What makes humans to humans? And how does that make them different from animals? If we want to talk about this we must talk – we need language to do that.[1]

The paradox can be formulated as: There is something that distinguishes a human from an animal, but we can describe this by using language only. However, what language is supposed to be can only be formulated using language, a circle.

"I think, therefore I am"[2] said Descartes. He tried to find something in the world that was irrefutably certain. He can be deceived, but he, as the person who is deceived, must still exist.

"I think, therefore I am" cannot be formulated without language. It remains undisputed that there must be an ego that uses this language. But if we want to describe what language is we need language again. Like the ego itself the describing tool is not being based on anything we have access to without language. Ego and language seem to be intertwined.

We note that language is the means of transport by which we understand the world. We create the world in language. We call the world made by language the second world. If a person has language, the elements of this world are given by linguistic descriptions. Language helps to structure impressions that our senses provide. The set of all linguistic descriptions forms a second world, parallel to the real primary world.

The first language humans spoke were closely related to the images that the speaker wants to convey. At this point, the speaker must not be self-aware. However, it cannot be avoided that in the process of speaking, the other person also appears as a linguistic term at some point, and with the other person, I myself. This may have started the process by which the speaker recognizes himself as an object and the world divides into me and the other. This then ends with Descartes, I speak, therefore I am, if it is permitted to modify the quote.

Things get exciting when the purpose of language is no longer to name objects in the everyday world. This can happen when the speaker comes into contact with other people who use different names for the same objects. Now language itself becomes an object, a reflexive process begins that makes linguistic expressions the subject of linguistic expressions. This process may have initiated the humanization of man.

The world and man thus separate, an expulsion from paradise into the reality of the second world. From now on, man lives in his own parallel linguistic world, the second world which is linked to the primary world around him. The type and strength of the link seems to be at the discretion of the person speaking. As long as the real world is not diametrically opposed to the linguistic world and there is synchronization, all linguistic worlds are possible. Leibniz was already concerned with this problem and developed the theory of pre-established harmony[3].

Let's jump in time from prehistory to a Greek shepherd named Papadopoulos. Papadopoulos has a flock of sheep and is proud of them. If Papadopoulos were asked how many sheep he owns, he would show incomprehension and maybe answer: "Look, here, these are my sheep." Papadopoulos need not to count. He knows his sheep by name, just as a mother knows her children.

The need for numbers, a special language, arises when Papadopoulos wants to get a cow. Alexandros is the proud owner of a herd of cows. He is not opposed to swapping sheep and cows in principle,

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[1] *There exists a vast philosophical discussion about this topic. You may look as Praetorius, N. (2000). The relation between language and reality. In: Principles of Cognition, Language and Action. Springer, Dordrecht. https://doi.org/10.1007/978-94-011-4036-2_5*

[2] *https://en.wikipedia.org/wiki/Cogito,_ergo_sum*

[3] *https://en.wikipedia.org/wiki/Mind%E2%80%93body_problem#Pre-established_harmony*

but: a sheep for a cow does not seem to him to be a good swap. His cows are much bigger than sheep. But three sheep for a cow, that is acceptable.

Up to this point, numbers and thus the language of mathematics are not necessary. The swap is organized in such a way that Papadopoulos puts three of his sheep next to the cow, both agree and Papadopoulos leaves with the cow.

Let's take this image further and go to a livestock market where many traders want to exchange many animals. Exchanging a cow for three sheep is still possible explicitly; you put three sheep next to the cow. Exchanging ten cows for thirty sheep is more difficult to achieve. It becomes clear that we must expand the language to the concept of numbers and basic arithmetic in order to be able to trade. If we replace the real objects with representatives, e.g. small stones, we can conclude deals by calculating, i.e. moving the "calculi"[4] on appropriate boards.

Basic arithmetic carried humanity into the Middle Ages without any major deficits in its application. Exceptions to this were measurements such as the length of the diagonal of a square, which refused to be treated conclusively using basic arithmetic, something the Greeks already knew. Basic arithmetic was sufficient for everyday needs, and the needs of a trading company could be met with it.

In the language of mathematics, we work with numbers, adding and multiplying. However, what a number is can only be articulated by language. Numbers cannot be seen, only the digits that represent them. We can formulate: "One is a natural number", but there is no object in the real world that we can point to. The number itself only seems to exist as a linguistic or mental unit.

There are many digits, including many digits that represent a certain number. These digits can be compared, but the mental object behind them cannot. Conversely, different numbers can be compared, for example the number two is obviously double the number one, but this does not apply to Arabic numerals. Early cultures such as the Mayans[5] have numbers that were designed in an analogous way. The dot corresponds to one, two dots to two, etc. However, there were practical limits that the Mayans reached with the number five, where a new number symbol appears that eliminates the numerical analogy.

Let us note at this point - we do not really understand what a number is. The concept of number is described by a recursive process embedded in language that cannot be concluded definitively. Number is a property that we can link to objects. To speak with Feynman, anyone who thinks he has understood the nature of numbers has not really understood it[6]. The good news is that we do not need to worry too much. We know how to handle numbers in our secondary world and can use them.

Let's go back to our image of the two worlds, the second language world and the primary real world. People being casted out of paradise are looking for two things in the world, security and control over events. They want to be able to understand and predict the world. Lightning, thunder, storms and rain hit them hard. Even if they learn to interpret environmental signs and react accordingly, nature remains eerie and threatening.

People may notice that their own breath is a kind of wind in miniature and voice is a kind of thunder in miniature. The following conclusion may have happened: storms and thunder also come from

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[4] *https://de.wikipedia.org/wiki/Calculus*

[5] *https://en.wikipedia.org/wiki/Maya_numerals*

[6] *https://www.bbvaopenmind.com/en/science/leading-figures/richard-feynman-the-physicist-who-didnt-understand-his-own-theories/*

someone, but this someone seems bigger and invisible – the birth of the gods. And since "gods are only people", gods also need families and suddenly find themselves in the same situation as the people who created them. Since they are also purely linguistic, fictional entities, there is no limit to the complexity of the families and the equipment.[7]

The Greek farmer now has an interpretive advantage over the primitive man. When it storms and thunders, he knows why – Zeus and Hera are having a family argument and he hopes that the two will soon come to an agreement so that the storm will be over. The inexplicable world becomes explainable for him.

The problem of control remains. If lightning strikes one of Papadopoulos' sheep, he knows who caused it (Zeus) and can secretly be angry with him. He will not express this anger openly, as he must expect consequences that he would like to avoid. However, he can try to control events. Since he has no command over the gods, he resorts to a means also working among humans: he offers the gods something to eat or other gifts. He sacrifices. Since the gods are not physically present, he resorts to a burning sacrifice. The sacrificed animal is consumed by fire, the smoke rises to the sky and disappears into the invisible, that could be enough.

The language community in which the sacrificer lives comes to the aid of the sacrificer. It is not that important whether the desired goal is actually achieved, it is enough if the community encourages him to do so. "Look, Papadopoulos sacrificed to Zeus, since then he has not lost a sheep" will encourage him. "Look, Papadopoulos sacrificed to Zeus, but he still loses a lot of sheep - he probably didn't sacrifice properly" will encourage him to try more or different sacrifices.

In physics, mathematics is the language that serves as the basis for describing and predicting processes. "The book of nature is written in the language of mathematics"[8]: This is how Galileo put it. Mathematics is a special language suitable for describing physical processes. Just as natural language creates a parallel world, mathematics also creates a parallel world, the parallel world of physics. If we transfer the peculiarities of natural language to the language of physics, the following holds: physics expressed linguistically or mathematically is a description of the real world, a second world. This second world can be designed in any way you like, as long as there are no blatant conflicts with the primary world. I would like to quote Feynman in a modified form: "Anyone who has understood classical physics has not really understood it". Only the linguistic/mathematical version of the physical second world is understandable, not the primary world behind it.

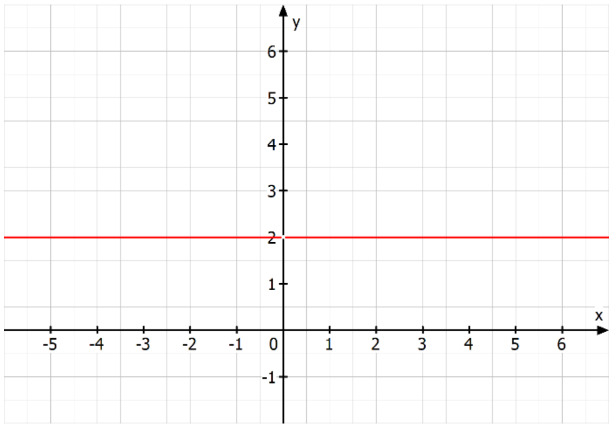
In mathematics, predetermined breaking points are built in. A predetermined breaking point was the length of the diagonal of a square[9], which could not be measured, i.e. expressed as a ratio of other lengths. Another predetermined breaking point, which only became a problem with Newton and Leibniz, was already formulated by the Greek philosopher Zeno. Zeno thinks about the movement of a flying arrow[10] and argues: The flying arrow passes every point on its trajectory. It must exist at each of these points for a short time. Since there are an infinite number of points on its trajectory, it must take an infinite amount of time to reach its destination. So, it either never reaches its destination or, if it does reach its destination, it has never really been at any point on its trajectory. Doesn't that sound like a quantum physics problem?

This problem appears again in analysis when we examine the concept of speed. The speed measured between two points is unproblematic and can be solved using basic arithmetic. We measure the time

[7] *https://en.wikipedia.org/wiki/List_of_Greek_mythological_figures*
[8] *https://physicsworld.com/a/the-book-of-nature/*
[9] *https://www.emis.de/journals/AMAPN/vol15/filep.pdf*
[10] *https://abel.math.harvard.edu/~knill/teaching/math21a2000/zeno/index.html*

that the object needs to get from A to B, the distance between A and B, and form the quotient: length divided by duration.

The attempt to define an instantaneous speed, i.e. the speed at a point, becomes problematic. In the fraction, both the numerator and denominator approach zero. There is no such thing as speed at a point, instantaneous speed. Leibniz[11] and Newton helped with the following trick. In a uniform, unaccelerated movement, the time difference is a fixed multiple of the path difference. If we represent the quotient of a uniform, unaccelerated movement as a function, we get the following picture:



The quotient of length divided by time always results in the same value, with the exception of zero where the fraction is not defined. The image suggests that the value at zero should be supplemented by the value of the function near zero, a removable discontinuity – the birth of infinitesimal calculus.

This allows us to define and deal with the instantaneous speed in the second world, the language of mathematics. We simply put aside what is supposed to be an instantaneous speed in the primary world and stop thinking about it. We have replaced the instantaneous speed of the primary world, which in our linguistic second world appeares as division by zero, by the mathematical construct of the limit. This obviously works well and as long as no contradictions with the primary world arise, we apply it. We modify our mathematical physics until it fits the real world. In this sense, the primary world means experiments. If the results of experiments agree with mathematical physics, we have no need to act.

In the context of our linguistic second world there are always scenarios that lead to logical short circuits. Zenon's arrow is an example, because the arrow either does not move or, if it does move, it is never really in one place. Mathematics is the tool we use to describe our linguistic world of physics. We therefore expand mathematics so that the logical short circuit disappears.

This pragmatic approach to the objects of our linguistic world is one of the recipes for success in physics and began with Galilei. Before Galilei, physics was called natural philosophy and investigated questions of why. "Why does a body move" was a question that was subject of speculation. An impetus, an inherent driving force, was postulated, and the idea of angels[12] pushing it forward was also discussed.

Galileo had a different approach. He left out the question of "why" and asked "how", because the "how" can be described in mathematical physics. When a body moves, how does change its location and the time required. This is measurable and mathematically describable and thus suitable for

[11] *https://amsi.org.au/ESA_Senior_Years/SeniorTopic3/3b/3b_4history_1.html*
[12] *https://en.wikipedia.org/wiki/Dynamics_of_the_celestial_spheres*

mathematical physics. He investigated this “how” and found the laws of motion. This meant that he did not know why bodies move, but he could describe motion.

This lasted until around 1860, when cavity radiation came into the focus of physics. Planck realized that a derivation of the radiation law[13] was not possible within the framework of classical physics and postulated smallest energy packets - the birth of quantum physics. Once again, we have natural phenomena that do not agree with the previous mathematical solution methods, so we adapt mathematics, the language of our second world, till it correctly describes the results of experiments, reflections of the primary world. We are obviously lucky, mathematics still provides this, descriptions that reasonable describe the results of experiments. And again, we quote Feynman: Anyone who understands quantum physics has not really understood it. We can only understand our second world, described by the language of mathematics. The primary real world eludes us.

Perhaps Feynman's quote should be reworked as follows: Anyone who understands the primary world has not really understood it in the sense that we only understand our secondary world, but not the real world.

Let us hope that we never reach the point where our language of mathematics will no longer be sufficient to establish synchronization between the secondary language world and the primary real world.

[13] *https://www.jiwaji.edu/pdf/ecourse/physics/Planck%20Radiation%20law.pdf*