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The Limitations of Reason or the Limitations of the Paradigm? Toward an Interdisciplinary Architecture for Reinterpreting the Question of Modern Knowledge

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Abstract

This article reformulates a classical epistemological question that has long remained at the intersection of the philosophy of mind, the philosophy of science, and contemporary cognitive studies. When human beings encounter the limits of their knowledge, when a well-established theory collapses, or when a scientific model fails to explain certain phenomena, an urgent question arises: Is this due to a limitation inherent in the structure of the human mind itself, or to deficiencies in the models and representations that it produces and operates with?

Drawing on a critical and synthetic reading of the literature of modern epistemology and interdisciplinary studies, the article distinguishes between three types of epistemic limits: limits of representation (the possibility of constructing accurate theories that exceed intuitive capacities), limits of intuitive understanding (the inability to internally comprehend certain representations), and limits of practice (contextual, historical, and social constraints). The study advances the argument that much of what is attributed to the "limitations of the mind" is in fact a limitation of modelling frameworks, of the normative horizon that conditions the possibility of experience, and of the network of relations between natural and artificial systems through which knowledge is actually produced.

The article then proceeds to examine scientific models as constructed epistemological tools subject to design decisions that enable certain questions to be asked while neglecting others. It warns against the "illusion of understanding" that arises from mastering a model's internal reasoning without connecting it to the real-world system. In light of the transformations brought about by Large Language Models (LLMs), neuroscience, and reverse engineering, the concept of "cognitive integration" is introduced. This concept rejects the mind/model dichotomy and advocates an interconnected conception in which natural systems (the brain and cognitive faculties), artificial systems (algorithms and software), and socio-historical systems cooperate in the production of knowledge.

The article further proposes a new interpretation of the question of knowledge that transcends the dichotomy of absolute limitation, placing the human agent at the centre of an integrated system of representations, tools, and institutions. The question is thus reformulated as follows: What can a mind equipped with appropriate models, tools, and contexts know, and what remains beyond its horizon not because of an intrinsic incapacity, but because of deficiencies in the frameworks employed or in the interaction among systems? Such a position is more epistemically productive, more ontologically faithful, and more consistent with the spirit of

modern science, which is founded upon integration and interconnectedness rather than fragmentation and insulation.

Keywords: Epistemology; Interdisciplinary Studies; Cognitive Engineering; Limitations of the Mind; Limitations of the Model; Modelling; Representation; Cognitive Integration; Natural and Artificial Systems; Reverse Engineering.

Introduction

The dominant characteristic of philosophical and epistemological inquiry throughout the twentieth century was precise specialization and confinement within limited fields of knowledge. However, the explosion of the modern information revolution, together with the developments that accompanied it in neuroscience, artificial intelligence, and cognitive linguistics, has imposed a different intellectual orientation founded on the unity of knowledge while acknowledging its diversification. This orientation has come to be known as "interdisciplinary studies"[1], a new field of knowledge based on the integration of scientific perspectives and the necessity of linking information within a comprehensive cognitive system that unifies specialization. It is regarded as an inevitable means of achieving objective outcomes for contemporary problems and of explaining emerging phenomena in both natural and artificial domains.

From this perspective, the present article addresses a classical problem in contemporary epistemology: when human beings find themselves incapable of understanding a given phenomenon, or when an established theory collapses, is the failure rooted in the intrinsic structure of the mind, or in the model and cognitive representation through which it operates? Reinterpreting this question does not merely require privileging one of these poles over the other; rather, it demands a precise distinction between different types of epistemic limits, an examination of the nature of models as constructed epistemological tools, and a repositioning of the mind within a network of natural, artificial, and social systems, according to an interdisciplinary vision grounded in integration and interconnectedness rather than dualism or opposition.

1. Types of Epistemic Limits: Necessary Distinctions in Light of Interdisciplinary Systems

1.1. The Level of Representation and Intuitive Understanding in the Construction of Knowledge: A common methodological confusion in epistemological discussions lies in the failure to distinguish between the ability to construct an accurate theoretical representation of the world and the intuitive ability to comprehend that representation internally. Boudry, Vlerick, and Edis clearly differentiate between these two levels, emphasizing that intuitive difficulty in grasping a highly abstract physical theory does not necessarily imply an inability to represent it scientifically. Human intelligence is capable of producing precise theories that exceed its intuitive capacity to imagine them.[2]

This distinction redraws the contours of the problem,
as many claims concerning the "impossibility of knowledge" are based on the absence of direct intuitive understanding rather than on the absence of representational capacity. Consequently,

[1] Miller, George. "The Cognitive Revolution: A Historical Perspective." Trends in Cognitive Sciences, Vol. 7, No. 3, Elsevier, 2003, pp. 142–143.

[2] Boudry, Maarten, Michael Vlerick, and Taner Edis. "The End of Science? On Human Cognitive Limitations and How to Overcome Them." Biology & Philosophy, Vol. 35, Springer, Dordrecht, 2020, pp. 4–6.

what appears to be an intrinsic limitation may in fact be a side effect of deficiencies in the representational framework or in intuitive training.

1.2. Structural Constraints of the Mind: Adaptive Intelligence Rather than a Catalogue of Deficiencies

Cognitive science does not deny that the human mind operates under real constraints related to time, computational resources, attentional capacity, and working memory. However, Griffiths argues that these very constraints help explain the distinctive characteristics of human intelligence rather than merely limiting it. Rapid learning from scarce examples, compositional reasoning based on the decomposition of problems, and the capacity for the cultural transmission of knowledge all emerged in response to these constraints rather than in spite of them.[1]In other words, the human cognitive structure is not merely a catalogue of deficiencies; it is an adaptive system that has generated forms of intelligence suited to its particular environment. This suggests that the alleged "limitation" observed in certain domains may actually reflect a lack of compatibility between the type of problem encountered and the type of cognitive framework mobilized to address it.

1.3. Beyond the Dichotomy of Absolute Limitation: The Mind Between Natural and Artificial Systems

At another level, philosophical research concerned with the critique of Western reason points to a third type of limitation: not a limitation in raw cognitive capacity, but a limitation in entrenched modes of thinking and in the normative frameworks that reason it self takes for granted. The concept of the "blind mind" emerges when reason remains captive to reductionist assumptions in its approach to highly complex phenomena[2]. This type of limitation reveals that the problem does not lie in absolute cognitive capacity, but rather in the model that the mind invokes, thereby opening the way for a critique of models and representations.

2. The Limitations of Models and Representations: An Examination of the Tool in Light of Cognitive Engineering

2.1. Human Reasoning between Formal Logic and Models of Possibility

The Mental Models Theory developed by Johnson-Laird and his colleagues offers a radical reformulation of the nature of human reasoning, reflecting a profound shift in our understanding of how human beings think. Contrary to the prevailing assumption in classical logic and early cognitive psychology that human reasoning consists in applying formal logical rules (such as Aristotelian syllogisms or propositional calculus) Johnson-Laird advances an alternative thesis: human beings do not reason through rules; rather, they construct mental models that represent possibilities rather than abstract rules.[3]

[1] Thomas L. Griffiths, "Understanding Human Intelligence through Human Limitations," Trends in Cognitive Sciences, Vol. 24, Elsevier, Cambridge (MA), 2020, pp. 873–874.
[2] Linda Martín Alcoff, "Epistemic Injustices," in Routledge Handbook of Epistemic Injustice, Routledge, 2017. Mohamed Boumediene and Allal Allal, "The Philosophy and Mechanisms of Deconstructing the Contemporary Western Cognitive Mind," Journal of Science, Education and Innovations in the Context of Modern Problems, Vol. 8, No. 4, 2025, pp. 4–7.
[3]Philip N. Johnson-Laird, Ruth M. J. Byrne, and Sangeet Khemlani, "Models of Possibilities Instead of Logic as the Basis of Human Reasoning," *Minds and Machines*, Vol. 34, Springer, Dordrecht, 2024, pp. 3–8.

What is meant by "models of possibilities"? Imagine that you are confronted with a piece of information or a proposition. Your mind does not begin by mechanically applying a rule such as "if A, then B." Rather, it attempts to construct a mental representation of the possible situations that would make the proposition true. It then explores these models and tests which of them remain viable in light of new information. This process is slower and less precise than formal reasoning, but it is closer to the way the mind operates in everyday life: we imagine possible scenarios, examine which of them survive contradictions, and then arrive at a conclusion.

The implications of this theory are revolutionary.

First, individuals often draw conclusions that appear "necessary" from their own perspective but are logically incorrect. Why? Because they have constructed an incomplete mental model that overlooks certain possibilities. They assume that their model encompasses all possible cases, whereas in reality it covers only a subset of them. This explains the phenomenon of "biased reasoning", whereby we accept conclusions that seem logical to us but fail to withstand rigorous analysis.

Second, individuals may reject conclusions that are logically valid simply because they conflict with their current mental model. This is not because the mind is incapable of understanding them, but because the model within which it is presently operating cannot accommodate them. Accepting such conclusions requires dismantling the existing model and constructing a new one a process that demands cognitive effort that individuals may not exert spontaneously. This lies at the core of "confirmation bias", whereby we prefer models that reinforce our prior beliefs and exclude information that challenges them.

This theory alone is sufficient to demonstrate the extent to which the structure of a model influences the outcomes of human thought. The issue is not one of intellectual incapacity; rather, it concerns the structure of the model that the mind is employing at a given moment. Changing the model that is, reconstructing the mental representation of possibilities can completely alter the conclusions reached. Consequently, what appears to be a "limitation of the mind" (such as the inability to understand a particular form of reasoning) may simply be a temporary limitation in the model that the mind has unconsciously adopted.

2.2. Scientific Models as Constructed Epistemological Tools

From the perspective of the philosophy of science, Tarja Knuuttila advances a highly significant argument that reflects a growing trend in contemporary philosophy of science known as the "instrumentalist approach" or "model-based pragmatism". According to this view,

"scientific models are not mirrors of reality"; that is, they are not exact replicas of the external world. Rather, they are constructed epistemological tools, constrained by entirely human design choices.[1]

To illustrate this, consider how a scientific model is constructed. A researcher selects certain variables while disregarding others, introduces simplifying assumptions (such as assuming friction to be negligible, a gas to be ideal, or a market to be in equilibrium), and determines the boundaries within which the model is applicable. None of these choices is imposed by reality

[1] Tarja Knuuttila, "Modelling and Representing: An Artefactual Approach to Model-Based Representation," Studies in History and Philosophy of Science, Vol. 42, Elsevier, Amsterdam, 2011, pp. 263–265.

"as it is"; rather, they are practical decisions arising from the researcher's objectives, the constraints of the available tools, and prevailing scientific traditions. A model is not a reflection of reality; it is a construction.

The crucial consequence is that every model, by virtue of its structure, enables certain questions to be asked while overlooking others. It illuminates some aspects of a phenomenon while leaving others in the shadows. This is not a flaw of the model but its very nature. A good model is not one that portrays reality in its entirety, but one that effectively answers our current questions and opens new avenues for inquiry.

The major methodological error occurs when a model is treated as if it were reality itself rather than a tool for investigating reality. When this happens, the model ceases to be a means and becomes an end in itself, and the researcher becomes captive to his or her own assumptions. This explains many scientific crises: when a theory encounters difficulties and proves incapable of explaining new phenomena, researchers often ask, "What have we missed in reality?" or "Which part of the truth have we overlooked?" Yet the more appropriate question is: "What does our model overlook by virtue of its structure?" In other words, which aspects of reality has our model been designed to ignore? This shift in questioning frees the researcher from the obsession with "faithful representation" and encourages a critical reassessment of the tools being employed.

2.3. The Illusion of Understanding: Mastery of Internal Reasoning versus Genuine Understanding

Kuorikoski and Ylikoski identify a subtle and misleading phenomenon that is present in nearly all scientific and educational practices: the phenomenon of the "illusion of understanding"[1]. This refers to the fact that mastery of reasoning within a model the ability to use the model skillfully, apply its rules, derive its results, and solve its problems generates a powerful feeling of understanding. However, this feeling may not reflect genuine understanding in the deeper philosophical sense.

What, then, is the difference between "mastery of internal reasoning" and "genuine understanding"? Mastery of internal reasoning means that one knows how to "operate" the model: one understands its rules, inputs, outputs, and associated tools.

Actual understanding, however, requires something additional and essential: the connection of internal inferences to the real-world system that the model is supposed to represent, as well as reliance on background knowledge that the model alone cannot provide. Genuine understanding means knowing why a model works in some contexts and fails in others, understanding the limits of its validity, recognizing the relationship between its abstract concepts and concrete entities in the world, and being able to translate between the model and alternative forms of representation. Genuine understanding involves an awareness of what lies beyond the model.

Put more clearly, a researcher may become highly proficient in handling a complex mathematical model without actually understanding the phenomenon it represents. This is not merely a theoretical possibility; it is a common reality in modern sciences that rely on models which are often difficult to grasp intuitively. Many physicists, for example, can work with the

[1] Jaakko Kuorikoski and Petri Ylikoski, "External Representations and Scientific Understanding," Synthese, Vol. 192, Springer, Dordrecht, 2014, pp. 3820–3825.

equations of string theory with remarkable skill, yet when asked, "What do these equations represent in reality?" they may find themselves uncertain. They have mastered the model's internal reasoning, but they do not necessarily possess an understanding connected to the physical world. The "illusion of understanding" suppresses the motivation for further inquiry. A researcher who feels that he or she has "understood" a phenomenon by virtue of mastering the model may cease to ask critical questions about the model's assumptions and limitations. As a result, the limits of the model become confused with the limits of possible knowledge. In this way, a model that was originally intended as a tool for expanding knowledge becomes a constraint on thought itself. This is one of the ways in which a "limitation of the model" is transformed into an apparent "limitation of the mind": the mind becomes satisfied with what the model provides, ceases to seek ways of transcending it, and projects its temporary limitations onto the nature of things themselves.

2.4. Critiques of Representationalism and Post-Modelling Approaches

Guilherme de Oliveira goes further than many other critics by arguing that representationalism itself that is, the philosophical assumption that genuine knowledge consists in a representational correspondence between a model and reality is a dead end in the philosophy of science. [1]In other words, the insistence that there exists a form of "true knowledge" that corresponds to an "independent reality" constitutes a philosophical problem that cannot be resolved and should instead be transcended altogether. As an alternative, he proposes a radically pragmatic framework in which models and knowledge are evaluated not according to a standard of representational fidelity to a presumed reality, but according to the success of scientific practice itself. Accordingly, instead of asking, "Does this model accurately represent reality?" we should ask: "Does this model enable prediction? Does it successfully guide action? Can it be relied upon in decision-making? Does it open new avenues for research?" These become the criteria by which models and knowledge claims are to be assessed. This shift from the criterion of correspondence to the criterion of effectiveness carries far-reaching implications for our central problem. If correspondence between a model and reality is not the sole standard of evaluation and may even be a misleading one then many criticisms advanced in the name of the "limitations of reason" turn out, upon closer examination, to be criticisms of the standards by which models are assessed rather than of the cognitive capacities that produced them. Consider, for illustrative purposes, a scientist who develops a statistical model to predict the spread of an epidemic. The model does not perfectly correspond to reality it simplifies assumptions and neglects numerous factors yet it generates predictions that enable governments to make better decisions than they could in the absence of any model at all. From a representational perspective, such a model is "incomplete" or "deficient." From a pragmatic perspective, however, it is a "good model" because it successfully fulfills practical objectives. If a critic argues that "human reason is limited because it failed to construct a perfectly corresponding model," that critic is conflating an unattainable ideal of correspondence since no model can perfectly mirror reality with achieved effectiveness. The real deficiency, therefore, lies not in reason itself but in the evaluative standards employed by the critic. What we commonly

[1] Guilherme De Oliveira, "Representationalism Is a Dead End," Synthese, Vol. 198, Springer, Dordrecht, 2018, pp. 210–215.

describe as "epistemic limitation" is thus often a reflection of our commitment to particular standards of evaluation typically idealized representational standards rather than an objective fact about the boundaries of human cognition. Moving beyond representationalism toward a broader pragmatism of models frees us from this circular predicament and allows us to conceive of knowledge as successful practice within specific contexts rather than as a mirror of reality. This perspective aligns with the central thesis of the present article: the limits we often take to be limits of reason may in fact be nothing more than limits imposed by some of our own philosophical criteria.

3. Reason within the Knowledge System: Between Natural and Artificial Systems

3.1. The Gap between Analytic and Continental Approaches and Its Impact on the Reason/Model Dichotomy: Moss argues that contemporary philosophy of mind stands before a profound and unresolved tension. Analytic approaches tend to portray the mind as a system of processes that can be decomposed, formalized, and potentially simulated, yet they struggle to bridge the gap to subjective experience. Continental approaches, by contrast, offer rich descriptions of subjectivity and consciousness but resist generalization and systematic formalization[1]. The divide between these traditions sustains the very illusion of the "reason/model dichotomy" and renders any attempt at reinterpretation dependent upon overcoming this longstanding philosophical separation.

3.2. Kant's Normative Horizon and the Normative Determination of the Conditions of Experience: Drawing upon the Kantian framework and Husserlian phenomenology, Foley emphasizes that every cognitive experience is conditioned by prior normative structures. The models we construct are not independent of these structures; rather, they are concrete realizations of them[2]. Consequently, the limits of a model are not merely technical contingencies but reflections of a deeper structure governing the very possibility of experience and knowledge. This Kantian dimension adds further depth to the reinterpretation of the question of knowledge. The task is not simply to improve our models, but also to interrogate the normative horizon that generates those models and determines what counts as "knowledge" in the first place.

3.3. The Anthropological Dimension of the Social and Historical Complexity of Knowledge Production: Bhattacharya expands the scope of analysis to encompass the social and historical sphere. Knowledge production is not a purely individual act; rather, it emerges from a network of experiences, representations, and social and cultural forces that shape what becomes visible and what remains unseen. Similarly, [3]Marcilia identifies a major shift in contemporary epistemology from a model of knowledge conceived as fixed, objective, and ahistorical toward a constructivist and pragmatic perspective that situates knowledge within its historical and social context. This expansion reframes the question. Instead of asking, "What is

[1] Adam Muss, "The Concept of Mind in Contemporary Philosophy," Voprosy Filosofii, No. 2, Institute of Philosophy (Russian Academy of Sciences), Moscow, 2021, pp. 101–103.
[2] Lucas Vollet, "Integrating Inferentialism and Representationalism: Kant's Synthesis Thesis, Normative Ceilings, and Phenomenological Data," Revista Dissertatio de Filosofia, Universidade Federal de Pelotas, Pelotas, 2025, pp. 4–9.
[3] Ujjwal Bhattacharyya, "Reconceptualizing Representation: Interconnections of Experience and Space in the Production of Knowledge," Journal of Human Values, Vol. 25, SAGE Publications, New Delhi, 2019, pp. 115–118.

reason absolutely incapable of knowing?", the more appropriate question becomes: "What does the context within which reason operates enable or constrain?" The issue thus shifts from intrinsic cognitive limitations to the conditions under which cognition itself is socially and historically constituted.[1]

4. Reason, Models, and Technology: Toward a Networked Interpretation Based on Cognitive Integration

4.1. Large Language Models and the Question of Understanding: Where Are the Limits?

The emergence of Large Language Models (LLMs) has revived, with renewed urgency, an enduring epistemological question: Can a machine understand? What is the nature of the "understanding" that we ordinarily attribute to conscious human subjects, and can it be reduced to symbolic or statistical processing of natural language? These questions, long confined to the domains of analytic philosophy and phenomenological studies of consciousness, have returned to the forefront following the remarkable performance of models such as GPT, Gemini, and others. These systems are capable of producing coherent texts, answering complex questions, and even generating outputs that resemble logical reasoning. Cascelli and his colleagues carefully distinguish between a functional similarity in linguistic outputs and a profound difference in the underlying mechanisms. Contemporary models, despite their scale and sophistication, do not possess embodiment in the phenomenological sense, nor do they engage in the kind of lived social interaction that philosophers such as Hubert Dreyfus and Harry Frankfurt regard as fundamental to meaningful action. Furthermore, they lack subjective experience, which many philosophical traditions consider
a necessary condition for consciousness[2]. Surface-level similarities in output can therefore be misleading: the ability of a model to generate coherent text does not imply, in any meaningful sense, that it understands that text in the human way. This critique reaches a deeper philosophical level when considered alongside John Searle's famous "Chinese Room" argumen[3]t. Searle's central claim is that the manipulation of symbols according to formal rules does not produce genuine understanding, regardless of how convincingly the results may resemble understanding. The person inside the room who follows English instructions to manipulate Chinese symbols does not thereby understand Chinese; similarly, a statistical model that predicts the next word in a sequence does not thereby understand the meaning of the words it processes. Human understanding, on this view, is rooted in biological and neurological capacities, in a history of sensory-motor interaction with the world, and in a subjective mode of existence that cannot simply be reduced to a mathematical algorithm. This does not imply that computers are incapable of understanding in principle future artificial systems might conceivably satisfy analogous conditions. It does suggest, however, that current Large

[1] Helen Longino, The Fate of Knowledge, Princeton University Press, 2002.Kristiana Marchelia, "Epistemologi Ilmu Dalam Perspektif Filsafat Kontemporer: Sebuah Tinjauan Sistematis," Journal of Innovation in Teaching and Instructional Media, Vol. 5, No. 3, 2025, pp. 3–5.

[2]Christine Cuskley, Ryan Woods, and Megan Flaherty, "The Limitations of Large Language Models for Understanding Human Language and Cognition," Open Mind: Discoveries in Cognitive Science, Vol. 8, MIT Press, Cambridge (MA), 2024, pp. 1060–1065.

[3]John Searle, "Minds, Brains, and Programs," Behavioral and Brain Sciences, Vol. 3, No. 3, Cambridge University Press, 1980, pp. 417–457.

Language Models, whose architecture is fundamentally based on statistical embeddings and probabilistic prediction, remain far removed from such a horizon. Tamir and Shesh raise a deeper question concerning whether it is possible to attribute "understanding" to deep learning models in any philosophically meaningful sense. In their careful analysis, they distinguish between two levels of cognitive representation. The first is "statistical-associative representation", the domain in which Large Language Models excel. This level enables them to capture patterns of linguistic distribution and probabilistic relationships among words and expressions. The second is "causal-model representation", which presupposes the existence of an internal model of the world that supports counterfactual reasoning, hypothetical intervention on variables, and the inference of causes from effects and vice versa. It is precisely this second level that contemporary deep learning models lack, despite ongoing attempts to integrate causal reasoning into deep architectures.[1] There is also a fundamental distinction between "understanding" as the capacity for formal inference and "understanding" as existential participation within a horizon of meaning. In the hermeneutic tradition, particularly in the philosophy of Hans-Georg Gadamer, understanding is not primarily a computational operation but rather an event of fusion between the horizons of the interpreter, the text, and its context. It is an open-ended process that does not culminate in absolute certainty but in continual dialogue, reinterpretation, and mutual enrichment of meaning.[2] From this perspective, Large Language Models remain incapable of genuinely "understanding" a text because they possess no subjective horizon through which they engage with it. Nor do they possess a history, a reservoir of lived experiences, or an emotional background capable of enriching such a horizon. Consequently, they simulate the outward products of understanding within discourse, but they do not undergo the lived event of meaning or comprehension itself. This critique should not be taken as a reason to dismiss the value of Large Language Models. Rather, it is a call for epistemological humility. Such models can serve as powerful tools for generating hypotheses, exploring the combinatorial spaces of texts, and revealing unexpected analogies between seemingly unrelated concepts. However, treating them as substitutes for understanding itself or as evidence of an inherent deficiency in human reason confuses two distinct levels: the level of procedural effectiveness and the level of understanding.[3] A model may pass increasingly sophisticated versions of the Turing Test, yet it remains a tool rather than a knowing agent, a representation rather than a thinking existence. This observation reinforces the central thesis of the present article: much of what is mistakenly interpreted as a "limitation of human reason" because the machine appears "more intelligent" is, in reality, a limitation of the model itself as a comparative instrument and evaluative standard and of our tendency to project inappropriate value judgments on to the nature of mental processes.

[1] Moti Tamir and Elay Shech, "Machine Understanding and Deep Learning Representation," Synthese, Vol. 201, Springer, Dordrecht, 2023, pp. 4–10.
[2] Artificial Intelligence, Hermeneutics, and the Future of Understanding," AI & Society, 2021.
[3] David Chalmers, "The Meta-Problem of Consciousness," Journal of Consciousness Studies, Vol. 25, No. 9–10, 2018, pp. 6–61.

4.2. The Tool, Not the Substitute: The Principle of Cognitive Integration between Natural and Artificial Systems

Yoo and Scribner defend a fundamental principle within the educational context: Large Language Models are powerful research tools, but they cannot replace embodied experience or the ethical and epistemic virtues cultivated through genuine human learning[1]. This position does not diminish the value of the tool; rather, it situates it in its proper place as a support mechanism that expands cognitive possibilities rather than as one party replacing another.

What may be inferred from this perspective is what can be termed "cognitive integration" between human reason and its representational and technological instruments. Rather than competing with one another, they assume different roles within a broader system of knowledge production, much as natural and artificial systems cooperate in the architecture of knowledge. This principle can be elaborated at three interconnected levels.

First: The Level of Functional Distribution

Human reason does not perform all cognitive tasks with equal efficiency. It excels at recognizing complex patterns in ambiguous contexts, reasoning by analogy, and exercising practical judgment informed by values and subjective experience. Computational tools and digital models, by contrast, excel in large-scale calculations, the storage of vast amounts of information, and the execution of repetitive operations without fatigue or loss of consistency.

Cognitive integration therefore entails distributing tasks according to the distinctive strengths of each party rather than treating one as a substitute for the other. Just as a computer cannot replace a teacher's moral intuition in the classroom, human cognition cannot compete with an algorithm capable of sorting millions of documents within seconds.[2]

Second: The Level of Cognitive Amplification

Tools do not merely perform tasks; they reshape the capacities of the mind itself. Since the invention of writing and the calculator, human cognition has relied upon its own artificial products to transcend its biological limitations. In the contemporary digital environment, Large Language Models function as a distributed external memory and as a suggestion engine that relieves the mind of routine retrieval tasks, thereby creating space for reflection, synthesis, and critical reasoning. This is the essence of cognitive amplification: the tool does not replace the agent but expands the range of what the agent can accomplish, provided that the human subject remains the final decision-maker and bears ethical responsibility for the outcomes produced.[3]

Third: The Level of Inter-System Feedback

The relationship between natural and artificial systems is not unidirectional. While computers are employed to process human language, their errors and limitations simultaneously reveal the boundaries of our own theoretical models of language and cognition. A failure to generate a coherent text may expose a deficiency in the structure of our cognitive representations. Conversely, the more successful we become in simulating particular mental functions, the more aware we become of the complexity of those functions that continue to resist simulation.

[1] Ji Eun Yoo and Charity Scribner, "The Limits of Large Language Models and the Necessity of Human Cognition in K–12 Education," Theory into Practice, Vol. 64, 2025, pp. 494–499.
[2] Edwin Hutchins, Cognition in the Wild, MIT Press, 1995.
[3] Andy Clark and David Chalmers, "The Extended Mind," Analysis, Vol. 58, No. 1, 1998, pp. 7–19.

This reciprocal process of feedback prevents us from falling into the illusion of substitution and sustains a necessary epistemological humility. In this sense, "cognitive integration" moves beyond the sterile debate concerning whether humans are superior to machines or machines superior to humans. Both sides lose when operating in isolation, and both benefit when cooperating within a framework of functional complementarity. The central question is therefore not, "Who truly understands?" but rather: "How can a system composed of human minds, technological tools, and social networks generate a form of understanding that is deeper and broader than what any single component could achieve on its own?"

4.3. Cognitive Pluralism and the Transcendence of Model Monism

Williams advances the concept of "cognitive pluralism" as an analytical framework that rejects the assumption that there exists a single optimal model of thought and knowledge[1]. Rather than searching for the "ideal mind" or the "optimal model," pluralism recognizes that different forms of cognitive processing some representational, some procedural, and some social cooperate in producing actual knowledge within diverse contexts.

This position converges with Zahorodniuk's argument that the contemporary epistemological question lies at the intersection of four fields: epistemology, ontology, phenomenology, and philosophical anthropology.

[2] The issue is therefore not one of an abstract "mind," but of the human being as a knowing and embodied entity situated within a world.From this perspective, cognitive pluralism may be analyzed into three principal dimensions:

First: Plurality at the Level of Cognitive Modes: There is no single "correct path" to knowledge. Human inquiry operates through multiple modes of reasoning: formal logical reasoning, probabilistic induction, analogical and narrative reasoning, and context-sensitive intuition. The effectiveness of each mode varies according to the domain of knowledge involved whether physics, history, art, or ethics as well as the context in which it is employed, such as scientific research, everyday decision-making, or philosophical reflection. To elevate one mode above all others is a form of "epistemic colonialism" that impoverishes cognitive diversity and obscures significant dimensions of reality. A genuinely pluralistic epistemology recognizes that different forms of reasoning reveal different aspects of the world and that no single cognitive mode can exhaust the complexity of knowledge.[3]

Second: Plurality at the Level of Models: No model can legitimately claim to be the sole "true" representation of reality. Newtonian, relativistic, and quantum models each provide valid representations within their respective domains while proving inadequate in others. Likewise, in linguistics, transformational-generative models, functional-cognitive approaches, and probabilistic statistical models each illuminate different dimensions of linguistic phenomena. Such model pluralism does not entail epistemic relativism. On the contrary, cumulative knowledge becomes possible precisely through the interaction and integration of multiple models. What pluralism rejects is the exclusion of a model merely because it fails to provide the complete picture. Since epistemic completeness is unattainable, plurality constitutes the

[1] Daniel Williams, "Cognitive Pluralism," Philosophical Psychology, Vol. 31, No. 1, 2018, pp. 140–142.
[2] Viktor Zahorodniuk, "Man and Knowledge: At the Intersection of Modern Epistemology, Ontology, Phenomenology, Philosophical Anthropology," Filosofska Dumka, No. 4, 2024, pp. 3–6.
[3] Boaventura de Sousa Santos, Epistemologies of the South: Justice against Epistemicide, Routledge, 2014.

most promising path toward a more comprehensive though always provisional understanding of reality.[1]

Third: Integrative Plurality: The most productive moments in the history of science have rarely occurred when one model completely displaced another. Rather, progress has often emerged through the integration of models operating at different levels of analysis, thereby generating richer and more comprehensive accounts of complex phenomena. In biology, for example, molecular, cellular, and physiological models complement one another to produce a deeper understanding of living systems. In consciousness studies, computational, neuroscientific, and phenomenological models interact to illuminate different aspects of conscious experience. This is the essence of "integrative pluralism": we do not choose between models; we combine them. We do not eliminate competing perspectives; we coordinate them within a broader explanatory framework. Such an approach leads to a conception of knowledge as a complex, multi-layered system whose interpretation requires both methodological and conceptual pluralism. In this sense, reinterpreting the question of knowledge does not require greater innate intelligence. Rather, it calls for "structural humility" and "synthetic boldness" at the same time: humility before the complexity of reality, which prevents us from claiming possession of a single definitive model, and boldness in integrating diverse models into a unified epistemic network. This, ultimately, is the objective pursued by the present article: the construction of an interdisciplinary architecture of knowledge capable of transcending both disciplinary isolation and model monism.

5. Toward a New Interpretation of the Question of Knowledge in Light of Interdisciplinary Knowledge Architecture

5.1. From Dualism to Network: The Architecture of Integrated Knowledge

The proposal emerging from the literature reviewed in this study, informed by interdisciplinary research and systems engineering approaches, is to abandon the traditional dualism of "reason versus model" and move toward a network-based conception of knowledge. Knowledge is neither the product of an isolated mind applied to a fixed external reality nor the outcome of a model that directly mirrors the world. Rather, it emerges from the continuous interaction among several interconnected systems:

1. A Human Agent with a Limited yet Adaptive Cognitive Structure (the Natural System): This agent is not a disembodied intellect but an embodied living being endowed with an evolutionary history and constrained by biological limitations in memory, attention, and information processing. At the same time, it possesses adaptive capacities that enable rapid learning, analogical reasoning, and decision-making under conditions of uncertainty. Human cognition is therefore simultaneously bounded and flexible, constrained yet capable of continual adaptation.[2]

2. Models and Representations Constructed through Design Decisions and Specific Purposes (the Artificial System): These include scientific theories, mathematical representations, maps, computational models, and even the conceptual frameworks through which we organize our understanding of the world. Every model is a construction rather than a

[1] Hasok Chang, Is Water H_2O? Evidence, Realism and Pluralism, Springer, 2012.
[2] Andy Clark, Being There: Putting Brain, Body, and World Together Again, MIT Press, 1997.

reflection. Embedded within its structure are implicit assumptions that determine what can be observed, emphasized, or ignored. Models do not simply reveal reality; they actively shape the conditions under which reality becomes intelligible.[1]

3. A Social and Historical Context that Determines Legitimate Questions and Acceptable Standards (the Socio-Cultural System): Knowledge is never produced in a vacuum. It emerges within scientific communities governed by norms, values, research traditions, distributions of authority and resources, and historically contingent definitions of what counts as a legitimate question or a convincing answer. The standards by which knowledge claims are evaluated are themselves products of historical struggles and transformations that cannot be reduced to purely logical criteria.[2]

4. Instruments and Technologies "Including Digital and Computational Systems" that Expand the Scope of Representation and Action (the Technological System): Microscopes, telescopes, particle accelerators, supercomputers, and Large Language Models all extend the boundaries of human perception and enable the representation of phenomena beyond the reach of unaided cognition. Yet these technologies do more than expand human capacities; they also introduce new constraints[3] and obscure aspects of reality that lie outside the frameworks they privilege. This networked conception is consistent with the view advanced by Edgar Morin, according to which knowledge is not generated within a closed system but within an open and dynamic configuration nourished by the interdependence and integration of multiple systems[4]. Knowledge, in this perspective, is neither an individual faculty nor a linear product. Rather, it is an "emergent property" arising from a complex web of interactions among biological, psychological, social, technological, and symbolic levels of organization.

Consequently, any form of epistemic limitation cannot be attributed exclusively to a single component of this network. More often, it results from failures of coordination among its various levels or from rigidity within one component that obstructs the circulation of interactions across the system as a whole. Three major methodological implications follow from this networked conception:

First, the investigation of the limits of knowledge should become an inquiry into the "architecture of interactions and relationships" rather than into the "capacity of reason". Instead of asking, "How much can the mind know?", we should ask, "How should networks tools, models, and contexts be reorganized in order to expand the horizon of knowledge?"

Second, the apparent "limitations of reason" may, in reality, be limitations in the "translation interfaces" between different levels of the network. Many epistemic failures arise from the difficulty of translating a representation from one level to another for example, from the neural level to the level of conscious experience, or from a mathematical model to intuitive

[1] Tarja Knuuttila, "Modelling and Representing: An Artefactual Approach to Model-Based Representation," Studies in History and Philosophy of Science, Vol. 42, 2011.
[2] Helen Longino, The Fate of Knowledge, Princeton University Press, 2002.
[3] Don Ihde, Technology and the Lifeworld: From Garden to Earth, Indiana University Press, 1990.
[4] Edgar Morin, The Method: Knowledge of Knowledge—Ideas, Their Habitat, Life, Habits, and Organization, trans. Youssef Tibes, 1st ed., Afrique Orient, Morocco, 2013, p. 397.

understanding. Such difficulties do not constitute definitive incapacity; rather, they represent challenges of "intermediate design".[1]

Third, robust knowledge is knowledge that becomes increasingly aware of the limits of its own network and continuously strives to revise and diversify its constituent elements. Knowledge that assumes it has attained the "final model" or has definitively overcome the "limitations of reason" is, in fact, the form of knowledge most vulnerable to blindness and stagnation.

5.2. From Absolute Incapacity to Systemic Limitations: Toward a Reformulation of the Question: The question is no longer: "Where do the ultimate limits of reason lie?" nor "Which model is most faithful to reality?" Rather, the relevant question becomes: "What can a mind equipped with appropriate models and tools come to know, and what remains beyond its horizon not because of an intrinsic incapacity, but because of limitations in the frameworks employed or in the interactions among the systems involved?" This reformulation shifts attention from "intrinsic limitation" which resembles a defect in the processor itself to "systemic limitation", which is analogous to a malfunction in the distribution of tasks and workflows within a knowledge network. Epistemic incapacity is therefore no longer viewed as an inherent attribute of the mind; instead, it is understood as a contingent condition that can be overcome through restructuring relationships within the network, incorporating new components, or redesigning the interfaces connecting existing ones. This reconceptualization leads to a number of clear research responsibilities:

First: Developing models is equivalent to expanding the horizon of knowledge.

Every new model, even if incomplete, creates possibilities for posing questions that were previously impossible to formulate. Investment in "model engineering" that is, in the construction of models that are more complex, integrated, and precise constitutes a direct investment in overcoming what once appeared to be "cognitive limitations." For example, neural simulation models of language could not have emerged without enormous computational capacities; today, however, they enable the testing of hypotheses concerning language processing that were beyond the reach of unaided human reasoning.[2]

Second: Diversifying normative frameworks is equivalent to reducing methodological blindness.: A mind operating within a single normative framework whether Kantian, utilitarian, positivist, hermeneutic, or otherwise may develop a form of "epistemic rigidity" that limits its ability to perceive phenomena inconsistent with its assumptions. Diversification the capacity to move among multiple normative frameworks according to context functions like a set of multifocal lenses that reveal what would otherwise remain concealed. This is precisely the role of the interdisciplinary researcher, who mobilizes methods drawn from different disciplines to address a single problem.[3]

Third: Investing in supportive technological tools provided they are grounded in a sound philosophical understanding is equivalent to enhancing the collective capacity of reason.: Yet this is also where a significant danger emerges. If the role of a technological tool is misunderstood, it may cease to be a support that expands the horizon of knowledge and instead

[1] James J. Gibson, The Ecological Approach to Visual Perception, Houghton Mifflin, Boston, 1979.
[2] Friedemann Pulvermüller, "Neural Reuse of Action Perception Circuits for Language, Concepts and Communication," Progress in Neurobiology, Vol. 160, 2018.
[3] Alasdair MacIntyre, Who is Justice? Which Rationality?, University of Notre Dame Press, 1988.

become a constraint that narrows it. Large Language Models, for instance, can be employed to generate new ideas and propose hypotheses, thereby extending the scope of inquiry. However, when they are used as substitutes for critical thinking, or accepted as unquestionable authorities, they become a cover for epistemic complacency and a source of deeper limitation rather than a means of overcoming it.[1]

Fourth: Adopting a reverse-engineering methodology for understanding natural cognitive systems before attempting to simulate them artificially.: It is impossible to construct an artificial system capable of genuine understanding without first comprehending how the natural system the mind/brain functions in terms of its structure, operations, and interactions with the environment. In this context, reverse engineering entails decomposing cognitive processes into their fundamental components and mechanisms and subsequently reconstructing them within a model suitable for simulation, while maintaining constant awareness that the resulting model remains an approximation rather than an exact replica[2]. Such a methodology guards against the illusion of "simulating understanding" through the superficial reproduction of outputs.

In this sense, the reinterpretation of the question of knowledge is not merely a philosophical maneuver but a practical research program. It calls for a transition from a culture of "complaining about limitations" to a culture of "engineering transcendence," from blaming the mind to developing its tools, models, and contexts. This is precisely what scientific and philosophical inquiry requires in an age characterized by increasing complexity and deep interdependence among natural and artificial systems.

Conclusion:

The literature reviewed in this article does not support a rigid dichotomy between the "limitations of reason" and the "limitations of models." Rather, it reveals that epistemic boundaries are multifaceted and that attributing a significant portion of them to reason in any absolute sense misses the true object of diagnosis. The human mind is a limited yet intelligently adaptive system; models are constructed instruments that simultaneously enable and constrain perception; and actual knowledge emerges from a network of integrated systems rather than from any single component.

Reinterpreting the question of knowledge in light of these insights and through the adoption of interdisciplinary studies and the engineering of cognitive systems does not diminish the responsibility of the researcher; on the contrary, it intensifies it. When a knowledge project fails, the primary questions should be directed toward the frameworks, models, normative horizons, and their interactions with natural and artificial systems, rather than toward any presumed innate impossibility of human reason.

This position is more productive epistemically, more faithful ontologically, and more consistent with the spirit of modern science, which is founded upon integration and interconnectedness rather than fragmentation and insulation. It invites a shift from viewing knowledge as the achievement of an isolated rational subject toward understanding it as an emergent property of dynamic interactions among cognitive agents, conceptual models, social contexts, and

[1] Nader N. Chokr, A Cognitive Critique of Algorithmic Culture, Cambridge Scholars Publishing, 2021.
[2] Chris Eliasmith and Charles H. Anderson, Neural Engineering: Computation, Representation, and Dynamics in Neurobiological Systems, MIT Press, 2003.

technological infrastructures. Within such a perspective, the challenge is no longer to determine the ultimate limits of reason, but to design, refine, and coordinate the systems through which knowledge becomes possible.

Consequently, the future of epistemological inquiry may lie less in debates over whether reason or models are fundamentally deficient, and more in the development of interdisciplinary architectures capable of continuously expanding, correcting, and renewing the conditions of understanding itself. In this sense, the project of knowledge becomes an ongoing process of cognitive and systemic engineering a process aimed not at eliminating limitations altogether, but at transforming them into opportunities for further discovery and innovation.

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