Indes à la planète Mars, étude sur un cas de somnambulisme avec glossolalie*.

⁴³ A trace of this patent has been found at the Office National des Recherches et Inventions, file no. 46927, dated October 1st 1936; it is indeed mentioned in the CNRS "patents and inventions", with the mention "(46 927. 3/10. PERDRILET [sic, spelling error in the digitized document])" and the title "La pensée électrique". The file is empty.

introduction of the new technique of electroencephalography. This simple technique, which was able to demonstrate electrical brain waves on the scalp of an awake subject, was greeted with fervor by the general public at a time when interest in science was reaching a peak. There is a paradox, however, in that this reception is made through the prism of the spiritualist imaginary of the transmission of thought at a distance, supposedly dependent on brainwaves that has yet to be demonstrated.

In the early 1930s, electroencephalography demonstrated that conscious thought and intention could arise simultaneously with a physiological correlate of an electrical nature. The brain of a subject striving to think of nothing is in fact the seat of a slow, synchronous electrical activity, known as the "alpha rhythm", which disappears when the subject performs a mental calculation or strives to have the simple intention of doing so voluntarily.

Figure 6 (next page). *Drawing La pensée électrique* (The electric mind) ; the central part drawn in 1936, and notes were added in 1962 (Archives nationales, fonds Jacques Paillard). The date 1936 is confirmed by Perdrizet's address: "Perdrizet dessinateur du Génie, 23 rue Turenne, Grenoble" where he was living that year. In 1936, Jean applied for a patent on "electrical thinking", a project that led to the invention the same year of his "Bobine de fils adapted to the mosaic photoelectric cell". The drawing *La pensée électrique* is an account of the work of American neurophysiologists Frederic Andrews Gibbs (1903-1992) and Hallowell Davis (1896-1992), written or copied by Jean. In fact, it was as early as 1934 that Jean seems to have been working on a project for artificial thought or 'electrical thought', which he would develop throughout his life and, in the first important phase, in the context of electroencephalography, from 1936 onwards. A trace of this patent has been found in the "Patents and Inventions" section of the CNRS, with the mention "(46 927. 3/10. PERDRILET [sic, spelling error in the digitised document])" and the title *La pensée électrique*. The file appears to be empty. The drawing on electrical thought from 1936 bears witness to this dream, already partly taken as reality by Perdrizet, according to which thought is nothing more than a kind of electrical wave with the erroneous belief that it can act materially at a distance, in accordance with spiritualism and telepathy, and which can be decoded by electrical amplifiers.



For spiritualists such as Perdrizet, this was proof that thought is an electrical activity that can be detected outside the cranium, and it objectifies the belief in spiritualist waves responsible for telepathy⁴⁴. The new imaginary of electroencephalography thus met the older imaginaries of T.S.F. and spiritualism. Furthermore, this technology enabled to draw an analogy between the brain, on the one hand, and a T.S.F. transmitter and receiver, on the other, in line with other earlier connections between spiritualism and electromagnetic technologies⁴⁵. The new Spiritist imaginary of electroencephalography thus renewed older ones, and gave Jean Perdrizet a new opportunity to develop his pre-Cybernetic imaginary by

⁴⁴ For a 1930s discussion of this topic, see J.G. Barbara, 2021, *op. cit.* p. 215-220.

⁴⁵ J.G. Barbara, 2021, *op. cit.* p. 214.

cultivating the belief in remote communication between a human soul and an electrical machine, the seat of thought, and the seat of what Perdrizet calls an "ame", without the circumflex accent of the French word *âme*, to distinguish it from the human soul.

In 1936, this new pre-Cybernetic imaginary made it possible to cultivate a sensibility that saw the thinking machine modelled on human thought, and the activities of human thought in the light of the processes used in electrical machines. Jean writes: "[Electroencephalography] is intended to show that the brain constantly emits electrical waves, and that their intensity, frequency and all their characteristics are a function both of the individual and of the concentration of his thought. The thinking man would thus seem to operate the electrical machine that is his brain; he excites it, to use an electro-technical term⁴⁶."

5. Jean Perdrizet's pre-Cybernetic robot imaginary of the 1940s

Jean Perdrizet's work of the 1930s contains all the elements needed to build an imaginary worthy of the robot myth that so enthuses the general public. But its realization would depend on specific conditions that would shape this new imaginary in their own way.

In 1939, Jean Perdrizet was struck down by a serious disabling disease, bone tuberculosis. While convalescing, he made one last attempt to prepare for the engineering competitive examination, but his weakened condition and overly strenuous intellectual effort caused him to sink into an acute psychopathological state. Barely recovering from this episode, Jean embarked on a personal career of more complex drawings than before, which he assembled in rolls, sometimes ten meters long, and which he tried to publicize from 1942 onwards at the University of Marseille. However, it was only after the war, from 1950 onwards, that his work began to arouse interest, initially on the part of a psychiatrist and a neurologist in Marseille, for its eccentricity, its incredible creative dimension and its psychopathological character.

Jean's complex drawings from the 1940s begin as plans for various mechanical calculating machines; at first, Jean seems to be copying mechanisms from existing machines, then he becomes increasingly inventive. This return to the theme of calculating machines ties in with his project for artificial thought, in a pre-

⁴⁶ Drawing *La pensée électrique*, Archives Nationales.

Cybernetic perspective that is also beginning to develop among the future protagonists of cybernetics.

Jean went on to devise mechanisms for creating robot organs, electric eyes, shape recognition and tracing devices, and articulated arms. But his central project remained the creation of an artificial mind whose main faculty would be shape recognition and the transformation of memorized images of objects perceived only from certain angles. However, this latter faculty no longer depended on his analytical geometry of the 1930s, as Jean was now considering devices for storing images and transforming them using digital calculations performed by electronic circuits – what he called his "electromechanical geometry".

While Jean still took his cue from electromechanical machines from the 1930s⁴⁷, he also devised his own mechanisms, and meticulously drew up plans for them, such as the one for "reading the number 2 by a robot" in the drawing entitled "Géométrie mécanique – Topologie électromécanique" (Mechanical Geometry – Electromechanical Topology, Archives Nationales).

At the same time, Jean was developing an Esperanto language for his robot, comprising 92 simple signs taken from the upper and lower case letters of the Greek and Latin alphabets. This language was designed to be easily learned by a conscious, imaginative robot. In the pre-Cybernetic perspective of such a robot, and following the example of cyberneticians, Jean considered that the human mind is probably simpler than it appears to us, and that it could therefore be imitated by the mechanisms of a robot. According to Jean, "our punctilious attention doesn't draw more than one turning point or inflection per second. So it is very well imitable by a machine". In 1942, Jean produced his drawing entitled *Bioélectronique – Bionique - Parapsychologie cybernétique* and *Résonateur lecteur du robot astronaute* (Bioelectronics – Bionics - Cybernetic Parapsychology and Reading Resonator of the Astronaut Robot, Musée Gassendi in Digne-les-bains), which represents the complete model of a robot's artificial soul (*ame* [sic]).

Finally, in 1945, Jean Perdrizet obtained an industrial property guarantee certificate from the *Institut national de la propriété industrielle (26 bis, rue de Leningrad, Paris 8^e, France)* for his invention of a "centrifugal flying pipe". The creation of flying machines remained an important activity for Jean, which he had begun at the age of sixteen and which, in his pre-Cybernetic perspective, became a necessity if his robots were to be able to go into space and communicate with the dead.

⁴⁷ Like the American "integraph" developed by Vannevar Bush during the Second World War to calculate missile trajectories.

III. Jean Perdrizet's cybernetic imagination

1. Jean Perdrizet's imagination in the age of cybernetics

From the 1950s onwards, Jean Perdrizet introduced the term "cybernetics" into his drawings. It was at this point that he became aware of this scientific field in the press. For example, in 1948 Jean may have been aware of Father Dominique Dubarle's article entitled *Une nouvelle science, la cybernétique : vers la machine à gouverner* ("A new science, cybernetics: towards the governing machine"), published in *Le Monde* on December 28, 1948. In January 1949, the French neurophysiologist of the Sorbonne, Paul Chauchard, whom Jean quotes several times, introduced cybernetics with his article *Une science nouvelle, La cybernétique* in *La Revue scientifique*.

From 1949 onwards, Jean produced new, highly complex plans for an artificial mind, such as the one entitled a posteriori in the 1950s *Vision cybernétique des formes* (Cybernetics visual recognition of forms, Archives Nationales), or his magnificent *Traité de géométrie* (Treatise of Geometry, Christian Berst gallery). It is conceivable that these new drawings were contemporaneous with the publication of Norbert Wiener's book by Herman (Paris) and MIT in 1948, which may have provided Jean with additional motivation. According to Pierre Cassou-Noguès, Perdrizet quickly became very well acquainted with the main international players in cybernetics, and even sent some of his works to renowned cyberneticists, including Norbert Wiener himself in 1952⁴⁸.

In 1951, Jean produced his most emblematic drawing, of which there are several versions: *Un robot ouvrier qui voit les formes par coupes de vecteurs en étoile – La révolution cybernétique – Son anatomie* (A worker robot that sees shapes by cutting star shaped vectors – The Cybernetic Revolution – Its anatomy). This drawing is mainly devoted to showing the possible general organization of a complete humanoid robot, equipped with an electric eye and psychological faculties, which sums up Jean's aspirations towards the creation of an artificial mind communicating with man and the souls of the dead. At the same time, other more technical drawings are devoted to detailing his robot's mechanisms of thought and imagination, such as the large assembly entitled *Parapsychologie cybernétique – résonateur lecteur – cerveau électrolyte – robots astronautes auto-reproducteurs*

⁴⁸ These archived plans were found by Pierre Cassou-Noguès in the Wiener archives. Pierre Cassou-Noguès, "'Vaucanson androïde': Jean Perdrizet, la cybernétique et le spiritisme", *op. cit.*, 2013, p.135-152: "[...] in the early 1950s, Perdrizet sent Norbert Wiener, the father of cybernetics, three packages of drawings (including a large scroll with seven parts), many of which do not seem to reappear elsewhere. Wiener kept these drawings, archiving them with the rest of his correspondence".

(Cybernetic parapsychology – reader resonator – electrolyte brain – self-reproducing astronaut robots, Archives nationales).

Jean continued to develop his Esperanto, which he then called "langue t", within the cybernetics movement, and his drawings now bear titles that include the term *cybernetics*⁴⁹. Gradually, Jean's scientific imagination was enriched by the new themes of cybernetic imagination and the cybernetic imagination of American science fiction. It is possible to follow this evolution step by step in his work, trying to disentangle what belongs to his earlier imaginaries and what joins the cybernetic imaginaries in the making at the same time.

2. Jean Perdrizet's cybernetic imagination around artificial thinking and gaming

The theme of calculating machines as akin to the human mind remains central to Jean's work, as it does to cybernetic imaginary, and also in France following the major international CNRS symposium in Paris on "Calculating machines and human thought" in 1951. After his calculating machines of the early 1940s, Jean returned to this theme in 1956⁵⁰. The Musée Gassendi in Digne-les-Bains has preserved a complete set of beautiful calculating machine plans, all dating from 1956 and not found elsewhere: *additionneuse à comes et à treuils & additionneuse à treuils électrique* (cam and winch adder & electric winch adder), *machine à calculer à treuils et à balanciers* (winches and pendulums calculating machine), *machine à calculer à treuils et à relais* (winches and relay calculating machine), *guitare additionneuse* (guitar adder), and *machine à calculer à treuils et à relais et disque embrayeur* (calculating machine with winches, relays and clutch disk), for which a current specialist, Alain Guyot, acknowledges the relevance of some of Jean's procedures⁵¹.

⁴⁹ *Formules développées de chimie psychologique – Thèse d'ingénieur docteur d'espéranto cybernétique – Culte cybernétique du dimanche 13 janvier 1952 – Cabestan de l'âme sémaphore, Flotille cybernétique – Imagination par flotteurs magnétiques – Toile métallique méninge – associatrice[sic] d'idées, Exploration visuelle mixte – Vision des formes – Bulletin cybernétique du 10 01 1954, Ancre de l'ame – Robot astronaute cybernétique , Espéranto cybernétique – Espéranto dessiné, Espéranto cybernétique 1/1/1958 en 4 leçons – Squelettes des images souvenirs dans les arcanes du cortex cérébral c'est un télégraphe – Chappe âme-sémaphore – Chaque lettre est un mot dont le sens correspond à sa forme, î : en haut ... ou encore Espéranto cybernétique Leçon IV – Travail d'Académicien à imprimer .*

⁵⁰ J.G. Barbara, 2021, *op. cit.* p. 262-267.

⁵¹ J.G. Barbara, 2021, *op. cit.* p.264-267.

Jean's new interest developed in parallel with the rise of cybernetics, but also at the precise moment of collusion between cybernetics and the appearance of the first commercial computers⁵², which, according to Sheryl Hamilton, characterizes the American cybernetic imagination. There can be little doubt that Jean equated the calculating machine, the computer and artificial thought when he proposed a reading machine for his robot called "eye for calculating machine – [which] reads the numbers put down" (*œil pour machine à calculer – [qui] lit les chiffres posés*). The miniaturization of calculating machines and computers reinforced Jean's dream of the future creation of artificial thought.

Sheryl Hamilton has also noted the role of the electronic games imaginary in the constitution of the American cybernetic imaginary, around, for example, the concept of the intelligence of electronic chess games calculating operations in view of a goal to be reached according to rules. In Jean's view, the intelligence of an artificial thought process or a robot lied precisely in its ability to achieve a goal that could be evaluated in terms of behaviour. The behaviour was programmed in the same way, but with some freedom, as the free drawing of a robot's tracing pen, inspired by the vision of an image and those memorized, in a way similar to the art created today by artificial intelligence. Jean had also made a link between the concept of programming computers using punched cards and his films printed with the digital images of the photoelectric cells of an artificial eye, with a view to transforming them.

But when Jean talks about the 1971 international symposium on artificial intelligence in London, which he mentions in a drawing⁵³, he explains that programmed intelligence is just one aspect of it, which should not overshadow the need for "ambiguity" in the main faculty of intelligence, which for him is *imagination*. Indeed, in his drawings, Jean develops more processes of artificial imagination than of artificial intelligence, because for him, imagination and creativity are forms of superior intelligence. In his drawing *Ancre de l'ame – Robot astronaute cybernétique – Imagination en dessins et vision des formes chez le Robot astronaute auto-reproducteur* (Anchor of the Soul – Cybernetic astronaut robot – Imagination in drawings and vision of forms in the self-reproducing astronaut robot, Archives nationales), Jean writes: "it is the reading and imagination of forms that distinguishes [sic] our robot from simply calculating robots".

⁵² Like the IBM 701 from 1952 and the IBM 704 introduced in 1954, both mentioned by Jean Perdrizet in his drawings.

⁵³ Drawing *Robot qui construit un pont ou une maison* (Robot building a bridge or a house), 1971, Galerie Christian Berst.

3. Jean Perdrizet's cybernetic imagination around the concepts of information, communication and future

From 1950 to 1975, Jean continued to compile large dictionaries of his "t-language", comprising several tens of thousands of entries. For Jean never forgot that his main aim was not to objectify the robot myth decried by Wiener himself and French philosopher Georges Simondon, but to conceive of possible communication between different forms of human, artificial and extraterrestrial intelligence. His "language-t" is thus at the heart of his utopia of communication, which is also that of cybernetic imagination. As with cyberneticians, Perdrizet's communication is the ability to receive and transmit information via the simplest possible code, which his artificial language represents for him.

In his personal utopia of cybernetic communication with the dead, Jean imagines a scientific and technological near-future, with a rationality that gives it the aspect of a new field of knowledge, as Sheryl Hamilton noted for the American cybernetic imaginary as well. For Jean, if his robot was to be able to communicate with the souls of the dead, then this robot could possibly go into space and reproduce itself there, in order to interact with these souls of the dead orbiting the earth. For Jean, the presence of robots in space becomes a necessity to save the souls of mankind in the aftermath of the earthly apocalypse, which he considered inevitable.

The constitution of Perdrizet's imaginary gives us a better understanding of how the scientific field of cybernetics was able to nourish science fiction writers at the same time. But in fact, this occurred partly the other way around, as cybernetic imaginaries also gradually emerged from the science fiction of the 1930s, i.e. before cybernetics. For example, the American science fiction editor, former physicist and former student of Norbert Wiener at MIT, John W. Campbell Jr. (1910-1971) had developed his own account of aliens and robots in a pessimistic yet rational future in his short story *Twilight* (1934), in which he described "a distant future in which the human species, having lost curiosity and energy, is deliberately being replaced by intelligent machines [...]"⁵⁴, a perspective also later adopted by Jean Perdrizet as well as by cybernetic science fiction.

⁵⁴ G. Cordesse, *La Nouvelle science-fiction américaine*, Collection USA Paris, Aubier, 1984, p. 10.

In a letter to French CNRS mathematician José Argémi, Jean clarified his own vision of the future:

"What you need to see in my robot [...] is more than an atomic bomb, it is a self-replicating robot, a generation of robots, which once unleashed will spread throughout the universe without the help of man and without man being able to stop them [...] in this integration of matter into intelligent mechanical brains [sic] and not a bestial atomic disintegration. This is more than the Apocalypse. As for our eternal soul, which the robot won't have – indeed, animals apparently don't have one [according to Descartes]– our soul [...] may be a psychon, a new atomic particle whose movements, instead of being Brownian, i.e. in disorder, are ordered in geometric figures; heat has only one coordinate, thought has two, x and y".⁵⁵

Without being able to go into the details, we can recognize such themes as being common to pre-Cybernetic science fiction and Jean Perdrizet's pre-Cybernetic imaginaries. They will renew the vision of the future, with the introduction, for example, of new elements such as the self-replicating robot from physicist John von Neumann's theory of automata⁵⁶.

CONCLUSION

Jean Perdrizet's work thus enables us to follow the step-by-step constitution of a cybernetic imaginary that builds on earlier imaginaries and feeds on the pre-cybernetic themes of science fiction, while gradually incorporating themes from the cybernetics of the 1940s-1950s.

The pattern of constitution of this cybernetic imaginary follows the broad lines of the American cybernetic imaginary as described and analyzed by Sheryl Hamilton, even if in her work the place of earlier imaginaries seems to us rather underestimated. Nevertheless, this demonstrates the value of analyzing personal scientific imaginaries in their precise mechanics, which are easier to dismantle, in order to place them alongside collective imaginaries. Jean Perdrizet's work thus helps us to better understand the weight of pre-Cybernetic imaginaries in the cybernetic imaginary, by following the filiations concerning the imaginary of machines, the imaginary of the properties of minds and the imaginary of remote communication, between the end of the 19th c. and the rise of the computer age.

⁵⁵ Perdrizet's letter to José Argémi, June 26 1971, at the back of the drawing *Robot cosmonaute* (50,5 × 65 cm, galerie Christian Berst).

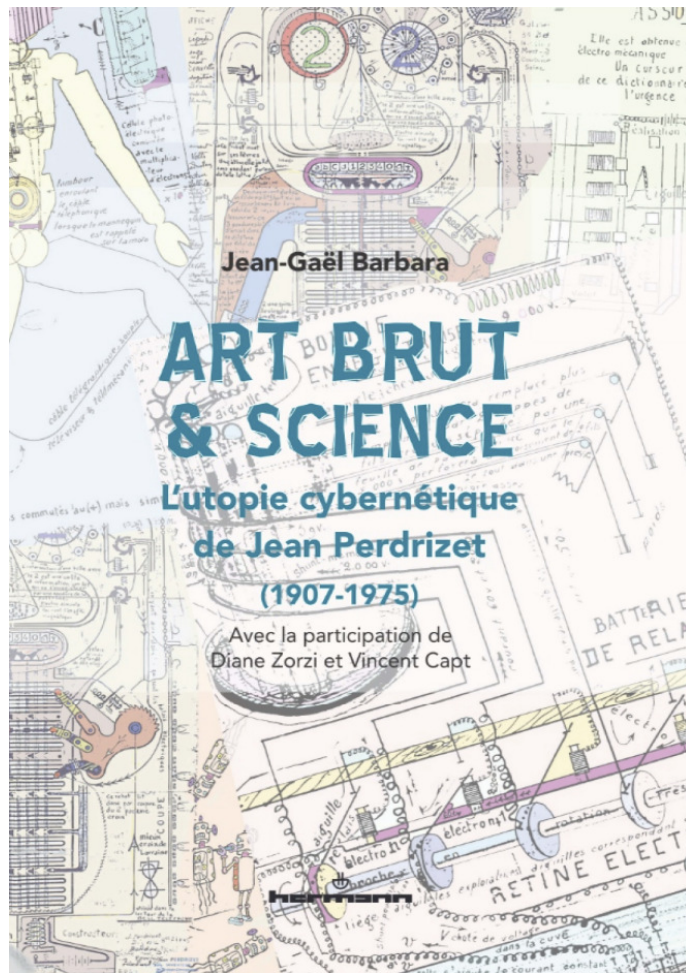
⁵⁶ See for example Dominique Perrin, Les débuts de la théorie des automates, *Séminaire de philosophie et mathématiques*, 1, 1993, 1-17.

Also, the work of Perdrizet enables the analysis of personal imaginaries which makes it easier to understand their psychological function. This function is for Perdrizet halfway between the scientific utility of inventing new machines and technologies, and its fictional, dreamlike and utopian aspect. In the particular case of the creators of *art brut*, this dimension takes on an existential character. Jean Perdrizet, whose professional career was wrecked, cultivated his ambitions by becoming the engineer he needed to be through his utopia, which explains his total involvement in his project, as well as his subsequent fusion with the scientific and cultural imaginary of cybernetics. On a more general note, it would also be legitimate to think that, over and above their epistemological dimension, scientific imaginary universes also relate to the conditions of existence of the representations that scientists have of themselves, and which guide them in what they think they should be and in what they are able to create.

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Author's translated version of : J.G. Barbara, 2024. "La constitution des imaginaires scientifiques: L'imaginaire cybernétique de Jean Perdrizet (1907-1975)", in C. Chérici (ed.), volume on imagination forthcoming.



Jean-Gaël Barbara, *Art brut & science, l'utopie cybernétique de Jean Perdrizet (1907-1975)*, Paris, Hermann, 2021, presents a meticulous analysis of Jean Perdrizet's work from 1923 to 1975.

