(This is a part of the book The Concept of Reality.pdf)

1. Why do Laws of Nature exist?

1.1. Preliminary Note

Part Two has been devoted to the search for the laws of nature. The existence of such laws has been presupposed. Due to the success of natural sciences, this presupposition appears like a matter of course. Actually, however, here a fundamental philosophical problem is still waiting for its solution: the question, *why* nature behaves according to laws.

From where do these laws originate? Where do they exist? How is it that the General in the form of laws comes into nature?

As substantiation of the existence of natural laws, this chapter represents the completion of the physical part. Since the laws of nature, however, are creations or – if they are true – discoveries of our mind, it is at the same time the first step in carrying out the task of this Third Part: the elucidation of the relationship between mind and matter

1.2. The Problem

An apple is rolling toward the table edge.

What will happen when it rolls beyond? – *It will fall down*.
Why? – *All objects fall down*.
Why? – *They obey a law of gravity*.

All three claims appear undoubtedly correct. There is nothing of which we are more certain. Therefore, it seems all the more strange that our present knowledge about the relation between the Individual and the General does not provide any way to justify them completely!

Let's review the last two statements. The answer: "*All objects fall down*" is not appropriate to serve as substantiation for the certainty that the apple will fall down. All we know is that in all previous observations objects have fallen down. But the phrase "all previous observations," refers to a finite

number of individual cases, and individual cases – no matter how many – cannot substantiate a universal statement of the form "all objects fall down".

In 1740 David Hume pointed out that the expectation, observed regularities would also be valid in the future, cannot be justified logically.[1] At first this is hardly surprising, because it seems obvious that in the area of observed regularities incidents happen. Such incidents may be remarkable, but we find nothing strange or even contradictory at their appearance. No one will feel any kind of metaphysical bewilderment when the bus, which always has left the station on time, still next time departs late.

Or to use one of Hume's examples: If we knew nothing about the sun, then the fear was justified, it could fail to appear. Only when we think we know *why* it appears, we feel safe. A God or a law could guarantee us that it will recur every day. Gods, however, are notoriously unreliable, and, in the past, too often they have been appeased not even by human sacrifice!

What about the more recent version, i.e. the confidence that stems from natural laws? Does the discovery of a natural law behind an observed regularity guarantee its future persistence? Does the law contain the answer, *why* there is a connection between cause and effect?

Within the framework of conventional physics, this is not the case. Any analysis of a causal connection inevitably ends up in a why-question that cannot be answered.

E.g. if we want to substantiate the fall of the apple through Newton's law of gravity, then it cannot be answered, why the earth attracts the apple.

In Einstein's law of gravity, there is no answer to the question, why mass bends space-time.

Thus, in both cases, yet we arrive at an assertion that has been prompted by observations and confirmed by further observations.

Therefore the discovery of the law changes nothing: If we accept that our knowledge is based exclusively on individual cases, we must also accept that the feeling of secureness, which the law

[1] In: *A Treatise of Human Nature,* I.IV.1. The question, whether empirical facts permit a conclusion to general statements is known in philosophy as "induction problem". This name, however, is simply inappropriate, because as regards the issue of induction, there is no problem: Induction is a suitable method for establishing hypotheses, but as a conclusion it is inadmissible, and that's all there is to say. However there is a *problem of justification of laws,* and this can only be called "induction problem", if it is presumed that our knowledge originates *exclusively* from experiences with individual cases.

provides, is unfounded. The persistence of observed regularities is not more reliable due to the law: *First*, the content of the premises cannot be increased by logical reasoning, and *second*, cause and effect are not linked together in a logically justifiable manner, but merely by definition, and therefore the law cannot provide more safety than the mere regularity of the individual cases, which to date coincided with it.

If we cannot conclude from observed regularities to the future validity of these regularities – what is it then, which gives us the feeling of secureness? According to Hume, it is just a believe, based on usualness.

Does this mean that there is indeed a reasonable doubt of the existence of lawful causal relations? Should we actually doubt that the apple will fall down?

Though the mentioned arguments could be understood in this sense – such a doubt, given the tremendous success of natural science, would certainly not be appropriate.

Moreover, the skeptical doubt: "Why should the earth continue to attract objects?" is also relativized by the obvious fact that the earth perpetually attracts all objects, such that one could also ask the other way round: "Why should the earth *cease* to attract objects?"

However, what must be concluded from the skeptical arguments is that our understanding of the ontological status of the General is insufficient. The General seems to have no place in nature, which is given to us always in the form of observable individual cases, and this leads to the strange and irritating fact that we cannot doubt the existence of natural laws, but at the same time, we are not able to justify this certainty.

The skeptical argument, however, also has a serious defect, which becomes evident if one asks, why regularities can actually be observed.

Indeed, habits could not evolve at all if the things themselves would not induce them. If the bus would not *in fact* leave every day at the same time, then we would not expect the same for the following day. And the reason for its regularity is *its law,* i.e. the timetable, which it obeys.

And further: We could not develop the expectation that the sun will rise tomorrow, if it had not always done so. Or another well-known example: If the planet mercury would not always have moved around the sun (almost) exactly on an ellipse, then the respective expectation could not have developed, in other words: then Newton's theory of gravity would not exist.

From this follows that Hume's skeptical arguments are not sufficient for the analysis of the problem. Though it is true that we cannot conclude from individual cases to a law, in Hume's approach the reason is missing, why nature exhibits regularities, with respect of which we develop habits and expectations.

Immanuel Kant thought he could remedy this deficiency by the assumption that causation lies not in the things – in the *thing itself* –, but in us – in the way things appear *for us*.

According to Kant, it is our mind that structures the observations as causal processes. This structuring is given *a priori* and therefore unavoidable. Thus, the reason for the universal validity of the principle of causality is, that everything which can be observed at all, is subjected to this categorical structuring.

In this way Kant avoids Hume's arguments, which of course relate only to the assumption of causality in the things themselves.

This, however, has absurd consequences on its own: The thing *in itself* is now completely under our control. It has no own, i.e. no regulations *in itself*, but merely satisfies *our* causal expectations.

One cannot help wondering what such a thing *in itself* actually does, if it does not affect the senses of an *a priori* structured being who commands it what to do. It must be lost in nothingness, because it is not only deprived of all regularities for its behavior – which is just categorical determinacy that stems from *us* – but also of space and time, which, as forms of perception, also belong to us and not to the thing *in itself.* Only when it again affects the senses of such a being, then it is released from its helplessness and knows eventually where and when it is and what it has to do.

Let us apply this strange assumption to a specific case – say: my car. The next morning, the thing *in itself,* which *for me* is my car, is still at the point where I parked it last night. Evidently, from this fact must be followed that gravity has been acting the whole night through – even in those moments when the car was not at all a car but just an unobserved thing *in itself*, which *as such* – if Kant were right – should not obey any natural law.

Or another example: the planet Mercury. We watch it for some time. It behaves in accordance with our *a priori* expectations (which, by the way, have changed since Kant: that time they were the expectations of Newton, currently the ones of Einstein, and lately there are also my own ones).

Then we interrupt our observations. Now the thing *in itself,* which *for us* is the planet Mercury, totters lawless in nothingness – but, if we look at it again, it appears nonetheless exactly at the position in space and time, where we expect it.

This idea is evidently nonsensical. The thing *in itself,* which *for us* is Mercury, must also have a determination *in itself,* by which it is guided if it is not observed. Moreover, the fact that it appears at the precalculated position proves that this determination must correspond either exactly or at least in excellent approximation to *our* law.

From this follows, that the observable regular behavior of things cannot sufficiently be explained by something, which is *in us* or stems *from us.* The observation of regularities presupposes in any case, that also the things *in itself* behave lawfully, which means that their regularity must lie in themselves and is not only imposed on them by us. And then, we arrive again at Hume's justification problem, and it remains again open, why the observed regularities should also apply in the future.

I close this introduction with an example. Everything said so far is summarized therein in a simple manner:

Suppose 10 experiments have been performed, which – except for position and time of the execution – have been identical with respect to any observable condition. Thus, in all experiments, the initial conditions were identical, and also the results.[2] (Since it is impossible to prepare *exactly* identical initial conditions, this example is a thought-experiment.)

Now we consider a further experiment. We assume that also in this experiment the initial conditions are exactly the same as in all previous experiments.

The decisive question is: *What can be predicted about the result of the 11th experiment?*

The *natural scientist* will argue as follows:

"The parameters which are relevant for the experiment are identical in all cases. Thus it is always *the same* experiment, which already has been carried out 10 times. This assertion is proven by the identical results. Therefore, with certainty, the 11th experiment will lead to an identical result.

The *skeptic* will reply:

[2] Here, anyone who would like to take into account the conventional interpretation of quantum theory, needs to replace "same results" by "same probability distributions" and interpret each experiment as a series of experiments.

"You are speaking of the *general case* – so, as if there were a general experiment A, with which all individual experiments A_i could be identified. But this A exists only in your mind; in the reality only the individual cases exist, that is: the actually performed experiments. The General, to which you assign the individual cases, is not real but only spread out over reality by you yourself. Therefore, nothing certain can be said about the 11th experiment – unless you mean that the General that you invented commands nature."

The natural scientist:

"My General does not command nature, it corresponds with nature – at least in good approximation!"

The skeptic:

"Your General does not correspond with *nature,* but only with the hitherto observed cases. Nothing entitles you to believe that this General will continue to apply in the future."

The natural scientist:

"If there are only individual cases, which are not connected with each other, how can you explain why the experiments one to ten have identical results? – and that, by the way, regardless of your doubt, the next experiment will have the same result?"

At this point, we interrupt the debate; the issue at stake is sufficiently obvious:

The experiential reality consists exclusively of individual cases. The General in the form of natural laws exists only in the description. So how can it be substantiated that the observed individual cases – not only the past but also the future ones – obey the laws that ***we*** *establish?* [3]

[3] It should be mentioned that modern science has weakened the skeptical arguments: If, in our example, the physicist contends that *the same experiment* has been carried out 10 times, only at different positions and time points, then he claims that the processes which occur in the experiments are invariant with respect to shifts in space and time and to rotations in space. Homogeneity of space and time and isotropy of space, however, are fundamental principles whose validity is unquestionable. Of course it can further be asked if they will apply also in the future, but such a distinction of a particular point in time – just the respective present – appears indeed more than absurd. But even if one believes that this argument is sufficient to eliminate the doubts about the validity of the laws of nature, there remains the uncertainty about the relationship between the Individual and the General and about the origin and the location of the General in the form of natural laws.

1.3. A Contradiction as Starting Point

The assumption that the laws of nature are just laws of our mind and that reality is directed by them – Kant's position – leads to nonsensical consequences and must therefore be rejected.

Hence the other assumption must be correct, i.e. the assumption that the regularities must be located in the reality itself.

However this assumption is opposed by the fact that reality *for us* consists exclusively of individual cases, which in turn would again entail that the General in the form of natural laws is only *in us.*

With this, we have once again arrived at a fundamental contradiction, which follows from a statement about reality as it appears *for us* – and I say "once again", because we have already met a contradiction of this kind: the contradiction which followed from the fact that being divides *for us* into substance and accident.

If a contradiction of this kind appears, it can only exist *for us* – reality *in itself* is free of contradiction. Thus, a difference has to be made: between what reality is *in itself* and what it is *for us.*

Here, the contradiction occurs, if it is assumed that there is no law in the reality itself and that reality consists only of individual cases, just as David Hume contended.

Therefore applies:

In the same way, as reality *in itself* does not divide into *substance and accident*, it does not divide into *Individual and General,* or, to say it more explicitly: it does not divide into that which *is* and the law which it obeys. Both are inextricably bound to one another.

The problem outlined in the introduction is therefore obsolete. The whole scenario must be analyzed anew and rebuilt.

We will now turn to this task.

1.4. The Origin of the Laws of Nature

The build-up of the scenario begins with the *origin of everything.* At the beginning of the Second Part, it has been determined as that which neither is nor is-not and which therefore is necessary.[4]

In itself, it is the precondition of reality. *For us,* it is the precondition of the *description* of reality.

The *origin of everything in itself* does not divide into substance and accident and is therefore unthinkable. In order to make it thinkable, we must divide it into substance and accident. Then the substance can become the subject of a proposition, and the accident can become the predicate of this proposition. And if the proposition has the form of an equation, then the substance is represented by the carrier of the variables and the accident by their connection.

What can be used for the first proposition? Or let us ask more precisely: What is *permitted* for establishing this proposition, such that it can serve as justification of the General in the form of laws of nature?

The following three kinds of knowings:

1. Knowledge about reality in the form of a general statement, which does not represent a generalization of individual cases. (Would it have been achieved by induction, then it would be inappropriate for substantiating the general validity of laws.)

2. The necessary and sufficient conditions for the description of reality. (This is a matter of course: since every being stems from that what the *origin of everything* is *in itself*, that what it is *for us* must contain everything that is needed for the description of being.)

3. Logical and mathematical considerations. (Their general validity cannot be doubted. But of course it is possible to ask also for the origin of logic and mathematics. However this is not relevant here. It will be discussed in the 6th chapter.)

We start with an assertion that is unquestionably true:

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[4] See Part 2, from 1.3. I will carry out the derivation of the first equation here once again, albeit in more detail and in a somewhat modified form, and, moreover, with special consideration of the justification of general statements about nature.

If exclusively knowings of the three just listed kinds are used for the derivation of the first proposition, then its general validity is granted. Under this condition, it contains only elements of general validity and, therefore, is itself generally valid.

Now to the derivation:

At the beginning stands the question of knowledge about reality. Is there any general assertion which we know about reality *directly,* not by generalization of individual cases?

The answer is *yes.* We know exactly that which was realized at the beginning of the Second Part:

Actually existing objects – in contrast to objects of a description system of reality – are *active,* which means they *change* something.

Is this secure knowledge? Yes, it is. Here is the necessity of thought which Hume demands and which any causal connection is lacking that is deduced *inductively.* Something, which does not change anything, does not exist.

Thus, the most general predicate must be *change.*

At the beginning of the Second Part, we have determined what the *origin of everything* is *for us: change of* AGENT. AGENT is, what everything comes from, what everything consists of and which everything owes its *activity.* AGENT is exactly that *nothing* which the subject of possible statements dissolves into, if one tries to determine the material carrier of the attributes of elementary objects – and which nonetheless cannot simply be identified with the purely notional nothing, because the purely notional nothing would not be able to change itself.

Thus, AGENT denotes that which disappears if one tries to think it, but of which is known at the same time, that it cannot be nothing. AGENT is the most general subject.

Can anything be said about this AGENT? Can it be concretized? This is indeed possible, due to the following consideration:

The *origin of everything in itself* is the ontological presupposition of all being, and nothing else. Therefore that, what it is *for us,* must be the logical presupposition of the *description of being*, and nothing else.

What are the presuppositions of the description of being?

Except logic and mathematics – whose validity here is assumed as given[5] – there are only two: *space* and *time.* [6]

Evidently, *space* is a necessary condition. *Some* kind of space is necessary to represent being and the change of being.

Time is also a necessary condition. Without time, nothing could change.

Space and time, however, (in connection with logic and mathematics) must also be *sufficient* conditions of the description of reality, simply because there are no other ones.

Therefore, space and time are necessary and sufficient conditions of the description of reality. This means: AGENT consists of space and time. AGENT *is* SPACE AND TIME.

Thus, SPACE AND TIME are the **first substance**. With this, they represent at the same time the subject of the most general proposition, whose predicate is the **first accident**: *change.*

So, to begin with, we have derived the following assertion: *For us,* the *origin of everything* is *change* of *space and time.* In other words: *For us,* reality is created through change of space and time.

Without the predicate *change* would be nothing. Thus from the change must follow something, and this consequence must again be a change of space and time. But only if reversely also the first change follows from the second one, then the unending chain of changes emerges that assures that there is not nothing. In this way, we arrive at an equation:

[(Change 1 $\Rightarrow$ Change 2) *and* (Change 2 $\Rightarrow$ Change 1)] $\Rightarrow$ Change 1 = Change 2

Therefore, sought are two changes of space and time which must be equated.

What does it mean that space and time change?

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[5] Evidently, also logic and mathematics do not exist somewhere "outside". There is but one reality. Therefore, also the conditions for the development of logic and mathematics must be contained in the primal scenario. This, however, can only be understood as part of an epistemological circle, which will be discussed in the 6th chapter. But since the validity of logic and mathematics cannot be doubted, for the moment they can be presupposed – just as if they came from "outside". This metaphysical inaccuracy will be corrected later.

[6] Here, alternatively can be set *space* and *motion.*

The only possible meaning is that spatial lengths[7] and temporal lengths change with respect to arbitrary *measuring units.* This can be expressed by the variables spatial density σ and temporal density ζ, which are intuitively understandable.

Here, the following must be observed: Whatever follows from a change of these variables, must not depend on the *absolute* size (of length or of time): At this point, we are *substantiating* existence, which means: we are *before* existence, and therefore there is nothing which a length or duration could be referred to. (Except for the chosen unity – but this choice is arbitrary.)

The condition, that the consequences of the changes of the variables must not depend on an absolute value, can be implemented mathematically if only changes of *ratios of lengths* are factored in. Thus, σ and ζ are not "normal" densities, which would relate to a fixed standard value. [8]

I call σ and ζ *metric densities*. (On the definition of σ see Part 2, 1.4 and 2.3; ζ is defined analogously). They are dimensionless. σ is defined as length per length, ζ as time per time.

The statement, that nothing exists which can serve as given, fixed measure for lengths and times, is equivalent to the statement, that there is *no memory,* and this means, that only from that which has changed since the immediately preceding moment can follow anything at all – everything else is "forgotten".

The everyday language phrase "change from the previous moment" can be brought into an exact form by the mathematical concept of the *differential quotient*:

If a variable p changes "from moment to moment", then this is expressed in the form $\frac{dp}{dt} \neq 0$.

However due to dimensional reasons, which will be clarified in the following, here ct instead of t must be chosen as time coordinate, where c is a constant that has the dimension velocity.

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[7] For simplicity, I confine myself here to length changes. Angle changes are completely analogous.

[8] It would be nonsensical to assign a "normal" density to space or time. Imagine the number line, which represents a one-dimensional space. If one pushes together the area between 0 and 100, such that it has only the range that previously had the area between 0 and 1, then cannot be asserted that now the density would be greater than before. Metaphysically spoken: here, it can be seen clearly that it is indeed not any existing object that changes but AGENT, which does neither exist nor not-exist.

Which parameters can change? In our scenario, there are only two: the spatial density σ and the temporal density ζ.

We start with a temporal change of ζ. This change will be the first term of the fundamental equation. First we write down:

$$\forall\,(r,t): \qquad \frac{d\zeta}{d(ct)} \neq 0; \qquad (\,\zeta = \zeta\,(t)\,)$$

The temporal change of the metric density of time is nowhere equal to 0.

Why? This must apply, since the time-density itself does not exist at all – only its temporal change exists. Expressed metaphysically: without change would be nothing.

To get to our equation, we need a second term. Since the equation describes a change of space and time, and since the first term represents a change of time, the second term must represent a change of space.

Thus, the second term is either $\frac{d\sigma}{dr}$ or $\frac{d\sigma}{d(ct)}$.

If we chose $\frac{d\sigma}{d(ct)}$ as second term of the equation, nothing would follow from it.

Therefore we must choose $\frac{d\sigma}{dr}$, the change of length per length. Thus the *simplest* equation [9] which can be established reads:

$$\frac{d\sigma}{dr} = \pm\frac{d\zeta}{d(ct)} \qquad (0)$$

Seen mathematically, this is just an equation. But seen ontologically, it represents what the formation process of reality is *for* us: ***the fundamental mechanism of the universe***.

[9] The postulate of utmost simplicity will be discussed subsequently. At first, we carry out the rest of the derivation.

With this, we have arrived at the point that is decisive for the understanding of the connection between Individual and General:

In equation (0), the relation between individual case and law is reversed. Equation (0) is not, as other natural laws, deduced from observed facts. It does not stem from experience, but from necessary metaphysical conditions and conclusions.

The equation describes *the generation of reality.* Therefore, it is not subordinated to reality, but precedes it.

Equation (0) is the law, which, by executing itself, turns into what is the case. The General turns into the Individual.

The general validity of this equation is contained in the conditions which it follows from. At first, however, it seems possible that it is only valid for a certain value of the two differential quotients. This can be excluded in the following way:

Let us denote the two differential quotients in (0) by x and y. We choose x and y as axes of a Cartesian coordinate system. In this system, $x = y$ is the 45°-straight line through the origin. Now we assume there was only one single value x_0 (and, accordingly, y_0) of the two differential quotients, for which equation (0) is fulfilled. Let (x_0,y_0) be the coordinates of a point $Q(x_0,y_0)$ on the straight.

Now we take into account that *there is no size* and that, therefore, (0) relates only to changes of *ratios* of lengths.

Mathematically, this means that in our (x,y) coordinate system the units can be chosen arbitrarily. Thus, also the position of the point Q on the straight is arbitrary.

And from this follows that there is no difference between the validity of the equation $x_0 = y_0$ *for a specific point* $Q(x_0,y_0)$ on the straight and the validity of the equation $x = y$ *for all* $Q(x,y)$, that is: *for the whole straight*.[10]

[10] This train of thought can also be understood by not-at-all-mathematicians. Imagine a (very large) piece of paper on which the x- and y-axes are drawn perpendicular to each other, and, additionally, the 45° straight. Now, the statement *there is no size* is tantamount to *the distance from which the paper is observed does not matter.* This follows from the fact that from any distance *the same* is seen. Only if units are fixed and the corresponding points are drawn on the two axes, a distance-dependent difference can be observed.

From this follows: The combined statement

> [*Equation (0) applies to points of the continuum with a specific value of the two differential quotients*] <u>and</u> [*there is no size*]

is equivalent to the statement

> [*(0) applies to all points of the continuum*]

Therefore, the relation expressed by (0) is a specific fact <u>and</u> a general law at the same time. Here, the General and the Individual cannot be discriminated any more.

The just performed argumentation is only possible if the relation between the two differential quotients meets certain conditions. *Linearity* is the *simplest* possibility.

I've given this thought train a little more room, because in it the fact is reflected that, *in itself,* the General and the Individual are not separated (as was stated in 1.3). Though this inseparability cannot be thought directly – just as the inseparability of substance and accident –, it is still possible to approach it by the above consideration.

It can also be recognized that the undividedness of Individual and General exists *for us* only as long as relation (0) is considered on its own – as a differential circumstance which is there *before existence.*

But if it executes itself, which means: if it generates the fabric of reality, then Individual and General separate in the following way:

That the metric densities σ and ζ have no memory, applies only to the differential relation itself. However, in order to describe a finite area of reality, $\sigma(r,t)$ and $\zeta(r,t)$ must be determined explicitly, which means: integration is needed. Then, though the initial value is still arbitrary, due to the fact that any differential change relates to the previous differential changes, a *memory* is created. Thus, all further mathematical consequences depend on the chosen initial value. The scale invariance of the differential law disappears.

These circumstances can be expressed in the following way:

The differential relation, which creates the fabric of reality, has no memory and no size. But in producing reality, it generates a memory and size relations. In this way, that which before has been the

Individual (an abstract fact) and, at the same time, the General (the fundamental law), turns into the Individual, i.e. to what is the case. But only *for us – in itself,* what is the case, the Individual, carries always the General.

One last step: If equation (0) should serve as basis of a physical description of reality, it must be transformed into a dynamic equation. This is achieved in the *simplest* way by interpreting the dimensionless quantity ζ as ratio of two velocities.

In (0), *one* velocity is already there – the constant c. Since only the necessary minimum of quantities is permitted in (0), c must also be used in the definition of ζ. Therefore we set:

$$\zeta = \frac{v}{c}$$

c is the constant, v is the variable. Then equation (0) turns into

$$\frac{d\sigma}{dr} = \pm \frac{d\frac{v}{c}}{d(ct)} \qquad (0')$$

or

$$\frac{d\sigma}{dr} = \pm \frac{1}{c^2}\frac{dv}{dt} \qquad (1)$$

So we finally arrived at the equation which was introduced in the Second Part.

(1) applies everywhere and anytime in the reality. (1) is the equation that describes the *generation* of reality.

Reality is a differential fabric of changes of space and time that are mutually dependent.

Everything that exists – any object, any interaction, any process – is a pattern of changes of the movement of AGENT.

Notes

1. At first three additions:

a) The basic concept "time" can be replaced by the basic concept "motion". Thus, instead of the concepts *space and time,* the concepts *space and motion* can be chosen as necessary and sufficient conditions of the description of reality. Then *their* changes – the differential quotients $d\sigma/dr$ and dv/dt – must be equated, and $1/c^2$ appears as proportionality constant. In this way, one arrives directly at (1):

$$\frac{d\sigma}{dr} = \pm \frac{1}{c^2} \frac{dv}{dt} \tag{1}$$

b) If one starts with a temporal change of ζ instead of a temporal change of σ, then follows

$$\frac{dv}{dr} = \pm \frac{d\sigma}{dt} \tag{1a}$$

(See Part 2, 1.5). From (1) and (1a) follows the wave equation

$$\frac{\partial^2 v}{\partial r^2} = \frac{1}{c^2} \frac{\partial^2 v}{\partial t^2} \tag{2}$$

c) Equation (1) has two interpretations: Instead as metric density of the length, σ can also be understood as metric density of the angle. (Part 2, 1.4).

2. At the transition from (0) to (0'), ζ was set equal to v/c.

From this follows that v/c is to be interpreted as *metric density of time.*

Here the relativistic fact appears that, with increasing speed, time is extended and space shortened. (Under the condition that, on the right side in (0) and (0'), the negative sign is chosen.)

3. On the question of *simplicity* of equation (1):

Apart from the fact that it is a dictate of reason to start with the simplest equation – and because Occam's knife anyway would cut off everything additional –, also a metaphysical argument can be introduced, why the first equation must have the simplest possible form. As follows:

In the *origin of everything,* there are two kinds of necessity:

First: it represents the necessary (and sufficient) condition for being.

Second: there is also a much more fundamental necessity in it, a *metaphysical* necessity, the one that follows from the fact that it neither is nor is-not. For everything that exists, there is the alternative that it does *not* exist. But for that which neither exists nor not-exists, there is no such alternative, and this means: it is necessary.

Now the question is whether this metaphysical necessity has a counterpart on the side of the description. I think that's the case, and I hope I succeed in demonstrating why I think so, without falling under suspicion of slipping into irrationality.

That the *origin of everything* is necessary means at the same time, that there is nothing superfluous in it. We cannot think what it "is", but whatever it is, must be free of anything superfluous. It "contains" only that, which makes it to what it is: the sole Non-contingent.

For this reason, that which the *origin of everything* is *for us,* should likewise contain only that, which makes it to what it is.

For us, the *origin of everything* is the origin of the description of everything: an equation, which contains a relation between two differential quotients.

What makes an equation to an equation? Or let us ask more concrete: What can be removed from equation (0) such that it does not cease to be an equation?

Since the differential quotients are determined by other conditions, the answer is *nothing*. Equation (0) has the simplest possible shape.

Conversely applies, of course, that anything which could be added to (0), is not necessary and therefore superfluous. Any further term, any additional variable, any exponent – which would represent an additional calculating operation – would be superfluous.

Thus, equation (0) contains exclusively what makes it an equation, which means: makes it what it is, and with this it represents the counterpart to the metaphysical necessity of the *origin of everything.*

4. Finally should be mentioned that (1) contradicts everything which is currently believed in physics – and also beyond physics – and which is considered to be secure knowledge about the foundations of being.

But that has already been discussed in the First Part.

1.5. Consequences

The just performed derivation leads to changes of the view of space, time and matter. Matter and space are brought under one concept, and, as an immediate consequence, time has a direction.

Since I've neglected as yet to explicitly point out these changes, now, at the end of the physical part, I'll make up for it with a few notes.

The Abolition of the Separation of Space and Matter

In standard physics, space and matter are separated from each other. Though by the concept of the quantum vacuum the border becomes permeable, the contrast between the two concepts remains. Even if "virtual particles" can originate in the vacuum, the concept of particle is still completely alien to the concept of space. Therefore, it is impossible to answer why matter in the form of material objects curves space (or space-time). Nor is it clear why energy changes space-time. Thus, also the concept "energy" cannot serve for an explanation.

From the viewpoint presented here, there is no substantial difference between space and matter (or energy). Equations (1) and (2) describe the generation of the *entire* reality, which means: of space *and* matter. In this sense, therefore, space and matter are *the same;* more precisely: they *are different states of the same*:

Material objects are (approximately) stationary states of metric flows and waves. *Space* is the area of metric flows and waves where such stationary states are either completely absent or occur only very briefly.

For us, the process of the generation of reality occurs *in* space. But *in itself,* space as such does not exist. There is no space, in which this process happens – the space where the representation takes place is only the background to which *we* must relate the changes, because we can think change only *within space*. But *in itself,* there is only change: the space, which does not change, does not exist, and the same applies to time.

The Impossibility of Reversing the Direction of Time

It is considered unsatisfactory by many physicists that, within standard physics, the direction of time can only be understood as a statistical phenomenon. The equations, which can be used for the description of physical processes, are time-symmetric. Therefore, *in principle,* also the processes themselves can be reversed in time, and the only reason, why such a reverse is never observed, is the – in most cases extremely low – probability of the initial conditions that would be required for a reversal.

Think for example of the well-known case of the glass that falls down to the ground and shatters. *In principle,* also the reverse process is possible: the pieces rise from the ground, join together, form the glass and land on the table. The required coordination of the random thermal motion of the floor molecules and of the glass molecules, however, is so extremely improbable, that it can be excluded that this ever happens.

The same applies to the pattern formation processes that occur in self-organizing systems, as described by chaos dynamics. In the mathematical description, the emerging patterns are represented by chaotic attractors in the phase-space. [11] Each attractor has a basin of attraction, within which any trajectory will approach the attractor. This means that here exists a direction of time.

But also here applies, that *in principle* also the reversed trajectory is possible (for $t \rightarrow -t$), and again the reason why this never happens is the extremely low probability that the system will move along this trajectory in the reverse direction. [12]

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[11] The phase space (or state space, or parameter space) of a system is defined as a space, the coordinates of which correspond to the values of variables, by which the temporal development of the system can be described. (E.g. the positions and momentums of all particles which the system consists of.) Thus, a point in phase space represents the state of the whole system at a certain time point, and the movement of the point along a path (trajectory) represents the temporal development of the system.

[12] A deeper analysis of this question, which leads to a different perspective, follows in 4.6.

In a universe whose fundamental law is equation (1), however, this issue changes in an essential manner:

In such a universe, *all* structures are patterns of the just described kind. Therefore, the time has everywhere a direction. Now, however, a system that organizes itself dynamically into patterns, does no longer consist of a finite number of particles, but is in any case a part of the continuum. From this follows that the probability, that any such self-organizing system – or also the universe in total – moves along a trajectory that lies within a basin of attraction *in the reverse direction,* is not just very small, but zero.

This, however, is not just a quantitative, but rather a fundamental qualitative – or say: ontological difference to the usual view. Now, the reversal of time is not only improbable – it is *impossible.*

In other words: the direction of time is a necessity.

1.6. Summary of the Relationship between Individual Case and Law

Reality presents itself to us as that which is the case. It seems as if reality consisted only of individual cases and as if nothing general could be found in it.

On the other hand, the General in the form of natural laws must exist, because otherwise the regular processes in nature that can be described by equations would not be possible.

Let us call this seemingly irresolvable contradiction *the paradox of the general*.

Also if being is investigated up to the elementary objects and the most general laws by which they are described, the contradiction remains. Still, being itself is individual, and the General exists only in the description.

Thus, in the area of the existing, no solution can be found.[13]

[13] Some physicists believe that the problem of the General in the reality is solved through the indistinguishability of elementary particles. In my interpretation of quantum mechanics, however, elementary particles are stationary wave states, which differ from each other exactly by those hidden parameters, which make the local and objective interpretation possible and permit the elimination of non-locality. (See First Part, Chapter 3.)

Therefore it is again necessary to go a step further – beyond that which exists to the *origin of everything*. Since everything which exists originates from it, it must be the origin of the Individual as well as of the General, which is present in the respective Individual.

For us, the *origin of everything* assumes the form of a proposition, which is of the utmost generality and therefore fundamental. It is not about being itself, but about the preconditions of being. It reads as follows:

The temporal change of the metric density of time is equal to the spatial change of the metric density of space.

This proposition meets the two conditions that are necessary and sufficient for substantiating the validity of general statements. *First* it is based on secure general knowledge – such knowledge which does not represent an abstraction of being, i.e. not a generalization of individual cases –, and *second* it describes the presupposition of *all* being: it is the description of the circumstance that generates reality.

For itself, this circumstance has no size and no memory. It can be seen either as a specific fact or as a general law. It is both at the same time.

By creating reality, it generates a memory and size relations, and, in this way, turns into that what is the case.

With respect to the description of reality, the fundamental proposition has exactly the status, which the *origin of everything* has with respect to reality itself: from the one emerges reality, from the other one follows the description of reality.

The general validity of the fundamental proposition is inherited by all statements that can be derived from it. If it is true, then this is the set of all deducible true statements about reality.

However we cannot know if the natural laws that we suppose to be valid are indeed true, as long as it is not known whether they are deducible from the first proposition. Can something be said about their general validity in spite of this uncertainty?

Yes. If a certain law A', which we assume, is at least an approximation of a correct law A, then, though we do not know if A' will apply in all cases, we still know that it differs from reality in some cases only because it is an approximation and *not* because its general validity must be doubted.

Thus, the general validity passes from the fundamental law not only to the laws derived from it but also to approximately valid laws. Also in the case of such laws, we are entitled to expect that they will apply also in the future to all cases, which are similar to those in which they have already proven to be appropriate. [14]

With this, the substantiation problem of general statements is solved; the *paradox of the General* has dissolved. The conviction that laws apply generally, is justified.

This has been achieved through the elucidation of the origin of the General in the form of natural laws.

With this, at the same time the *direction* of reasoning has been reverted: now, instead of induction, deduction takes place. The (impossible) deduction from Individual to General is replaced by the deduction from General to Individual.

As regards the *induction problem,* it vanishes, because induction is no longer needed.

We experience reality in the form of phenomena that exhibit regularities. At first, we are not able to substantiate these regularities, indeed we cannot even consider them real – the General eludes us. But if we analyze the relationship between the Individual and the General on the basis of the preconditions of being, then we recognize that both, the phenomenon and its law, stem from the same last ground.

In any individual case there is also the General – it is made of it.

<u>Addendum</u>

I should explain a little more in detail *how* the general validity of the fundamental law is inherited by other laws.

I start with the question: *Why is induction not permitted?*

Let us call the assumption that identical circumstances have identical consequences *the principle of identity.*

Then the answer to the above question is: *Because the principle of identity cannot be presupposed.*

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[14] From this follows that it is not necessary to assume that the fundamental proposition, which has been derived here, is true. For the justification of general statements, the assumption of the existence of a fundamental and true proposition is sufficient. This proposition need not be known.

This is the real core of the problem of induction, and exactly this deficiency is corrected by the fundamental law.

However it is a purely differential law. Thus, at first it ensures only that the principle of identity is true for *differential circumstances* – i.e. for differential spatial and temporal neighborhoods of points of the continuum.

Now we look at an arbitrary area of reality of finite extent at a certain point in time. Let us call such a temporal section an *extended circumstance.* Then the following applies:

Any extended circumstance can be seen as uncountably infinite set of differential circumstances, which are arranged in a definite way and to which the fundamental law applies.

Therefore, the principle of identity can be transferred to extended circumstances: identical extended circumstances must have identical consequences.

With this, the induction problem is solved. The general validity of laws and their validity in the future is proven.[15]

However, due to this train of thought, another problem becomes visible: If reality is understood as fabric of differential circumstances, then the probability, that two areas of reality are completely identical, is evidently zero.

This means: The justification of the principle of identity represents at the same time the limitation of its applicability. This essential limitation and its far-reaching consequences will be discussed in chapters 4 and 6.

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[15] At last, a note to Karl Poppers proposal to replace induction by falsification. This is in fact *not* a solution of the induction problem, for the following reason: If the *principle of identity* is not already presupposed (that, in identical cases, nature will behave in the future exactly as it has behaved in the past), then from the fact that an individual case contradicts a law follows *nothing*. The law could actually have been true, but nature does no longer abide by it.

This means: only if the *existence* of true general statements about the reality is presupposed, then falsification is possible. However, since Popper does not proof their existence, he does not *solve* the induction problem – on the contrary he *presupposes* induction.