BRUNO DE FINETTI'S *MACHINES THAT THINK (AND MAKE YOU THINK)* AND THE EARLY RECEPTION AND DISSEMINATION OF ARTIFICIAL INTELLIGENCE IN POSTWAR ITALY

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ABSTRACT: ***BRUNO DE FINETTI'S*** **MACHINES THAT THINK (AND MAKE YOU THINK)** ***AND THE EARLY RECEPTION AND DISSEMINATION OF ARTIFICIAL INTELLIGENCE IN POSTWAR ITALY***

This article examines Bruno de Finetti's 1952 publication Machines That Think (and Make You Think) *(original Italian: Macchine che pensano (e che fanno pensare)) as a foundational text in the early reception and dissemination of ideas related to artificial intelligence (AI) in Italy. Based on his 1950 study tour of U.S. computing centers, de Finetti's reportage combines firsthand observation of early digital calculators with critical reflections on cybernetics, memory systems, and the conceptual boundaries of thought. Positioned between technical report and philosophical essay, the text offers a unique mediation of emerging computational paradigms for an Italian scientific audience. By contextualizing this work alongside parallel developments by Silvio Ceccato, Louis Couffignal, and Norbert Wiener, the article argues for its significance in the broader European intellectual history of AI. It highlights de Finetti's role as a cultural broker and underscores the cross-cultural nature of AI's early history—a narrative often dominated by U.S. and British developments.*

KEYWORDS: History of AI; Intellectual History; Bruno de Finetti; Cultural Brokerage; Postwar Europe.

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1. *Introduction: A Forgotten Foundational Text*

In 1952, the Italian mathematician and statistician Bruno de Finetti (1906–1985) published an article titled *Machines That Think (and Make You Think)* in the journal *Tecnica e Organizzazione*[1]. At first glance, the piece may appear to be a work of popular science or a reflective travelogue recounting his 1950 study tour of the United States. Yet beneath its accessible prose lies a layered meditation on the conceptual and technological novelties of the postwar world: electronic computation, cybernetics, information theory, and—above all—the unsettling notion that machines might "think."

This article argues that *Machines That Think* deserves recognition as a foundational moment in the Italian reception and conceptual framing of artificial intelligence (AI). More than a technical report, de Finetti's text offers a rare and timely synthesis of cutting-edge developments in American computing, conveyed with both technical clarity and philosophical restraint. His reflections emerged in a national context that lacked formal infrastructure for AI research and where public discourse on the topic was virtually non-existent—making his intervention all the more significant. His ability to translate abstract innovations—such as binary logic, feedback mechanisms, and programmable memory—into concepts intelligible to Italian engineers, scientists, and educated readers constituted a remarkable act of epistemic mediation.[2]

While the global history of AI typically centers on canonical figures such as Alan Turing, Norbert Wiener, and John von Neumann, this article situates

[1] B. de Finetti, *Macchine che pensano (e che fanno pensare)*, in «Pubblicazione delle Facoltà di Scienze e di Ingegneria dell'Università di Trieste», Serie A, 1952, pp. 2-34 [excerpt from «Tecnica ed Organizzazione», N. 3-4, 1952, pp. 182-215].

[2] Among the most significant publications available in English a few years before 1952, one can mention N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Hermann & MIT Press, Paris-Cambridge 1948; A.M. Turing, *Computing Machinery and Intelligence*, in «Mind», 59, 236, 1950, pp. 433-460.

de Finetti within a parallel European narrative of reception and dissemination.

Methodologically, this paper integrates textual analysis with intellectual history. By examining de Finetti's 1952 article and situating it within the broader landscape of postwar European thought, the study traces not only the language and structure of his arguments but also the cultural and philosophical currents that shaped his interpretations of artificial intelligence. The textual analysis delves into both the explicit content and the underlying analogies, highlighting how de Finetti's narrative bridges technical exposition and philosophical inquiry. This intellectual-historical perspective, meanwhile, contextualizes his work in relation to contemporaneous figures, debates, and technological advancements, allowing for an assessment of de Finetti's role as a mediator and translator of ideas. Through this dual lens, the paper seeks to illuminate how foundational concepts of AI were received, reframed, and disseminated within the Italian scientific community, while also drawing connections to broader European and global developments. To this end, de Finetti's work will be examined in relation to contemporaries such as Silvio Ceccato in Italy and Louis Couffignal in France,[3] and in the shadow of Wiener's cybernetic revolution.[4] Through this comparative framework, de Finetti emerges not merely as a mathematician reporting on foreign innovation, but as a cultural broker: an early and critical voice helping to shape the conceptual boundaries of machine intelligence in postwar Europe.

1.1 *Bruno de Finetti: The Mathematician as Public Intellectual*

To appreciate *Machines That Think*, it is essential to view Bruno de Finetti as more than a statistician or mathematician. He was a distinctive kind of public intellectual—committed to bridging scientific expertise, philosophical

[3] S. Ceccato, *Il linguaggio con la Tabella di Ceccatieff*, Éditions Hermann, Paris, 1951; L. Couffignal, *Les machines à penser*, Les Editions de Minuit, Paris 1952.
[4] N. Wiener, *The Human Use of Human Beings: Cybernetics and Society*, Houghton Mifflin, Boston 1950.

reflection, and civic responsibility in postwar Italy.[5] His subjectivist interpretation of probability, first articulated in the 1930s and later formalized in the 1970s, conceived probability as a measure of coherent personal belief rather than as an objective property of the world. Within this framework, knowledge appears as a cooperative and revisable enterprise grounded in rational judgment.[6]

A similar ethos is reflected in de Finetti's approach to public discourse. He sought to democratize mathematics and science without simplifying them, cultivating a prose style that often invites readers to think alongside him rather than passively receive instruction. Already in the 1930s, during his work at the Assicurazioni Generali in Trieste, de Finetti had explored the automation of actuarial and statistical calculation, developing early ideas about data organization and rationalized office procedures. As Ermanno Pitacco has shown, these contributions—ranging from mechanical computation to reflections on electronic calculation—anticipated later concepts in computer science and management informatics.[7] Alongside his continued efforts to improve the teaching of mathematics in Italy,[8] this engagement exemplifies de Finetti's dual identity as a man of enterprise and a man of learning: a figure capable of unifying applied, institutional, and pedagogical rationality. Seen in this light, *Machines That Think* continues one of de Finetti's enduring projects—to train readers to think critically about knowledge itself.

It was precisely this commitment to critical inquiry that informed de Finetti's engagement with the technological transformations of his time. When, in 1950, he visited U.S. laboratories and later reflected on their

[5] F. de Finetti, L. Nicotra, *Bruno de Finetti, un matematico scomodo*, Belforte Editore, Livorno 2008.
[6] B. de Finetti, *Probabilismo. Saggio critico sulla teoria delle probabilità e sul valore della scienza*, in «Logos. Organo della Biblioteca Filosofica di Palermo», XIV, 1931, pp. 163-219; Id., *Teoria delle probabilità*, cit.
[7] E. Pitacco, *Bruno de Finetti e le macchine che pensano*, in «Rivista IBM», 1, 1987, pp. 41-47.
[8] G. Anichini, L. Giacardi, E. Luciano (eds.), *Bruno de Finetti e l'insegnamento della Matematica. «Dalla Realtà, nella Realtà, per la Realtà»*, special issue of «La Matematica nella Società e nella Cultura. Rivista dell'Unione Matematica Italiana», serie 1, VIII, 3, 2015.

innovations in *Machines That Think*, he confronted a landscape in which the boundaries between human and mechanical reasoning were being rapidly redrawn.

2. *The Context: America as a Technological Frontier*

In early Cold War America, electronic calculators evolved from wartime instruments into prototypes of a new epistemic regime—one in which machines no longer merely supported human reasoning but began to automate, simulate, and even redefine it. De Finetti's visits to leading institutions—such as the Institute for Advanced Study in Princeton, the National Bureau of Standards in Washington, and the University of California at Los Angeles—gave him firsthand exposure to the front lines of computational innovation. Among the devices he encountered were the ENIAC, the UNIVAC, and the SWAC, then among the most advanced digital calculators in the world.[9]

This encounter should be understood within the broader history of computing and cybernetics. As Andrew Pickering and Slava Gerovitch have shown, the postwar circulation of cybernetic ideas produced a complex network of translations across nations and disciplines.[10] Norbert Wiener's *Cybernetics* (1948) and *The Human Use of Human Beings* (1950) did not travel unchanged; they were reinterpreted through the conceptual grammars and institutional needs of each receiving culture. In Latin America, as Eden Medina demonstrated, cybernetics became a tool for reimagining socialist governance,[11] while in France, Louis Couffignal reframed automation as a philosophy of order and rationality.[12]

[9] Places visited as well as machines studied during de Finetti's research stay are provided in B. de Finetti, *Macchine che pensano*, cit.
[10] A. Pickering, *The Cybernetic Brain: Sketches of Another Future*, University of Chicago Press, Chicago 2010; S. Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, MIT Press, Cambridge MA 2002.
[11] E. Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile*, MIT Press, Cambridge MA 2011.
[12] L. Couffignal, *op. cit.*

For the Italian scientific community—still emerging from the disruptions of war and Fascism—the encounter with American computational power signaled a dramatic shift. Italy had yet to develop a comparable technological infrastructure. De Finetti's report thus served a dual purpose: it not only conveyed technical information about logic circuits, memory devices, and program-controlled operations, but also introduced a cultural and conceptual framework for understanding how machines might alter the very architecture of knowledge. He does not treat these machines as mere American curiosities or as expressions of military-industrial prowess. Instead, he frames them as manifestations of a broader transformation in the modes of knowledge production. At a time when few Italian researchers had direct access to these technologies—and when Wiener's writings were not yet available in Italian translation—*Machines That Think* functioned as a relay point through which cybernetic thought could enter Italian intellectual discourse.

Crucially, de Finetti's article distinguishes itself from purely descriptive accounts. It is neither a travelogue of technological marvels nor a celebration of American supremacy. Chronologically, it may be situated within what Paul Edwards calls the "closed world discourse" of the early Cold War—a cultural framework that linked information, control, and prediction to the management of complexity and uncertainty.[13] Yet, unlike many contemporaries who adopted this logic uncritically, de Finetti's reflections on machine intelligence inverted the usual narrative: his tone is reflective, even cautiously critical. While he acknowledges the unprecedented power of these machines, he also urges his readers—scientists, engineers, and thinkers alike—to question how such machines should be interpreted and integrated into existing frameworks of thought. In this way, the article exemplifies not only the transfer of technical knowledge but also the mediation of scientific values across national, cultural, and institutional boundaries.

[13] P. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America*, MIT Press, Cambridge MA 1996.

3. *De Finetti's Text as Epistemological Translation*

What makes *Machines That Think* particularly remarkable is not merely its early access to cutting-edge technologies, but the way in which de Finetti translates complex technical concepts into epistemologically charged reflections for a broad Italian readership. The article occupies a unique position: poised between scientific exposition and philosophical provocation, it invites readers not only to understand new machines, but to reconsider the very meaning of thought, memory, and reasoning.

De Finetti's use of analogies plays a key role in this epistemic mediation. He explains the function of memory units in early computers—such as mercury delay lines or electrostatic Williams tubes—by comparing them to familiar systems like a ski lift, where chairs circulate in sequence and can be temporarily "loaded" with information.[14] These analogies are not merely pedagogical simplifications; they perform a deeper cognitive function. They enable readers to reconceptualize abstract computational operations through temporal, spatial, and mechanical metaphors—thus fostering new habits of thought aligned with a computational worldview.

In this sense, the article anticipates what later historians and philosophers of technology would describe as an *epistemic shift*: the moment when information processing emerges as a dominant model for understanding knowledge, action, and even biological and psychological processes.[15] De Finetti avoids metaphysical claims about machines being truly intelligent, yet he also resists the opposite stance—dismissing them as mere automata. He emphasizes the boundary between human and machine thought not to resolve it, but to destabilize it, to problematize the categories that sustain it. This gesture situates his text within a broader postwar philosophical reconfiguration of the human, reminiscent of Alan Turing's provocative question: "Can machines think?"[16]

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[14] B. de Finetti, *Macchine che pensano*, cit., p. 8.
[15] G. Simondon, *Du mode d'existence des objets techniques*, Aubier, Paris 1958; N. Wiener, *The Human Use of Human Beings: Cybernetics and Society*, cit.
[16] A.M. Turing, *op. cit.*

De Finetti is particularly attuned to the plasticity of epistemological categories. Just as earlier generations were forced to accommodate the paradoxes of wave-particle duality or the relativity of simultaneity, so too, he suggests, must we now reconsider our understanding of thought, decision-making, and intelligence in light of machines that reproduce human-like functions—often faster and more reliably. This is not a celebration of technological mastery but a philosophical provocation: a call to rethink our own thinking in relation to machines that both mirror and challenge it. This refusal to simplify the ontological question into a binary opposition is captured in a particularly rich and revealing passage from the article:

> *Giant brains*, *machines that think*: this is how electronic calculators are described by those most impressed by them, or those seeking to impress, pointing out how vast and complex the operations of thought are that these machines can be commanded to perform. Mere *auxiliaries*: this is the retort from others, who emphasize that these are still operations the machines *are commanded to execute* — and that the creative function of thinking remains an untouchable attribute of the human being who builds and uses them.
>
> Framed in these terms, as a stark opposition between two sharply defined positions, the issue is poorly posed: it devolves into a vain metaphysical dilemma, further entangled in every imaginable moral preconception. It's the same kind of situation we encounter when trying to determine the boundary between the animal and plant kingdoms, or between the living and the non-living world (or, in another domain, between waves and particles). This analogy is worth keeping in mind, because here too, one might say, we are dealing with the challenge of identifying the frontier of what should properly be considered the *domain of thought*.[17]

The opening phrase—"*Giant brains, machines that think*"—is itself a citation, echoing computer scientist Edmund Callis Berkeley's 1949 popular

[17] B. de Finetti, *Macchine che pensano*, cit., p. 2; my translation. The original text is available in *Appendix*.

science book, which de Finetti read during his U.S. visit.[18] Yet the subtitle of de Finetti's article, "and make you think" introduced in brackets, signals a critical stance. It marks a departure from the promotional tone of Berkeley's book and instead foregrounds de Finetti's epistemological skepticism. His aim is not to endorse the idea that machines think, but to provoke reflection on what it means to say so. His comparison with the wave-particle duality in physics is particularly illuminating: just as quantum theory destabilized classical ontologies, so too do thinking machines unsettle anthropocentric assumptions about cognition and agency.

> Truly significant, interesting, and instructive questions arise instead when we closely examine the factual data — patiently, methodically, and sharply. These are the facts that not only help answer the questions we pose within our mental frameworks, but sometimes even force us to revise those frameworks themselves — and, in particular, to blur and complicate distinctions we are accustomed to seeing as clear and self-evident.
>
> A comparative and analogical study of certain physiological or psychic functions in animals, and the corresponding ones in large calculators or other machines with similar characteristics, turns out to be quite instructive — in both directions. That is, it can assist in the design and analysis of appropriate devices by drawing on knowledge of analogous organs in animals; and conversely, it can support the development of hypotheses or theories about those biological organs and their (mal)functions, using insights from a fuller understanding of artificial devices. This creates a mutual benefit, and even more so, a broader synthesis — one in which a complex set of concepts and problems, made particularly timely by current developments in science and brilliantly discussed by Norbert Wiener, come into full view. […][19]

[18] E. Berkeley, *Giant Brains, or Machines That Think*, John Wiley & Sons, New York 1949.
[19] B. de Finetti, *Macchine che pensano*, cit., p. 2; my translation. The original text is available in *Appendix*.

Rather than seeking definitive boundaries between the human and the mechanical, de Finetti advocates a careful, comparative investigation that is as open-ended as it is rigorous. By foregrounding the value of analogy—not as a mere pedagogical device, but as a tool for deep epistemic engagement—de Finetti demonstrates how the study of artificial systems and biological organisms can illuminate each other, leading to a pluralistic reimagining of both domains. This mutual illumination is not simply an academic exercise; it is a critical maneuver in an era when technological innovation challenges the most stable of conceptual oppositions. De Finetti neither privileges the biological as the site of authentic intelligence nor the mechanical as a straightforward extension of human will. Instead, he urges readers to embrace the complexity of "blurring and complicating distinctions" that formerly seemed self-evident. In this way, his analysis serves as a model of epistemic vigilance: a refusal to rest in comfortable binaries, and a call to perpetually revise our frameworks in light of new empirical data.

The invocation of figures like Norbert Wiener situates his argument within the emergent discourse of cybernetics—a field that, by its very nature, dissolves the boundaries between organism and mechanism, signal and meaning, action and feedback. The "broader synthesis" he envisions is both timely and forward-looking, capturing not just the scientific milieu of his moment but also the ongoing philosophical task of negotiating the shifting terrain of thought, agency, and life itself. For de Finetti, it is not the answers provided by machines, or by animal physiology, that matter most, but the questions that arise in their mutual comparison—the questions that force us to reconsider what it means to think at all.

> Electronic calculators are the central object and primary purpose of this discussion, and they will provide ample opportunities to touch on various issues pertaining to cybernetics. But even before getting to them, simpler examples will suffice to outline — with reference to something concrete — the ideas sketched thus far in abstract and general terms.

Think of an anti-aircraft device automatically guided by radar: it detects the airplane, identifies its trajectory, forecasts its path based on the most efficient instructions, aims the gun, and fires. Impressive, yes — but does it have intelligence? It only performs automatic operations based on pre-established instructions. And yet, we call intelligent a soldier who may carry out similar instructions less precisely. The mechanisms of detection are unconscious and automatic even in humans: the sight of something bright or moving at the edge of the visual field (that is, the peripheral regions of the retina) triggers eye movement (and possibly head or body movement) to bring the object into sharp focus (often based on stored images — e.g., recognizing an upright face rather than one that is upside down or angled). The targeting mechanism, based on perceiving at each instant the difference between the desired and actual direction and striving to reduce it, is the same; even the malfunctions arising in servomechanisms due to a lack or excess of corrective tendency manifest in humans as certain nervous disorders (failure to respond to stimuli, or overcorrection causing oscillations).
Certainly, a human can question the instructions received, and sense if they are wrong; but a machine could also be programmed with general instructions enabling it to reject specific instructions that violate certain criteria — and flag the error. Even the process of learning or training by which the human mind is conditioned for such discernment finds its most natural analogy in how general instruction-sets are built into a machine.
So then—does every difference disappear?

I wouldn't go that far. We *feel* that it doesn't. And yet, it becomes hard to say just where that difference begins, without falling back on more primitive assumptions like those we encountered earlier. One begins to suspect that the difference is not so much one of substance as of perspective: when we think about a machine, we place ourselves on the level of the human who built it, knowing that he understands its workings and attributing its behavior to him. When we think about a human or an animal, we place ourselves on their level, without invoking a hypothetical creator to explain their behavior. But

> this raises the real problem: what criterion could we use to distinguish between the two, if faced with a being whose behavior alone is observable, and whose outward appearance gives no clue as to whether it is a human-made machine or a naturally evolved animal?[20]

Through analogies spanning from anti-aircraft mechanisms to the neurophysiology of perception, de Finetti exposes how both human and mechanical systems can be described in terms of feedback, learning, and correction. The narrative's insistence on analogy is not meant to erase difference, but to dislodge simplistic oppositions. By paralleling servomechanisms with nervous disorders, and programming with human conditioning, de Finetti urges us to recognize that the distinctions we draw are often rooted more in interpretive perspective than empirical substance.

Yet, the author resists reductive conclusions. The lingering sense of difference serves not as a foundation for retreating to metaphysical binaries, but as a prompt to reflect on our interpretive habits. De Finetti's argument pivots on the observer's vantage point: the attribution of intentionality and creativity to humans, and mere instrumentality to machines, is shown to be a matter of conceptual framing rather than intrinsic ontological status. When faced with a "being" whose behavior gives us no clues as to its origins, the passage asks us to confront the insufficiency of our inherited criteria.

In sum, de Finetti resists metaphysical closure and instead advocates epistemic vigilance. Rather than asserting what machines are, he challenges readers to consider how our interpretive frameworks must shift in the presence of artifacts that mimic processes traditionally reserved for minds. Therefore, *Machines That Think* is not simply about what machines can do—it is about how we must reconfigure our own epistemic assumptions when confronted with them. De Finetti's intervention thus functions as a true epistemological translation: it renders visible the conceptual stakes of a technological transformation that, in 1952, was still in its infancy in Europe.

[20] Id., *Macchine che pensano*, cit., p. 3; my translation. The original text is available in *Appendix*.

4. *De Finetti in Dialogue with Ceccato, Couffignal, and Wiener*

To fully appreciate the intellectual import of de Finetti's *Machines That Think*, it is crucial to situate it within the broader European discourse on machine intelligence in the early 1950s. Although the term *artificial intelligence* would not be officially coined until 1956, thinkers such as Silvio Ceccato in Italy, Louis Couffignal in France, and Norbert Wiener in the United States were already rethinking cognition, logic, and information through the lens of automation. De Finetti's reflections resonate with, and at times diverge from, those of his contemporaries—revealing a dense, if implicit, network of transnational dialogue.

Philosopher Silvio Ceccato represents the most immediate Italian counterpart. In his early works, such as *The Language with Ceccatieff's Table* (original Italian: *Il linguaggio con la Tabella di Ceccatieff*),[21] Ceccato proposed that mental operations could be analyzed as syntactic sequences—observable, discrete, and mechanically reproducible. His research aimed to map consciousness as a series of procedural steps, much like a computer executing instructions. De Finetti shares Ceccato's fascination with the procedural and programmable nature of thought, but he resists reducing consciousness to operational syntax. Where Ceccato seeks a formal reconstruction of mental activity, de Finetti insists on preserving the philosophical ambiguity and open-endedness of the term "thinking." His reluctance to draw ontological conclusions from functional analogies reflects a deeper concern: the need to maintain the epistemic complexity of thought itself.

The contrast with Louis Couffignal is equally illuminating.[22] A pioneer of French cybernetics, Couffignal advocated for the use of logical machines to model human reasoning, and embraced their philosophical implications. His approach, grounded in mathematical logic, leaned toward affirming the capacity of machines to simulate cognition. In his essays, Couffignal explored

[21] S. Ceccato, *op. cit.*
[22] L. Couffignal, *op. cit.*

not only the architecture of calculating machines but also the possibility of artificial reasoning systems. De Finetti, by contrast, adopts a more methodologically agnostic stance: while he marvels at the capacities of American machines, he underscores that the question "Do they think?" remains unresolved—perhaps even unanswerable—with the conceptual tools then available.

Among these figures, Norbert Wiener's influence is perhaps the most pervasive. *Cybernetics* (1948) and *The Human Use of Human Beings* (1950) introduced both European and American audiences to the unifying principle of *information* as a bridge between control systems, biological processes, and machine behavior. De Finetti frequently engages with Wiener's conceptual vocabulary: feedback loops, memory as information storage, negative entropy as a counter to thermodynamic disorder. And yet, de Finetti resists Wiener's universalizing tendencies. While Wiener aspired to construct a comprehensive cybernetic framework across disciplinary boundaries, de Finetti presents cybernetics as a provisional language, still under construction—promising, but far from settled.

What emerges from these comparisons is de Finetti's distinctive role. While Ceccato constructs a syntactic theory of mind, Couffignal builds formal models of reasoning, and Wiener sketches a universal cybernetic program, de Finetti offers something different: a reflective and translational approach. He does not attempt to define thinking through new technical schemas; instead, he invites his readers to problematize its definition in light of technological change. In doing so, he opens a space of inquiry where philosophy, engineering, and statistical reasoning intersect—a space in which the mind of a probabilist begins to take shape.

5. *Probabilism as an Epistemic Lens*

To fully grasp de Finetti's intellectual stance in *Machines That Think*, it is essential to understand his foundational contributions to probability theory—not merely as mathematical achievements but as epistemological commitments. De Finetti was among the earliest and most rigorous advocates

of the subjectivist interpretation of probability.[23] For him, probability did not express an objective property of the world but rather a degree of belief, based on prior knowledge and continuously revisable in light of new information. This view, grounded in the principle of coherence rather than frequency, reshapes how we understand knowledge, inference, and prediction.

Seen through this lens, the question of machine intelligence becomes less about what is or is not intelligence, and more about how we model belief, agency, and information under conditions of uncertainty. The ambiguity that de Finetti maintains throughout *Machines That Think* mirrors his probabilist caution against imposing fixed categories on fluid, historically contingent phenomena. Just as probabilism resists metaphysical absolutism in favor of revisable judgments, so too does de Finetti approach the distinction between humans and machines—not as an ontological divide, but as a gradient of functional, analogical, and epistemic similarities.

This alignment becomes particularly evident in his analogical reasoning. Whether comparing servomechanisms to neurological reflexes or machine learning to human habit-formation, de Finetti is not claiming equivalence but pointing to the heuristic value of analogy in refining our models of thought. Probabilism here underwrites a broader methodological attitude: a resistance to essentialist categories, a preference for operational definitions, and a commitment to epistemic modesty. These commitments prepare the conceptual ground for interpreting machine behavior without lapsing into either technological triumphalism or humanist defensiveness.

From this perspective, *Machines That Think* can be read as an early and subtle application of subjectivist probabilism to the emerging philosophical challenges of cybernetics and artificial intelligence. Where others sought to define or refute machine cognition, de Finetti reframed the issue as one of inference, interpretation, and conceptual humility. His legacy as a

[23] Among others, B. de Finetti, *La prévision: ses lois logiques, ses sources subjectives*, in «Annales de l'Institut Henri Poincaré», 7, 1, 1937, pp. 1-68; Id., *Teoria delle probabilità*, vol. 1-2, Einaudi, Torino 1970. See also M.C. Galavotti, *Bruno de Finetti, Radical Probabilist*, College Publications, London 2009.

probabilist thus resonates with his broader philosophical outlook on science and technology.

6. *De Finetti and Scientific Dissemination in Italy*

De Finetti's *Machines That Think* must be understood within the broader ecosystem of scientific dissemination in postwar Italy. The earliest reports regarding advancements in computing appeared in Italy just before the end of World War II. For instance, Howard Aiken's demonstration of the IBM Mark I at Harvard University was documented in a 1944 Italian issue of US military newspaper, *The Stars and Stripes*.[24]

During the early postwar period, various initiatives emerged to advance computing technologies, either through domestic development or by acquiring systems from the United States.[25] In this context, de Finetti embarked on his research trip to the United States in 1950—a journey undertaken by only a few other Italian scientists seeking opportunities in American and British computing. His journey, commissioned by the National Research Council (CNR – Consiglio Nazionale delle Ricerche), was conducted alongside mathematicians Gaetano Fichera and Mauro Picone.[26] In 1927, Picone had founded an institute of applied mathematics in Naples. This institute later relocated to Rome, where it became known as INAC (Istituto Nazionale per le Applicazioni del Calcolo – National Institute for Applied Mathematics) and was integrated into the CNR. In 1951, INAC gained international recognition when it was selected as the winner of a UNESCO competition to establish an International Computation Center.[27] The UNESCO competition is referenced by de Finetti in the concluding section of his article,

[24] *World's Greatest Mathematical Calculator – Super-Brain Calculator Solves Any Math Problem*, in «The Stars and Stripes», 1, 63, August 24, 1944, p. 3.
[25] C. Bonfanti, *Information Technology in Italy*: *The Origins and the Early Years (1954 - 1965)*, in A. Tatnall (ed.), *Reflections on the History of Computing*, IFIP Advances in Information and Communication Technology, vol. 387, Springer, Berlin-Heidelberg 2012, pp. 320-347.
[26] *Ibid*., p. 326.
[27] H. Goldstine, *The Computer from Pascal to von Neumann*, Princeton University Press, Princeton 1993, pp. 321-324; A. Guerraggio, M. Mattaliano, P. Nastasi, *L'IAC e l'affaire Unesco*: *i documenti*, in «Pristem-Storia», 21-22, 2008.

where he emphasizes the significance of this achievement for the field of computing in Italy and highlights the opportunities such recognition presents for Italian institutions engaged in applied mathematics, such as the INAC. He expresses hope that Italian investors would seriously consider the computing technologies he studied and described during his travels, noting that these machines had moved beyond their pioneering phase and were poised to play a decisive role in the near future. Given the enhanced prestige of Italian applied mathematics resulting from success in the UNESCO competition, de Finetti also voices concern about preventing another migration of talent like that which had seen Italian physicists depart to the United States. He further aspires for his article to persuade stakeholders that INAC should acquire one of the electronic computers he documented.[28]

Published in *Tecnica e Organizzazione*—a journal addressed to both engineers and managers—de Finetti's article was strategically situated at the intersection of science, industry, and public education. At a time when Italy lacked formal research programs in cybernetics or advanced computing, de Finetti's contribution served as a crucial vector of knowledge transmission, making the rapidly advancing American field of electronic computing accessible to a wider Italian audience. As already acknowledged by historian of computing Corrado Bonfanti, it "represented the early source of reliable and detailed information ever made available to the Italian scientific community." Among others, Italian physicist Alfonso Caracciolo di Forino relied on de Finetti's article in his 1954 report on modern electronic computers, prepared for the Study Center for Electronic Computers (Centro Studi Calcolatrici Elettroniche, CSCE) at the University of Pisa.[29]

In contrast to academic treatises, *Machines That Think* speaks in a polyphonic register. It is technically informed yet, when possible, avoids jargon, speculative yet grounded in empirical observation, rigorous yet

[28] B. de Finetti, *Macchine che pensano*, cit., p. 19.
[29] A. Caracciolo di Forino, *Rapporto sulle moderne calcolatrici elettroniche*, CSCE Internal note, December 1954. The document is available open access at http://pumax.isti.cnr.it/dfdownloadnew.php?ident=cnr.isti/cnr.csce/1954-B4-001&langver=it&scelta=Metadata (accessed December 9, 2024).

written for an audience beyond the academy. This careful balance reflects de Finetti's broader intellectual project: to democratize scientific reasoning without sacrificing conceptual depth. In a country where most readers had never seen, let alone programmed, an electronic calculator, his article introduced not only new machines, but a new mode of thinking.

De Finetti's work reveals an acute awareness that abstract systems—especially those involving computation and automation—require conceptual anchoring. His analogies and explanatory strategies are not simplifications, but forms of epistemic scaffolding: rhetorical and conceptual tools designed to shift mental models without diluting theoretical integrity. In this way, *Machines That Think* prepares its readers—mathematicians, engineers, and philosophers alike—for the cognitive and institutional transformations that cybernetics and AI would soon demand.

The article's publication in a semi-technical but broadly accessible venue underscores the importance of intermediary figures in shaping scientific culture. De Finetti does not claim to be an inventor of electronic calculators, nor does he offer a new theory of machine thought. Instead, he positions himself as a translator of epistemic regimes—a mediator between technological novelty and conceptual comprehension.

In sum, *Machines That Think* is not merely a reportage—it is an intellectual artifact that reflects, interprets, and disseminates a critical moment in the history of thought. It captures the early stages of Italy's engagement with machine intelligence and deserves a central place in any serious historiography of European AI. Its enduring value lies not only in the facts it conveys but in the epistemic posture it models: reflective, translational, and open to reconfiguring categories long assumed to be fixed.

7. *Conclusion*

Bruno de Finetti's *Machines That Think* occupies an underappreciated position in the early intellectual history of artificial intelligence. Neither a purely scientific article nor a straightforward work of popularization, it operates as a crossroads between disciplines, cultures, and epistemologies.

Through the medium of reportage, de Finetti achieved what few others in postwar Italy could: he offered a lucid, critical, and conceptually rich account of the emerging computational paradigm, grounded in direct engagement with the most advanced technologies of his time. In doing so, de Finetti acted not merely as a chronicler of American innovation but as a cultural broker capable of translating hardware architectures, cybernetic models, and probabilistic reasoning into a language accessible to an Italian readership largely unfamiliar with digital computation. His refusal to collapse philosophical categories into technological functions, and his resistance to premature conclusions about what machines are, mark *Machines That Think* as much a philosophical intervention as a scientific report.

This study has argued that *Machines That Think* deserves recognition as a foundational contribution to the dissemination and conceptual framing of artificial intelligence in Italy. Its significance lies not only in the information it conveys but in the epistemic posture it models: one of methodological caution, conceptual openness, and sustained reflection. De Finetti reframes the arrival of intelligent machines not as a threat to human uniqueness or a triumph of mechanization, but as a stimulus to reconsider what it means to think in an age of programmable systems.

Viewed through the lens of his subjectivist probabilism, de Finetti's intervention reflects an epistemic stance that is anti-essentialist in spirit and later came to resonate with certain constructivist approaches to knowledge. Rather than seeking fixed definitions of intelligence, he invites readers to examine how analogies, models, and technical artifacts reshape our categories of knowledge. His epistemological modesty—deeply modern yet skeptical of determinism—renders his work both historically important and conceptually prescient.

In a historiography still dominated by Anglo-American narratives, recovering texts like de Finetti's is essential for building a more plural, transcultural, and dialogical account of artificial intelligence. As noted by several historians of technology, the emergence of machine intelligence was not a unidirectional story of progress, but a mosaic of

translations, hesitations, and conceptual recalibrations that unfolded across linguistic, disciplinary, and political boundaries.[30] *Machines That Think* is one such moment of epistemic translation—a work that not only reported on thinking machines but compelled its readers to think again about what thinking itself might entail.

8. *Appendix*

The original Italian passages referenced above are provided below.[31]

Cervelli giganti, *Macchine che pensano*: così definiscono le calcolatrici elettroniche coloro che più rimangono colpiti o intendono colpire rilevando quanto vaste e complesse operazioni del pensiero esse possono venir comandate ad eseguire. Semplici *ausiliarie*: così ribattono altri facendo rimarcare che si tratta pur sempre di operazioni che esse *vengono comandate ad eseguire*, cosicché la funzione creativa del pensare rimane intangibile attributo dell'uomo che le costruisce e le usa.

Concepita in questi termini, di contrapposizione di due tesi nettamente definite, la questione è mal posta: si ridurrebbe a un vano dilemma metafisico, per di più connesso con ogni possibile preconcetto di natura morale. È la stessa situazione che si incontra nel voler indagare sulla linea di demarcazione fra regno animale e vegetale, o fra mondo vivente e inerte (o, in altro campo, tra onde e corpuscoli). E tale analogia sarà utile da tenersi presente, perché anche qui si può dire, nello stesso modo, che si tratta di indagare sul confine di ciò che va considerato come *effettivo dominio del pensiero*.

[30] Among others, E. Medina, *op. cit.*; S. Dick, *The Politics of Representation*: *Narratives of Automation in Twentieth-Century American Mathematics*, in M. S. Morgan, K. M. Hajek, D. J. Berry (eds.), *Narrative Science: Reasoning, Representing and Knowing since 1800*, Cambridge University Press, Cambridge 2022, pp. 309–327; M. Pasquinelli, *The Eye of the Master*, Verso, London 2023; S.M. Ali, S. Dick, S. Dillon, M.L. Jones, J. Penn, R. Staley, *Histories of artificial intelligence*: *a genealogy of power*, in «BJHS Themes», 8, 2023, pp. 1-18; T. Haigh, *Artificial Intelligence Then and Now*, in «Communications of the ACM», 68, 2, 2025, pp. 24-29.
[31] See B. de Finetti, *Macchine che pensano*, cit. pp. 2-3.

Questioni realmente significative, interessanti, istruttive, si hanno invece esaminando da vicino, con pazienza, metodo, acutezza, i dati di fatto: quei dati di fatto cui spetta non solo di rispondere ai quesiti che ci poniamo nell'ambito dei nostri schemi mentali, ma anche, di tanto in tanto, di obbligarci a rivedere schemi tradizionali e, in particolare, a render sfumate e problematiche delle distinzioni che si è abituati a considerare nette e evidenti.

Risulta infatti istruttivo e significativo uno studio analogico comparato di determinate funzioni fisiologiche o psichiche nell'animale e quelle corrispondenti nelle grandi calcolatrici e in altre macchine con caratteristiche — sotto questo aspetto — analoghe. E risulta istruttivo in entrambi i sensi: per aiutare, cioè, sia a impostare e analizzare problemi concernenti l'ideazione di dispositivi appropriati basandosi sulla conoscenza degli analoghi organi nell'animale, sia inversamente ad elaborare ipotesi o teorie concernenti tali organi e le loro funzioni e disfunzioni basandosi sulla più piena conoscenza dei dispositivi artificiali. Ne risulta un vantaggio bilaterale, e, inoltre, una superiore sintesi in cui vengono posti in piena luce un complesso di concetti e problemi la cui posizione di particolare attualità nel presente momento della scienza è stata ampiamente illustrata da Norbert Wiener. […]

Le calcolatrici elettroniche costituiscono l'oggetto e lo scopo principale della presente esposizione, e forniranno ben più ampiamente motivi per toccare diverse questioni attinenti alla cibernetica. Ma, ancor prima di giungere a parlarne, altri esempi più semplici basteranno a tratteggiare con riferimento a qualcosa di concreto le idee accennate fin qui in forma del tutto astratta e generica.

Si pensi a un dispositivo per tiro antiaereo comandato automaticamente dal radar: esso provvede ad avvistare l'aereo, individuarne la traiettoria, prevederne la continuazione secondo le istruzioni apparse più efficienti, puntare il pezzo, e sparare. D'accordo: meraviglioso, ma non ha intelligenza; non fa che eseguire automaticamente operazioni conformi a istruzioni prefissate. Però diciamo *intelligente* un servente che sappia anche meno esattamente attenersi ad analoghe istruzioni. Il meccanismo

dell'avvistamento è inconscio e automatico anche nell'uomo: la visione di qualcosa che abbaglia o si muove ai margini del campo visivo (ossia sulle regioni periferiche della retina) provoca il movimento e l'accomodamento degli occhi (ed eventualmente della testa e del corpo) atti a fissare l'oggetto nella posizione più favorevole (anche in base a comparabilità con immagini immagazzinate nella memoria: p. es. un volto ecc. in posizione eretta piuttosto che capovolta od obliqua). Il meccanismo del puntamento, basato sulla percezione ad ogni istante del divario tra la direzione desiderata e quella effettiva e sulla tendenza a diminuirla, è il medesimo; anche le disfunzioni derivanti a un servomeccanismo da difetto o eccesso di tale tendenza adeguatrice sono gli stessi con cui si manifestano nell'uomo certe malattie nervose (insufficienza nel rispondere allo stimolo, o esuberanza che per tendere alla mèta la fa oltrepassare, e poi fa troppo retrocedere, dando così luogo a oscillazioni).

Certamente, l'uomo può discutere le istruzioni ricevute, avvertire se sono errate; ma anche una macchina potrebbe venir predisposta sulla base di *istruzioni generali* in modo da rifiutare *istruzioni particolari* non conformi a certi canoni e segnalarne l'erroneità; ed anche il processo dell'esperienza, dell'ammaestramento, dell'istruzione, con cui la mente dell'uomo viene predisposta a tale funzione trova la sua più naturale interpretazione in forma perfettamente analoga a quella della predisposizione di una istruzione *generale* in una macchina.

E allora? ogni differenza scompare?

Non dico questo. *Sentiamo* che no. Eppure diviene difficile indicare dove questa differenza cominci, senza tema di dover ripiegare su posizioni più arretrate, in base a riflessioni del tipo incontrato poc'anzi. E s'insinua il dubbio che la differenza, più che di sostanza, sia forse di prospettiva: pensando a una macchina noi ci collochiamo sul piano dell'uomo che l'ha costruita, sappiamo che egli ne conosce il trucco, e a lui facciamo risalire quanto essa fa; pensando a un uomo o a un animale noi ci collochiamo sul suo medesimo piano senza ricorrere all'ipotesi di un costruttore cui far risalire la spiegazione del suo comportamento. Ma, questo sarebbe allora il problema, quale criterio di

distinzione potremmo applicare se ci trovassimo di fronte ad un essere di cui si possa soltanto osservare il comportamento (behavior) senza comprendere dalle fattezze esteriori se si tratti di ima macchina costruita dall'uomo oppure di un animale?