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RESEARCH ARTICLE

The Synthetic Concept of Truth and Its Descendants

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Dedicated to Jozo and Rajka Ištuk,
victims of war and victims of lies on the Internet

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Abstract: The concept of truth has many aims but only one source. The article describes the primary concept of truth, here called the synthetic concept of truth, according to which truth does not belong exclusively to us nor exclusively to nature: truth is the objective result of the synthesis of us and nature in the process of rational cognition. It is shown how various aspects of the concept of truth – logical, scientific, and mathematical aspect – arise from the synthetic concept of truth. Related to these aspects, (i) the role of the predicate of truth in the concept of truth is analysed, (ii) Tarski's definition of truth and its role in the concept of truth are analysed, and (iii) the position of the paradoxes of truth in the concept of truth is analysed.

Keywords: truth; truth in logic; truth in science; truth in mathematics; the truth predicate; Tarski's definition of truth; paradoxes of truth.

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> "The ideal subject of totalitarian rule is not the convinced Nazi or the convinced Communist, but people for whom the distinction between fact and fiction (i.e., the reality of experience) and the distinction between true and false (i.e., the standards of thought) no longer exist."
> Hannah Arendt: *The Origins of Totalitarianism* (Arendt 1973)

> [Pontius Pilate]: What is truth?
> [Yeshua]: The truth is, first of all, that your head aches…
> Mikhail Bulgakov: *Master and Margarita* (Bulgakov 1997)

1. Introduction

Many of the ambiguities associated with the concept of truth stem from the fact that the concept has various aspects that are not sufficiently differentiated. Tarski's T-scheme (Tarski 1933) is a classic example of this. T-scheme is a set of T-sentences, the sentences (biconditionals) of the form:

$$T(\ulcorner\varphi\urcorner) \leftrightarrow \varphi^*$$

where "T" is the symbol of the truth predicate, φ any sentence of a language L (usually the language we are considering), $\ulcorner\varphi\urcorner$ is the name of that sentence in a language *ML* (usually the metalanguage in which we consider L), while φ^* is a translation of that sentence into *ML*. To get a concrete example of a T-sentence, I will take the English sentence "Svrco is afraid of thunder" (the language L will be part of the English language), and my native language as the language *ML*:

T("Svrco is afraid of thunder") ↔ Švrćo se boji grmljavine

where $\textit{Svrco is afraid of thunder}^* = \textit{Švrćo se boji grmljavine}$ is a translation of the English sentence into my native language (Croatian). Here the concept of truth appears in five places: as the truth values of the left and right sides of the biconditional, as the truth value of the whole biconditional, as the meaning of the truth predicate symbol "T," and as the truth value of the sentence "Svrco is afraid of thunder." Only the last sentence belongs to the language L, while the other sentences and the symbol "T" belong to the language *ML*. However, all of them have a semantic source in the sentence "Svrco is afraid of thunder" of the language L. The left side of

the biconditional through the symbol T allows to speak in *ML* about the truth value of the sentence "Svrco is afraid of thunder" of the language *L*, the right side of the biconditional is related to the truth value of the translation of that sentence into *ML*, while the truth value of the whole biconditional is related to the success of the translation. Thus, the key aspect of the concept of truth is related to the truth value of the sentence "Svrco is afraid of thunder" of the language *L*, while other aspects are connected to this primary aspect for various reasons.

In what follows, I will focus on this primary concept of truth – the truth values of the atomic sentences of the language *L*, leaving aside the truth values of the sentences of the metalanguage in which I will carry the considerations. After analysing the primary concept of truth, I will consider other aspects of the concept of truth. Related to these aspects, in the last part of the article (i) the role of the predicate of truth in the concept of truth is analysed, (ii) Tarski's definition of truth and its role in the concept of truth are analysed, and (iii) the position of the paradoxes of truth in the concept of truth is analysed.

There is a vast philosophical literature on the concept of truth. Although various aspects of the concept of truth have been addressed (Glanzberg 2023), I have not come across a differentiation of the concept of truth as done in this article.

The basic assumption of the analysis of the concept of truth conducted here is that rational cognition and abstract thinking are in their final form the creation and use of language. A common view of the role of language in rational cognition and thinking is that it plays a passive role there: language is a medium for expressing and communicating thoughts, and for describing reality. The first philosophers to fully recognize the essential role of language in rational cognition and thinking were Hamman, Herder and Wilhelm von Humboldt in the second half of 18th century and the first half of 19th century, and Cassirer later, in the first half of 20th century. In the first half of the 20th century, linguists Sapir and Whorf came to the same conclusion. However, they did not systematically analyse the essential role of language in rational cognition and thinking, and the key role of the concept of truth in it. The essential role of language is systematically analysed in (Čulina 2021). In this article, the key role of the concept of

truth is systematically analysed. Some parts of these articles overlap. In addition to the fact that these parts are now improved, I believe that the importance of the concept of truth deserves a separate article dedicated to that concept.

In the analysis that follows, I will stick to two methodical principles. The first is that all the language of rational cognition can be understood as an extension and improvement of everyday language.[1] Experience in using everyday language is more or less unconsciously transferred to the entire language of rational cognition. I will analyse the hidden assumptions of this generalization that are significant for the concept of truth.

Another methodical principle that I will adhere to is that I will deal primarily with the effects of language forms in rational cognition, and not with the biological, psychological, social, empirical and theoretical processes on which these effects rest. For example, I will primarily deal with the question of what it means for my use of language to possess the full meaning of a language form, and not what the full meaning of a language form consists of. I consider that it is just a proper level of abstraction which, on the one side, explicates all precise effects, and on the other side, hides all complexities and obscurities of the use of language in the process of rational cognition. Of course, it does not mean that the meanings of language forms are not important. Moreover, the meanings are necessary. We cannot use language in rational cognition without the meanings of language forms. However, unlike the determinable effects of language use in rational cognition, the meanings of language forms are too fluent to be able to say something definite without limiting their necessary fluency. Although there are essential differences between what Frege calls "sense" and "reference" and what I call in this paper "the possession of the full meaning" and "semantic value" of a linguistic form, my focus on the effects of language forms corresponds to Frege's insistence on reference: "The reference is thus shown at every point to be the essential thing for science." (Frege 1892a).

[1] This is the language form of Einstein's claim that "The whole of science is nothing more than a refinement of everyday thinking." (Einstein 1936, 349)

2. The Synthetic Concept of Truth

Adhering to the principles stated above, I will begin the analysis with the sentence from everyday language: "Svrco is afraid of thunder." To determine the truth value of the sentence "Svrco is afraid of thunder" we must know the meaning of its parts. Knowledge of English grammar tells us which parts they are and what their linguistic meaning is: "Svrco" is the name of an object, and "is afraid of thunder" is a predicate expression. However, to determine the truth value of the above sentence, we must know exactly which object the word "Svrco" names and what the meaning of the predicate expression "is afraid of thunder" is. Svrco is my only dog, and every connoisseur of English possesses the meaning of the word "is afraid of thunder," despite the fact that we do not know clearly enough what the "meaning of a predicate expression" means. The possession of these meanings is necessary but not sufficient to determine the truth value of the sentence "Svrco is afraid of thunder." We still have to do an appropriate experiment, let nature give its contribution, to determine that it is a true sentence.

This example from everyday language illustrates the basic cognitive situation: the use of a predicate expression leads to the creation of a binary experimental framework that we apply to the named object. We generate a binary experiment in which nature chooses one of the two offered values, *yes* or *no*, as the result of the experiment. We apply a predicate symbolized by "P" to an object a and describe the situation with the declarative atomic sentence "$P(a)$." Two possible results of the application are the so-called *truth values* termed *True* and *False*. We take the result chosen by nature as the truth value of the language form "$P(a)$." *True* and *False* are designed by us as a part of the binary experimental framework and selected by nature in the realization of the experiment. These binary experiments are the essence of our rational cognition. We make the question and offer two possible answers, and nature selects an answer. The selected truth value does not belong exclusively to us nor does it belong exclusively to nature. It is the objective result of the synthesis of us and nature in the process of rational cognition: it differentiates what is from what is not. That is why I have termed this primary concept of truth *the synthetic concept of truth*.

An everyday cognitive situation illustrated and described above, simple as it might seem, has a number of underlying characteristics and assumptions that are essential for the process of rational cognition and that need to be clarified. First, it reflects our innate approach to the world which we divide into objects with which something happens and predicates that determine what happens. This division is not absolute – something that is a predicate in one context can become an object to which other predicates are applied in another context. This *object - predicate dualism* is a fundamental characteristic of the cognitive framework described here. It is reflected in language through the structure of the atomic sentence "$P(a)$." Symbols "a" and "P" have different roles in the sentence. We use symbol "a" to name (mention) an object a. We use symbol "P" to say something about the object a. The symbol "P" does not name anything: it leads to a certain binary experiment on the object a.

To my knowledge, Whorf is the first one to recognise that the object-predicate dualism is a prominent feature of Indo-European languages: "Our language thus gives us a bipolar division of nature. But nature herself is not thus polarized." (Whorf 1940, 247). He also recognizes that the dualism and the way we analyse nature is not inherent to nature but to our approach to nature: "We dissect nature along lines laid down by our native language. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds – and this means largely by linguistic systems in our minds. We cut nature up, organize it into concepts and ascribe it significance as we do" (Whorf 1940, 231).

Furthermore, the language form "$P(a)$" is not a passive description of the associated binary experiment: it is a part of the experiment. Although names for objects and symbols for predicates can be arbitrary, their presence in our rational cognitive processes is essential. Through names, we control our connection with objects and through predicates we control our connection with associated experimental frameworks. Moreover, as I will explain below, objects and predicates do not exist by themselves – they also exist as parts of our rational syntheses with nature. Since names and predicates are a means of extracting objects and binary experimental frameworks

in rational cognition, each name is a part of the object it names and each predicate symbol is a part of an associated experimental framework. Thereby, a particular syntactic form is not important. What is important is the very presence of the form.

To my knowledge, von Humboldt is the first to recognize the importance of the above-described connection between language forms and the formation of concepts, and who finds in this relation the key to understanding why language is essential for thinking: "Language is the formative organ of thought. Intellectual activity, entirely mental, entirely internal, and to some extent passing without trace, becomes, through sound, externalized in speech and perceptible to the senses. Thought and language are therefore one and inseparable from each other. But the former is also intrinsically bound to the necessity of entering into a union with the verbal sound; thought cannot otherwise achieve clarity, nor the idea become a concept. The inseparable bonding of thought, vocal apparatus and hearing to language is unalterably rooted in the original constitution of human nature, which cannot be further explained […] without this transformation, occurring constantly with the help of language even in silence, into an objectivity that returns to the subject, the act of concept formation, and with it all true thinking, is impossible." (Humboldt 1836, 50). Umberto Eco says this poetically in the last sentence of the 1980 novel *The Name of the Rose*: "Stat rosa pristina nomine, nomina nuda tenemus."[2]

A fundamental semantic assumption of the use of an everyday atomic sentence "$P(a)$" in rational cognition is that "a" names an object. This rests on the assumption that it is possible to extract from the world something to be named. I will term the named object *the semantic value of the name*. Every name has the same general meaning – to name something. I will say that I *possess the full meaning of a name* if I have means to identify the named with the help of nature. These means can be different, even for the same object. They can be based on the senses. For example, I can identify my dog Svrco by sight, but also by hearing. They can be based on some physical equipment. For example, a star invisible to the naked eye can be identified using a telescope. They can be based on social contact. For example, I cannot directly identify person X but I know person Y who can

[2] "Yesterday's rose stands only in name, we hold only empty names."

identify person *X*. They can be based on some knowledge. Let's take the famous example of the planet Venus. If I know that *Venus = the morning star = the evening star*, then I can identify Venus in various situations in various ways. Sometimes a whole theory can help us identify an object. For example, Newton's theory of gravitation allows us to calculate the coordinates of the planet Venus in the sky at any moment and thus identify it. What are the meanings of the various names for Venus, and whether knowing that all these names refer to the same object changes their meanings, are questions I will not go into.[3] As I stated in the introductory section, I will deal only with the effects of meaning in the use of language. And this is exactly what the concept of possessing the full meaning of a name encompasses. Moreover, for the purpose of analysing the concept of truth, my aim in the next few paragraphs is to present the arguments only for the following two claims about names:

(i) Like the truth value of an atomic sentence, the process of naming is also a kind of synthesis of us and nature.

(ii) When we use language, we assume that every name of the language names an object, no matter how this connection is achieved and whether it is achieved at all. Expressed in terms of meaning: when we use language, we possess general meaning of names (that a name names something), but not necessarily the full meanings of names.

In doing so, I will not deal with defined names, but only with primitive names of the language, because the definition of a name ultimately reduces the possession of its full meaning to the possession of the full meanings of primitive names and primitive predicate symbols.[4]

When looking at my dog, I realize the connection between the word "Svrco" and my dog almost with a pure perception. However, in the moments when I cannot see him, I keep the connection on the basis of some definite knowledge and the theory that my dog exists somewhere as a distinct object. In everyday life, we keep the connection between the name and

[3] An overview of the various approaches to the meanings of names can be found, for example, in (Cumming 2023).

[4] Predicates are analysed below.

the named across time in such a way that, using some commonly established knowledge, we trace the named object, and any changes made upon it until the moment when we decide that it is no longer the same object (because it is destroyed or it is transformed into something else). When this connection terminates depends on an accepted world view. For example, when Svrco dies, whether the name "Svrco" denote his bones or his spirit, or neither, depends on a world view. I like to call this "the problem of Trigger's broom." Trigger is a likeable street sweeper in a British TV Series "Only Fools and Horses." He has got a medal from local authorities because of his thriftiness – he has been using the same broom for the last twenty years. However, we soon learn that in those twenty years he has replaced the broom head 17 times and the broom handle 14 times. Is it the same broom despite the changes? In everyday situations the decision is a matter of an (established) convention, more or less.

Other obscurities emerge when we analyse the connection between names and objects we cannot perceive directly. Here, the connection is more complex and more dependent on a theory. When we investigate in an experiment if a particle x was an electron, how do we know (i): that there is a distinguished object we can investigate, (ii): that the connection between name "x" and the object is preserved during the experiment, and (iii) that another object didn't appear, or the named object of the investigation hasn't changed?

Even if we ignore changes over time, the connection between name and the named is a complex mechanism of our interaction with nature. To begin with, I would use the game of recognizing figures in the clouds. Not only does the recognition of a figure in the clouds depend on the place of observation, but two people in the same place will see different figures. In ordinary situations, we all recognize and name the same beings and objects, so it seems to us that we are only giving names to existing objects. But as soon as we move away from the usual situations, extracting from the situation what will be our object (the named) becomes increasingly dependent on our approach. For example, in fluid dynamics, we distinguish between two approaches to the study of fluids, depending on what we have extracted for study – whether our object is a fluid that occupies a certain space and is constantly changing in time (Euler's approach) or always the same piece

of fluid that is constantly changing space in to which it is located (Lagrange's approach). A step further in the analysis would require us to "dive" into the fluid and turn into, for example, a jellyfish, while retaining the same linguistic abilities. Due to different needs and perception, the world would look completely different to us: the naming abilities would be completely different, and we would extract completely different parts of reality for the named objects.[5]

I believe these considerations are compelling enough to accept the first assertion about names: that, like the truth value of the atomic sentence "$P(a)$," *the process of naming is also a kind of synthesis of us and nature.*

When I use the name "Svrco," I exactly know what is named: my dog Svrco. However, even in everyday situations, we use names for which we don't know the exact object they name, for example, the name of a person we don't know. Even worse, it is possible that such a person does not exist, as it the case today with fake profiles on the internet. In the same unwarranted way, we extend the language used in everyday situations to other situations, when we are involved in science and mathematics, or when we talk fairy tales to children. However, we think "with names" in the same way, whether we know what they name or not and whether they name anything at all. For example, when we are involved in the fairy tale *Snow White and the Seven Dwarfs* we think, discuss and make conclusions as if all the characters in the story exist, because we are "tuned" to think in this way in semantically clear everyday situations. Only, when we step out of the language of the story (and use another language) we acknowledge that there are no such objects. This consideration supports the second assertion about names: concerning names, the moral is that *when we use language, we assume that every name of the language names an object, no matter how this connection is achieved and whether it is achieved at all.* Expressed in terms of meaning: when we use language, we possess general meaning of names (that a name names something), but not necessarily the full meanings of names. In the same way that we use language in everyday situations,

[5] In (Atiyah 1995), the famous mathematician Michael Atiyah described a thought experiment with an intelligent jellyfish, in which he showed that its mathematics would be significantly different from ours, thus arguing that mathematics is human invention, not discovery.

we use it in all situations. We can refine the language, replace it with a precise mathematical model, for example the language of first-order logic, but the assumptions of its use remain the same.

I believe that naming, as a kind of synthesis of us and nature, together with the fundamental assumption of the language use of names, that every name names an object (although we may not even know which object it names and whether it names anything at all), is a key primitive element of language. I think it is wrong to minimize the importance of naming as in Russell's theory of descriptions (Russell 1905), in Quine's reduction to values of variables (Quine 1948) or more radically in Quine's reduction to "ideal nodes at the foci of interesting observation sentences" in his naturalized epistemology (Quine 1990).

The next fundamental semantic assumption of the use of an everyday atomic sentence $P(a)$ in rational cognition is that the predicate "P" applied to the object a gives, with the help of nature, the truth value of the corresponding atomic sentence $P(a)$. The application of "P" consists of finding the associated binary experimental framework which, applied to a, gives an experiment in which nature gives the result: *True* or *False*. Thus, by *predicate* I consider the predicate symbol (predicate expression) together with this interpretation. Each predicate determines, through the intervention of nature, a mathematical function (function in the mathematical extensional sense) from objects to truth values. I will call this extensional function the *semantic value of the predicate*. However, we must not equate the predicate and its semantic value. Otherwise, we would destroy the whole language mechanism of rational cognition. The predicate is a part of the process of rational cognition, while its semantic value on a given object is the final result of this process, in which nature is substantially involved. Each predicate has its own general meaning: to generate a binary experimental framework. But each predicate has its own binary experimental frameworks. I will say that I *possess the full meaning of a predicate* "P" if I have means that for each object a I associate with the predicate a binary experimental framework in which nature will determine the truth value of the sentence $P(a)$. For a given predicate "P" we can have several different means, in the same way as with naming, from perception and experimental apparatus to the theories in which that predicate is incorporated. Using these means, we

can generate multiple experimental frameworks associated with the predicate. I will illustrate it using the example of the predicate "is a dog."

From the moment of birth, we form the possession of the full meaning of the predicate "is a dog," I would say almost by perception, as a part of our ability to differentiate beings. The semantic means of the predicate expression "is a dog" are deeply rooted in our sensory world, and only later do we complete it (make it more precise) with determinations which vary from everyday experience (for example that a dog does not necessarily have fur) to advanced theoretical knowledge (for example about its genetic code). This development does not mean that we did not possess the full meaning of that predicate before, but that the predicate itself changes, although its language form remains the same. The predicate "is a dog" leads to a whole host of binary experimental frameworks, from visual and auditory perception to the examination of the genetic code.

The possession of the full meaning of a predicate is manifested in our ability to apply it to objects by various means. Unlike the insufficiently clarified concept of meaning, the concept of the possession of the full meaning is verifiable to us and that is why I will use it.[6] For the purpose of analysing the concept of truth, my aim in the next few paragraphs is, similar to the analysis carried out for names, to present the arguments only for the following two claims about predicates:

(i) Like the truth value of an atomic sentence and like the naming, predicates are also a kind of synthesis of us and nature.

(ii) When we use language, we assume that we possess the full meaning of every predicate of the language without considering how we possess the full meaning and whether we possess it at all.

In doing so, I will not deal with defined predicates, but only with primitive predicates of a language, because the definition of a predicate ultimately reduces the possession of its full meaning to the possession of the full meanings of primitive names and primitive predicate symbols.

[6] The question of the meaning of predicates is one of the most difficult philosophical questions. An overview can be found, for example, in (Margolis and Laurence 2023) and (Orilia and Paoletti 2022).

From the fact that predicates are essentially connected to binary experimental frameworks, which are our biological or conceptual design integrated with nature, it follows that predicates are also a kind of synthesis of us and nature. The process of seeing leads to such a synthesis: light comes from the world but light processing belongs to our perception and brain. That is why predicates for colours are a typical example of the biological synthesis of us and nature.

For some predicates, it is clear that they were designed according to our intentions. Even in common situations, different people use different predicates. Predicates are the basic means by which we abstract what is important to us from a given situation. Let's imagine a group of hikers who have decided to have lunch. They have found a stone with a flat upper surface which is adequate to put out food and consume it. For them, the stone is a table. It is the same stone on which a ranger stood yesterday because he had a good view from it. For hikers, the stone is a table, for the ranger it is an observation post. Each of them extracted what they needed from the stone using the appropriate predicate. Even when I described that object as a stone, I have abstracted something from it by the predicate expression "is a stone." Even when I described it as an object, I have abstracted something from it by the predicate expression "is an object." All the above abstractions are conditioned by our preferences, but they are abstractions over nature. They also testify to the synthesis of us and nature in the formation of predicates. Further relativization would lead us to thought experiments in which we would analyse what kind of predicates other organisms (elephants or microbes) would develop in the same situation if they had our linguistic abilities. By means of their predicate expressions, they would surely create different abstractions and structure the situation differently. Thus, predicates depend on us as individuals, but also on us as a human community.

Those predicates with which we try to say something objectively about nature are especially important for science. However, in order to possess the full meaning of such a predicate, our presence is necessary. We usually achieve this through complex measuring devices that are a kind of extension of our senses. Thus, objectivity means not that such a predicate belongs to nature itself, but that it is invariant to the individual or group that applies

it. To all of them, nature will give the same answer in the application of such a predicate. However, there is another important problem that I will illustrate with the example of a predicate "is an electron." This predicate is applied to objects out of our direct experience. We must develop adequate experimental tools, built on some theory (world view), to have an indirect experience of such objects. Dealing with the meaning of the term "is an electron" opens up a lot of questions. Does one type of experimental framework determine the meaning of the predicate expression "is an electron"? Or is the essence of "is an electron" something else which only coincides with the concrete meaning in the context of the experiment? We would like that "is an electron" have a deeper meaning than it manifests in particular experimental settings. However, is such a "transcendental" predicate independent of various experimental settings or is it just their "common denominator"? In other words, does the predicate attached to the expression "is an electron" exist independently of us or does it exist only through our cognitive interaction with nature? A simple picture is that all such predicates exist independently of us, and that we only discover them through our interaction with nature. However, we have no rational ground for this claim. On the other hand, if we were to bound ourselves to predicates that strictly correspond to experimental settings we would lose any power of deeper cognition of nature. However, for the predicate "is an electron" to have any cognitive value, it must necessarily be part of our cognitive interaction with nature, otherwise it loses meaning. This problem also occurs in our everyday rational cognition. Moreover, the everyday situation clearly shows us the solution. I will take the already discussed predicate "is a dog" as an example. I can determine that a being is a dog with several types of experiments. One experimental framework is based on seeing that being, another on listening to that being, the third on analysing its genetic code. However, I have the knowledge that all these experiments on the same being will give the same answer. This knowledge allows me to possess the full meaning of the predicate "is a dog" over any of these experimental frameworks and invariant to them, because they all give the same answer. If another experimental framework appears tomorrow that gives the same answers as these, I will include it too in the possession of the full meaning of the predicate "is a dog." The same solution applies to the predicate "is an

electron." The theory of electromagnetism (if we stay within the framework of classical physics) allows us to associate with the predicate "is an electron" many binary experimental frameworks for determining whether a particle is an electron or not. We don't have to prefer any of these experiments because they all give the same answers. As with the predicate "is a dog," we possess the full meaning of the predicate "is an electron" through these experimental frameworks and invariantly to them. It is important to note here that this possession is based on a scientific theory which is also largely our construction. Thus, we participate in the predicate "is an electron" not only through the design of the associated experimental frameworks, but also through the scientific theory to which it belongs.

I believe these considerations are compelling enough to accept the first assertion about predicates: that, like the truth value of an atomic sentence and like the naming, *predicates are also a kind of synthesis of us and nature*.

Already in everyday language we use predicates for which we do not possess the full meaning. On a personal level, this happens constantly while growing up. Let us imagine a situation where a child has heard of kangaroos. At the beginning, all she knows about them is that kangaroos carry young in a pouch on their stomachs. If the child understood this information as a distinguishing characteristic of a kangaroo, then she possesses the full meaning of the predicate "is a kangaroo." She can determine for each animal, by examining whether it has a pouch, whether that animal is a kangaroo or not. Of course, her predicate "is a kangaroo" is different from the predicate "is a kangaroo" established by the human community. Through further learning, the child will have to change the meaning of her predicate and adapt it to the one accepted by the human community. When the child learns additional information, that only female kangaroos have a pouch and that there are other animals that have a pouch, then she knows she doesn't possess the full meaning of the predicate "is a kangaroo," and her further learning of that predicate will consist of completing the predicate. One photo of a kangaroo will allow her to possess the full meaning of the predicate, which is in accordance with the socially established understanding of the predicate. However, the child may see some beings that she is not sure are kangaroos. This means that she still does not possess the full meaning

of the predicate "is a kangaroo," but will have to complete it.[7] If one day she becomes a biologist specializing in kangaroos, only then will she possess the full meaning of the predicate "is a kangaroo." But is it really so? What if a new species is discovered and her knowledge is not enough to determine whether it is a kangaroo or not? Given that she can no longer compare her understanding of the predicate "is a kangaroo" with the understanding of the scientific community, because it has been agreed upon, this situation definitely leads to the conclusion that the scientific community does not possess the full meaning of this predicate but must complete it.

We could carry out a similar analysis for other predicates. In (Waismann 1968), Friedrich Waismann showed that we can almost never be completely sure that we possess the full meaning of a predicate. If I use his terminology, predicates have an "open texture." However, unlike predicates that do not belong to rational cognition (for example, the predicate "is a fairy"), predicates that belong to rational cognition usually develop over time towards greater precision and efficiency. Let us just take the predicate "is an electron" as an example. This predicate not only developed historically but also changed significantly with each more advanced physical theory. It has a different meaning in classical electromagnetism than in quantum mechanics or quantum field theory. Frank Wilczek, winner of the Nobel Prize in Physics writes: "What is an electron? That question was central to the development of quantum theory early in the twentieth century and remains at the frontier of physics today. There are several inconsistent answers, each correct." (Wilczek 2013). This is a good example of a predicate that essentially depends on the entire theory of which it is a part. That within various theories the concepts of electron are mutually inconsistent, yet correct, is not contradictory and can easily be explained by the connection between scientific theories about nature and nature. Scientific theories are only models of nature that approximate it well enough within a certain scope of the phenomenon. Thus, the predicates of the theory are also just approximations that we try to fix within the theory or change them significantly by

[7] Another possibility is to decide to reject everything that she does not recognize as a kangaroo as not being a kangaroo. But that would sooner or later lead to collisions between her understanding of that predicate and the scientific understanding.

changing the theory. That is why, as a rule, we never possess the full meaning of a predicate, but a sufficiently full meaning for the needs of knowing a phenomenon. Possessing a full meaning is an idealization, similar for example to the idealization of point particles (material points) in classical mechanics.

This brings us to the second assertion about predicate symbols: concerning predicates, the moral is that *when we use language, we assume that we possess the full meaning of every predicate of the language without considering how we possess the full meaning and whether we possess it at all.*

Due to the further analysis of different aspects of the concept of truth, it should also be pointed out that there are situations where we do not use predicates as an investigative tool to address questions to nature. Commonly, these are situations which we create and over which we have control, for example, in designing a game, a story or a mathematical world (as I will explain later in Section 6). Then, for some predicates, we directly decide on which objects they give *True,* and on which objects they give *False.* For example, we can decide which character in a fairy tale will be good or which natural numbers less than one hundred will have some (unimportant) property U (we will just enumerate such numbers). This is another use of predicates in which we directly reduce them to their semantic values. The role of these predicates in our rational activities is quite different than the original role of predicates as investigative means in rational cognition.

As I have analysed one-place predicate symbols, I can also analyse multiplace predicate symbols. The analysis of function symbols is similar to the analysis of names. I will say that I *possess the full meaning of a function "f"* if I have means to identify the named $f(a)$ with the help of nature, assuming that I possess the full meaning of the name "a." A nice example of these functions are measurement functions, such as mass or temperature, which associate numbers with parts of nature through an appropriate measurement process.[8] The *semantic value of the function* is the corresponding mathematical (extensional) function between objects. As with predicates, so with functions, it is essential to distinguish the function from its semantic value. A function is a part of the process of rational cognition, while its

[8] These functions are analysed in (Čulina 2022).

semantic value on a given object is the final result of this process, in which nature is substantially involved.

To conclude, the essence of the synthetic concept of truth is the following one. By dis-joining the world and our actions in it into objects and predicates, which we control through language symbols, we put binary questions to nature. By selecting one of the two offered answers, nature brings its contribution to the framework, besides its contribution to the processes of naming and of predicating. In a binary experiment of applying predicate "P" to object a, when nature selects an answer, *True* or *False*, it "says" something about itself. With this valuation of the language form "$P(a)$," the form which describes and controls the experiment, we gain knowledge about nature. This is the starting point for the overall role of the concept of truth in our rational cognition.

It should be noted once again that this is an idealized situation. Often in real situations we do not know exactly what a name names and whether it names something at all, as well as how to apply a predicate to a given object. However, when we use the language to which these names and predicates belong, an integral part of its use is that we assume that these names name objects and that we know how to apply predicates to objects. This is how we use everyday language, and we extend such use to the total language (languages) of rational cognition. Only when we take the names and predicates of that language as objects of our thinking, only then do we deal with the problem of the fulfilment of the assumptions of their use. Then we use another language (the metalanguage of the given language). Then these names and predicates are not means of our (object) language (where we use them) but are objects of another language (where we mention them). In Section 5, dedicated to the scientific aspect of the concept of truth, the use of object language in science will be considered. In Section 7, dedicated to the assertion-valuation distinction, the use of metalanguage in the examination of object language will be considered.

I consider that the synthetic concept of truth is the solution to the philosophical problem of truth – is there any connection between truth and reality and, if so, what is the connection. The synthetic concept of truth shows that there is a connection and precisely shows what the connection is.

3. Comparison of the Synthetic Concept of Truth with Other Concepts of Truth

Clearly, the synthetic concept of truth is not any kind of a deflationary concept of truth that diminishes the importance of the concept of truth.[9] The synthetic concept of truth is of crucial importance for rational cognition. Also, the synthetic concept of truth is not a kind of a correspondence theory of truth where the truth value of the sentence is determined only by whether the sentence corresponds with reality or not. Thereby, reality is considered something independent of us and language: language only serves to describe reality.[10] In the synthetic concept of truth, atomic sentences themselves, with their interpreted parts – names and predicate symbols – and with their truth values, where nature is involved, form reality: reality is the result of the synthesis of us and nature through the creation and use of language.

Although formal parallels can be drawn between Frege's analysis (Frege 1891, Frege 1892a, Frege 1892b, Frege 1892c) and my analysis of the atomic sentence, especially between Frege's insistence on the distinction between the concept and the extension of the concept and my insistence on the distinction between the predicate and the semantic value of the predicate, the results of the analysis are fundamentally different. For Frege, sense and reference have a metaphysical meaning: an atomic sentence expresses a thought, and the thought belongs to a kind of Platonic world (Frege 1918), as well as the truth value of the thought. In Frege, the thought is primary, and it can be decomposed into object and the remaining unsaturated part – concept (Frege 1906a, Frege 1906b). Thus, the object and the concept as part of the thought also belong to the Platonic world. In my analysis, predicates and objects are primary. They belong to the world of our real activities: from predicates and objects we build binary experiments in which, with the help of nature, they are synthesized into the truth values of the

[9] Various formulations of the deflationary concept of truth can be found, for example, in (Armour-Garb, Stoljar and Woodbridge 2023).

[10] Various formulations of the correspondence conception of truth can be found, for example, in (David 2022).

corresponding sentences. Language is not a lifeless description of the Platonic world, but it is a living organism that changes and completes itself in the synthesis with nature.

The ideal situation in which a predicate possesses a full meaning is a kind of formulation of the verification principle, an idea that is at the basis of logical empiricism. In the words of Moritz Schlick: "The meaning of a proposition is the method of its verification" (Schlick 1936). In the words of Rudolph Carnap: "Thus the meaning of a sentence is in a certain sense identical with the way we determine its truth or falsehood; and a sentence has meaning only if such a determination is possible." (Carnap 1936). The only elaborated version of this principle, which at the same time diminishes its value, is Carnap's version of logical empiricism (Carnap 1936, Psillos 2000, Carnap 1966), so I will stick to it. At the level of atomic sentences, Carnap's analysis of the idea of verification leads to the division of predicates into observational predicates (e.g. "is red") and theoretical predicates (e.g. "is an electron"). Although a clear boundary cannot be drawn, we can roughly say that observational predicates have a high degree of verifiability. On the other hand, theoretical predicates are not directly verifiable, and that is why Carnap requires the introduction of correspondence rules that will connect them with observational predicates. These rules will not make them verifiable but will give them a certain indirect empirical meaning. Carnap develops the entire structure of such a language in which he tries to give each sentence, not only atomic sentences, some degree of empirical meaning.[11] If we stay at the level of atomic sentences, unlike Carnap's division into observational and theoretical predicates, which is quite questionable and heavily criticized by Quine (Quine 1951), my approach is uniform. All primitive predicates have the same status in the idealized situation of possessing their full meaning, and in the assumption of this possession we adhere to when we use language. How much we really possess the meaning of a predicate, i.e. to what extent the assumption of language use is fulfilled on it, are questions that belong to metalanguage and which, in my opinion, due to the fluency of the concept of meaning (its sensitivity to a multitude

[11] I will comment on that language in Section 5, dedicated to the scientific aspect of the concept of truth.

of factors that include even the accepted theory on which we rely on) cannot be adequately formulated in the language itself, as Carnap tried.

On the level of ideas, in addition to a different understanding of language, my move away from logical empiricism is a move towards the ideas of pragmatism: placing the human being at the centre of rational cognition, as an active biological and sociological being whose needs and motives significantly shape their rational cognition. In William James memorable words: "In our cognitive as well as in our active life we are creative. We add, both to the subject and to the predicate part of reality. The world stands really malleable, waiting to receive its final touches at our hands. Like the kingdom of heaven, it suffers human violence willingly. Man engenders truths upon it." (James 1907, 254). Not various dualisms but a synthesis: "Does the river make its banks, or do the banks make the river? Does a man walk with his right leg or with his left leg more essentially? Just as impossible may it be to separate the real from the human factors in the growth of our cognitive experience." (James 1907, 250). However, due to the wide variety of pragmatism and its remaining at the programmatic level, it is difficult for me to draw some more specific connections with my approach.

The founders of pragmatism based their insistence on the integrity and uniqueness of the human being in the cognition of the world on the theory of evolution. Today, in their work, M. R. Bennett and P. M. S. Hacker base it on cognitive neuroscience: "A human being is a psychophysical unity, an animal that can perceive, act intentionally, reason and feel emotions, a language-using animal that is not merely conscious, but also self-conscious – not a brain embedded in the skull of a body.…it is human beings who think and reason, not their brains." (Bennett and Hacker 2022, 3). In their view of language and concepts, I find similarities with my approach. These authors also give a key importance to language in human thinking and cognition: "…it is the capacity to speak and the mastery of a language that is a condition of all that is distinctively human, and hence too a condition for the sciences and the arts of humanity" (Bennett and Hacker 2022, 13). The connection between form and meaning is very similar to mine. For me, a predicate is a predicate symbol together with its meaning, where the concrete form is not important, but its very presence is important. They have a similar relation between words and concepts: "A concept is an abstraction

from the use of a word" (Bennett and Hacker 2022, 404). I am talking about the possession of the predicate; they are talking about the possession of the concept. However, for them, possessing a concept means knowing how to use the concept-word in the "language game": "To have a concept is to have mastered the use of a word" (Bennett and Hacker 2022, 404). For them, to master a concept means to master "the rule-governed use of the word that expresses the concept" (Bennett and Hacker 2022, 404). And this is achieved through "emulation: learning by doing; parental and sibling training and teaching; learning by engaging in language games; learning from informal instruction" (Bennett and Hacker 2022, 403). In my opinion, for a predicate that is part of rational cognition, the acquisition of its application to the world is of primary importance and not the acquisition of the use of its expression in language, although these processes are connected. Here my move away from these authors is a move towards the ideas of logical empiricism.

Davidson (2005, 77) points out the key problem of "unity of proposition" that the theory of truth and predication must solve:

> …if we do not understand predication, we do not understand how any sentence works, nor can we account for the structure of the simplest thought that is expressible in language. At one time there was much discussion of what was called the "unity of proposition"; it is just this unity that a theory of predication must explain. The philosophy of language lacks its most important chapter without such a theory, the philosophy of mind is missing its crucial first step if it cannot describe the nature of judgement; and it is woeful if metaphysics cannot say how a substance is related to its attributes.

For Davidson, the concept of truth is a primitive concept, as it is for me. But to me it is more than that. The truth value of an atomic sentence, as the result of our synthesis with nature in the process of rational cognition, gives unity to the atomic sentence that Davidson seeks: it makes the atomic sentence to be something more than just the concatenation of its parts, the predicate symbol and the name involved in the sentence.

4. The Logical Aspect of Truth

We can build various language structures over atomic sentences. The object-predicate dualism naturally leads to first order languages, which not only have a simpler and clearer semantics than other languages but also prove to be the most important type of logical language. In what follows, I will assume this type of language.

The basic building blocks of a first-order language are atomic sentences which are analysed above, and which are the primary bearers of the synthetic concept of truth. Consequently, all the assumptions of the use of atomic sentences are now the assumptions of the use of an interpreted first-order language. These are all the assumptions mentioned above that we accept when we use (not when we mention) these atomic sentences: that each name names an object, that for each predicate we possess its full meaning, and consequently and with the help of nature, that each atomic sentence is true or false.

Each complex sentence of an interpreted first order language is a description of a binary experiment which is a combination of binary experiments associated with atomic sentences. For example, the sentence $P(a)$ *and* $Q(b)$ describes a binary experiment composed of the binary experiments described by the sentences $P(a)$ and $Q(b)$. The associated binary experiment applied to a and b yields *True* when both atomic experiments yield *True*, otherwise it yields *False*. Likewise, the sentence *for all* x $P(x)$ describes an experiment that gives the value *True* when for each valuation of the variable x the experiment described by $P(x)$ gives the value *True*, while otherwise it gives the value *False*. Why do we need these combinations at all, given that there is nothing new in them concerning rational cognition which is not present in atomic sentences? There are several reasons but by far the most important reason to combine binary experiments is to recognize and determine a regularity that is repeated in certain types of combinations. For example, every time when we assert that an object is a dog, we, or somebody else, sooner or later, will also assert that the object is mortal. We combine the experiments "x is a dog" and "x is mortal" into the experiment "if x is a dog then x is mortal," which gives the value *True* for each evaluation of x. We capture in a simple way the observed regularity

by claiming that the sentence "For all x, if x is a dog then x is mortal" is true. However, quantification poses the so-called problem of induction (Hume 1738 – 1740). We can determine the truth value of "if x is a dog then x is mortal" for any value of x (in principle) but we cannot do it for all (potentially infinite) values. This is a situation in which we can possibly get the answer "no" but never the answer "yes." We could conclude that this sentence does not describe a binary experiment at all, and we could exclude this type of sentences from language. However, then we could not express regularities which we observe and which are the main sources of knowledge, as the history of science confirms.[12] *As with naming and predicating, we extend the use of language in ordinary situations to all situations and assume that every sentence of an interpreted first-order language is true or false, regardless of the way we find its truth value, and even regardless of whether we can find it at all.* We accept such universal and existential sentences (and corresponding experiments) despite all uncertainty they bring. This assumption is of foremost importance for the scientific concept of truth, which will be described in the next section, but also for the logical concept of truth to which this section is dedicated. This assumption and all the assumptions of the use of atomic sentences I will term *the external assumptions of an interpreted first-order language*. Their fulfilment is crucial for the application of the language but not for the logic of the language. The only important thing for the logic of the language is that these assumptions are part of the specification of the language, not whether they are fulfilled. By *the logic of a language*, I mean the internal organization of the language – the connection of semantic values of language forms, which is independent of the reality that the language speaks about – together with the external assumptions of the language use.

For a first order language, a mathematical (extensional) function is connected with each language construction of a sentence from simpler sentences. The function determines the truth value of the constructed sentence on the basis of the truth values of the sentences from which it is constructed. For example, the construction of the conjunction *A and B* is connected with the two-place Boolean function that outputs *True* only when both inputs

[12] As C. D. Broad said: "induction is the glory of science and the scandal of philosophy" (Broad 1952, 143).

A and *B* are *True*. The important property of any such function is that it is an internal semantic function, a function that connects semantic values independently of the reality the language speaks of. So, it belongs to the logic of the language. I will term such a function *the semantic function of the construction*. These semantic functions give recursive conditions for truth values which, together with the truth values of atomic sentences, determine the unique mathematical function that assigns, in a given evaluation of variables, a truth value to each sentence. This means that in an interpreted first order language, under the external assumptions of its use, the truth value of each sentence is entirely determined by the truth values of atomic sentences. According to the synthetic concept of truth, the truth values of atomic sentences are primitive semantic elements of language determined by the process of rational cognition. In this way, with the assumptions of language use, the truth value of each sentence is connected with reality in a completely determined way.

Because the semantic functions of the sentence constructions in a first order language belong to the logic of the language, they determine the logical connection of truth values of the sentences. This aspect of truth, the internal interconnectedness of the truth values of sentences of a language, I will term *the logical aspect of the concept of truth*. Important concepts of logical truth and logical consequence belong to this aspect. *Logical truth* is the sentence whose truth is determined, under the external assumptions of language use, by the internal semantic structure of the language regardless of its particular connection with reality. E.g. the sentence *not A or A* is a logical truth, because its truth is determined by the internal semantics of the connectives *not* and *or*, regardless of the truth value of sentence *A*. Also, that from a set of sentences $\{A_1, A_2, \dots\}$ *logically follows* a sentence *B*, means that starting from the truth of the sentences $A_1, A_2, \dots$, the internal semantic structure of the language, not the reality the language speaks of, determines the truth of *B*. Thus, for example, the internal semantics of the connective *and* determines that a sentence *B* logically follows from the sentence *A and B*. The relationship of logical consequence between sentences is one of the crucial language mechanisms in the development of rational cognition.

The logical elements of first order languages are analysed in detail in (Čulina 2024).

5. The Scientific Aspect of Truth

As analysed above, the first order language built upon interpreted atomic sentences has the external assumptions of its use. These are: (i) the fundamental assumption of the language use of names: every name names an object, (ii) the fundamental assumption of the language use of functions: for each function symbol we possess its full meaning, (iii) the fundamental assumption of the language use of predicates: for each predicate symbol we possess its full meaning, and (iv) the fundamental assumption of the language use of sentences: every sentence is true or false. In a real process of rational cognition, already in everyday situations and especially in scientific theories, we use names for which we do not know completely what they name, predicate and function symbols for which we do not possess the full meaning, and quantified sentences for which we do not know if they are true or not. However, it is important to emphasize that regardless of whether the exterior assumptions are fulfilled or not, the logic of the language demands that when we use the language, we assume that they are fulfilled. In thinking itself there is no difference whether we think of objects that really exist, or we think of objects that do not really exist and whether the predicate symbols we use can be applied to such objects at all or not. That difference can be registered only in a "meeting" with reality.

Furthermore, although semantic values of the complex language forms are determined by semantic values of the simpler forms from which they are built, in the process of rational cognition we invert this original priority. An assertion about a particular object is more confident and more determined rational cognition then an assertion about all objects. However, we cannot apply all primitive (undefined) predicates to all objects because there are too many objects, potentially infinitely many. Furthermore, some objects disappear, some come into existence. So, we cannot know the truth values of all atomic sentences. We rely more and more on the regularities which we notice. These regularities are formed by universal and existential sentences (laws). These sentences gradually become the main basis for rational cognition, although we cannot perform completely the complex binary investigations they determine. Moreover, these sentences speak often about idealized situations and idealized objects using idealized predicates.

For example, in classical mechanics, we analyse a motion of the so-called material particles which at each moment of time occupy exactly one point in space. Hence, we assert something about objects which even do not exist in the strict sense of this word. We make assertions about such objects without any corresponding atomic sentence we could verify experimentally. Despite this, such assertions are the result of a deeper analysis of real situations and, through a kind of synthesis, give us powerful knowledge of real situations.

All this means that our real knowledge, regardless of the degree of its accuracy, is almost always only a fragment of some assumed ideal semantically complete language. The whole dynamics of a scientific theory can be understood as the dynamics of completing and changing an appropriate language. In the process of rational cognition, we decrease unspecified parts of the language, even change the meanings and the semantic values that had been already formed. However, this process is not chaotic, but it is, looking over longer periods, a constant advance in rational cognition of nature.[13] That is because it has powerful regulatory mechanisms which control and drive it – the exterior interaction with nature through experiments and the logic of language. Namely, for a theory to be a scientific one, at least some names and some function and predicate symbols must have an exterior interpretation, an interpretation in the exterior world, not necessarily a complete one. This partial external interpretation enables us to perform at least part of the binary experiments described by atomic sentences. This allows nature to put its answers into our framework, so that we can test our conceptions experimentally. Without this part the theory is unusable. On the other hand, the language disciplines us in a way that we shape our cognition and understanding into a set of sentences which we consider to be true. In an ideal case, we choose a not too big set of sentences we are pretty sure to be true, the axioms of the theory. Then, we are obligated, by the logic of the language, to consider true all sentences which logically follow from the axioms. So, another rationalized part of our conceptions consists of a set of sentences we consider to be true and to which we try to give an axiomatic organization.

[13] Even Kuhn's scientific revolutions (Kuhn 1962) can be interpreted as radical changes of established language frameworks.

Therefore, a scientific theory about nature is in its most explicit form a junction of a set of sentences (the sentence part of the theory) and partial external interpretation of the language (the interpreted part of the theory). From the axioms of the theory, we logically deduce the truth values of sentences. Particularly, we deduce the truth values of atomic sentences which belong to the external interpretation, and which are, therefore, experimentally verifiable. If the truth values do not coincide with the truth values which nature gives, then the theory is wrong. If they are identical, it makes the theory trustworthy but, as we know, it is not a proof that it is right. As Popper emphasizes, theories must be experimentally verifiable so that they can be falsifiable. In this interaction of the sentence part and the externally interpreted part of a theory, the real dynamics of the theory takes place: the axioms, as well as the interpreted parts, evolve, even change, and the same happens with the whole language framework. Science is the construction of the language which is not semantically complete in any phase of the construction.

I will term this aspect of the concept of truth *the scientific aspect of the concept of truth*. At the core of this scientific dynamics is the synthetic concept of truth. It gives legitimacy and perspective to scientific research described above as a development of truth valuations of sentences and external interpretation of a language.

This approach is fundamentally different from Carnap's approach. This difference is not only in the approach to primitive predicates, as commented at the end of Section 3, but also at the level of complex sentences. By dividing the language into empirical and theoretical sentences and connecting them using the correspondence rules, Carnap strives to obtain a language that is a semantically complete language for empirical sentences and, through the correspondence rules, complete in a way for theoretical sentences at every stage of development (Psillos 2000, Carnap 1966). In the approach developed here, science is the construction of the language which is not semantically complete in any phase of the construction. On the level of ideas, my move away from logical empiricism is again, as with the interpretation of atomic sentences, a move towards the ideas of pragmatism and the active role of the human being in rational cognition. A scientific theory is Neurath's ship, which we repair in parts, but which sinks as a whole.

6. The Mathematical Aspect of Truth

The concept of truth in mathematics essentially depends on the accepted philosophy of mathematics (Horsten 2023). Thus, the mathematical concept of truth presented here also depends on a certain philosophy of mathematics, which is elaborated in (Čulina 2020).

I consider mathematics primarily the internal organization of rational cognition, a thoughtful modelling of that part of the process of rational cognition that belongs to us. Building a logical language is one such modelling. So, I consider that logic is part of mathematics. A first order language is a mathematical model constructed for the use in rational cognition just like natural numbers are constructed for counting. It is the result of thoughtful modelling of intuition about our natural language. Thoughtful modelling of other intuitions about our internal world of activities, for example, intuitions about quantity, symmetry, flatness, nearness, etc., lead to other mathematical models. By "our internal world of activities" I mean the world that consists of activities over which we have strong control and which organize and design by our human measure (e.g., movements in space, grouping and arranging small objects, writing on paper, painting, playing music, …).

It is from these concrete activities that the idea of an idealized mathematical world emerges, the world that expands and supplements the internal world of activities. Let's take real numbers, for example. Although we can approximate irrational numbers by rational numbers with arbitrary precision (if we had enough space, time and materials – again an idealization), their existence is outside our means of construction – we have just imagined irrational numbers.[14] By choosing names, function symbols and predicate symbols, we shape the initial intuition into one structured conception. However, here the role of functional and predicate symbols, as well as the truth values of sentences, is different than in rational cognition. Predicates are not investigative tool to address questions to nature, there is no intervention of nature, and thus no synthesizing role of truth values. Truths are truths "by fiat." Because we create a mathematical world we

[14] In his book (Mac Lane 1986), Sounders Mac Lane describes this process of idealization on a multitude of examples.

have a complete control in its design. We determine on which objects the predicate will give truth, in the same way as we decide which character in a fairy tale will be good. It's the same with functions. We cannot experimentally verify that $||+||=||||$ $(2+2=4)$ because it is not the truth about nature – it is the way we add tallies.

However, since the conception usually goes beyond our constructive capabilities, the constructed language has only partial interpretation in our internal world of activities. Since the interpretation is only partial, and because the imagined domain of interpretation is usually infinite, we cannot determine the truth values of all sentences of the language. Therefore, we must further specify the conception by appropriate choice of axioms. When we describe a mathematical world by some set of axioms, inferring logical consequences from the axioms, we establish what is true in that world. This can be very creative and exciting work, and it seems that we discover truths about some existing exotic world, but we only unfold the specification. The inferred sentences are not true because the world they describe is such, but that world is so conceived that those sentences are true in it. They are the conditions that the world must satisfy. I will term this aspect of the concept of truth, as a specification of an imagined mathematical world that emerged from our internal activities, *the mathematical aspect of the concept of truth*. Since I consider logic to be part of mathematics, the logical aspect of the concept of truth is also part of the mathematical aspect of the concept of truth. I would note that we have already encountered this mathematical aspect in logic on the example of a linguistic construction using the connective *and*. This connective is directly associated with its semantic value, the corresponding Boolean function, without an intensional intermediate step.

Although, in contrast to synthetic truths, mathematical truths are completely determined by us, the very fact that mathematics is our tool of cognition results in the subordination of the mathematical concept of truth to the synthetic concept of truth. We can understand mathematical truths as extreme examples of synthetic truths, in which nature does not participate at all, but everything is subordinated to our actions. An important consequence of this is that mathematical and cognitive language have the same semantic and logical structure, a structure that has its source in the synthetic concept of truth. In both languages, we think in the same way,

and that thinking is based on the same assumptions of language use. This uniformity enables the double connection of mathematics as a tool of cognition with cognition itself. I will illustrate the first way using the example of Euclidean geometry. In my view, Euclidean geometry is an idealized conception derived from intuition about our internal spatial activities (Čulina, 2018). However, we can preserve the sentence part of the theory but change the interpretation. If we ask ourselves whether the physical space obeys the axioms of Euclidean geometry, we must extract from space what we consider as points (maybe enough localized parts of space), as directions (maybe directions of light rays), and the distance between two points (maybe the time needed for light to pass from one point to another). If in such an interpretation the physical space satisfies the axioms of Euclidean geometry then we have an experimentally verifiable theory. Its sentence part is the same as in our mathematical theory of the space of our human activities, so we can transfer all results to the structure of physical space. Only the interpreted part is different. It does not belong to mathematics anymore, but it is a base for an experimental verification of the theory about the external world. Thus, thanks to the uniformity described above, the mathematical concept of truth can be understood as a matrix for the synthetic concept of truth: by changing the interpretation, we directly turn a mathematical statement into a synthetic statement. Considering that through various interpretations the same mathematical statement can generate various synthetic statements, with this mechanism we achieve great efficiency in thinking.

The uniformity of mathematical and cognitive language described above is the basis for an even more essential connection between these two languages in the process of cognition: when mathematical language is literally part of cognitive language. Perhaps the best example for this is quantum mechanics, where we associate a Hilbert space with a physical system: we associate the cognitive language of physical systems with the mathematical language of Hilbert spaces. In that common language, mathematical terms are organically combined with physical terms in the formulation of claims. However, we can already illustrate this organic connection with the well-known simple use of natural numbers. Through the process of counting, we connect nature with the world of natural numbers. For example, the true

statement about the world that there are now 3 objects on my table includes an imaginary mathematical object, the number 3. When I add a coffee cup to the table, the true statement about the world, that there will then be 4 objects on my table, in addition to some assumptions about the world (for example, that there will be no explosion), follows from the mathematical statement that $3 + 1 = 4$.

Despite its uniqueness, both in its structure and in its purpose, the mathematical concept of truth arises from the synthetic concept of truth.

7. The Role of the Truth Predicate in the Concept of Truth

All considerations about the concept of truth in this article have been done in the appropriate metalanguage whose sentences also have their truth values. The basic connection between the truth of the sentences of the language L we are considering and the language ML in which we are considering L is achieved through the truth predicate "T." The truth value of the sentence φ in the language L corresponds to the truth value of the sentence $T(\ulcorner\varphi\urcorner)$ in the language ML. It is precisely Tarski's T-schema that expresses this role of the truth predicate:

$$T(\ulcorner\varphi\urcorner) \leftrightarrow \varphi$$

This aspect of the T-scheme underlies the basic idea of deflationism that the truth predicate is unnecessary: asserting $T(\ulcorner\varphi\urcorner)$ is the same as asserting φ. However, in the context of language and thinking, the left and right sides of the biconditional differ significantly. Without loss of generality, I will show this difference on the example of the sentences "Svrco is afraid of thunder" and "'Svrco is afraid of thunder' is a true sentence."

The main difference in the use of these sentences is that when I say "Svrco is afraid of thunder," the subject of my expression and thought is my dog Svrco, and when I say "'Svrco is afraid of thunder' is a true sentence," the subject of my expression and thought is the sentence "Svrco is afraid of thunder." This is a typical use-mention distinction. In the first case I use the sentence "Svrco is afraid of thunder" to say something about Svrco and in the second I mention the sentence to say something about it. What is specific here is that one sentence speaks about the truth of another

sentence, where each of the sentences has its own truth value. If, for example, we were talking about the number of letters in the sentence "Svrco is afraid of thunder," nothing would be disputable. The very fact that one sentence speaks of the truth of the other leads to an important difference between these sentences in the process of thinking. I will term it *assertion-valuation distinction*. Namely, the very way we use a (declarative) sentence conveys the information that we consider it true. So, when I assert "Svrco is afraid of thunder," in addition to the information about Svrco, I convey the information that it is a true sentence. So, there is no need to assert it in a roundabout way with the sentence "'Svrco is afraid of thunder' is a true sentence" (by which I again convey the information that this sentence is true). However, if someone considers the truth of the sentence "Svrco is afraid of thunder," they will not use this sentence but will mention it and evaluate its truth. If they conclude that it is true, they will end their analysis with the assertion "'Svrco is afraid of thunder' is a true sentence."

This assertion-valuation distinction distinguishes the left and right sides of Tarski's T-scheme. It is also a mechanism for stopping or prolonging truth regression. For example, using sentences of the metalanguage *ML* I discussed the truth values of sentences of a language *L*. The insights I gained that way are composed of sentences which also have truth values, which may be the subject of other sentences. And so on indefinitely. The assertion aspect stops the regression, and the valuation aspect continues the regression. So, if we agree on something, that's where the regression ends. Usually, the regression stops in the metalanguage. If someone disputes what I have said about the truths of sentences of the language *L*, they dispute the truth of the corresponding *ML* metalanguage sentence. But the subject of their analysis will again be the language *L* and the conclusion they draw will be the assertion of the metalanguage *ML* and not its metalanguage *MML*.

As far as I know, the importance of the linguistic mechanism of assertion was first pointed out by Frege (1897). How subtle and important the concept of assertion is in Frege can be read in (Pedriali 2017). Contemporary considerations on the concept of assertion can be found in (Brown and Cappelan eds. 2011).

8. Tarski's Definition of Truth

As analysed in the introductory part of the article, Tarski's T-scheme is a classic example in which various aspects of the concept of truth are mixed. This extends to Tarski's definition of truth (Tarski 1933), too: some see the definition as an argument for the correspondence theory of truth, others for the deflationary theory of truth. A comprehensive analysis of Tarski's work and various critiques of the work can be found in (Patterson 2012). In this section, Tarski's T-scheme and Tarski's definition of truth are analysed in relation to the aspects of truth differentiated in this article, especially in relation to the synthetic concept of truth.

Regarding the analysis of the concept of truth, the assertion-valuation distinction shows that truth value occurs in two ways, implicitly as part of an assertion or explicitly through the truth predicate symbol, i.e. through mentioning the truth value of a sentence. To assert the sentence $T(\ulcorner \phi \urcorner)$ which explicitly says that the sentence ϕ of a language L is true is to assert the sentence ϕ, and vice versa. If we ignore the translation problems and consider that the metalanguage *ML* is an extension of the language L, this means that all T-sentences are true. We can assert that for every sentence ϕ of the language L:

$$T(\ulcorner \varphi \urcorner) \leftrightarrow \varphi$$

The nature of the truth of these T-sentences can be viewed in various ways, depending on how we view the truth predicate symbol through which the truths of the left and right sides of the biconditional are equated, as I will show below. However, regardless of these differences, the truth of T-sentences belongs to the mathematical aspect of the concept of truth because their truth belongs to the internal organisation of rational cognition. If we were to use the more general T-scheme $T(\ulcorner \varphi \urcorner) \leftrightarrow \varphi^*$ related to a metalanguage that is not an extension of the language L, due to the question of correctness of translation, the scientific aspect of the concept of truth could be present, too.

It is common to consider T-sentences $T(\ulcorner \varphi \urcorner) \leftrightarrow \varphi^*$ as partial definitions of the truth predicate of a language L. In this case, T-sentences are analytical truths of the metalanguage *ML*. So, this is a logical aspect of the concept of truth. This view is directly related to Tarski's analysis of the concept

of truth. Tarski's definition of the truth predicate for the language L in the language *ML* (Tarski 1933) is a formally correct definition because it enables the elimination of the defined predicate symbol T in every sentence of the language *ML*. The definition is also a materially adequate definition in the sense that all T-sentences logically follow from it. However, Tarski's definition of truth has the role of a definition in the proper sense of that term only when we want to set the truth of the sentences of one yet uninterpreted language L by using the truth of the sentences of another language *ML*. This definition transfers the meaning, and thus the truth value of the sentence φ^* of *ML*, to the truth of the sentence φ of L via the appropriate T-sentence. That is why Tarski's definition is so important in mathematical logic.

However, for the interpreted language, Tarski's definition is not a definition in the proper sense of that term because it "defines" something that has already been determined. In such a context, Tarski's definition simply gives a *translation* from the language L to the language *ML* via the T-scheme: each sentence φ of the language L is translated into the sentence φ^* of the language *ML*. If the translation is correct, it preserves the meanings and thus the truth values of the sentences. In this situation, Tarski's definition is simply a mathematical construction of the translation function. It makes possible to connect the truths of sentences of two different languages.

But whether Tarski's definition is a substantive definition or just a mechanism of translation from one language to another, it only transfers the problem of the truth of a sentence of one language to the same problem of the truth of the corresponding sentence of another language. For example, using the T sentence T("*Svrco is afraid of thunder*") ↔ *Švrćo se boji grmljavine* from the introductory part of the article, instead of examining the truth of the statement "Svrco is afraid of thunder," we can now examine the truth of the statement "Švrćo se boji grmljavine," and vice versa. If the translation is correct, it is the same problem. This is best seen when the metalanguage *ML* is an extension of the language L, i.e. when we have a T-scheme $T(\ulcorner\varphi\urcorner) \leftrightarrow \varphi$. Then Tarski's definition translates the problem of the truth of the sentence "Svrco is afraid of thunder" to the problem of the truth of the sentence "Svrco is afraid of thunder" ($\varphi^* = \varphi$).

The problem with Tarski's definition of the concept of truth and the interpretation of his contribution to the analysis of the concept of truth is as follows. Tarski says: "We should like our definition to do justice to the intuitions which adhere to the classical Aristotelian conception of truth – intuitions which find their expression in the well-known words of Aristotle's metaphysics: 'To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, or of what is not that it is not, is true.'" (Tarski 1944, 342). However, Frege showed (Frege 1897) that it is not possible to give an absolute definition of truth, because the application of such a definition depends on the truth of definiens, so it is a circular definition. As a special case, Frege shows that a correspondence theory of truth is impossible because it reduces the problem "is a sentence true" to the problem "is it true that the sentence corresponds with reality," which again leads to circularity. Tarski's definition of the truth of a sentence is not an absolute definition of truth neither does it refine an intuition about truth as correspondence with reality. It is a relative definition of the truth of sentences in one language (object language) by the truth of sentences in another language (usually metalanguage). The definition enables a translation of the truth for sentences in one language into truth of sentences in another language, as Tarski explicitly states in his T-convention (Tarski 1933). Hence, in Tarski, the intuition about a correspondence theory of truth is realized as a correspondence of truth between two languages and not between language and reality. Tarski's recursive definition of truth reduces the truth values of compound sentences to atomic sentences. Tarski's and the synthetic conception of truth differ in the way they treat atomic sentences. Tarski finishes his definition by giving a translation of atomic sentences to metalanguage, and by this transferring the concept of truth from language to metalanguage. Contrary to this, in the synthetic conception of truth, the truth values of atomic sentences are undefined primitive elements determined by the process of rational cognition. In this way, the truth value of every sentence is connected with reality in a completely determined way. Tarski's definition of the concept of truth correctly formulates recursive conditions that connect the truth of a constructed sentence with the truth of the sentences from which it is constructed, while by translating the truth of atomic sentences of language L into the truth of

sentences of metalanguage, or vice versa, it ceases to be a content-wise theory of truth.

9. The Truth Predicate and the Paradoxes of Truth

In this section, my goal is to show that the paradoxes of truth are not paradoxes of the synthetic concept of truth but are limited to a certain part of the logical aspect of the concept of truth.

The basic purpose of the truth predicate "T" is that we can use it, in the corresponding metalanguage *ML*, to describe the truth values of the sentences of the language *L*. According to the meaning of the truth predicate "T," the sentence $T(\ulcorner\varphi\urcorner)$ is a true (false) sentence of *ML* when φ is a true (false) sentence of *L*. When the language *L* is not part of the language *ML*, the role of this predicate is the same as, for example, the predicate expression "is a diesel engine." Just as in the language of mechanical engineering we speak about engines using the predicate expression "is a diesel engine," so in *ML* we speak about the truth values of the sentences of *L* using the "T." "T" is a non-logical symbol of the language *ML*, just as "is a diesel engine" is a non-logical expression of the language of mechanical engineering. As "is a diesel engine" connects engine types with the truth values of the corresponding sentences of the language of mechanical engineering, so the truth predicate "T" connects the truth values of the sentences of the language *L* with the truth values of the corresponding sentences of the language *ML*.

However, when *L* is part of the language *ML*, then the truth predicate "T" connects the truth values of sentences of the same language. Truth conditions on the truth predicate "T," that $T(\ulcorner\varphi\urcorner)$ is a true (false) when φ is a true (false), where φ belongs to *L*, now belong to the internal semantics of the language in the same way as, for example, truth conditions on connectives. In this case, the truth predicate "T" is a logical symbol of the language *ML*, like connectives and quantifiers. The only difference in relation to connectives and quantifiers is in universality. Only a language that has its own sentences in the domain of its interpretation (possibly through coding) can have a logical symbol of its own truth predicate.

However, this situation, when *ML* is an extension of *L*, and so the truth predicate symbol is a logical symbol of *ML*, opens the possibility of the paradoxes of truth. In a standard situation in science, atomic sentences of the language *L* do not contain the truth predicate "T," and they have a certain truth value as the result of rational cognition. Such a situation does not lead to paradoxes. Namely, according to the above-described truth condition on the logical symbol "T," in order to examine whether the atomic sentence $T(\ulcorner\varphi\urcorner)$ of the language *ML* is true, we need to examine whether the sentence φ of the language *L* is true, and its truth is completely determined by the truth of the atomic sentences of the language *L*. Thus, the truth value of the sentence $T(\ulcorner\varphi\urcorner)$ is unambiguously determined. However, in a natural language the truth predicate symbol is applicable to all its sentences ($L = ML$): *L* contains "T." Now, too, by the truth condition on the logical truth predicate "T," the examination of the truth of the atomic sentence $T(\ulcorner\varphi\urcorner)$ is reduced to the examination of the truth of the sentence φ, and the examination of its truth is reduced to the examination of the truth of atomic sentences. But now some of these atomic sentences can again be of the form $T(\ulcorner\psi\urcorner)$, so that the process does not stop but continues again. While for the standard language *L* which speaks of some natural phenomenon and does not contain its own truth predicate symbol, this procedure gives a unique answer, now we have no guarantee that the reduction procedure will stop at some step or that we will get unique truth values of sentences covered by such procedure. Let us consider the two simplest examples where the truth determination procedure is not successful:

the sentence L: not $\mathrm{T}(\overline{\mathrm{L}})$ (The Liar)

the sentence I: $\mathrm{T}(\overline{\mathrm{I}})$ (The Truth-teller)

For the sentence L we have the following chain of reduction:

$$\mathrm{L} \mapsto \text{not } \mathrm{T}(\overline{\mathrm{L}}) \mapsto \mathrm{T}(\overline{\mathrm{L}}) \mapsto \mathrm{L} \mapsto \ldots$$

It is easy to see that no evaluation along this chain satisfies the truth conditions: the assumption that L is true gives that L is false, and the assumption that L is false gives that L is true. Thus, we cannot assign any truth value to the sentence L. On the other hand, for the sentence I we get the following chain of reduction:

$$\mathrm{I} \mapsto \mathrm{T}(\overline{\mathrm{I}}) \mapsto \mathrm{I} \mapsto \ldots$$

Now both evaluations, the evaluation according to which I is true and the evaluation according to which I is a false sentence, satisfy the truth conditions along the chain. So, this sentence can be both true and false in an equally (un)convincing way.

The paradoxes of truth stem precisely from the fact that the classical procedure of determining truth values, which grew out of everyday language use, does not always have to give a classically assumed (and expected) unique answer. Such an assumption is an unjustified generalization from common situations to all situations. We can preserve the classical procedure, but we must reject universality of the assumption of its success. The awareness of that transforms paradoxes of truth to normal situations inherent to the classical procedure.

The conclusion is that the paradoxes of truth arise from the internal organization of language, so they belong to the logical aspect of the concept of truth and do not concern the synthetic concept of truth. Thus, the solution should be sought in the internal organization of the language.[15]

10. Epilogue

In 1991, Milošević and Tuđman, presidents of Serbia and Croatia, met in Karađorđevo, in the former Yugoslavia. They talked behind closed doors, with no witnesses, and no record was left of the conversation. Did they then make an agreement on the partitioning of Bosnia and Herzegovina along so-called ethnic lines, and thus destroy so many human lives and cause so much human suffering? The synthetic concept of truth gives us the legitimacy to ask that question, and all of the above aspects of the concept of truth can help us get the answer.

[15] A good overview of various solutions to the paradoxes of truth can be found in (Beall, Glanzberg and Ripley 2023). The author's solution can be found in (Čulina 2001, Čulina 2023).

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