**On the Impossibility of Artificial Intelligence to Represent Reality and its Alternative**

**Indeed, AI Can Only be a Formal Presentation of Languages Without any Content of the Specific Human Cognitive Representation of Reality**

Moreover, intelligence is the ability to think and to act by representing reality and our conduct in it and moreover, without cognitive representation of reality, there is no content to signs and words and they remain empty and meaningless (Nesher, 2000-2023)

**1. On the Impossibility of Artificial Intelligence to Represent Reality and its Alternative**

* 1. **On the impossibility of Artificial Intelligence, as a neo-Kantian epistemology, to represent reality and its Alternative**

The reciprocal relationship of epistemology and science is of a noteworthy kind. They are dependent upon each other. Epistemology without contact with science becomes an empty scheme. Science without epistemology is—insofar as it is thinkable at all—primitive and muddled. (Einstein, 1949: 683–684).

On Analytic Philosophy and its failure to explain human knowledge of itself and external reality (Nesher, 1996, 1998)

Pragmatist’s analysis versus formal semantic analysis of the truths of elementary (atomic) propositions: Knowledge from within versus knowledge from outside. (Nesher, 1998c)

The question to be addressed here is what epistemology scientists use when building and operating artificial intelligence. My answer is that while looking for an industrial revolution in the 20th -century, they found their solution in artificial i[ntelligence](file:///C:\\inteligenc). However, because their epistemological tradition is grounded in Kantian transcendental epistemology, they develop it by appealing to the formal logic and pure mathematics of Kant and the modern neo-Kantian philosophers, who have no theory of truth. Moreover, they hold formal systems with which we cannot prove the truth of their axioms, and their inferred theorems cannot represent external reality (Nesher, 2002- 2021). Thus, we can conclude that artificial intelligence cannot replace human intelligence in truly representing reality and helping us to live properly in nature (Nesher, 2001-2021).

Moreover, we must ask, what is the gist of the conception of artificial intelligence and what was the revolution it brought about, as it seems to be similar to the earlier Industrial Revolution, which began in the 18th century when agricultural society developed more industrialized and urban centers, the transcontinental railroad, the cotton gin, electricity, and other inventions that permanently changed social life. And yet, the question is how and to what extent this AI-centered industrial revolution is related to the epistemological revolution. The epistemological answer is that cognitive epistemology cannot be mechanical-artificial when the latter can only produce new machines to replace human workers with their muscles and to sustain their life in nature. Still, the philosophical problem is to explain the relations between the following disciplines: Philosophy, Epistemology, and Metaphysics, without which we can compose only empty verbalizations with no relation to our experiential knowledge of ourselves and of external reality (Nesher, 1918).

AI could be considered no more than that, as according to Kant, logic is formal and mathematic is pure, and both lack any meaning or relation to reality. Within AI, they operate as mere empty formal signs of a closed game, and as such, they are just meaningless verbalizations (Nesher, 2021).

**1.2. The Kantian Conception of Formal Logic and Pure Mathematics Ended in Their Being Closed Games as Modern AI is Separated from any Empirical Reality**

Formal axiomatic systems accept that all formally deduced theorems are contained, at least implicitly, in *assumed axioms*. Such systems are therefore analytic, and their propositions are detached from reality (Nesher, 2011). Since mathematicians and philosophers in the Euclidean and Kantian traditions consider mathematics a formal axiomatic system, it cannot be a *synthetic a priori* discipline. As a result, mathematicians can use their formal intuitions to infer and prove their synthetic *a priori* mathematical propositions to synthesize its conclusions by implicitly adding the matter of their sensual intuitions to compensate for the sterility of the mathematical *a priori* form. This is quite clear from Kant’s writings about the basic nature of numbers in counting, in measuring physical objects, and in the very possibility of our cognitions of space and time, whose forms we cannot cognize without the *sensual intuition* ‘meters,’ which accounts for their role in mathematics (Kant, *CPuR*: B14-15, Nesher, 2010, 2011).

Considering Kant’s use of pure intuitions in mathematics and the pure intuition of space and time in explaining human cognition of reality, this use of *intuition* to explain *a priori* synthetic knowledge is just a mistake of practically introducing the *sensual intuitions,* or rather, his intentional device to save his Transcendental Revolution.

This criticism of Kant's transcendental epistemology is based on my interpretation and reconstruction of the Peircean-contra-Kantian Copernican Revolution within empirical realism, wherein human cognitions evolve from the initial perceptual operation, with form and matter as its two aspects (see, e.g., my book *On Truth*, in which I followed Spinoza and Peirce, and elsewhere, e.g., Nesher, 2002). Moreover, in my critical work on Gödel and his attempt to formally prove the truth of the mathematical axioms upon mathematical reality, I showed that this can only be done by elaborating Peircean semiotics into a realistic proof (Nesher, 2011).

Numerous academic researchers became concerned that AI was no longer pursuing the original goal of creating versatile, fully intelligent machines. Much of current research involves statistical AI, which is overwhelmingly used to solve specific problems, even highly successful techniques such as [deep learning](https://en.wikipedia.org/wiki/Deep_learning" \o "Deep learning). This concern has led to the subfield of [artificial general intelligence](https://en.wikipedia.org/wiki/Artificial_general_intelligence" \o "Artificial general intelligence) (or “AGI”), which had several well-funded institutions by the 2010sWikipedia.[[13]](https://en.wikipedia.org/wiki/Artificial_intelligence" \l "cite_note-Artificial_General_Intelligence-14)

Indeed, no formal bridge can connect the artificial mechanism with the epistemology of the cognitive experiential proof of the true representation of reality, and this is the basis of all of our intelligence.

**1.3.** **The Problem with the Researchers and Explanans of Artificial Intelligence**

The problem with the researchers and explanans of AI is that they have constructed it in Kantian and neo-Kantian epistemology to explain their hypothetical AI. As such, we can see how corporations and their pursuit of ‘big money’ destroy the coherence of society and undercut the role of universities in research and in developing new methods, theories, comprehensive philosophical methods, epistemologies, and more. Since the social culture under the powerful control of big corporations is to pursue money as the essential motivation, it also affects scientific research so that philosophical investigations are satisfied with producing mere new combinations of past theories. Philosophers merely aim to publish to pursue celebrity status, and similarly, we find that the reconstruction of the formality of language under the guise of AI is considered intelligence. However, artificial language cannot have any meaning without being developed from experiential intuitions and proven true. Therefore, we can see it as falling under the Kantian conception of formal logic and pure mathematics, which are meaningless without experiential intuitions and thus remain meaningless closed games unless they receive their meaning, in some context, from experiential languages connected to real experience. Moreover, the formalism of logic and mathematics cannot explain our experience and knowledge, as indicated by Russell indicated about mathematic and as I develop from Peircean semiotic the epistemic logic and mathematics, which is an empirical discipline about real-world facts and not the traditional pure and formal deductive closed game (e.g., Nesher, 2007, 2010, 2011, 2012, 2018; cf. AI, Wikipedia 2024). On this difficulty, Russell said:

Mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true (Russell, 1901, reprinted in, 1919: 75).

However, although AI cannot replace human cognitive representations of reality, its calculations can assist the scientific discovery and presentation of some components of the human scientific enterprise. Thus, in a post-capitalist culture, scientists and philosophers can earn their reputations and financial gain by increasing their publications mechanically rather than creatively, namely through an artificial mechanism. As Kant says about philosophers:

From the aforementioned distinction between *objectively* and *subjectively* rational cognitions, it becomes clear that, in a certain way, one can learn philosophy without being able to philosophize. He who truly wants to be a philosopher must practice the free use of his reason and not merely an imitative and, so to speak, mechanical use. (Kant, *Logic*, 1800: III: 26).

Indeed, there are different ways to explain the role of AI, not as any replacement of human representation of reality, but as formally presenting our information, or knowledge, of reality, e.g.:

# … [artificial intelligence](https://en.wikipedia.org/wiki/Artificial_intelligence" \o "Artificial intelligence) (AI) dedicated to representing [information](https://en.wikipedia.org/wiki/Information" \o "Information) about the [world](https://en.wikipedia.org/wiki/World" \o "World) in a form that a computer system can use to solve complex tasks such as [diagnosing a medical condition](https://en.wikipedia.org/wiki/Computer-aided_diagnosis" \o "Computer-aided diagnosis) or [having a dialog in a natural language](https://en.wikipedia.org/wiki/Natural_language_user_interface" \o "Natural language user interface). (Knowledge representation and reasoning, Wikipedia 2024b).

# Indeed, there is no true AI since it cannot represent reality; it only represents our cognitive representation of it. Anything else is mere fiction. Language without any context is meaningless, and therefore, when AI pictures language, it is empty of meaning.

AI is considered intelligence. But artificial language cannot have any meaning without being developed from experiential intuitions and proved true, and therefore, we can see it as the Kantian conceptions of formal logic and pure mathematics which are meaningless without experiential intuitions and thus remain meaningless closed games unless we think that they received their meaning from experiential languages connected to real experience but in different context. Moreover, the AI uses the logic and mathematics are taken from the misunderstanding is mistake that their formalism cannot explain our experience and knowledge as Russel indicated about mathematics and as I develop from Peircean semiotics the epistemic logic and mathematics which is an empirical discipline about the real-world facts and not the traditional pure and formal deductive closed game (e.g., Nesher, 2007, 2010, 2011, 2012, 2018; cf. AI, Wikipedia 2023).

### Reasoning, problem-solving:

Early researchers developed algorithms that imitated step-by-step reasoning that humans use when they solve puzzles or make logical deductions. By the late 1980s and 1990s, methods were developed for dealing with [uncertain](https://en.wikipedia.org/wiki/Uncertainty" \o "Uncertainty) or incomplete information, employing concepts from [probability](https://en.wikipedia.org/wiki/Probability" \o "Probability) and [economics](https://en.wikipedia.org/wiki/Economics" \o "Economics).

Many of these algorithms proved are insufficient for solving large reasoning problems because they experience a “combinatorial explosion”: they become exponentially slower as the problems grow. Even humans rarely use the step-by-step deduction that early AI research could model. They solve most of their problems using fast, intuitive judgments. (AI, Wikipedia 2024b).

The epistemological question is about the development of metaphysics as the new comprehensive picture of the universe and of our lives in it. Metaphysics is not just a generalization of the sciences into a comprehensive picture of the universe but also an evaluation and critical combination of the sciences and their composition into a coherent, comprehensive picture of reality. This is the role of philosophers, while its application is that of scientists. It seems that so long as we can continue to prove the truth of our scientific hypotheses by assuming our new picture of reality, as opposed to theorists who assume a previously accepted picture of reality, such proofs can support or even validate the new picture as the generally accepted epistemic proof conditions of our time. Indeed, in every scientific revolution, scientists have new philosophical perspectives and epistemological attitudes, à la the Kuhnian concept of paradigmatic revolution, which affect their general picture of nature (cf.Wikipedia)**.**

**2. Epistemic Logic and How it can Explain Our Mathematical Operation**

Mathematics is the subject in which you don’t know what you’re talking about and don’t care whether what you say is true (Bertrand Russell, 1901, reprinted in, 1919: 75).

The reciprocal relationship of epistemology and science is of a noteworthy kind. They are dependent upon each other. Epistemology without contact with science becomes an empty scheme. Science without epistemology is—insofar as it is thinkable at all—primitive and muddled. (Einstein, 1949: 683–684)

**2.1. Introduction to Logic and its Role in Mathematics**

The fundamental epistemological question is: what is logic, and what is its role in human affairs? Epistemic logic is the basic science representing our confrontation with reality by proving the truth that we represent it. Formal systems are merely *closed games of argumentation* that assume the *truth* and the *falsity* of the initial *propositions* of the *syllogisms* or *axioms*, and, by assuming the *validity* of the inferences, reach their conclusions. The difference between *formal systems* and *realist theories* lies in their different proof conditions. *Formal systems* are *hermetically closed games* under their fixed axioms, which cannot be proved true, and their formal rules of inference cannot evaluate the correspondence of their theorematic conclusions to reality. Hence, *axiomatic formal systems are* *complete* and isolated from reality. In contrast, *realistic theories* *are* Gödelian *incomplete,* but they can be proved true relative to their proof conditions, i.e., relative to the facts of reality that have been proven true and the methods of proving their hypotheses. However, if *mathematics is to be a theoretical science* it cannot be a *pure* *axiomatic closed system* isolated from reality, but an empirical science. In this way, mathematicians can avoid the ambiguity, contradictions, and paradoxes in creating mathematics from unproven axioms (Byers, 2007).

**2.2. The Basic Epistemological Question is: What is Logic and What is Its Role in Human Affairs?**

In his book, *Logic*, Kant summarizes the conception of logic as an *a priori* pure discipline of our rules of thought. The book impacted the following generations of philosophers, logicians, and mathematicians, who accepted aspects of his philosophical system and are known as neo-Kantians. It is still the dominant tradition in philosophy, logic, and mathematics.

If, however, we set aside all knowledge that we can only borrow from *objects*, and reflect simply on the exercise of the understanding in general, then we discover those rules which are absolutely necessary, independently of any particular objects of thought, because without them we cannot think at all. These rules, accordingly, can be discerned *a priori*, that is, *independently of all experience*, because they contain merely the conditions of the use of the understanding in general, whether pure or empirical, without distinction of its objects. Hence, also, it follows that the universal and necessary laws of thought can only be concerned with its *form*, not with otherwise with its *matter*. And we can form a conception of the possibility of such science, just of the *universal grammar* which contains nothing beyond the mere form of language, without words, which belongs to the matter of language. This science of the necessary laws of the understanding and the reason generally, or, which is the same thing, of the mere form of thought generally, as we call *logic*. (Kant, *Logic*, 1800: 171-172)

According to Kant, the science of logic discovers the *necessary* *a priori* rules of our faculties of Understanding and Reason, whereas the rules of other sciences, which are about our relations to *particular objects*, are *contingent*, connected to our particular experience with objects, and can be changed accordingly. However, according to Kant’s transcendental epistemology, for the logical rules of our pure cognitions to be *necessary* and valid, they must be separated from our sensual experience; they must be *formal*, without the *matter* of our sensual experience. As such, those *pure* rules remain meaningless to us. This Kantian epistemology of logic is, in a nutshell, his essential influence on the philosophy of logic and on logic itself, as we can see in Frege, Hilbert, Russell, Carnap, Tarski, and others, to our present days (Hintikka, 1973: #VIII). As a result, formal logic remains sterile, Platonist, syntactical, and intuitionist, and faces difficulties due to its lacking any objective control of its inferences and its so called proofs (Krantz, 2011). Indeed, such logics are closed systems, isolated from our experience of reality. They are mere arguments that start from axiomatic assumptions and end up with conclusions without any objective criterion for the *validity* of the inferences and the *truth* of their conclusions. (Hintikka, 1996; Nesher, 2002, 2011, 2016, 2017). Kant does not have any comprehensive theory of truth to prove the validity of the rules of formal logic and must, therefore accept them as *absolute* and *necessary*, *independently of all experience*. But without knowing their meanings we cannot think rationally (Kant, Logic 1800: 171).

**2.3. Axiomatic Formal Systems Are Artificial by Abstraction from Human Cognitive Operations and Are Closed Games That Cannot Explain the True Representation of Reality and Direct Our Conduct in It**

Axiomatic formal systems cannot explain and direct the human cognitive operations that prove our true representations of reality and guide human conduct. *Formal systems* are, by definition, *closed games* with rigid rules and axioms that cannot be formally proved true since the deductive rules of inference cannot evaluate the truth of theorems upon reality. The epistemological basis of axiomatic formal systems lies in the conception of truth and its acceptance, in the assumption that truth and falsity are ideal and determine whether our sentences are true or false. Hence, every sentence is bivalent; it can either be asserted or disavowed, and, per the *law of the excluded middle*, it can only be true or false. In practice, however, formal logicians do not live in a Platonic heaven, so they rely on their experiential intuitions, which remain vague, to compensate for their rigid formal rules to discover axioms and rules of inference. Due to the abstraction and sterility of logical formal systems, they are divorced from reality, and logicians may therefore go astray and face antinomies and paradoxes. The axiomatic formal systems are *artificially* abstracted from human cognitive operations, but logicians attempt to accommodate their formal systems only by intuiting new axioms and new modes of logic without being able to reach reality (Hintikka, 1996: #2).

The description of AI above arises from the neo-Kantian conception of knowledge that dominated most of the epistemology of the last two centuries. This conception cannot explain the role of language in our representation of reality (Nesher, 2018-2023).

The difficulty with validity and truth in formal logic can be overcome only with *epistemic logic*, in which the meanings of the logical components essential for proof originate in our basic perceptual experiences of our confrontation with external reality. However, there is an epistemological distinction between the conceptions of the notion of interpretation that is in play in Peircean semiotics of interpretation of signs as *meanings* and as proved *true* representations of reality and the formal Tarskian semantic interpretation of signs as representing artificial models. So, too, is the intuitionist conception of interpretation as an inner mental activity of proof, a hermeneutic interpretation isolated from reality (Tarski, 1969; Nesher, 2002: II, V). Accordingly, the completeness of formal systems is only with respect to their assumed true axioms and valid inferences, but not with respect to any representation of external reality, unless we pretend that the axioms cover the facts of reality by being identical with the model itself. Hence, we cannot hold the model-theoretic picture, which is floating above the world without any known support, without the realistic approach that already belongs to the Gödelian revolution in mathematics and eventually in logic as well. However, logical and mathematical realities cannot be Platonic entities that come from nowhere, à la Gödel (Gödel, 1951: 313; Nesher, 2002: X, 2011).

**2.4. Peirce Developed Semiotics as Epistemic Logic from Introspection into Our Perceptual Operations by the Complete Trio of Inferences Quasi-Proving Our Perceptual Judgments**

Peirce’s phaneroscopic inquiry is an essential break from the traditional and contemporary difficulty of how we might logically understand our representation of external reality. Indeed, only epistemic logic in its entire *trio* sequence of Abduction of Discovery, Deduction of Prediction, and Induction of Evaluation, can provide the complete proof of the truth of human cognitions, which originate in our pre-rational operations, and quasi-prove their perceptual judgments (Peirce, *CP*: 5.121–145, 1903)

Hence, the semiotic complete cognitive operation is the *trio* sequence of Abduction, Deduction, and Induction:



**Figure 1:** Peircean basic semiotics revolutionizing Kantian Transcendentalism.

Thus, => is the *plausibility connective* suggesting the hypothesis A,  is the *necessity connective* deducing the abstract object or fact C, and =❥ is the *probability connective* evaluating the relation of the concept or theory A to the new experience of objects or proved facts C. Peirce developed his semiotics into epistemology of our perceptual confrontation with reality, which is manifested in the duality of the expectation of the iconic feeling sign, the *ego*, and the indexical emotional reacting sign, the *non-ego*. Interpreting our genuine signs in their *coherent* synthesis into the complete proof of the true representation of reality is a condition on the *validity* of the *meaning* interpretation and the *soundness* of the proofs.

The confrontation with physical reality by coherent interpretation of meanings of the three inferences in the quasi-proof of the truth of perceptual judgments representing reality:



**Figure 2:** Peirce’s complete semiotics as the basis for epistemic logic

We find that through our cognitive clashbetween the iconic sign of*ego* and the indexical sign of *non-ego*, we first become conscious of the reality that is independent and external to us:

And what do we mean by real? It is a conception which we must have had when we discovered that there was an unreal, an illusion; that is, when we first correct ourselves. (Peirce, *CP*: 5.311, 1868).

This explanation can be considered a philosophical proof of the existence of something external that is independent of the way we initially present it; and when we interpret the *coherency* of themeanings of iconic and indexical signs, we can prove our positive knowledge of this external reality. (Peirce, *EP*I: 136–137, 1878)

This is the early explanation of Peirce’s realist conception and epistemology, when he abandoned the Kantian transcendental nominalist epistemology to explain our initial knowledge of ourselves and reality through our perceptual judgments, proving the true basic facts representing reality.

**2.5. Epistemic Logic Empirically Explaining Our Confrontation with Reality is the Basis of a Realist Theory of Truth, Eliminating the *Principle of the Excluded Middle.***

Axiomatic *formal systems* are *complete* and isolated from reality, and *realistic theories* are *incomplete* and true, relative to their proof conditions. Epistemic logic is a basic and universal science whose rules represent the method of self-control in reality by proving that we truly represent it, and in this way, refute Berkley’s *solipsism* and Kant’s *apriorism*. The basic conceptions of *epistemic logic* hold that every instance of knowledge was proved to be a true representation of reality, and thus, we prove our cognitions to be either *true* or *false*,and if we do not prove them, they remain *uncertain*. Therefore, we can no longer accept the *principle of excluded middle*, and *truth* cannot be separated from being proven, in contrast with the logic of formal systems and other kinds of metaphysical realism and internal realism (Nesher, 2002: III, 2011). Since the validity of logical inferences depends on the coherence of their signs-meanings with respect to the *proof conditions* in which their true interpretations are decided, all inferences are valid by the coherence of their meanings in true interpretation. However, different proof conditions can have different meanings and truths; thus, if **P** does not include the meaning of **C,** we cannot infer **C,** since the implication **P** ➞ **C** is not valid. With the rules of inference, **Pi** ➞ **Ci**, **Pi ∧ Ci**,and **Pi ∨ Ci**, the epistemological and logical question is how the elimination of the *law of the excluded**middle* by the realist theory of *truth* can affect *deductive inference* as it operates in Pragmaticist epistemic logic. Hence, if the propositions **Pi** and **Ci** are proved true or false or uncertain, what are the conditions of validity for the inferences **Pi ➞ Ci**, **Pi ∧ Ci**, **and Pi ∨ Ci**? Thus, **Pi ➞ Ci** is valid when the meaning of the consequent **Ci** is contained in the meaning of its antecedent **Pi**. Further, their *truths* must be proved by their trio of complete proof according to common proof conditions for **Pi.** and **Ci**, since if they were proved true on different proof conditions, the truth **Pi** cannot entail the truth of **Ci** since the complete, true meaning interpretation depends on the entire proof of truth. In epistemic logic, the deductive rule of inference ((**Pi ➞ Ci**), **Pi**) ➞**Ci**), **Pi** and **Ci** evaluated in induction ((**Pi** Ab, **Ci** In) =❥Pr. m/n (**Pi** Ab **➞ Ci** in)), when empirically proved true. This entailment cannot be achieved by the conventional formal semantic *truth tables* since in epistemic logic, the *truth* and *falsity* of propositions are proved in confrontation with reality. Thus, the formal semantic language with “if,” “suppose,” “provable,” “unprovable,” etc., is meaningless and disallowed (Gödel, 1931; Hintikka, 1996: 46-87; Nesher, 2011, 2016).

**2.6. The Epistemology of Mathematics: The Conception of Pure Mathematics Isolated from Reality and How it Can Be Practical Operation in Conduct and the Theoretical Sciences**

The problem with Euclidean geometry and formal mathematics, which were created to investigate some structures and properties of reality, is that they remained pure sciences with their a priori assumptions and without confrontation with reality (Russell, 1919: Chap. XVIII-204; Nesher, 2017).

Now, the intuition which pure mathematics lays at the foundation of all its cognitions and judgments which appear at once apodictic and necessary are space and time. For mathematics must first present all its concepts in intuition, and pure mathematics in pure intuition; that is, it must construct them. If it proceeded in any other way, it would be impossible to take a single step; for mathematics proceeds, not analytically by dissection of concepts, but synthetically, and if pure intuition be wanting there is nothing in which the matter for synthetical judgments *a priori* can be given. Geometry is based upon the pure intuition of space. Arithmetic achieves it concept of number by the successive addition of units in time,... (Kant, *Prolegomena* (1783): 282-283; Hintikka, (1973; schema [4]))

Kant based his epistemological conception of pure mathematics on his analysis of syllogistic structures and operations, as a conception of *axiomatic systems of transcendental logic and mathematics*. The following explains Kant’s epistemology of knowledge in which *pure mathematics* is a closed game isolated from any reality and which cannot prove any truth (Kant, *CPuR*:B316-7; Nesher, 2011, 2012, 2016).

At the end of his inquiries, Kant indeed admits his failure to bridge the gap between the transcendental formalism of pure reason, with its *empty concepts*, and the *blind objects* of *sensual intuition* of the phenomenalsubject, which he attempted to do with his mysterious schematism. The following is a concise schema presenting the epistemological structure of the *First Critique*,the Kantian conception of knowledge based on pure concepts and sensual intuition: The evolution of empirical concepts from blind sensual intuitions and the empty pure concepts into their synthesis in perceptual judgment, and the pure mathematics in pure intuition:



**Figure 3:** The evolution of empirical concepts from the empty pure concepts of reason and blind objects of sensual intuition into their habitual synthesis in perceptual judgment

This schema aims to explain the synthesis of the meaningless *empty pure concepts* of pure reason with the indeterminate meaning of the *blind object* to make the concept meaningful and the object determinate. Thus, the *empirical object* can be determined by being subsumed under the *pure concept*. However, Kant’s transcendental epistemology is based on a *mystical* conception of the *schematism* that is meant to bridge *form* and *matter*. Without it, his philosophical system cannot hold. This schematism of our understanding, i.e., the schematism regarding appearances and their mere form, is the secret art residing at the depth of the human soul, an art whose true stratagems we shall hardly ever divine from nature and lay bare before ourselves. Only this much can we say: The *image* is [here] a product of the productive imagination’s empirical ability. (Kant, *CPuR*: A141/B180-1; cf. A121, B185-187).

This schema can explain the synthesis of the indeterminate meaning of the *blind object* with the *empty pure concept* that makes the concept meaningful and the object determinate, thus determining the *empirical object* by subsuming it under the *empirical concept*. However, the evolvement of the empirical concepts in perception from sensual intuitions and pure concepts along with the imagination to their synthesis in perceptual judgment reveals Kant’s difficulty with the epistemology of empirical concepts (Kant, *CPuR*: #24-B150-151). However, Kant’s transcendental epistemology is based on a *mystical* conception of *schematism* thataims to bridge *form* and *matter*. Without it, his philosophical system cannot hold. The component of pure *a priori* knowledge includes the conception of *pure mathematics*, but formalism cannot work without empirical matter as the meaning of the form. However, since Kant assumed that mathematics is pure science based on transcendental pure intuition, he had difficulties explaining this intuition, and in his *Critique of Pure Reason* B-1787 he empirically explains basic mathematical intuition, by counting fingers or dots.

In thinking merely that union of seven and five, I have by no means already thought the concept of twelve; and no matter how long I dissect my concept of such possible sum, still I shall never find in it that twelve. We must go beyond these concepts and avail our ourselves of the intuition corresponding to one of the two: e.g., our five fingers or (as *Segner* does in his *Arithmetic*) five dots. In this way we must gradually add, the units of the five given in intuition. …. For then it is very evident that, no matter how much we twist and turn our concepts, we can never find the [number of the] sum by merely dissecting our concepts, i.e., without availing ourselves of intuition. (Kant, *CPuR*: B14-15)

The first epistemological difficulty is with numbers, whether they are ideas or objects, and this can be seen from the semantic structure of the signs-symbols: Therealist platonic ideas are to the left and the nominalist phenomenal object is to the right side of schema [6]. The epistemological difficulties in mathematics are how to determine *what numbers are*, objects of signs or signs of objects, and what *mathematics* and *mathematical* *proof* amount to (Russell, 1901).

After Russell, as a philosopher and mathematician, showed the challenges mathematicians face in intuitively understanding their work with pure mathematics, it is interesting to see how Shila Kishore relates mathematics to its essential role in artificial intelligence:

The application of mathematics in AI is fundamental to the development and success of intelligent systems. Mathematics provides the tools and concepts necessary for AI algorithms to process data, learn patterns, and make informed decisions. As AI continues to evolve and shape our world, the synergy between mathematics and AI will remain crucial, unlocking new frontiers and possibilities for innovation. By harnessing the power of mathematics, AI has the potential to transform industries, solve complex problems, and enhance our daily lives in remarkable ways. (Kishore, 2023)

The following is my elaboration of the difficulties with using formal mathematics to explain our scientific operation only through mathematic intuition.

# 3. Epistemic Logic, Representing Our Confrontation with Reality, is the Methodology of All Our Knowledge

## **3.1 Epistemic Logic is the Methodology of Perceptual and Scientific Operations when Proving Representations of Reality True and Guiding Human Conduct**

Pragmaticistically, every cognitive operation consists of descriptive and normative components that compose both the rules of the habits of our cognitive operations and the rational norms embedded in every rational judgment, including scientific theories, that promote our rational conduct in self-controlling ourselves based on human intelligence (Peirce, *CP* 1.281, cf. 1902, *EP*II: 198–199, 1903; cf. Nesher 1982: 80–82, 1983b, 1990: 24–26).

That which any true proposition asserts is real, in the sense of being as it is regardless of what you and I may think about it. Let this proposition be a general conditional proposition as to the future, and it is a real general such as is calculated really to influence human conduct; and such the pragmaticist holds to be the rational purport of every concept. (Peirce, *CP* 5.432, 1905)

However, from this pragmaticist conception of semiotics, it is essential to understand the epistemological deficiency of syntactic and semantic axiomatic formal systems. Formal systems cannot explain human cognitive operations of proving our representation of reality true to guide human conduct (Nesher 2004, 2011).

In order to gain a clear understanding of the origin of the various signs used in logical algebra and the reasons of the fundamental formulae, we ought to begin by considering how logic itself arises. (Peirce, *EP*I: 200, 1880)

The epistemic difference between formal logic and epistemic logic lies in their different proof conditions, the formal system being hermetically closed upon its fixed formal proof conditions, which are detached from external reality. Epistemic logic is only relatively closed upon its proof conditions, being the method of complete proof and thus also quasi-proving the truth of our perceptual judgments as our basic facts. Thus, formal systems are complete and sterile, and human perception and science based on epistemic logic are incomplete but true in representing reality relative to accepted proof conditions (e.g., Peirce, *CP* 4.582, 1906).

In the first place, all our knowledge rests upon perceptual judgments … Now consider any other judgment I may make. That is a conclusion of inferences ultimately based on perceptual judgments, and since these are indisputable all the truth which my judgment can have must consist in the logical correctness of those inferences … To say that a proposition is certainly true means simply that it never can be found out to be false, or in other words that it is derived by logically correct arguments from veracious perceptual judgments. Consequently, the only difference between material truth and the logical correctness of argumentation is that the latter refers to a single line of argument and the former to all the arguments which could have a given proposition or its denial as their conclusion. … These three kinds of reasonings are Abduction, Induction, and Deduction. (Peirce, *EP*II: 204-205, 1903)

This is the distinction between formal logical inferences being isolated from reality and therefore being unable to be true about it and the epistemic logic of complete proof, whether true or false, which consists of the trio of abduction, deduction, and induction. Complete proof, then, stands on reality with its two legs, abductive and inductive material logical inferences (Nesher 2001, 2002b: Chs. II and X, 2007a, 2011, 2016).

It does not seem to me that mathematics depends in any way upon logic. It reasons, of course. But if the mathematician ever hesitates or errs in his reasoning, logic cannot come to his aid. (Peirce, *CP* 4.228, 1902)

However, epistemic logic, as the semiotics of our cognitions, is the science of reasoning. As a result, mathematicians cannot make their reasoning sound as though it is without controlling the logic of their operations in confronting mathematical reality.

And to say that mental phenomena are governed by law does not mean merely that they are describable by a general formula; but that there is a living idea, a conscious continuum of feeling, which pervades them, and to which they are docile. (Peirce, *CP*: 6.163, 1892)

For pragmaticist epistemology, every human behavior and conduct, perceptual and scientific, is based initially on *logica utens*, as our habitual reasoning is instinctively and practically self-controlled, which evolves into logical ducens, whose rules are formulized and reasoning is rationally self-controlled (Peirce, *EP*I: 141, 1878).

Indeed, here we can see the beginnings, as well as the limitation of, Peirce’s revolution against the Kantian transcendental nominalist epistemology.

## **3.2 Our Propositional Meanings Proved Clear and Distinct by Proving Their True Representation of Reality**

Philosophical and logical sciences develop together in our experience and allow us to understand their contributions to our knowledge and our conduct in nature. Thus, we prove that epistemic logic is our basic science, representing our confrontation with reality from perceptual operations to all other sciences in proving the truth of their representations (Peirce, *EP*II: 256–257, [1903]). According to epistemic logic, all knowledge is proved to be a true representation of reality, and so logical knowledge is as well. However, we can prove our cognitions to be either true or false, and if we do not prove them, they remain uncertain. Thus, truth cannot be separated from being proved, which is in contrast to classical formal logic, whose propositions are either true or false independent of being proved (Nesher 2002b: Ch. 5, 2011). Therefore, we can no longer accept the principle of excluded middle and cannot prove the provability of any proposition but only their real values or neither, in which case they remain doubtful (Peirce *EP*II: 168 [1903], 351 [1905]; Gödel, 1986 [1931]; Heyting, 1971 [1956]: 18; Brouwer, 1981 [1949]: 5, 92; Kleene, 1952: Ch. 13; Weyl, 2012: 188–189; Nesher, 2011). Hence, the meanings of validity, proof, and truth in epistemic logic differ from their meanings in classic logic (Nesher, 2016).

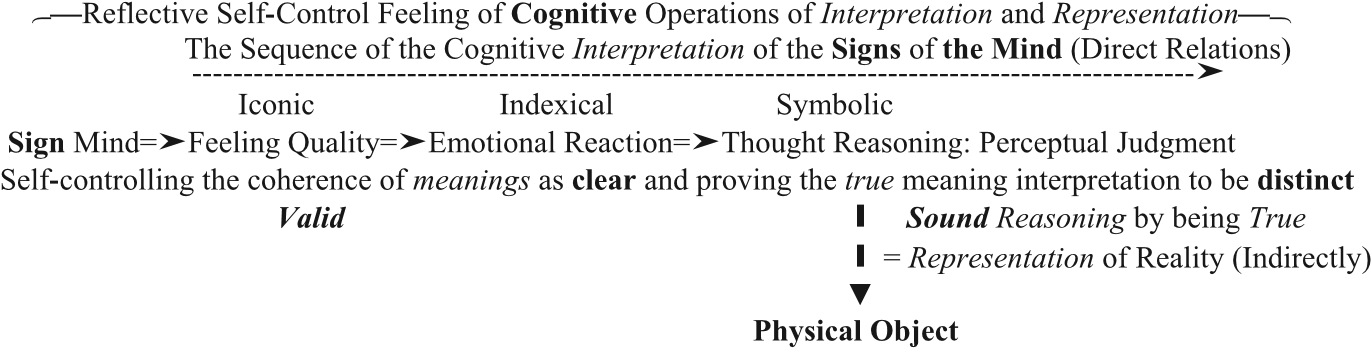
A sign (under which designation I place every kind of thought, and not alone external signs), that is in any respect objectively indeterminate (i.e., whose objects is undetermined by the sign itself) is objectively general in so far as it extends to the interpreter the privilege to carry its determination further. (Peirce, *CP*: 5.447, 1905)

The determination of a sign by the interpreter lies in proving the true interpretation and the representation of its object, and this holds likewise for propositions and their component sign. The identity of a sign is in making its meaning clear by comprehending its meaning in further interpretation, while the meanings of signs are made clear and distinct by proving the truth of their interpretation in the representation of reality, and this latter accounts for the soundness of the reasoning. However, the validity of these operations is manifested in the coherence of meaning interpretations and the soundness of this reasoning is the proof of their truth in representing external reality. This contrasts with the Cartesian subjective feeling of intuiting clearly and distinctly the truth of propositions, which are without any objective criterion for their meanings and truth (Descartes 1985 [1628]: Rule Three, 1985 [1644]: Part One, n. 43–50; Peirce, *EP*I: 124–142, 1878; *CP*: 5.448, 1905).

The very first lesson that we have the right to demand that logic shall teach us is, how to make our ideas clear; … To know what we think, to become master of our own meaning, will make a solid foundation for great and weighty thought. (Peirce, *EP*I: 126, 1878)

Hence, we can make the meanings of our ideas clear by valid interpretation, and distinct by proving their truth in representing external reality in sound reasoning (Nesher 2002b: Ch. 3; Gaukroger 1989: 60–71).

The Structure of Peircean Semiosis as the Germ of Epistemic Logic:



**Figure 4**: The interpretation of signs to determine their meanings to be clear by their coherence and to prove their interpretation to be distinct and sound reasoning representing reality.

We have, hitherto, not crossed the threshold of scientific logic. It is certainly important to know how to make our ideas clear, but they may be ever so clear without being true. (Peirce, *EP*I: 141, 1878)

Meaning is clear by its coherent interpretation and is distinct by being proved a true interpretation by a true representation of reality, such that the true proposition enables our self-controlled conduct in reality.

Logic is the theory of self-controlled, or deliberate, thought; and as such, must appeal to ethics for its principles. It also depends upon phenomenology and upon mathematics. All thought being performed by means of signs; Logic may be regarded as the science of the general laws of signs. It has three branches: (1) Speculative Grammar, or the general theory of the nature and meanings of signs, whether they be icons, indices, or symbols; (2) Critic, which classifies arguments and determines the validity and degree of force of each kind; (3) Methodeutic, which studies the methods that ought to be pursued in the investigation, in the exposition, and in the application of truth. Each division depends on that which precedes it. (Perce, *EP*II: 260, 1903)

It is interesting to see that, though Peirce’s semiotics is the basis of epistemic logic, Peirce himself continued to hold a traditional formal logic and pure mathematics, following Kant’s transcendental epistemology. In the realist interpretation of cognitive signs, no complete-absolute determination of their meanings is possible, since all proofs of meaning interpretations are relative to the accepted proof conditions by which their truth is proven and which amount to the real context in which we operate. However, logical reality cannot be the physical reality that the physical sciences represent, or the cognitive reality that the psychological sciences represent, or any ideal metaphysical reality (Hintikka and Sandu 2006).

Logic does rest on certain facts of experience among which are facts about men, but not upon any theory about the human mind or any theory to explain facts. (Peirce, *CP* 5.110, 1903)

Indeed, this is pragmaticist epistemic logic, the implicit *logica utense* and explicit *logica docens* as the basis of all human knowledge, the perceptual and the scientific, including mathematical science. Epistemic logic is, we might say, the Boolean “laws of thought,” representing our cognitive confrontation with reality that enable knowledge and sustain our conduct in it (Nesher 1983a: 244–250, 2002b, 2016).

## **3.3 The Role of Meaning in the Operation of Validity, Proof, and Truth as the Soundness of Epistemic Logic**

We learn the components of epistemic logic from our basic experience, and we naturally begin by reflecting on our basic inferences of the implication of the perceptual operation of signs. In formal semantics, if the antecedent is accepted as true, then its implied consequent is also true, and if the antecedent is false, then the entire implication is true. The pragmaticist explanation of implication is that the conditional relation is such that we interpret the meaning of the antecedent in the meaning of the consequent by self-controlling their coherency. This is the validity of the interpretation, yet it is not a tautology, which is only a repetition and not an interpretation of content. The connection between the validity of such arguments and the forms of their expression is the meanings involved in the laws of the mind, without which the formalizations remain meaningless.

The last objective criterion of the validity of cognitive meanings is the proof of the truth of their interpretation in representing reality. However, different proof conditions can result in different meanings and different relative truths (Peirce, *EP*I: 56–83, 1869; *EP*II: 208–226, 1903; Nesher 2007b). Hence, by being separated from reality, formal syntax has no theory of meaning based on experience, and formal semantics has no theory of truth based on confrontation with reality. Although we intuitively understand their meaning and their truth, respectively, we cannot prove their validity and soundness. Hence, we must look for a logic that can conduct and explain our cognitive confrontation with reality, and we find this in Peircean semiotics, our epistemic logic, as I understand it.

In formal systems, we begin by assuming that the primitive definitions, the axioms, and the rules of inferences are true, but in sciences, according to epistemic logic, we do not have to assume these truths, since we can obtain them by proving their truth. However, in epistemic logic, our premises are hypothetical and can be proved true only at the end of our reasoning through the material logic of inductive evaluation applied to the available proved true facts, the perceptual facts themselves, upon which we prove all our knowledge (Peirce, *EP*I: 124–142, 1878; *EP*II: 350–354, 1905; Nesher 2002b: Chs. 2, 3, and 10).

The following is the confrontation with logical reality through the coherent interpreted meanings of three inferences in the quasi-proof of the truth of the perceptual judgment:



**Figure 5:** The Origin of Epistemic Logic

Hence, by being separated from reality formal syntax has no theory of meaning based on experience, and formal semantics has no theory of truth based on confrontation in reality; although we intuitively understand their meaning and their truth,

The ultimate purpose of the logician is to make out the theory of how knowledge advanced … so Methodeutic which is the last goal of logical study, is the theory of the advancement of knowledge of all kinds. But his theory is not possible until the logician has first examined all the different elementary modes of getting at truth and especially all the different classes of arguments, and has studied their properties so far as those properties concern [the] power of the arguments as leading to the truth. (Peirce, *EP*II: 256, 1903)

These different classes of arguments are the trio sequence of the abductive logic of discovery, the deductive logic of consistency, and the inductive logic of evaluation, which compose the complete proof of truth. Without the methodology of epistemic logic, mathematical hypotheses cannot be proved true or false upon the proved facts of reality. In this way, mathematics depends on the habitual rules of epistemic logic and its rational formulations in order to prove the truth of mathematical theories and thereby make their reasonings sound. However, epistemic logic itself, in confronting its reality, is the methodeutic of all our knowledge (Kerr-Lawson 1997; Nesher 2002b: Ch. 10, 2007c).

**4. The Basic Epistemological Question is: What is Logic, What is its Role in Human Affairs, and Can it Explain the Impossibility of AI?**

**4.1. Kant’s Conception of Logic Is the Traditional Conceptions from The Greek**

Kant in his book Logic summarizing the conception of logic as a priori pure discipline of our rules of thoughts, which affected the following generations of philosophers, logicians, and mathematicians that somehow accepted aspects of his philosophical system, known as neo-Kantians, the tradition which is still dominating philosophy, logic, and mathematics.

If, however, we set aside all knowledge that we can only borrow from *objects*, and reflect simply on the exercise of the understanding in general, then we discover those rules which are absolutely necessary, independently of any particular objects of thought, because without them we cannot think at all. These rules, accordingly, can be discerned *a priori*, that is, *independently of all experience*, because they contain merely the conditions of the use of the understanding in general, whether pure or empirical, without distinction of its objects. Hence, also, it follows that the universal and necessary laws of thought can only be concerned with its *form*, not with otherwise with *matter*. And we can form a conception of the possibility of such science, just of the *universal grammar* which contains nothing beyond the mere form of language, without words, which belongs to the matter of language. This science of the necessary laws of the understanding and the reason generally, or, which is the same thing, of the mere form of thought generally, as we call *logic*. *(*Kant, Logic, 1800: 171-172)

According to Kant the science of logic discovers the *a priori* *necessary* rules of our faculties of Understanding and Reason, but the rules of other sciences that are about our relations to *particular objects* are *contingent* connected to our particular experience with objects and can be change respectively. However, according to Kant’s transcendental epistemology the logical rules of our pure cognitions to be *necessary* and valid they must be separated from our sensual experience and are *formal* without the *matter* of our sensual experience, thus those *pure* rules remain meaningless for us. This Kantian epistemology of logic is, in a nut shell, his essential influence on the philosophy of logic and the logic itself that followed him historically, as we can see in Frege, Hilbert, Russell, Carnap, Tarski and more, and also in our days (Hintikka, 1973: #VIII). Hence, it makes the formal logic sterile, and remaining Platonist, Syntactical, Intuitionist, and facing difficulties, due to lacking any objective control to its inferences and the so called proofs (Krantz, 2011). Indeed, such logics are closed systems isolated from our experience in reality and are mere kinds of argumentations which starts from axiomatic assumptions, to argue for the conclusions without any objective criterion for the *validity* of the inference and the *truth* of their conclusions. (Hintikka, 1996; Nesher, 2002, 2011, 2016, 2017). Indeed, Kant does not have any comprehensive theory of truth to prove the validity of the rules of formal logic and he must accept them as *absolute* and of *necessary* *independently of all experience*, but without knowing their meanings we cannot think rationally (Kant, Logic 1800: 171).

**4.2. Axiomatic Formal Systems Are *Artificial* by Abstraction from Human Cognitive Operations, and Are Closed Games that Cannot Explain True Representation of Reality to Direct Our Conduct**

Axiomatic formal systems cannot explain and direct human cognitive operations of proving our true representation of reality to guide human conduct. *Formal systems* are by definition *closed games* with rigid rules and axioms that formally cannot be proved true, since the deductive rules of inference cannot evaluate the truth of theorems upon reality. The epistemological basis of axiomatic formal systems lies in the conception of truth and its acceptance, in the assumption that truth and falsity are ideal and determine whether our sentences are true or false. Hence, every sentence is bivalent and can be either asserted or un-asserted, and, according with the *principle of the excluded middle*, it can be only true or false. In practice, however, formal logicians do not live in any Platonic haven, and to discover axioms and the rules of inference, they use their experiential intuitions, which remain vague, to compensate for their formal rigid rules. Due to the abstraction and sterility of logical formal systems they divorce from reality, and thus logicians might go astray and face antinomies and paradoxes. The axiomatic formal systems are *artificially* abstracted from human cognitive operations, but logicians trying to accommodate their formal systems only by intuiting always new axiomatic and new modes of logics without being able to reach reality (Hintikka, 1996: #2).

The difficulty with formal logic validity and truth can be overcome only in *epistemic logic*, in which the meanings of the logical components that essential for the proof, originated in our basic perceptual experience of confrontation in external reality. However, there is an epistemological distinction between the conceptions of interpretation in Peircean semiotics of interpretation of signs as *meanings* and proved *true* representations of reality, and the formal Tarskian semantic interpretation as representing artificial models. So also the Intuitionist conception of interpretation as inner mind activity of proof, a hermeneutic interpretation isolated from reality (Tarski, 1969; Nesher, 2002: II, V). Accordingly, the completeness of formal systems is only in respect of their assumed true axioms and valid inferences, but not of any representation of external reality, unless we feign that the axioms cover the facts of reality by being identical with the model itself. Hence, we cannot hold the picture of model-theoretic, which is floating above the world without any known support without the realistic approach which already belongs to the Gödelian revolution in mathematics, and eventually in logic, as well, but then logical and mathematical realities cannot be Platonic entities a`la Gödel that come from nowhere (Gödel, 1951: 313; Nesher, 2002: X, 2011).

**4.3. Peirce Developed Semiotics as Epistemic Logic from The Introspection into Our Perceptual Operations by The Complete Trio of Inferences Proving Our Perceptual Judgments**

Peirce’s Phaneroscopy inquiry is an essential break from the traditional and contemporary difficulty of how logically we can understand our representation of external reality. Indeed, only epistemic logic in its entire *trio* sequence of Abduction of Discovery, Deduction of Prediction and Induction of Evaluation, can provide the complete proof of the Truth of human cognitions, originate in our pre-Rational operations, to quasi-prove their perceptual judgments (Peirce, *CP*: 5.121–145, 1903). In Peircean semiotics thecomplete cognitive operation is the *trio* sequence of abduction, deduction and induction:



**Figure 6:** The basis of the Peircean Semiotics

Thus, => is the *plausibility connective* suggesting the hypothesis A, when → is the *necessity connective* deducing the abstract object or fact C, and =❥ is the *probability connective* evaluating the relation of the concept or theory A to the new experience of objects or proved facts C. Peirce developed his semiotics into epistemology of our perceptual confrontation in reality, manifested in the duality of the expectation of the Iconic feeling sign *ego* and the indexical emotional reacting sign *non-ego*. Interpreting our genuine signs in their *coherent* synthesis into the complete proof of the true representation of reality is a condition on the *validity* of the *meaning* interpretation and the *soundness* of the proofs. From his semiotics I developed epistemic logic, which represents our confrontation with reality and is the methodology of all our knowledge.

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**Figure 7:** Epistemic Logic

We find that through our cognitive clashbetween the iconic sign of*ego and* the indexical sign of *non-ego*, we first become conscious of the reality that is independent and external to us:

And what do we mean by real? It is a conception which we must have had when we discovered that there was an unreal, an illusion; that is, when we first correct ourselves. (Peirce, *CP*: 5.311, 1868)

This explanation can be considered a philosophical proof of the existence of something external that is independent of the way we initially present it; and when we interpret the *coherency* of themeanings of iconic and indexical signs, we can prove our positive knowledge of this external reality (Peirce, *EP*I: 136–137, 1878).

Axiomatic *formal systems* are *complete* and isolated from Reality and *realistic theories* are *incomplete* and true relative to their proof conditions. Epistemic logic is basic and universal science that its rules represent the method of self-control in Reality by proving that we truly represent it, hence refutes Barkley *solipsism* and Kantian *a priorism*. The basic conceptions of *epistemic logic* hold that every instance of knowledge had proved to be a true representation of reality, and thus we prove our cognitions to be either *true* or *false* and if we do not prove them, they remain *uncertain*. Therefore, we can no longer accept the *principle of the excluded middle*, and *truth* cannot be separated from being proved in distinction from the logic of formal systems, and also all kinds of Metaphysical Realism and Internal Realism (Nesher, 2002: III, 2011). Since the validity of logical inferences depends on the coherency of their signs-meanings in respect of the *proof conditions* in which their true interpretations are decided, then all inferences are valid by the coherency of their meanings in true interpretation. However, different proof conditions can have different meanings and truths; thus, if **P** does not include the meaning of **C,** then we cannot infer **C,** since the implication **P** ➞ **C** is not valid. With the rules of inference, **Pi** ➞ **Ci**, **Pi ∧ Ci**,and **Pi ∨ Ci**, the epistemological and logical question is how the elimination of the *law of the excluded* ***middle*** by the realist theory of ***truth*** can affect *deductive inference* as it operates in Pragmaticist epistemic logic. Hence, if the propositions **Pi** and **Ci** are proved true or false or uncertain, what are the conditions for inferences **Pi ➞ Ci**, **Pi ∧ Ci**, **and Pi ∨ Ci** to be ***valid***? Thus, **Pi ➞ Ci** is valid when the meaning of the consequent **Ci** is contained in the of its antecedent **Pi** and their *truths* are proved only at their trio of complete proof in common proof conditions of **Pi** and **Ci**, since if they were proved true on different proof conditions the truth **Pi** cannot entail the truth of **Ci**, since the complete true meaning interpretation depends on the entire proof of truth. In the epistemic logic the deductive rule of inference ((**Pi ➞ Ci**), **Pi**) ➞**Ci**), **Pi** and **Ci** evaluated in Induction ((**Pi** Ab, **Ci** In) =❥Pr. m/n (**Pi** Ab **➞ Ci** in)), when empirically proved true. But this entailment cannot be by the formal semantic conventional *truth tables*, since in epistemic logic the *truth* and *falsity* of propositions are proved on confrontation in reality, thus, the formal semantic language with “if,” “suppose,” “provable,” “unprovable,” etc. is meaningless and not allowed (Gödel, 1931; Hintikka, 1996: 46-87; Nesher, 2011, 2016).

**5. The Epistemology of Mathematics: The Conception of Pure Mathematic Isolated from Reality and How It Can Be Empirical Operation**

**5.1.** **Euclidean Geometry, Formal Logic, and Pure Mathematics are Epistemically Closed Games**

The problem with the Euclidean Geometric and Formal Mathematics created to investigate some structures and properties of the reality but remained pure sciences with their a priori assumptions, without confrontation in reality (Russell, 1919: Chap. XVIII-204; Nesher, 2017).

Now, the intuition which pure mathematics lays at the foundation of all its cognitions and judgments which appear at once apodictic and necessary are space and time. For mathematics must first present all its concepts in intuition, and pure mathematics in pure intuition; that is, it must construct them. If it proceeded in any other way, it would be impossible to take a single step; for mathematics proceeds, not analytically by dissection of concepts, but synthetically, and if pure intuition be wanting there is nothing in which the matter for synthetical judgments *a priori* can be given. Geometry is based upon the pure intuition of space. Arithmetic achieves it concept of number by the successive addition of units in time,... (Kant, Prolegomena (1783):282-283; Hintikka, (1973; schema [4]))

Indeed, Kant based his epistemological conception of pure mathematics on his analysis of the syllogistic structure and operation, being the conception of *axiomatic systems of transcendental logic and mathematics*. The following explains Kant’s epistemology of knowledge while *Pure Mathematics* is a closed game isolated from any reality and cannot prove any truth (Kant, *CPuR*:B316-7; Nesher, 2011, 2012, 2016).

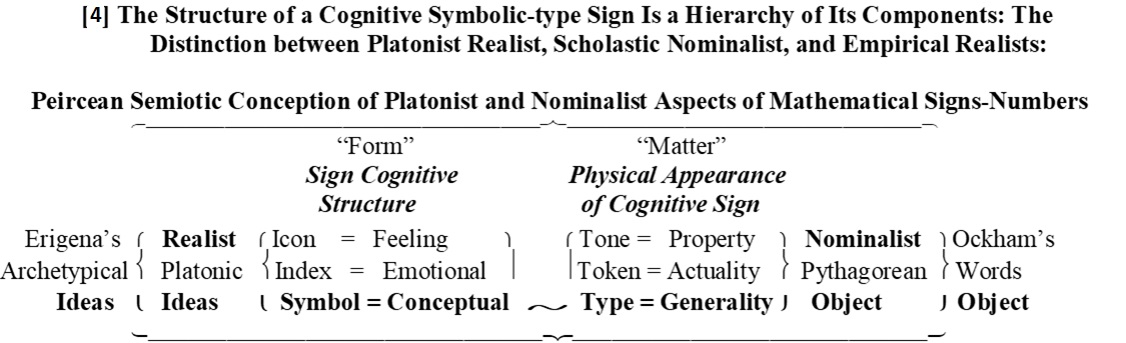
The following is the Kantian Conception of Knowledge Based on Pure Concepts and Empirical Sensual Intuition: The Evolvement of Empirical Concepts from Blind Sensual Intuitions and the Empty Pure Concepts, into their Synthesis in Perceptual Judgment, and Pure Mathematics in Pure Intuition:****

**Figure 8:** TheKantian Conception of Knowledge

This schema can explain the synthesis of the indeterminate meaning of the *blind object* with the *empty pure concept* makes the concept meaningful and the object determinate and thus the *empirical object* can be determined by being subsumed under the *empirical concept*. However, the evolvement of empirical concepts in perception from sensual intuitions to pure concepts, and with imagination to their synthesis in perceptual judgment leads to Kant’s difficulty with the epistemology of empirical concepts (Kant, *CPuR*: #24-B150-151). However, Kant’s transcendental epistemology is based on the *mystical* conception of *schematism*, to bridge between *form* and *matter* without it his philosophical system cannot hold. The component of pure *a priori* Knowledge includes the conception of *pure mathematics*, but the formalism cannot work without the empirical matter, the meaning of the form. However, since Kant assumed that mathematic is pure science based on transcendental pure intuition, he had difficulties to explain this intuition and in his *Critique of Pure Reason* B-1787, he explains empirically the basic mathematical intuition, empirically by counting fingers or dots.

In thinking merely that union of seven and five, I have by no means already thought the concept of twelve; and no matter how long I dissect my concept of such possible sum, still I shall never find in it that twelve. We must go beyond these concepts and avail our ourselves of the intuition corresponding to one of the two: e.g., our five fingers or (as *Segner* does in his *Arithmetic*) five dots. In this way we must gradually add, the units of the five given in intuition. …. For then it is very evident that, no matter how much we twist and turn our concepts, we can never find the [number of the] sum by merely dissecting our concepts, i.e., without availing ourselves of intuition. (Kant, *CPuR*: B14-15)

The first epistemological difficulty is with numbers, whether they are ideas or objects and this can be seen from the semantic structure of the signs-symbols: Therealist platonic ideas on the left and nominalist phenomenal object on the right side, schema [6]. The epistemological difficulties in mathematics is *what numbers are*, objects of signs or signs of objects, and what is *mathematics* and *proof* in it (Russell, 1901).

**Mathematical Reality Upon which Operates the Pragmaticist Structure of Cognitive Symbolic-Signs**

**Figure 9:** Hierarchy of the sign’s components of mathematics in different epistemologies

Plato conceived of numbers as *ideas,* and Pythagoras conceived of them as *objects*, but this is an epistemological confusion. Those two aspects ofsigns-numbers *must go together* since otherwise *they are not signs*; we cannot grasp sign *meaning* without its *appearance* and cannot understand the appearance without its meaning. The sign in Peircean semiotics is the conjunction of “form” and “matter,” or better, the **sign** has two components, which cannot exist separately. Moreover, modern mathematicians and philosophers are unclear whether *numbers* are signs or objects. They consider these aspects two separate entities, such that numbers are both signs and objects. This confusion about the nature of numbers resulted in the difficulties, ambiguities, and paradoxes of set theory, namely, by considering the phenomenal-objective component of the sign-number as the object of its cognitive idea component (Nesher, 2012). Thus, the number’s phenomenon was assumed to be the object of the number’s idea; that is, the number can be the object of itself. This confusion is the basis of Russell’s paradox in set theory, based on the assumption that a number can be a member of its own set, but if a number is a sign, it cannot be an object and, of course, not an object of itself (Russell, 1901, 1919). Moreover, the formalist epistemology of logical positivism and analytic philosophy, which assume that cognitive signs and language, with their syntactical and semantical aspects, can be represented by other meta-signs and meta-languages, brings with them further difficulties and paradoxes (Byers, 2007). Hence, cognitive signs and languages are not physical objects that can be cognitively represented; we can only interpret their meaning and prove their truth or falsity (Wittgenstein, 1921: 3.33-3.34; Nesher, 1986, 2011, 2012).

**5.2. On the Nature of Mathematics: Mathematical Proofs at a Crossroad from a Pure Formal Game to Empirical Theory**

Sign-numbers cannot be objects of empirical experience, but the discovered signs are components of the human empirical operations of counting, grouping, and measuring physical objects. (Nesher, 2011). The *discovery* of the concepts of these operations of enumeration contains natural numbers, and the further *discovery* oftheir expansion through abstraction and generalization constitutes our mathematical hypotheses, which will be evaluated and proved upon extended mathematical reality (Krantz, 2011). Hence, by proving the truth of perceptual facts representing mathematical operations, we represent mathematical reality.

By understanding that mathematical reality consists of perceptually self-controlled numerical operations on physical objects, we can see how Peirce and Gödel confuse the meaning-content of mathematical signs with abstract Platonist mathematical forms as objects. The arithmetical numbers are neither *physical objects* nor *abstract concepts* but the *conceptual components of our quantitative operations on physical objects* as the mathematical reality upon which we prove the truth or the falsity of our abstract mathematical hypotheses (Nesher, 2012; cf. Schema **[5]**).

**5.3. Mathematics is an Empirical Enterprise, Neither Queen nor Servant of other Empirical Sciences but their Quantitative Backbone**

The problem is to explain the differences between mathematical science and other sciences and their collaboration, given that all empirical sciences represent different aspects of reality. In mathematics, we cannot have true theories without proving them in mathematical reality. Mathematicians essentially develop their theories by discovering hypotheses as formulations of theoretical patterns, typically within physics but also within all other sciences, and evaluate them upon mathematical reality by applying quantitative operations on predicted physical observations. Thus, physicists and mathematicians have different realities to represent with their theories, and the mathematical theory that is proved true in the measurement of observed physical facts is the condition for evaluating physical theories. The truth of mathematical theories enables the experimental proof of the truth and falsity of physical theories. In this way, we can understand the Gödelian epistemic intuition about the nature of mathematical theories without confusing mathematics with other sciences and identifying mathematical reality with physical reality.

When difficulties emerge between a physical picture of reality and its mathematical model, such that it becomes impossible to make measurable predictions, the challenge is to inquire why we are unable to evaluate the physical hypothesis experimentally. Hence, mathematics without operationally measuring the predicted and eventually observed true facts of reality cannot be true and cannot be on much firmer ground than physics without a testable prediction. Both have to prove their own truths upon their realities.

However mathematical intuition in addition creates the conviction that, if these formulas express observable facts and were obtained by applying mathematics to verified physical laws (or if they express ascertainable mathematical facts), then these facts will be brought out by observation (or computation) (Gödel, 1953/9-III: #16).

How may one understand the relationship Gödel intimates between intuitive mathematical truth representing its own reality and its application to physical theories to enable their observable prediction? In the end, mathematics is neither the *queen* of science nor its *servant* —it is an empirical science that, when its hypotheses are consistent by being proved true, can serve as the *quantitative* *backbone*—that is, the quantified formulations of scientific theoretical structures and their operations on scientific observations—without which physical and other sciences cannot be evaluated experimentally (Nesher, 2011). This empirical explanation can be seen in Gödel’s late philosophical writings on the foundations of mathematics:

If mathematics describes an objective world just like physics, there is no reason why inductive methods should not be applied in mathematics just the same as in physics.... This whole consideration incidentally shows that the philosophical implications of the mathematical facts explained do not lie entirely on the side of rationalistic or idealistic philosophy, but that in one respect they favor the empiricist viewpoint. (Gödel, 1951: 313)

Hence, we can know experientially the mathematical facts of mathematical empirical reality.

**6. Pragmaticist Realism: Can Mathematical Reasoning Be Sound Without Being a True Representation of Mathematical Reality?**

**6.1. The *Gap* between the Nominalist/Platonist Epistemology of Mathematics and Realist Empirical Sciences**

Peirce revolutionized philosophy by developing a realistic epistemology of the true representation of reality, in contrast to Cartesian metaphysical realism and Kantian transcendental phenomenalism. Peirce developed his semiotics as the eventual epistemic logic representing our human cognitive confrontation with external *reality*, thus providing proof of the truth of our true cognitive representations of *reality* (Nesher, 1981, 2002b: II, X, 2005). Hence, unlike nominalism, we can realistically quasi-prove the truth of our perceptual judgments and, upon them, prove that true scientific theories represent reality with their *general natural kinds* and *general laws of nature*. This realist epistemology is the basis of all our knowledge of reality. However, since pure mathematics and formal logic do not confront reality experientially, according to Peirce, he cannot explain how such subjective reasonings can *determine* the *meaning* and the *truth* of their formalisms (Nesher, 2016).

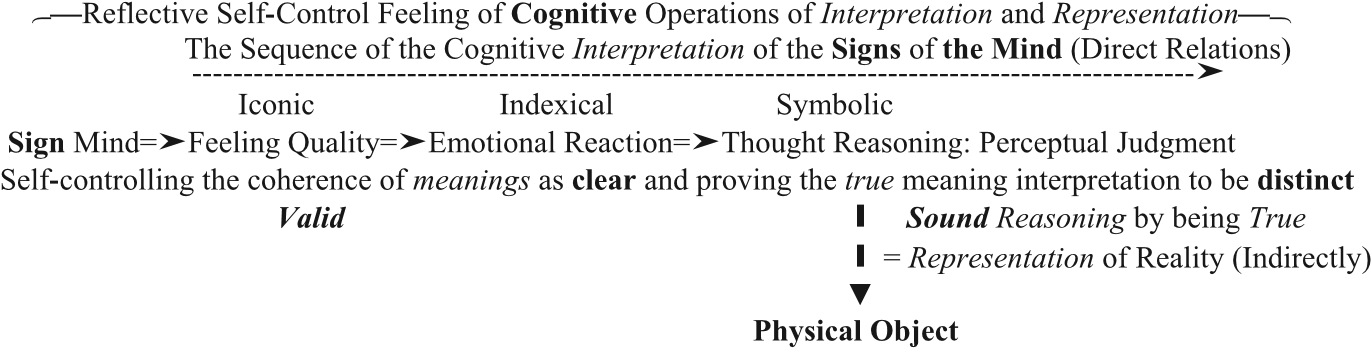
Every reasoning takes place in some mind. It would not be that mind’s reasoning unless it satisfied that mind’s feeling of logicality…. But as long as it does that, nothing can be gained by criticizing the reasoning any farther, since there is no other possible sign by which we could know that it was good than the feeling of logicality in the reasoner’s mind.... Consequently, since every reasoning satisfies the reasoner’s feeling of logically, every reasoning is as good as any reasoning can be. That is, there is no distinction of good and bad reasoning. (Peirce, *EP*II: #17, 243–244, 1903)

In his mature realism, Peirce understands that our reasoning cannot be sound without proving its true representation of external reality, but this is incompatible with his conceptions of pure mathematics and formal logic as, we might say, pure formally-closed games (Nesher, 2011, 2012). Accepting Peirce’s understanding that validity cannot be determined only by the reasoner’s feeling, one is surprised that his conception of pure mathematics is itself based on subjective feeling without any objective criteria by which to prove its valid meaning and sound truth (Peirce, *CP*: 4.227–245, 1902; Murphey, 1961: XII). Later in life, Peirce considered theoretic, aesthetics, and ethics as normative sciences as opposed to logic and mathematics as pure cognitions separated from experienced reality.

Yet the maxim of Pragmatism does not bestow a single smile upon beauty, upon moral virtue, or upon abstract truth; – the three things that alone raise Humanity above Animality. (Peirce, *EP*II: 465, 1913)

Historically there have been prominent examples of an alliance between nominalism and Platonism. … The reason of this odd conjunction of doctrines may perhaps be guessed at. The nominalist by isolating his reality so entirely from mental influence as he has done, has made it something which the mind cannot conceived; he has created the so often talked of “improportion between the mind and the thing in itself.” And it is to overcome the various difficulties to which this gives rise that he supposes this *noumenon*, which,being totally unknown, the imagination can play about as it pleases, to be the emanation of archetypical ideas. The reality thus receives an intelligible nature again, and the peculiar inconveniences of nominalism are to some degree avoided. (Peirce, *EP*I: #5, 100, 1878; cf. *EP*II: 260, 1903).

This is Kant’s difficulty with his nominalism, yet it seems that Peirce accepted “this odd conjunction of doctrines,” of *ideal realism* and *phenomenal nominalism* concerning pure mathematics and formal logic. The following is the interpretation of signs to determine their meanings to be *clear* by their coherency and to prove the truth of their interpretation to be *distinct* in *sound* reasoning representing reality:



**Figure 10:** The interpretation of signs to determine their meanings

We have, hitherto, not crossed the threshold of scientific logic. It is certainly important to know how to make our ideas clear, but they may be ever so clear without being true. (Peirce, *EP*I: 141, 1878)

Meaning is *clear* by its *coherent* interpretation andis*distinct*by being proved a *true interpretation* by a *true representation of reality*, such that the true proposition enables our self-controlled conduct in reality. In a nutshell, the Jamesian position considers behavior as based on the semiotic interpretation of meanings; if our interpretations lead us to accomplish our intentions, they can be considered *behaviorally* true. Although James’ formulation seems to echo Peirce’s initial explanation of the Pragmatic Maxim of 1878, in his later work (about 1898-1907) Peirce elaborated his realist epistemology and named it *Pragmaticism*, to separate it from James’ *Pragmatism*. According to Peirce, proving the true interpretation of cognitive meanings is connected to the proof of the true representation of reality and this is the condition for successful conduct in such known reality (Nesher, 1983, 2018). Epistemologically, James’ pragmatism is rather similar to Peirce’s early pragmatism, in being nominalist and “pure Kantist.” However, it is in conflict with Peirce’s mature realist Pragmaticism, as Peirce admitted:

The present writer was a pure Kantist until he was forces by successive steps into Pragmaticism. The Kantist has only to abjure from the bottom of his heart the proposition that a thing in itself can, however indirectly, be conceived; and then correct the details of Kant’s doctrine, and he will find himself to have become a Critical Common-Sensist. (Peirce, 1905 *EP*II: #25, 353-4)

Moreover, philosophers of our times, who call themselves Pragmatists like Popper, Davidson, Putnam, Hintikka, Reacher, and many others, do so based on Peirce’s early writings and, like the early-Peirce, have unfortunately remained pure Kantist and nominalists.

Pragmaticism makes the ultimate intellectual purport of what you please to consist in conceived conditional resolutions, or their substance, and therefore, the conditional propositions, with their hypothetical antecedents, in which such resolution consist, being the ultimate nature of meaning, must be capable of being true, that is, of expressing whatever there be which is such as the proposition expresses, independently of being thought to be so in any judgment, or being represented to be so in any other symbol of any man or men. (Peirce, *CP*: 5.453, 1905)

Kant’s *transcendental logic* provides the justification by which the *empty transcendental concepts* make contact with the *blind objects* of *sensual intuition* that give meaning to these concepts. In the end, Kant was unsuccessful in this enterprise due to the unbridgeable gap in his epistemology between the transcendental *formal* components and the sensual *material* components of cognition, as he admitted in a letter to a friend (1798). Thus, we find that the forms of the *empty concepts* cannot have any meaning without closing the gap between the empty transcendental language and the blind objects of sensual intuition. In this is way, we can understand Peirce’s conception of Kantian nominalism, as names of concepts without content or meaning, which then led Peirce to his contra-Copernican Revolution against Kant in his realist epistemology.

To say, as the article of January of 1878 seems to intend, that it is just as an arbitrary “usage of speech” choses to arrange its thoughts, is as much as to decide against the reality of the property, since the real is that which is such as it is regardless of how it is, in any time, thought to be. (Peirce, *CP*: 5.457, 1905)

This emphasizes the transition of Peirce’s epistemology from pure Kantianism to the realist epistemology of his Pragmaticism (between 1878-1905).

“Epistemic Logic: All Knowledge is Based on our Experience, and Epistemic Logic is the Cognitive Representation of our Experiential Confrontation in Reality.” *Semiotica* 2021

**6.2. Peirce on the Basis of Pragmaticism in the Normative Sciences Replacing the Kantian Transcendental Epistemology**

Peirce on the Basis of Pragmaticism in the Normative Sciences Replacing the Kantian Transcendental Epistemology of the three Critiques: Are Logic and Mathematics Also Normative Sciences?!!!On The Impossibility to Have Meaning and Representation of Reality by The Kantian Pure Reason with the Empty Formal Structures of The So Called Artificial Intelligence AI is the neo-Kantianism, the dead ends**.**

All the philosophical movements of the 20th century were neo-Kantian and mainly ascribed to his empty formalism, without providing any theory of truth that could reach the internal and external realities that are the basis of artificial intelligence. These include [analytic philosophy](https://simple.wikipedia.org/wiki/Analytic_philosophy" \o "Analytic philosophy), logical positivism, [ordinary language philosophy](https://simple.wikipedia.org/wiki/Ordinary_language_philosophy" \o "Ordinary language philosophy), pragmatism, and universal grammar à la Kant.

Kant (whom I *more* than admire) is nothing but a somewhat confused pragmatist (Peirce, *CP*: 5.525, 1905).

As I have shown elsewhere, we can understand Peirce’s criticism of Kant’s nominalism as resting on the gap between his transcendental formalism and sensual experience, which cannot explain our knowledge of external reality and ourselves. To overcome Kant’s Copernican Revolution, Peirce developed his realist epistemology to show that all our knowledge and practices must arise from our sensual experiences that get interpreted in our perceptual judgments, which constitute our basic facts (Peirce 1906, *EP*I 1867-1893: #27; Nesher, 2007). Hence, we can assume that for Peirce, the role of the *normative sciences*,, is to show how to solve the difficulties of Kant’s three Critiques: Pure Reason, Practical Reason and Judgment. These remained epistemologically barren, and this fact affected the entire field of philosophy, especially during the 20th century. Peirce aims to show how his conception of the normative sciences solves Kant’s difficulties with his empty formalism, which is the basic epistemology of artificial intelligence.

However, the natural alternative to pure reason as the basis of AI should be the theoretical sciences, which aim to represent reality and, by being normative, to manipulate it to increase the quality of life within it. Similarly, the practical reason of ethics can make it practical by transforming absolute ethical freedom, with its ideal categorical imperative, into relative freedom, according to our knowledge of reality and the relative power we have to practice our ethical values in reality. However, in aesthetic judgment, the pragmaticists must show that the *beauty of artworks is an aesthetic true representation of reality* and that the role of this normative science is to contribute to our knowledge of reality and of ourselves and to our ability to elaborate upon the beauty, harmony, and humanity, in ourselves, our society, and in nature (Nesher, 2002b: X, 2007, 2021, 2022).

#### **6.3. Kant’s Pure Reason with its Formal Logic and Pure Mathematics is Like Artificial Intelligence and its Impossibility to Know Reality of Self, of External Nature, and the Peircean Pragmaticist Alternative**

In his Copernican Revolution, which was intended to overcome Hume’s empiricism, Kant suggested to start with transcendental *a priori* formal concepts to control our material sensual experiential intuitions, yet he did not have any method to combine them. Thus, Kant suggested the bizarre notion of *schematism*, which cannot overcome the gap between the *empty pure concepts* of the transcendental understanding and the *blind objects* of empirical intuitions. Indeed, at the end of his inquiries, Kant admitted his failure to bridge this gap.

However, Kant’s transcendental epistemology is based on a mystical conception of schematism that aims to bridge form and matter. Without it, his philosophical system cannot hold, and pure empty concepts remain meaningless as nominal empty words and blind objects remain no more than vague feelings (Kant, *CPuR*: #24-B150-151). In schema [7] below, Kant artificially binds the experiential components of his transcendental epistemology. According to my interpretation, Peirce criticizes it and constructs his realist epistemology to revolutionize Kant’s transcendental epistemology.



**Figure 11:** Transcendental logic and pure mathematics in pure intuition

This schema can explain the attempted synthesis of the indeterminate meaning of the sensual *blind object* with the *empty pure concept*, which Kant supposed would make the concept meaningful and the object determinate. Thus, the *empirical object* can be determined by being subsumed under the *empirical concept* (Kant, *CPuR*: #24-B150-151). Since Kant assumed that mathematics is a pure science, based on transcendental pure intuition, he had difficulties explaining this intuition, and in his *Critique of Pure Reason* B-1787, he explains the basics of pure mathematical intuition by counting fingers or dots.

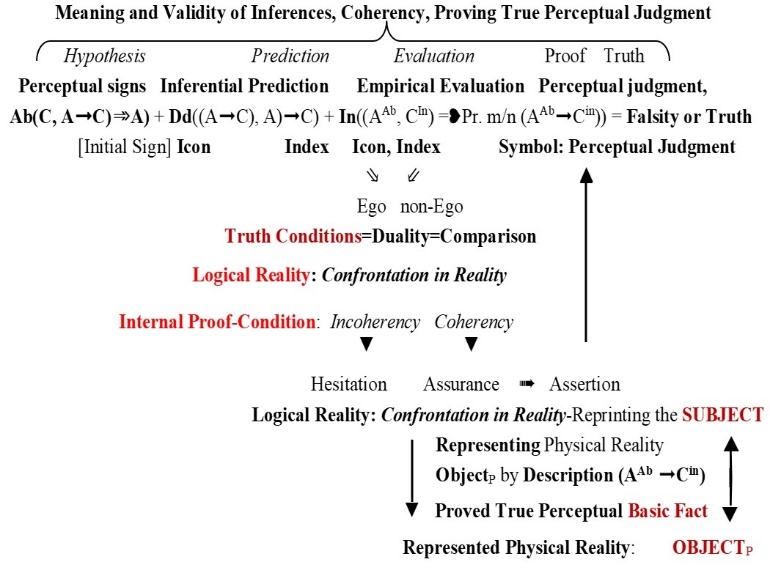
This schema is meant to explain the synthesis of the meaningless *empty pure concepts* of pure reason with the indeterminate meaning of the *blind object*, to make the concept meaningful and the object determinate. Thus, *empirical objects* can be determined by being subsumed under the *pure concept* in order to determine the perceptual judgment by which phenomenal reality is presented. However, Kant’s transcendental epistemology is based on a *mystical* conception of *schematism* that is meant to overcome the gap between *form* and *matter*, without which his philosophical system cannot hold. This schematism of our understanding, i.e., the schematism regarding appearances and their mere form, is the secret art residing at the depth of the human soul, an art whose true stratagems we shall hardly ever divine from nature and lay bare before ourselves. Only this much can we say: The *image* is [here] a product of the productive imagination’s empirical ability. (Kant, *CPuR*: A141/B180-1; cf. A121, B185-187).

We can see that all of Kant’s efforts in his first Critique to explain our scientific knowledge of nature through our phenomenal experiences cannot work within his transcendental epistemology. Furthermore, I suggest that following Peirce’s mature realist epistemology we must begin from our empirical experience and show how our conceptual knowledge develops from our basic perception and the proof of the truth of our perceptual judgments. Moreover, those judgments are our first cognitive facts upon which we can develop our true scientific cognitions with our *epistemic logic*, which I developed from Peircean Pragmaticism and his theory of truth (Hintikka, 1997; Nesher, 2002, 2010, 2011, 2016, 2018).

**6.4. Peirce’s Epistemological Alternative to the Kantian Epistemological Failure and How Epistemic Logic Can Explain the Impossibility of AI**

The following is Peirce’s epistemological alternative to Kant’s failure: the proof of the truth of our perceptual judgments. Peirce developed his semiotics into the epistemic logic of our perceptual confrontation with reality, manifested in the duality of the *ego* and *non-ego*, by interpreting our genuine signs as complete proof of the true representation of external reality, as a condition on the *validity* of the interpretation and the *soundness* of the proofs. Indeed, the epistemology of epistemic logic is the natural alternative to Kantian and neo-Kantian blind formalism, as the basis of artificial indigence. In contradiction to the human and animal intelligence which by instinctive and rational proofs of the Truth of Perceptual Judgment which is the basic Representation of their inner and outer Reality, the Subject and the Object which are the *Siamese Tweens* (Nesher, 1997).

Epistemic Logic involves the coherent interpretation of meanings through the three inferences in the quasi-proof of the truth of perceptual judgments representing inner and outer reality, the *Siamese Twins* of Subject and the Object, as in the following:



**Figure 12:** The natural intelligence of knowing oneself with the external reality

We find that through our cognitive clash with inner reality, we first become conscious of the reality external to us: this is our negative knowledge of reality, whereby we cognize the existence of something that contradicts our expectation, yet we still do not have a positive true representation of it (Nesher, 2017). Thus, the evolvement of the empirical concepts in perception from the sensual intuitions and imaginations into their synthesis in thought of perceptual judgment reveals Kant’s difficulty with the transcendental epistemology of pure formalism, which remains empty verbalizations. This is Kant’s nominalism, as Peirce explains it (Kant, *CPuR*: #24-B150-151; Peirce, 1905 *EP*II: #25). From this realist solution Peirce, in his latter research, developed his conception of normative science to show the practicality of the theoretical sciences in enhancing human ability to adjust nature and society for the benefit of increasing their freedom and their quality of life(Peirce, 1906 *EP*II: #27; Nesher, 2007a, 1994).

Since we cannot know ourselves without knowing external reality, we understand what human intelligence or the intelligence of other living beings is. We can therefore infer that artificial mechanisms cannot be intelligent because as artificial entities, they cannot know themselves and external reality as s*iamese twins.* Since AI cannot replace human intelligence, the question remains whether it can help human beings and whether we can understand its mechanisms and utilize them to improve our lives in nature. This explanation of the empty formalism of AI also applies to the realist epistemological criticisms of Kantian and modern neo-Kantians, as the formalist epistemologies of our time, in modern a[nalytic philosophy](https://simple.wikipedia.org/wiki/Analytic_philosophy" \o "Analytic philosophy), logical positivism, [ordinary language philosophy](https://simple.wikipedia.org/wiki/Ordinary_language_philosophy" \o "Ordinary language philosophy), which cannot transcend the empty formalism and reach an understanding of ourselves and of the reality we live and operate in.

**Conclusion:**

**According to Realist Epistemology, the Formal Signs of AI Remain Sterile, “Primitive And Muddled” (Cf. Einstein, 1949: 683–684, Nesher, 1996).**

In the centuries following the appearance of Kant’s transcendental writings and his Copernican Revolution against empiricist philosophy and its epistemology, modern philosophy has been basically neo-Kantian. Components of his epistemology, at least, pervade *phenomenalism*, *logical positivism, analytic philosophy, ordinary language philosophy, universal grammar*, *Russell and Wittgenstein’s philosophies* etc. They do not have any theory of truth or methods to represent reality. Alternative epistemologies can be found in Spinoza’s realist epistemology, with his theory of truth and his conception of freedom as relative to our knowledge of ourselves of nature and to other factors that may restrict our freedom (Nesher, 1999). In his latter Pragmaticist works, Peirce developed his *semiotics* as an experiential theory of truth, which I further developed into *epistemic logic*. In his epistemology of the *normative sciences*, he showed how we can overcome the difficulties of the three Kantian Critiques and explained how we can prove the truth of our discovered hypotheses by making experiential judgments and theories of ourselves and reality. Moreover he showed how to use them to adjust social and physical realities to improve our lives (Nether, 2007). This evolvement of Peircean Pragmaticism in his later work differentiates him from other philosophers, who call themselves Peircean Pragmatists, such as William James and John Dewey, though they actually remained neo-Kantians who do not follow Peirce’s realist revolution, as I have explained.

The question of Peirce’s mature methodology is why, in developing his semiotics as the solution to Kant’s inability to connect the transcendental *pure empty concepts* with the *sensible blind objects*, he did not develop his *semiotics* into *epistemic logic*, with which we might also explain our scientific knowledge of reality. The answer might be that he would then have to give up nominalistic *formal logic* and *pure mathematics*. This might have been a revolution beyond his epistemological horizons, which has progressed from the Euclidian to the Kantian and on to our time, when we consider *formal logic* and *pure mathematics* as special absolute kinds of knowledge that we can understand epistemologically as *closed games* whose *axioms* we cannot prove and the truth of whose theorems we cannot evaluate against reality. We are surprised to find in them *contradictions* and *paradoxes* as they are, so called, *scholastic disciplines* (Russell, 1901, 1910, 1919; Gödel, 1951, 1953: Nesher, 2011, 2012, 2018, 2021).

It is this atmosphere of neo-Kantian philosophical epistemology, of empty and sterile formalisms, that affects also the enterprise of artificial intelligence (among other things), without any epistemology that can explain it (cf. Einstein, 1949: 683–684).

As a result, we must utilize *epistemic logic* to prove the truth or falsity of our scientific hypotheses and show how *epistemic logic* and *realist mathematics* can be empirical *normative enterprises*. This can show us how artificial intelligence merely employs a formalism that cannot amount to any knowledge and cannot reach the self and external reality together. It is therefore merely an empty game that some entrepreneurs are trying to elaborate into intelligence. In fact, it is only an artificial mechanism, very limited in its ability to cope with human and even animal knowledge (Nesher, 2012, 2018).

The crucial question is whether artificial mechanisms can help human beings lead their lives in nature or rather destroy them? (cf. Hanna, 2024 ).

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