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Human and Machine: A View through Kant's Use of Regulative Reason

İnsan ve Makine: Kant'ın Düzenleyici Akıl Kullanımı Doğrultusunda Bir Bakış

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Human and Machine: A View through Kant's Use of Regulative Reason*

Abstract

This study examines the qualitative difference between human intelligence and artificial intelligence (AI) through the lens of Immanuel Kant's philosophy. This difference is based on the human mind's idea of unity and its intuitive ability to limit this unity. Kant argues that, through the regulative use of reason, it is able to obtain conceptual wholes such as God, soul, and universe. We argue that this idea of unity, derived through regulative reason, plays a significant role in distinguishing the human mind from *AI*. Based on Kant's idea of unity, our study determines that the human mind constructs a unity such as a *formal system*. Artificial intelligence, which is made possible by this construction, is inadequate in solving many problems that have shown surprising developments in recent years. We attribute this inadequacy to the inability of computers to model the aforementioned idea of wholeness. We justify this claim through the problem of "narrowing the brute search space" in computational complexity, which is a significant issue in computer science. This problem arises from the lack of a formal procedure for narrowing down a problem space with very large boundaries. When computers lack an efficient procedure or an analytical solution to the problems they aim to solve, they are forced to try all available solutions. In contrast, the human mind has cognitive abilities that allow it to intuitively narrow down these large problem spaces.

Kant's use of regulative reason provides a framework for understanding this human faculty. According to Kant, the regulative function of reason supplies the concepts of pure reason that guide scientific inquiry. For example, through a concept of pure reason, such as the cosmos, the human mind is able to limit the physical domain in such a way as to conduct physical science. Through Kant's use of regulative reason, we consider that the human mind, by bringing together a set of formal signs, makes a limitation such as a formal system. Since we can conceptualize a unity such as a formal system, we can discuss algorithms that operate according to this system. The regulative use of reason, which enables the establishment of such wholes, creates a qualitative difference between AI and the human mind when combined with the human's intuitive thinking ability. However, establishing the link between Kant's idea of *unity* and *intuitive thinking* based solely on Kantian philosophy is quite difficult. Thus, we refer to the views of Henri Bergson and Nazif Muhtaroğlu to establish this connection. Bergson, while explaining the concept of motion, argues that the mind reaches such an idea of unity through an instinctive synthesis. In this respect, movement is a mental synthesis, insofar as it is a transition from one point to another. Similarly, Muhtaroğlu, after emphasizing that the intuitive cognition that accompanies reason is a direct, unmediated and rapid cognition, identifies the type of intuition that leads to the idea of unity as immediate intuition. Stating that this type of intuition is a cognitive intuition, Muhtaroğlu cites Archimedes' discovery of the laws of fluids as an example of this way of thinking. In our study, we use the example of Archimedes to show how intuition accompanies the narrowing of the field of brute force search.

Thus, when the regulative use of reason and intuitive thinking come together, a difference emerges in the cognitive abilities of the human mind and artificial intelligence. Thanks to the regulative use of reason, the human mind is able to have an awareness of the unity of the object field it is confronted with. The fact that this awareness is accompanied by intuitive thinking allows this field of unity to be narrowed. Since artificial intelligence cannot model both the use of regulative reasoning and intuitive thinking, it is subjected to the brute search method. We argue that such a deficiency underlies the lack of analytical solutions to problems of computational complexity. This deficiency reveals the difference between the human mind and artificial intelligence in problem solving and narrowing down large search spaces.

Keywords: Philosophy, Artificial Intelligence, Immanuel Kant, Human Mind, Regulative Reason, Brute Force Search, Intuition.

İnsan ve Makine: Kant'ın Düzenleyici Akıl Kullanımı Doğrultusunda Bir Bakış**

Öz

Bu çalışma, insan zekâsı ve yapay zekâ (YZ) arasındaki niteliksel bir farkı Immanuel Kant'ın felsefesinin merceğinden incelemektedir. Bu fark, insan zihninin bütünlük (unity) fikrine ve bu bütünlüğü sınırlama konusundaki sezgisel düşünme kabiliyetine dayanır. Kant, aklın düzenleyici kullanımı yoluyla Tanrı, ruh, evren gibi kavramsal bütünleri elde edebildiğini öne sürer. Kant'ın düzenleyici aklın kullanımı yoluyla elde ettiği bu bütünlük fikrinin insan zihnini yapay zekadan ayırmada önemli bir işleve sahip olduğunu düşünüyoruz. Çalışmamız, Kant'ın bütünlük fikrinden hareketle insan zihninin biçimsel sistem gibi bir bütünlüğü inşa ettiğini tespit etmektedir. Bu

* This study is based on the author's PhD dissertation entitled *The Problem of Computational Complexity and Undecidability from the Perspective of Transcendental Philosophy*, conducted under the supervision of Prof. Dr. A. Ayhan ÇİTİL at Istanbul 29 Mayıs University, Institute of Social Sciences.

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inşanın mümkün kıldığı yapay zekâ, son yıllarda şaşırtıcı gelişmeler göstermiş olsa da pek çok problemin çözümünde yetersiz kalmaktadır. Bu yetersizliği, bilgisayarların yukarıda sözünü ettiğimiz bütünlük fikrini modelleyemiyor oluşuna dayandırıyoruz. Bu iddiamızı bilgisayar biliminde bir problem alanı olan hesap karmaşıklığı içerisindeki "kaba arama uzayını daraltma" problemi üzerinden gerekçelendiriyoruz. Bu problem, sınırları çok geniş olan bir problem uzayının daraltılabilmesi için gerekli olan formel prosedürün olmayışına dayanmaktadır. Bilgisayarlar çözmek istedikleri problemlerle ilgili etkili bir prosedüre ya da analitik bir çözüme sahip olmadığında eldeki tüm çözüm yollarını denemek zorunda kalmaktadır. Buna karşılık insan zihni, bu geniş problem uzaylarını sezgisel olarak daraltmaya imkân tanıyan bilişsel yetilere sahiptir.

Kant'ın düzenleyici akıl kullanımı, insanın bu yeteneğini anlamak için bir çerçeve sağlamaktadır. Kant'a göre, aklın düzenleyici işlevi bilimsel araştırmaya rehberlik eden saf akıl kavramlarını temin etmektedir. Örneğin, kozmos gibi bir saf akıl kavramı sayesinde insan zihni fizik bilimini yapacak şekilde fiziksel alanı sınırlandırma imkanına sahiptir. Kant'ın düzenleyici akıl kullanımı sayesinde insan zihninin biçimsel birtakım işaretleri bir araya getirerek biçimsel sistem gibi bir sınırlama yaptığını düşünüyoruz. Biçimsel sistem gibi bir bütünlüğü kavramsallaştırabildiğimiz için bu sisteme bağlı olarak işleyen algoritmalardan söz edebiliyoruz. Bu tarz bütünlükler kurmayı sağlayan aklın düzenleyici kullanımı, insanın sezgisel düşünme yetisiyle birleştiğinde *YZ* ile arasında niteliksel bir fark yaratmaktadır. Ancak Kant'ın felsefesindeki bütünlük fikri ile sezgisel düşünme arasındaki bağlantıyı sadece Kantçı felsefeden hareketle temellendirmek oldukça zordur. Bu sebeple, söz konusu bağlantıyı kurmak için Henri Bergson ve Nazif Muhtaroğlu'nun görüşlerine başvuruyoruz. Bergson, hareket kavramını açıklarken, aklın içgüdüsel (instinctive) bir sentez yoluyla böyle bir bütünlük fikrine ulaştığını ileri sürmektedir. Bu bakımdan, bir noktadan diğerine geçiş olduğu ölçüde, hareket zihinsel bir sentezdir. Benzer şekilde Muhtaroğlu, akla eşlik eden sezgisel kavrayışın doğrudan, aracısız ve hızlı bir kavrayış olduğunu vurguladıktan sonra bütünlük fikrine götüren sezgi türünü anlık sezgi (immediate intuition) olarak belirler. Bu sezgi türünün bilişsel bir sezgi olduğunu ifade eden Muhtaroğlu, Arşimet'in sıvılarla ilgili bulduğu yasalara kaynaklık eden keşfini bu düşünüş biçimine örnek gösterir. Biz de çalışmamızda kaba arama alanının daraltılmasına sezginin nasıl eşlik ettiğini gösterirken Arşimet örneğinden yararlanıyoruz.

Böylece, aklın düzenleyici kullanımı ile sezgisel düşünme bir araya geldiğinde insan zihni ile yapay zekanın bilişsel yetenekleri bakımından bir farklılık ortaya çıkmaktadır. Aklın düzenleyici kullanımı sayesinde insan zihni, karşı karşıya kaldığı nesne alanının bütünlüğüne dair bir farkındalığa sahip olabilmektedir. Bu farkındalığa sezgisel düşünme biçiminin eşlik etmesi ise bu bütünlük alanının daraltılmasına imkân tanımaktadır. Yapay zekâ hem düzenleyici akıl kullanımını hem de sezgisel düşünüş biçimini modelleyemediği için kaba arama yöntemine maruz kalmaktadır. Hesap karmaşıklığı konusundaki problemlerle ilgili olarak analitik çözümlerin bulunamayışının altında böyle bir eksiklik olduğunu düşünüyoruz. Bu eksiklik, insan zihninin problem çözme ve geniş arama alanlarını daraltma konusunda yapay zekâ ile olan farkını ortaya çıkartmaktadır.

Anahtar Kelimeler: Felsefe, Yapay Zekâ, Immanuel Kant, İnsan Zihni, Düzenleyici Akıl, Kaba Arama Uzayı, Sezgi.

Introduction

When starting a discussion about the *Human-Machine* dichotomy, one pertinent question arises: Is such a dichotomy philosophically legitimate? In our opinion, it is not correct to treat this dichotomy as an ordered pair within the same system. In mathematics, considering ordered pairs like (3,5) or (7,9) within the set of natural numbers is legitimate because these numbers are *homogeneous* units as elements of the same set, differing only in quantity, not quality. However, when we consider the pair (human, machine) as homogeneous units, what would the name of the set containing these elements be? Suppose we call this set the "thinkers". If a human, as the agent of the act of thinking, is a member of this set, can machines, as proxies for human thinking, also be members? Are machines merely proxies, or are they agents themselves in thinking?

These questions aside, we must acknowledge that developments since 2022 have significantly altered human-machine interaction. OpenAI's *ChatGPT-4* has brought this interaction to global prominence. With the new update announced on May 13, 2024, we find it fitting to describe the current state of AI as "astonishing." AI can now speak almost in real-time using voice, image, and text inputs, establishing logical relationships between them, much like a human. Given this remarkable development, discussing the horizons of AI has become even more crucial. Programs like *ChatGPT* can engage in conversations about conceptual unities such as *universe*, *God*, and the *soul*. But does AI genuinely possess awareness of these conceptual wholes? To show that it does not, we turn to Kant's views on the regulative use of reason. In this respect, the point of

departure of this study is the regulative use of reason in the Kantian sense and the idea of *unity* that this use reveals. However, we do not only consider Kant's view on the regulative use of reason within the scope of obtaining the concepts of pure reason mentioned above. In addition, we think that the regulative use of reason also plays a role in the achievement of a unity such as the *formal system* that constitutes the basis for artificial intelligence. The human mind, which possesses Kant's idea of *unity*, has designed a machine that operates according to a set of rules to represent all the functions it can compute. This design, which we can think of as the formalization of computability, requires the use of reason, which also makes artificial intelligence possible.

We argue that AI does not possess such a use of reason. We base this claim on *computational complexity*, a problem area within computer science. Specifically, we focus on the problem of narrowing the brute search space, which is crucial in computational complexity. The theory of computational complexity has its origins in computability theory and early developments in algorithmic analysis. The first issue is that Gödel, Church, Turing, Kleene, and Post, in the 1930s, were interested in Hilbert's *Entscheidungsproblem*- that is, the *FO-VALID* problem of determining whether a given formula in first-order logic is decidable[1]. In this paper, we will focus on the reasons that lead to *computational complexity* rather than this history. Since this discussion is usually done from the perspective of computer scientists, our work differs from theirs. There is hardly any work in the literature that addresses the problem of *computational complexity* from a philosophical perspective. Nevertheless, there are a few works that draw attention to the philosophical aspects of the issue.

The title of an article written by American computer scientist Scott Aaronson in 2013 reads as follows: "Why Philosophers Should Care About Computational Complexity". In this study, Aaronson argues that when we know that something is computable, the question of how efficient or effective that computation is a very important philosophical question. According to Aaronson, the gap between what is computable and the time of computation is sometimes so large that we need to think of them not only as quantitative gaps but also as qualitative gaps. To imagine this, consider the difference between writing down a thousand-digit number and counting to that number[2]. Aaronson's qualitative gap, expressed through the act of counting a thousand-digit number, points to a qualitative deficiency in the computational capability of computers. Walter Dean, who responded to Aaronson's invitation above, has put forth a work that deals with the subject from the perspective of the philosophy of mathematics. In this work, Dean emphasizes the importance of complexity theory in relation to questions traditionally asked by philosophers engaged in mathematics. In addition, he discusses why the problem of *P vs NP* is difficult to solve in relation to non-classical forms of computation and proof.[3]

Michael Sipser, has likened the search for a solution to Prime Factorization on the problem set Np to "looking for a needle in a haystack". Based on this example, Sipser asks: Is there an easier and faster way to find the needle in the haystack than looking under the individual stalks? According to Sipser, as difficult and time-consuming as searching for a needle in a haystack is, prime factorization is just as difficult. However, like a magnet that can be used to find a needle quickly, could there be a mathematical method or algorithm that would make prime factorization

[1] Walter Dean, "Computational Complexity Theory", *Stanford Encyclopedia of Philosophy* (Erişim 2 Ağustos 2022).
[2] Scott Aaronson, "Why Philosophers Should Care About Computational Complexity", *Computability*, ed. B. J. Copeland et al. (Cambridge, Massachusetts: The MIT Press, 2013), 264.
[3] Walter Dean, "Computational Complexity Theory and the Philosophy of Mathematics", *Philosophia Mathematica* 27/3 (2019).

easier?[4] The search for a mathematical method that Sipser tries to explain through the magnet example is related to the procedure that gives us the way to solve a problem. When it comes to searching for an object in a vast space of possibilities, computers can greatly speed up the search. In some cases, however, this search space can become so huge that even the fastest machines imaginable need geological time to search it. In such cases, the only practical solution is to find a method that avoids brute-force search. Roughly speaking, the *P vs NP* question generally asks whether such a method exists.[5]

When we talk about an algorithm running in polynomial time, it should be understood that we have such a procedure. However, the lack of such a procedure for solving Prime Factorization or Sudoku problems leads to computational complexity. So, in the absence of such a procedure or algorithm, how do computers go about solving the problem at hand? As we will show later, the only way out for computers that do not have an efficient solution is to resort to brute force search. Our aim is to show that the human mind, with its unmodelable faculty in computers, can narrow this space thanks to its *unity* idea and intuitive thinking ability. This creates a qualitative difference between the human mind and AI.

1. An Overview of Kant's Conception of Reason

Before delving into the regulative use of reason, let's outline how reason is treated in Kantian philosophy. Kant treats the construction of experience and the construction of concepts regarding the objects of experience at the level of the faculty of understanding (*Verstand*). Therefore, for Kant, the faculty that functions in the construction of experience is not reason but the understanding. However, even though Kant attributes the task of the construction of concepts to the faculty of understanding, he attributes the activity of judgment as a synthetic unity of these concepts to reason. From this, we understand that the most fundamental function of reason is to make judgments.

Kant identifies two primary uses of reason: theoretical and practical. This distinction is made in his *Groundwork of the Metaphysics of Morals as* pure theoretical reason (*reinen speculativen Vernunft*) and pure practical reason (*reinen praktischen Vernunft*).[6] In his *Groundwork*, which he also expresses as *a critique of pure practical reason,* Kant aimed to present the unity of practical and theoretical reason in a common principle. For, in the end, it is one and the same reason that must be distinguished only in practice.[7] The meaning Kant attributes to *theoretical reason* is rather related to the use of reason through representations and conceptions. Theoretical reason corresponds to a use that establishes the object, categorizes the concepts that are related to the object, and makes it possible to make judgments about the object. Theoretical reason makes possible the construction of the object through the faculty of understanding, as well as judgments such as *determinative*, *reflexive*, and *regulative judgment*.

The theoretical reason, which Kant deals with especially in the First Critique, stands out as a use that plays a role in the formation of cognition of the object. Practical reason, on the other hand,

[4] Michael Sipser, "Beyond Computation: The P vs NP Problem", by Poincare Duality, Youtube, 13 min., 40 sec. https://www.youtube.com/watch?v=msp2y_Y5MLE (Erişim 21 Eylül 2023).
[5] Michael Sipser, "The History and Status of the P Versus NP Question", *Theory of Computing: Twenty-Fourth Annual ACM Symposium: Proceedings*, ed. Rao Kosaraju et al. (New York: Association for Computing Machinery, 1992), 603.
[6] In his *Groundwork of the Metaphysics of Morals* and some of his other works, Kant uses both "theoretical reason" and "speculative reason" for the same purpose. Although Kant also uses the latter in the statement we cited above, we have translated it as "theoretical reason" to avoid terminological confusion.
[7] Immanuel Kant et al., *Groundwork of the Metaphysics of Morals*, ed. Mary J. Gregor-Jens Timmermann (Cambridge: Cambridge University Press, 2012), 5.

functions more in making an object *actual*.[8] Returning to the use of theoretical reason, according to Kant, reason, which is a faculty of reasoning and enables inference, can make three different inferences. Kant explains these three different inferences in relation to *the faculty of understanding*, the *faculty of judgment* and *reason*. In each inference, reason first thinks of a rule through the faculty of understanding (the great premise). Second, through the faculty of judgment, it makes knowledge the condition of the rule (minor premise). Finally, it determines knowledge *a priori* through the predicate of the rule, that is, through reason. Thus, Kant classifies different types of inference based on the relation between a cognition and the condition that the major premise represents as a rule. In terms of the way they express the relation of the cognized to the understanding, then, these inferences are of three kinds: *categorical*, *hypothetical*, and *disjunctive*.[9]

According to Kant, three terms must be synthesized in certain ways to make such inferences. This synthesis occurs according to the category of relation, which has three subcategories: *substance-accident*, *cause-effect* (causality), and *community*. The synthesis of concepts through the substance-accident category produces categorical inferences. The synthesis of concepts through the causality category produces hypothetical inferences. The synthesis of concepts through the community category makes disjunctive inferences possible. However, Kant emphasizes that the pure reason concepts synthesized in these three inferences have a subjective function rather than an objective one. For instance, Kant argues that empirical objects considered within the causality relation constitute the idea of the cosmos. Similarly, the pure reason concept that makes disjunctive inferences possible through the community category corresponds to the idea of *God*. However, Kant believes that concepts like *cosmos* or *God* cannot be attributed objectivity. Because these concepts are not obtained as those acquired through the construction in pure intuition by understanding, any attempt to attribute objectivity to these concepts results in an illusion.[10] We will discuss in what sense the concepts of pure reason have a subjective function later on.

Kant refers to *thinking* (*Denken*) as the unification of representations in a consciousness, calling this in a very general sense a *judgment*.[11] In this respect, Kant, who speaks of the act of judgment of reason as the unification of representations in a consciousness, makes a clear distinction between the faculties of *sensation*, *understanding* and *imagination,* which play a role in the comprehension of representations, and *reason* (*Vernunft*). According to this distinction, reason does not have a constitutive function in the construction of experience, but only a regulative function. According to Çitil, what Kant means by experience (*Erfahrung*) is the visualization of the intuitive correspondences (*Gegenstand*) of the *a posteriori* objects (*Objekt*) established and perceived by synthetic *a posteriori* judgments within the unity of intuition.[12] Therefore, there is no function of reason in the construction of experience in the sense of the emergence or cognition of an empirical object. In terms of Kant's conception of construction in pure intuition, faculties such as the *understanding*, *sensibility* and *imagination* function in the construction of concepts. Concepts are constructed as a result of the activity of these faculties and reason comes

[8] Immanuel Kant, *Critique of Practical Reason: Kritik Der Praktischen Vernunft* (Ankara: Philosophical Society of Turkey, 1999), 16.
[9] Immanuel Kant, *Critique of Pure Reason*, trans. Paul Guyer-Allen W. Wood (Cambridge: Cambridge University Press, 1998), B361.
[10] Kant, *Critique of Pure Reason*, A645/B673.
[11] Howard Caygill, *A Kant Dictionary* (Oxford: Blackwell, 2008), 113.
[12] Ahmet Ayhan Çitil, *Matematik ve Metafizik, Kitap I: Sayı ve Nesne* (İstanbul: Alfa Yayınları, 2012), 49.

into play after this stage. Kant thinks that all our knowledge starts from the senses and passes from there to the understanding and ends in the reason. He also argues that there is no higher faculty than reason to process the material of intuition and bring it under the highest unity of thought.[13] According to Kant, reason functions independently of sensibility and understanding as "the origin of certain concepts and principles."[14]

2. The Regulative Use of Reason and the Idea of Unity

We should note that Kant uses the principles (*Prinzipien*) mentioned above in a special sense and assigns them to the regulative principles of reason. Kant defines these principles as "synthetic knowledge derived from concepts" and compares them to knowledge derived from mathematical axioms.[15] Kant calls these principles "transcendental *ideas*" or "*ideas* of pure reason".[16] The transcendental *ideas* Kant refers to function to assign a certain origin to the possibility of experience. This is because Kant thinks that there must be a full or complete determination (*durchgängige bestimmung*) that would make the individual objects of experience belong to experience as a whole. To explain what he means by this complete determination, Kant, in his last work known as *Opus Postumum*[17], addresses the difference between the perception and the experience of a particular substance with a specific property. For Kant, the existence of a particular thing is not a particular predicate of that thing; rather, it is the absolute manifestation of that thing together with its other predicates. Therefore, there is only *One* experience, and if one speaks of *experiences*, it is only in the sense of the *distributive* unity of various perceptions, not the *collective* unity in the "complete determination" of its object.[18] It follows from Kant's account that the complete determination of experience is the unity of *Experience* as the sum of all possible predicates, rather than a predicate based on the perception of a particular object. Kant developed this idea of the unity, which emerges through the regulative use of reason, in *the Critique of Pure Reason*, Transcendental Dialectic, Book II, Chapter III.

Since Kant's understanding of experience is always directed towards a particular object, it is not possible to represent a whole set of objects in pure intuition. For this reason, Kant states that complete determination can never be represented *in concreto* in its entirety and is based on an *idea* that exists only in the reason.[19] According to Kant, this *substratum* or *idea is* a transcendental ground that contains a storehouse of material from which all possible predicates of things can be taken. This substratum is nothing other than the idea of an All of reality (*omnitudo realitatis*). For, according to Kant, All true negations are then nothing but *limits*, which they could not be called unless they were grounded in the unlimited (*the All*).[20] The reason why *the idea of* All of reality as a pure *idea* of reason cannot be a concept belonging to the faculty of understanding is that the faculty of understanding cannot concretely limit it in such a way as to hold it in a certain aspect. As we have already mentioned, since a concrete or *in concreto* representation can only be made through intuition, and since the unity of experience cannot be represented in intuition, it is not possible for the faculty of understanding to have such a concept.

[13] Kant, *Critique of Pure Reason*, A299.
[14] Kant, *Critique of Pure Reason*, A299/B355.
[15] Kant, *Critique of Pure Reason*, A300-A301/B356-B357.
[16] Kant, *Critique of Pure Reason*, A311/B368 and A669/B697.
[17] Immanuel Kant, *Opus Postumum* (Cambridge: Cambridge University Press, 1999).
[18] Michael Friedman, *Kant and the Exact Sciences* (Cambridge, Mass.: Harvard University Press, 1994), 300.
[19] Kant, *Critique of Pure Reason*, A573/B601.
[20] Kant, *Critique of Pure Reason*, A575-576/B603-604.

Thus Kant argues that the idea of the unity, which he expresses as the transcendental *ideal,* is the only true *ideal* that human reason is capable of. For only in this one case is the universal concept of a thing in itself fully determined through itself.[21] So what is the reason behind Kant's attribution of a regulative function to reason? This reason largely stems from Kant's conception of science. It is known that Kant's explanation of scientific reasoning is heavily influenced by Newton's views. According to Kant, Newton's laws of gravity unify Copernicus' hypothesis, Galileo's observations, and many other empirical experiences. According to Kant, these laws, as regulative principles, are universal and therefore encompass not only the motion of the sun relative to the earth but also the motion of all celestial bodies.[22] However, Kant states that no matter how extensive our experiences are and no matter how many people's experiences we benefit from, experience is limited and it is not possible to experience all events. From this point of view, he argues that the universality of laws does not mean that these laws will be valid in the future. Nevertheless, after stating that reason is justified in adopting these regulative principles, he adds: "these principles should guide scientific inquiry, that is, they are "regulative", but they are not "constitutive" since they do not provide knowledge of the world".[23]

From the above explanation, the difference between reason as regulative and reason as constitutive is clear. The regulative use of reason reveals pure concepts or *ideas* that regulate human actions and give them a certain orientation. Kant attributes such a use to reason in order to fictionalize the unity of the sciences in such a way as to provide a certain unity to experience. We use the word "fiction" deliberately here because, according to Kant, the transcendental *ideal*, as an *idea of* reason, has no objective existence. It is only as the concept of all reality that reason puts it on the basis of the objective givenness of reality and the complete determination of things in general without having to constitute anything itself. With his conception of *the ideal,* Kant states that he aims to determine something that is universal yet particular as follows: "for such a thing consists of a fiction in which we, as a particular being, encompass and realize the manifold of our idea in an ideal".[24]

So, what could be the reason for Kant to fictionalize such a thing or to base experience on some kind of assumption? According to Kant, the reason must guide the activity of the faculty of understanding in grasping objects from certain aspects. Otherwise, as stated above, a complete determination of the whole experience would not be possible. An object of sense in empirical experience can be fully determined only when it is compared with all the predicates of the phenomenon and represented positively or negatively through them. But since what constitutes the thing itself (in appearence), that is, what is real, must be given (otherwise the thing itself cannot be thought at all), but since the place where the real in all appearences is given is the one all-encompassing Experience, the material of the possibility of all sense-objects has to be presupposed as given in one sum total, and all possibility of empirical objects, their difference from one another and their complete determination, can rest only on the limitation of this sum total.[25]

For Kant, All manifoldness of things is only so many different ways of limiting the concept of the highest re ality, which is their common substratum, just as all figures are possible only as different

[21] Kant, *Critique of Pure Reason*, A576/B604.
[22] Kant, *Critique of Pure Reason*, A663/B691.
[23] Garrath Williams, "Kant's Account of Reason", *Stanford Encyclopedia of Philosophy* (Erişim 3 Ağustos 2024).
[24] Kant, *Critique of Pure Reason*, A580/B608.
[25] Kant, *Critique of Pure Reason*, A581-582/B609-610.

ways of limiting infinite space. Hence the object of reason's ideal, which is to be found only in reason, is also called the *original being* (*ens originarium*); because it has nothing above itself it is called the *highest being* (*ens summum*), and because everything else, as conditioned, stands under it, it is called the *being of all beings* (*ens entium*).[26] Thus, Kant aims to identify the concept of the *highest reality*, which is the common substratum of all manifoldness of things. Through this concept, Kant aims to identify the first being as a singular, simple, omnipotent, eternal, etc. being of the highest reality. This concept of the first being is the concept of *God* conceived in the transcendental sense, and therefore the aforementioned *ideal* of pure reason is the object of a transcendental theology.[27] According to Kant, the most important among *the ideas is the idea of* God, who is identified as the wise creator of the world or the highest intellect. Kant claims that it cannot be proved in any way whether there is an object corresponding to this *idea*. Nevertheless, this *idea* functions as an indisputable heuristic tool that allows us to systematically pursue our empirical investigations of nature.[28] Kant states that things in the world should be thought of as deriving their existence from the highest intellect. Under its guidance, this supreme intellect, or *God-idea*, shows us how we should investigate the structures and connections of objects of experience in general.[29] Therefore, in terms of the idea of the unity of the sciences, *the idea of* God is hierarchically above both *the* idea of *the soul* and the idea of *the cosmos*, since it provides guidance and orientation to the sciences.

Thus, after identifying the idea of *God* as an absolute possibility to which the things in the world owe their existence, Kant argues that empirical investigations into this existence are guided by the idea of *the cosmos*. If we think in terms of *the* idea of *the cosmos*, Kant's attribution of a regulative use to reason is meant to construct the unity of the sciences in such a way as to provide a certain unity to experience. Because Kant thinks that reason should not only focus on a certain object and make judgments about individual objects such as "this pencil is green" but also have a systematic unity regarding these object fields. Otherwise, he believes that it would not be possible to do science about individual objects that appearing in the external sphere. This is because, although the idea of the cosmos does not establish a unity that encompasses the objects in nature and their motions, it provides a certain guidance to reason in order to act *as if* such a unity *exists*. According to Kant, one cannot speak of the science of "physics", which encompasses the totality of research on physical objects, without mentioning the idea of the cosmos.

Let us briefly touch upon Kant's explanation of the idea of the cosmos in terms of Newton's understanding of absolute space. On the one hand, Kant rejects Newton's absolute conception of space, and on the other hand, he identifies space as an imaginary focus (*focus imaginarius*) that physical science can never reach.[30] *In Principia*, Book III, Newton develops an approach that results in the determination of the center of mass of the solar system, where, according to him, neither the Earth nor the Sun can be considered absolutely motionless. However, Kant thinks that this empirical procedure cannot end in this way. Because, the center of mass of the solar system exhibits a slower rotation than the center of mass of the Milky Way Galaxy. Even this last point, according to Kant, furnish us with a privileged state of rest, because the Milky Way Galaxy also rotates around the common center of galaxies. In other words, Kant argues that even though

[26] Kant, *Critique of Pure Reason*, A579/B607.
[27] Kant, *Critique of Pure Reason*, A580/B608.
[28] Friedman, *Kant and the Exact Sciences*, 48.
[29] Kant, *Critique of Pure Reason*, A670-671/B698/699.
[30] Kant, *Critique of Pure Reason*, A644-645/B672-673.

we aim for the center of "the common gravity of all matter", it is always out of our reach. Therefore, instead of Newton's absolute space, he argues that we have no object at all, only a procedure to determine better and better *approximations* to a privileged frame of reference. This is why Kant calls absolute space "a necessary concept of reason, thus nothing other than a mere idea"; for absolute space can be thought of only as the ideal end-point towards which the Newtonian procedure for determining the center of mass of a rotating system is converging, as it were.[31]

This means that reason must have a holistic awareness of the appeared objects and their space in order to determine the scientific framework within which these objects are to be handled. Kant thinks that such an idea of *unity* can be achieved through the concepts of pure reason that make reasoning possible. We have touched upon Kant's views on the regulative use of reason through three concepts or *ideas of* pure reason. After emphasizing that the pure concepts of reason are regulative, Kant warns against using them as if they were constitutive concepts. For the pure concepts of reason do not express the objective relation of an actual object to other things, but only the relation of an idea to concepts, leaving us in complete ignorance regarding the existence of a being of such preeminent excellence.[32] As we have already mentioned, Kant's idea of a highest being is *God*. Therefore, it is not possible to reason or have knowledge about God's existence. Nevertheless, if one tries to reason about the essence of a being like *God*, one will suffer from a transcendental illusion.[33] The same applies to the pure concepts of *soul* and *cosmos*. According to Kant, the crucial mistake, in other words, is to move from the notion of the real of appearance-which, by its very nature, can only be given progres sively in the course of the advance of experience-to that of experience as a single given (finished and complete) totality.[34] This is because, as we have already noted, knowledge of these concepts transcends the limits of experience, and the use of reason in a way that transcends the limits of experience leads to illusion.

3. Narrowing the Brute Search Space

So, what significance can the regulative use of reason have for machines and artificial intelligence in particular? Let us approach this issue through the problem of *computational complexity*, a problem domain in computer science, which is based on formal systems. *Computational complexity* theory deals with how much time and memory is required to solve problems depending on the size of their solution space. A problem is called *feasibly decidable* if it can be solved by a conventional Turing machine in a sequence of steps proportional to a polynomial function of the size of the problem input. The class of problems with this property is known as *P* or *polynomial time*.[35] Being polynomial time or not is related to the growth rate of the search space of an algorithm. If the size of the search space grows in polynomial time, the solution can be computed in feasible time, whereas if it grows exponentially, the computation time becomes infeasible.

There is then a dramatic difference between a polynomial time increasing search space like n^3 and an exponential time bounded search space like 2^n. For example, let's say n is 1000 as a reasonable input size for an algorithm. In this case, n^3 is a large but manageable number like a

[31] Friedman, *Kant and the Exact Sciences*, 47-48.
[32] Kant, *Critique of Pure Reason*, A580/B608.
[33] Kant, *Critique of Pure Reason*, A645/B673.
[34] Friedman, *Kant and the Exact Sciences*, 302.
[35] Walter Dean, "Computational Complexity Theory and the Philosophy of Mathematics", *Philosophia Mathematica* 27/3 (2019), 400.

billion, while 2^n corresponds to a number much larger than the number of atoms in the universe.[36] The former is a description of polynomial-time algorithms, while the latter describes exponential-time algorithms. Polynomial-time algorithms are fast enough for most purposes, whereas exponential-time algorithms are not, which makes them impractical.
Obtaining an efficient procedure for solving a particular problem means that an algorithm that can decide that problem has been obtained. However, there are some problems for which it is not possible to obtain an algorithm, and for which there is no solution other than trying all available algorithms. In searching for solutions to these problems, computers have to traverse *large search spaces* that require trying all possible solutions. This method, which requires computers to try all possible possibilities, is called the *Brute Force Search*.[37] The faster this method yields results, the less difficult the problem is. However, polynomial-time algorithms for *NP* (*non-deterministic polynomial-time*) problems that cannot be solved in polynomial time have not been found so far. The lack of a polynomial-time algorithm for these problems makes it necessary to resort to *brute search*. We will discuss the rationale for why computers have to resort to brute search later. But before we go there, let us touch on the relation between Kant's conception of *unity* and the narrowing of the space of brute search.

As stated above, thanks to the regulative use of the concept of pure reason, which makes hypothetical inferences possible, physical objects and their corresponding concepts can be considered as a whole in certain relations. According to Kant, otherwise one cannot speak of physical science as a science that studies physical objects. When we proceed from such a framework, we think that just as physical science makes it possible to present and analyze objects of experience as certain unities, the same is true for the unity called the *formal system*. When we speak of a formal system, it is as if we are talking about a collection of sequences of signs that are related according to certain rules. But to what extent is it possible for a computer to represent such a unity? Since the unity that Kant calls the *imaginary focus* cannot be constructed in pure intuition, it cannot be represented formally. That is, since there is no formal way for a computer to make the units it processes belong to a certain absolute unity, it is also impossible for it to have knowledge of such an infinite horizon. Because a computer that performs computation by moving from one sequence of signs to another sequence of signs is only interested in giving unity to the signs it processes per unit of time within certain relations and functions. For this reason, the facts in a formal string or the propositions expressing these facts cannot be in a categorical or causal relation.

At this point, we should briefly mention *the frame problem*, which is a *perennial* problem for artificial intelligence. Clark Glymour explains *the frame problem* succinctly as follows: "Given an enormous amount of material and a task that must be done using some of that material, what is the material relevant to that task?"[38] Following Glymour's point, let's consider an artificial intelligence program that needs to make a decision about the solution to a problem. This program has to somehow eliminate all possibilities, both related and unrelated to the problem, in order to arrive at a solution. But this is not as easy as it sounds. In this respect, we think that *the frame problem* is closely related to the problem of *narrowing the brute search space*. This is because the human mind, when faced with a problem to solve, has the ability, which computers

[36] Michael Sipser, *Introduction to the Theory of Computation* (Florence: Cengage Learning Inc, 2012), 285.
[37] Dean, "Computational Complexity Theory and the Philosophy of Mathematics", 396.
[38] Zenon W. Pylyshyn (ed.), *The Robot's Dilemma: The Frame Problem in Artificial Intelligence* (Norwood, New Jersey: Ablex, 1988), 65.

do not, to narrow down the search space that may or may not be relevant to the problem. Thanks to the regulative use of reason, the human mind can also have an awareness of the unity of the problem space it encounters. Drawing the boundaries of this unity also means narrowing the solution space of the problem. We attribute this ability, which we think is present in humans but not in computers, to a kind of *intuition* that enabled Archimedes to make the discovery about liquids.

Human survival requires that we quickly and selectively apply what we know about the world to the situation in front of us and produce useful results. Cognitive science is far from satisfactorily explaining how we do this, which seems simple and straightforward in practice. Among philosophers, this is commonly known as *the frame problem*.[39] The human mind, by contrast, has the ability to make an abstraction on the data sets that the computer processes and to limit the sum of these data sets. This capability, as Kant puts it, is made possible by the regulative use of reason. Therefore, just as *the idea of God* is a concept of pure reason that gives unity to all beings, it also gives unity to formal systems.

Based on Kant's idea of unity, the human mind can design a machine that operates according to a certain set of rules to represent all the functions it can calculate. In this respect, all the elements of the formal system are a set of elements that are initially contained in a fiction of the human mind and then put into a formal language. If human had not presented these elements to himself in his mind as certain unities for his own purposes, it would not have been possible for them to come together to form a formal language. From this point of view, we have determined that the *mental* takes precedence over the *formal*. When we consider that a formal language consists of signs and sequences of signs, these sequences of signs do not actually have to form a unity on their own. However, thanks to the regulative use of reason, our minds think of sequences of signs as if they have a certain unity, and theorems derived according to certain rules emerge. The emergence of a formal system was also possible based on such an idea of unity. In this respect, human beings actually acquire certain unities through an activity of their own minds and reflect these unities into a formal language. The computer, on the other hand, makes certain manipulations on the systematic unities produced by the human mind through its regulative activity.

3.1. The Role of Intuition

We think that human beings' ability to construct unities in the sense we have mentioned above has an important function in terms of narrowing the brute search space. As we will discuss in a moment, when the human mind is confronted with a huge search space, it has a special intuition that can find the information it needs very quickly within that space. We should clarify what kind of intuition we are talking about when we say a special *intuition*. We think that Kant is not very interested in the kind of *intuition* we are talking about here, but that this kind of intuition is connected to Kant's idea of unity. Behind this idea lies the idea that the unities obtained as a result of the regulative use of reason play a role in narrowing the space of brute search. In this way, when the human mind encounters a problem it has never encountered before, it is able to narrow the space of brute search by limiting it to a certain unity instead of trying all possible solutions. The question of how the mind makes this narrowing in a way that limits the space of brute search has been widely discussed after Kant.

[39] Scott Hendricks, "The Frame Problem and Theories of Belief", *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition* 129/2 (2006), 317.

Henri Bergson argues that the mind reaches the idea of such a unity through an *instinctive* synthesis. Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness* [*EssAI sur les donnees immediates de la conscience*][40], Bergson tries to explain the concepts of *duration* and *motion* by referring to the idea of a certain *unity*. For him, in general, when we say that a movement takes place in space and when we claim that movement is homogeneous and divisible, we think of the space traversed, as if it could be changed by the movement itself. Now, if we think a little more, we see that the successive positions of the moving body do indeed occupy space, but that the process by which it moves from one position to another, a process that occupies time (duration) and has no reality except for a conscious observer, is stripped of space. From this point of view, Bergson states that movement has two elements: (1) the homogeneous and divisible space traversed; (2) the act of traversal, which is indivisible and real only for the space of consciousness.[41] According to Bergson, in this act of traversal we are not dealing with an object but with a process: movement, insofar as it is a passage from one point to another, is a mental synthesis, a psychic and therefore *unextended* process. Space contains only parts of space, and at whatever point in space we take the moving body, we obtain only a position. If consciousness is aware of something more than positions, it is because it holds successive positions in mind and synthesizes them.[42] Bergson states that here we are faced with a synthesis that is qualitative, a progressive organization of our successive sensations, a *unity* that resembles a phrase in a melody. For him, this is *the idea* of *motion* that we create when we extract mobility from motion.[43]

Muhtaroğlu, acting on the idea of unity in Bergson's example of melody given above, thinks that such an idea of unity is realized through an *intuition* that accompanies the activity of the mind. According to Muhtaroğlu, Bergson argues that truth can be known not through a method based on analysis but through an *intuition* that directly grasps the unity. Because when we hear a song, instead of understanding it by thinking about the consecutive notes one by one, we hear a melody in a state of flow in which the notes intertwine with each other. It is intuition that allows us to grasp this melody holistically.[44] Making distinctions between different types of intuition, Muhtaroğlu defines the type of intuition that leads to the idea of unity as *immediate intuition* after stating that the intuitive comprehension that accompanies reason is a direct, unmediated and rapid comprehension. Stating that this type of intuition is a cognitive intuition, Muhtaroğlu gives the example of Archimedes' discovery, which is the source of the laws he found about liquids.

According to legend, King Hieron commissioned a gold crown but suspected the goldsmith had mixed in silver. He asked Archimedes to determine if the crown was pure gold without damaging it. Despite his efforts, Archimedes couldn't find a solution. His wife suggested he relax at the bathhouse. There, Archimedes noticed the water level rose when he entered the tub. This observation led him to realize that an object's volume could be measured by the water it displaced. Archimedes tested his idea by submerging a pure gold ingot and a pure silver ingot of equal weight in water, finding that silver displaced more water than gold. Finally, he submerged the crown and saw it displaced more water than the gold ingot, proving it was not

[40] Henri Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness* (Mineola, NY: Dover Publications, 2001).
[41] Bergson, *Time and Free Will*, 110.
[42] Bergson, *Time and Free Will*, 111.
[43] Bergson, *Time and Free Will*, 111–12.
[44] Nazif Muhtaroğlu, *Aklın Üç Yüzü: Eleştirel, Çok-Yönlü ve Yenilikçi Düşünce* (İstanbul: Bilge Kültür Sanat, 2022), 150.

pure gold. Thus, Archimedes demonstrated that the goldsmith had mixed silver into the crown. Based on this event, Archimedes formulated the principle known today as "Archimedes' Principle" as a result of his experiments on liquids.[45] Based on this story, Muhtaroğlu uses the term *epiphany*, which James Joyce often uses in his works, to clarify what he means by *immediate intuition. Epiphany* is when many things that seem ordinary offer very different meanings on a deeper level, allowing one to look at oneself and one's life from a different perspective.[46] In this case, Archimedes' intuition is a immediate intuition that suddenly appears in a moment of congestion. This also means that it is impossible to predict when a immediate intuition will appear. This is because Archimedes' intuition emerged independently of reason, even though it had a reasoning process that preceded it. In other words, there is a *gap* between the use of reason and this type of intuition, and this gap is overcome by a sudden *leap*.[47]

Muhtaroğlu discusses the role of reason and immediate intuition together in scientific discovery through the example of Archimedes and touches upon the relation of the subject with artificial intelligence. According to him, there is a rule-free and unmediated transition between the phenomenon of Archimedes' body overflowing the water in the bathtub and the problem of whether the king's crown is made of pure gold. Therefore, the problem of computer modeling of the immediate intuition that enables the transition between fact and problem creates a distinct difference between human intelligence and artificial intelligence. According to which set of rules will artificial intelligence determine that water is related to this problem, and that the ability of water to change its displacement as much as the volume immersed in it from a set of properties will produce a solution to the problem? In other words, how will it establish such a relation between the crown problem and water?[48]

In explaining this difficulty in modeling intuition, Muhtaroğlu draws attention to what we call the "narrowing of the brute search space". Even an algorithm that can try many alternatives in a very short time assumes a bounded space of alternatives. But what range of alternatives will such an algorithm scan if it is not given sufficient criteria to draw boundaries? Muhtaroğlu points out that the Archimedes problem is not a well-defined problem space, and that it would be difficult for a *deep learning algorithm* trained with a large dataset to solve this problem. This is because the clue to solve the problem is not an undiscovered pattern in a very large dataset, but an immediate relationship between the mentioned property of water and the crown problem. In this respect, even if the computer is given some guiding rules in terms of *a shortcut algorithm*, these rules will not be sufficient to establish the relationship in question. This is because the Archimedes example points to a completely different type of intuition that enables humans to capture the relationships between seemingly unrelated situations in an instant. Therefore, unless this type of intuition can be explained algorithmically, it can be concluded that humans have an aspect that surpasses computers and artificial intelligence in this respect.[49]

If we continue with the immediate intuition in the Archimedes example, the question of where the intuition is directed and where it finds what it is looking for is an important question in terms of artificial intelligence discussions. When we approach this question from the perspective of transcendental philosophy, we think that the space to which intuition is directed is one and the

[45] Britannica, T. Editors of Encyclopedia, "Archimedes' Principle", Encyclopedia Britannica https://www.britannica.com/science/Archimedes-principle (Erişim 28 Mayıs 2024).
[46] Muhtaroğlu, *Aklın Üç Yüzü*, 173.
[47] Muhtaroğlu, *Aklın Üç Yüzü*, 151–52.
[48] Muhtaroğlu, *Aklın Üç Yüzü*, 203.
[49] Muhtaroğlu, *Aklın Üç Yüzü*, 203–4.

same space as the space constituted by the regulative use of reason. As in Archimedes, the reason, faced with a problem, makes certain constrictions in the solution space in line with the regulative use of reason. Kant's transcendental philosophy provides an important ground for how reason makes such narrowings. However, as we tried to express above, it is extremely important how an intuition such as *immediate intuition*, which operates together with reason, plays a role in this narrowing. Therefore, the fact that reason, which has the idea of unity, can narrow this unity with an intuitive ability reveals the most fundamental difference between human and machine.

Conclusion

In this study, we have addressed the difference between the human mind and artificial intelligence through Kant's idea of unity, based on the regulative use of reason. According to Kant's theory of reason, the regulative function of reason yields principles that guide scientific knowledge but are not constitutive. These principles, combined with the human mind's ability to think intuitively, allow humans to narrow down large problem spaces. This enables many scientific discoveries because it gives humans a distinctive ability to solve problems. When this capability is compared to the computational capabilities of artificial intelligence, a unique situation emerges, highlighting the distinctiveness of the human mind.

Although AI has made remarkable progress in recent years, it lacks the idea of unity and intuitive thinking that the human mind possesses. The problem of "narrowing the brute search space", one of the biggest challenges faced by AI, further illustrates this difference. Additionally, Kant's idea of unity, which facilitates the narrowing of the brute search space, plays a critical role in constructing formal systems. When the human mind designs formal systems to represent all the functions it can compute, it does so through the use of regulative reason. This construction is realized through the formalization of the concept of computability, forming the basis of artificial intelligence. To address the problem of narrowing the brute search space through the regulative use of reason, we have drawn on Bergson's and Muhtaroğlu's concepts of intuition. Bergson's notion of instinctive synthesis and Muhtaroğlu's notion of immediate intuition are instrumental in explaining the role of the idea of unity, based on the regulative use of reason, in the problem-solving ability of the human mind. Archimedes' immediate intuition, in establishing the relationship between the volume-changing property of water and the king's crown, exemplifies this intuitive thinking.

In conclusion, the difference between the human mind and AI lies in the human ability to grasp the idea of unity and think intuitively. Demonstrating this difference is crucial for understanding the computational challenges faced by AI. The problem of narrowing the brute search space stems from the absence of a formal procedure to define the criteria for narrowing a problem space with very large boundaries. The lack of such a formal procedure makes it impossible for a computer to solve the problem. However, the human mind can narrow this field through the idea of unity and intuitive thinking. This ability shows that humans are not only bound by formal boundaries when solving problems, thereby deepening the rift between the human mind and artificial intelligence.

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