OBJECTIVE TIME AND THE EXPERIENCE OF TIME

Husserl and Kant

In the light of some theses of A. Einstein’s time-theory

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Supposez qu’on ait été phénoménologiste dès l’Antiquité. Je vous pose cette question : est-ce que notre science existerait?
E. Bréhier to Merleau-Ponty

1 – Introductory remarks about physical and phenomenological time

1905 was the year of a remarkable coincidence though it was kept completely quiet until today. This silence somehow contains in itself a whole symptomatology. It was the year phenomenology first confronted the problem – or rather, the constellation of problems – of time-consciousness. The lectures given by Husserl on Zeitbewusstein as part of a course on “Capital Elements of Phenomenology and the Theory of Knowledge,” expanded on in subsequent years in many working manuscripts, finally organised by Edith Stein in 1917 and published by Heidegger in 1928, are perhaps Husserl’s most read book and, according to Michel Henry, “the most beautiful of phenomenology.” As it was known from a long time and is today accessible to the public, Husserl’s work on the enigma of time did not end here. At Bernau in 1917 and in the early 1930s are two more major moments of confrontation with the problem, a
problem which radiated from 1905 and reached ever wider circles: time arises in the horizon-made world as totality, it arises in the description of perception, in the distinction between individual and categorical objects, it arises once again in the self-appearance of the subject, in the self-constitution of the flow of consciousness and the unity of experiences as immanent temporal objects, and also in the constitution of monadological intersubjectivity. The problem of time is included in a decisive manner both with the problems of objectual constitution and the problems of the self-constitution of subjectivity, and in such a way that the classic duality of an approach to time either psychological (time as distentio animi) or cosmological (time as a form of the world as a whole) is definitely dissolved.

The 1905 issue of time, therefore, widened more and more, though it still remained a unitary problem because, if the determinations of temporality change as they pass from one plane to another, it is the subject’s self-constitution that commands, as a primitive source, every subsequent stratum of temporality. The relevance of the issues of time to phenomenology-inspired philosophy would never stop growing, and nor would the network of connections in which time would emerge as a guiding concept: time and Existenz, and Sein, and historicity, and memory, time and rapport à autrui – these are some of the multiple ramifications of the problem of time and the many-layered planes in which temporality has been found. Reflection on time was so much focused on the core of philosophical questioning that its treatment almost began to dispense with prior justification for its relevance, and at the same time the meaning of the theme itself lost the precision of its original theoretical outline and evolved towards an increasingly diffuse nebula. It was precisely on this situation that Ernst Orth spoke of a Mythologie der Zeit.³

But 1905 is Albert Einstein’s annus mirabilis as well. It was the year in which his article “On Electrodynamics of Moving Bodies” was published in the Annalen der Physik, and is where the theory of special relativity was presented for the first time with its revolutionary consequences for the understanding of the nature of space and, above all, time.⁴ The beauty of the 1905 theory is the way in which it inescapably derives from two simple postulates: firstly, that all inertial frames are equivalent in relation to the laws of physics, and, secondly, that the speed of light in the void, c, is a constant in relation to any observer, regardless of its movement. The second postulate is a direct
consequence of the null result of Michelson-Morley’s experiments on ether. Concerning $c$ and in a decision of pure genius, Einstein assumes that the speed of light is not a constant in relation to ether but in relation to any observer, whatever its state of movement might be. But it is this that has extraordinary consequences for the review of the notion of time, and for space as well.

To make it visible, let us imagine a simple situation: consider an observer $A$ and another observer $B$ moving in a rectilinear and uniform motion in reference to $A$ at a speed of $2/3 \, c$; let us suppose that $B$, as he goes past $A$, synchronises his stopwatch with that of $A$ and emits a light beam forward in the direction of his movement.

Question: what does $A$ measure on his own stopwatch after one second? First, the movement of light and that of $B$ cannot be added, according to the classic theorem of velocity addition. The speed of light is still $c$ for $A$, and $B$ moves in relation to him at $2/3$ of $c$. After one second on his stopwatch, the beam of light will therefore be at $3 \times 10^8$ m and $B$ will be at $2 \times 10^8$ m. So far, all is normal. But what does $B$ measure on his stopwatch when $A$ measures 1s on his (let us suppose that $A$ can somehow see $B$’s watch)? Due to the second hypothesis of relativity, the beam of light also moves in relation to $B$ at the speed of $c$ and not $c - 2/3 \, c$. Thus, $A$’s and $B$’s measurement of time and space could only be the same if the distances to the beam of light were the same. But they are not. If the speed of light does not differ for both, then this implies that it is space and time that differ for $A$ and for $B$. By how much? Lorentz transformations, put forward as a subterfuge to accommodate the negative results of the experiments with ether, are now rediscovered by Einstein in their true meaning.\(^5\) For $B$, the proper time elapsed is not 1s, but about 0.75s, and the space measured by $B$ down to the photon is not $3 \times 10^8$ m, but about $2.24 \times 10^8$ m.\(^6\) In a word, time “expands” for $B$, as if running “more slowly” in relation to $A$’s stopwatch, while inversely space “contracts.”

The extraordinary consequence is that the passage of time and the measurement of space are therefore functions of movement. There is no such thing as a universal time and a single measure of space but rather times and space measures are always relative to a given reference frame, measures that convert into each other through Lorentz transformations and from which results, as an invariant, not time or space per se, but a new magnitude designated as space-time interval. This is, therefore, not only a major change in common conceptions about the universality of objective space and time, but
also a surprising and wholly unsuspected connection between them: all happens as if the decrease in speed in space “accelerated” the flow of time and, inversely, as if the increase in speed “delayed” the passage of time down to the limit point of its “immobilization.” It is as if both were visible dimensions for our experience of a single magnitude in such a way that the parameters of “space” and “time” would vary in inverse proportion. But are there other controversial issues that relativity suggests to philosophical reflection – what really is, after all, the phenomenon we call the “flowing” of time, i.e. the phenomenon we grasp in the experience of transit and passage? How are the several observer-times composed or not in a single objective time, which will be valid (and accessible) for them all? How to account for this way in which time somehow “conceals” itself behind space?

The relativistic subversion of the ordinary meaning of the concepts of time and space – a meaning that was really a kind of commonsense Newtonianism – would culminate, in 1908, in the extraordinary geometry of Minkowski’s light cones, in which space and time are treated as coordinates of a four-dimensional continuum and integrated in the unitary structure of space-time. Minkowski’s words with which he began his famous conference in Cologne are well-known: “From now on, the concepts of space per se and time per se should completely plunge into shadow, and only a kind of union of the two will preserve autonomy.”

1905 was, therefore, the year in which something in our ordinary understanding of time was revised and a new era opened up. Will it be possible to establish a productive dialogue between the physical revolution and the phenomenological clarification of the multiple senses of temporality? The most common strategy concerning this purpose is a defensive one. It speaks of a divorce. Its strong point is the marking of distances. A phenomenology of the experience of time – it says – moves on a different level and has no immediate connection to a physical theory of time: on the one hand, we undertake a return to the intentional formations from which time emerges, a return therefore to the consciousness of time and intuitively given time; on the other, we are confronted by a measure of objective time, the time “of” nature and real processes, therefore, a determination of time as a magnitude accessible through stopwatches and no longer connected to experience and intuition, a time that a phenomenology should rightly put in brackets to open up its own area of investigation.
There would not simply be a difference in purpose between the two approaches. The time that phenomenology puts in brackets (in the text of the Lectures, the word is Aussenaltung – exclusion, not Einklammerung) is precisely that time of the world, the objective time of things and real processes that are the only theme of physics. A physical approach to the structure of time and a phenomenological inquiry on the experience of time would not only be connected by a relationship of mutual exclusion, but also by an equivocalness of the concept – physical time and lived time would be “two times” without relation. Such are the words which, to give credence to the defensive strategy, would close the debate even before opening it.

2 – Phenomenology of time and objective time-constitution

Actually, it seems that Husserl himself could claim this marking of an insuperable distance. At the 1935 Vienna lecture, called The Crisis of European Humanity and Philosophy, we can indeed read the following categorical statements:

Einstein’s revolutionary innovations concern the formulae through which the idealized and naïvely objectified physis is dealt with. But how formulae in general, how mathematical objectification in general, receive meaning on the foundation of life and the intuitively given surrounding world – of this we learn nothing; and thus Einstein does not reform the space and time in which our vital life runs its course.9

These statements, however, should be returned to their proper context. There are, in fact, two aspects that should be considered, which give them quite a different meaning from what is apparently theirs.

First of all, these statements by Husserl do not mean an attempt to lessen or circumvent the scientific-natural rationality as it was erected, in Modernity, by the reconfiguration of the physis on the basis of the idealities of mathematics. The Husserl who retracted himself at the end of his career, the Husserl who painfully said “the dream is over,” speaking of his commitment to rationality and philosophy as a strenge Wissenschaft, this Husserl is largely a fabrication of interpreters anxious to see in the so-called “final Husserl” the beginning of a transition towards a fundamentally different
philosophical position. The intention in these statements is, rather, to highlight a gap in the underlying principles of modern rationality, particularly showing that the processes of idealisation and substruction of an “exact” reality “behind” the Lebenswelt lack a final clarification concerning their possibility and a justification of the intrinsic validity of an “objective being” as a final correlate of “exact” theories. In the words of Formal and Transcendental Logic, an in-principle clarification is needed of the connection of the “logos of the world of pure experience” with the “logos of Objective worldly being and of science, in the “higher” sense: the logos of the science that investigates under the guidance of the ideas of “strict” being and strict truth, and develops correspondingly “exact” theories.” This “great problems” pertaining to a “world-logic” and a “genuine mundane ontology,” as they are designated there, should clarify the way in which the subjective-relative structure of the world of pure experience is reconfigured by the substruction of an “exact” nature according to idealisation processes whose constitutive genesis should be re-conducted on the founding ground of the Lebenswelt. It is precisely for this reason that Husserl, in the same passage at the 1935 conference, states in an ambivalent way that the mathematical sciences of nature are a “triumph of the human spirit” and then, in view of the non-clarification of their own possibility, presents them as “technique” and states that their rationality would be like the “pyramids of Egypt” – i.e. they are there, in their magnificence, but no-one knows how they were built.

In this light, it is not necessary to stress how much the relationship between a phenomenology of the experience of time and a physical-mathematical reinstatement of time leads us to the core of this Husserlian problem. The connection and the set of underlying conditions that guarantee the relation between given intuitive time and reinstated time in the physical-mathematical formalism, the processes by which an objective time of nature constitutes itself in a process of idealisations emanating from the founding ground of the experience of time, are precisely one of the particular aspects of that “great problem” of the configuration of objective-being and “exact nature” announced by Husserl. He seeks to explain the methodically conducted processes of transcension which lead from the primitive formations of sense of what Husserl calls the world of the reine Erfahrung to the physical-mathematical concept of time which poses, as its correlate, an “objective” time as the time of nature.
Further – and this is our second observation – the general direction emerging from the initial paragraphs of the Lectures on the Consciousness of Internal Time from the Year 1905, particularly in the second paragraph, already contains an announcement of this Husserlian view on the problem. The leading question of the Lectures is that of the “origin of time” (Ursprung der Zeit), taken as a gnosiological issue and not as a question about the psychological origin of “our” representation of time. As a question about the origin, it effects a return (Rückgang) of the time posed as objective to the intentional formations into which time constitutes itself. This return is directed to “the primitive formations of time-consciousness, in which the primitive differences of the temporal become constituted intuitively and properly as the original sources of all the evidences relating to time.”

Thus, the question of the Lectures is, from the start, determined by the idea of a clarification of the formations of sense, in which time is given, i.e. by a clarification of the experience in which the objective-temporal appears. If the incorporation of experiences in the time of the world is, from the start, excluded by phenomenological apperception, the acts by which objective time is meant are, on the other hand, the very theme of this inquiry on the “origin” of time:

It does interest us that data “in objective time” are meant in these experiences. … Naturally, I mean by this laws of the following obvious sort: that the fixed temporal order is a two-dimensional infinite series, that two different times can never be simultaneous, that their relation is a nonreciprocal one, that transitivity obtains, that to every time an earlier and a later time belong, and so on.

The leading question in the Lectures contains, therefore, three levels: first, the experiences by which time is meant (the act-characters and the supposed primary contents of the apprehension of time); second, the forms that the temporal takes, i.e. the modes in which time is intuitively given (the phenomenon of “flowing,” the temporal modes of present, past and future); and third, the constitution of a single objective time as Naturzeit and Weltzeit (the processes of idealisation that lead to the position of a time of the world). For Husserl, all these dimensions are integrated in the unity of the “erkenntnistheoretische Frage nach dem Ursprung der Zeit.”

It is quite clear how the Husserlian question of the origin of time is totally different from the Heideggerian question of the originary time. The distinction between
the originary temporality of care, as a genuine way of being of Dasein, and the “ordinary” time of concerned circumspection seeks to locate in the latter a “decayed” form of understanding of temporality as an “unbreakable and infinite succession of the nows,” and see in this understanding the place of the determination of time by the sciences of nature. We can glimpse here a strategy to situate the place of scientific rationality and, simultaneously, to go “beyond” it through the reconquest of the temporal meaning of the question of Being. We find none of this in Husserlian questioning. It is not simply about not finding in Husserl this foundation of the ec-static horizon of intratemporality on a more originary ec-static temporality of the Dasein, as Rudolf Bernet has rightly pointed out. In fact, instead of an originary time as opposed to an “ordinary” understanding of time, we find in Husserl, as Bernet also stressed, a strict correlation between the objective, public time of things and real processes, determinable by the sciences of nature, and a gnosiological inquiry (eine erkenntnis-theoretische Frage) into the subjective experience of time as the place of its originary constitution. On this precise point and in general, Husserl's focus is, thus, at the antipodes of the Heideggerian critique of modern rationality: the phenomenological origin of objective time (of Weltzeit), as a return to the experience of time, is not a question about the originary time of the “authentic” existence as opposed to the “ordinary” time of intratemporality. Instead of the purported overcoming of modern rationality, we rather find here, as everywhere else, an attempt to find an effective foundation for it.

3 – The three strata of the Husserlian problems of space and time

Furthermore, this debate between phenomenology and the new physical conceptions about the objective time of nature, and also of space and matter, is not – despite the long silence to which it has been doomed by generations of scholars – something that has to be rebuilt in retrospect by an external exercise of comparison. It emerged, in Husserl’s time, at least on two occasions of exceptional importance.

Firstly, in the domain of science, the mathematician and physicist Hermann Weyl, Husserl’s student (on an occasion Husserl replaced Hilbert) and colleague at Göttingen
and then a teacher in Zurich from 1913 until 1930, in *The Continuum* (a work where he states that the house of analysis “is to a large degree built on sand”), in “On the New Crisis of the Foundations of Mathematics” (a defence of intuitionism, which Husserl regretted, as he expressed to the author, not having been published in his *Jahrbuch*), and in *Space, Time, Matter,* developed his views on the theory of the continuum and the issues of relativistic physics at a time when he was admittedly influenced by the idealistic phenomenology of *Ideas.* This influence started with his wife, Hella Weyl, Husserl’s student in Göttingen. In *The Continuum,* the attempt to present a predicative-based analysis was, in Weyl’s own words, “concerning the epistemological side of logic,” in agreement “with the conceptions which underlie Husserl’s [*Ideas, 1913*].” The Introduction to *Space, Time, Matter,* on the other hand, follows beyond any doubt Husserl’s general position concerning *Wirklichkeit* and its dependence regarding the sense-conferring acts of absolute consciousness. This is the constructivist position, coming from Husserl, which underlies Weyl’s restatement of Einstein’s physics. Nine pages were enough for Weyl to present the essentials of Husserlian views as they were expressed in *Ideas.* Indeed, we can read there pronouncements of idealistic phenomenological style like the following: “the real word [*die wirkliche Welt*], regarding its constitutive portions and all of its determinations, is and can only be given as an intentional object of acts of consciousness.”

After that, the phenomenologist Oskar Becker began some important research on the issues of mathematics and physics with his long study “Contributions to the Phenomenological Foundation of geometry and its Physical Applications,” a work Husserl himself closely accompanied and profusely commented on in their correspondence. Becker, who based himself on Weyl’s works, sought to clarify the foundations of Geometry and their application to the problems of physics phenomenologically through the “return to the strata of originary phenomena that constitute spatiality” and to time-consciousness. The issues of the continuum and non-Euclidean geometries are foremost in Becker’s theoretical concerns. As far as they were concerned, the aim of the work was to attempt “a philosophical clarification” by means of the phenomenological theory of constitution (which he calls “*principle of transcendental idealism*”) thus building “a bridge from phenomenology to modern mathematics and physics.”
Husserl confided to Weyl about this work that it is “no less than a synthesis of his [Weyl’s] and Einstein’s investigations with my phenomenological investigations of nature,” which show that nature’s “structural lawfulness,” disclosed by Einstein’s new Physics, should be demanded from “the deepest transcendental-constitutive foundations.”

Nevertheless, the core of the Husserlian question of 1905 on the origin of time still remains to be understood, as well as the way in which the rational core of the problem makes possible a productive confrontation between a phenomenological theory of the constitution of an objective time and the modern conceptions of relativistic physics. For this, a good key is the strict correlation with the problem, which is identical but rather more structured in its theoretical outlines, of the “origin of space representation” (Ursprung der Raumvorstellung), which occupied Husserl from the 1890s on, and whose connection with the 1905 time problem remains largely ignored by critics.

This problem is determined by the situation resulting from non-Euclidean geometries. They raised an in-principle question about the nature of the “real” space. The proposal of Helmholtz, whose works Husserl knew and discussed in a critical vein, was to take the invariance of distances and infinity as the criteria for the determination of the “true” geometry among the many possible geometries. His first conclusion was that the only geometry that preserved invariance and maintained the infinity of space was precisely Euclidian geometry. His readings of Beltrami’s work and of one letter from Beltrami himself showed him, however, that Lobatchevski’s negative curvature of space also preserves the possibility of translation and is infinite like Euclid’s. The problem was, therefore, far from a final conclusion.

Meanwhile, Riemann’s work, developed on a higher level of abstraction, had already been understood in its full significance. His idea was to depart from a very general structural notion, such as that of a “magnitude stretched several times” (eine mehrfach ausgedehnte Grösse), i.e. a magnitude that varies according to various dimensions (two, three or more), continuous or not, on which it is possible to define several kinds of metric determinations. We are before the idea, so dear to Husserl, of a “theory of multiplicities” (Mannigfaltigkeitslehre), which he would incorporate into the concept of a mathesis universalis. The transition from pure multiplicities, formally
determined by various topologies, curvatures and dimensions, to real space fell back on a fact from experience: the possibility of the transport of solids by translation and rotation. The measurement of the distance between points was resolved, for Riemann, by integrating a differential formula of the increments of magnitudes \( ds = \left( \Sigma dx^2 \right)^{1/2} \), a formula which is a generalisation of the Pythagorean theorem. It was, therefore, about examining different possibilities of forms, mathematically developed by the theory of multiplicities as pure possibilities, and verifying whether they could adapt to “real” space.\(^{34}\)

Such is the “Helmholtz-Riemann problem”: to find those geometries in which displacements leave a metric form invariant. The Euclidean space of zero curvature emerges only as one of the possibilities obtained by variation within a more general theory of multiplicities that supposedly develops without any recourse to “our” intuition of space. A plethora of mathematicians worked on this problem. Husserl himself did.\(^{35}\) More important, though, is his theoretical decision that the very problem is “incorrectly settled” insofar as it fails to clarify how algebraic relationships between elements of a multiplicity are converted in geometric relations between lines without already presupposing the fact of space representation: “through simply formal determinations we will never go from multiplicity to space.”\(^{36}\) The whole outlook on the Helmholtz-Riemann problem is thus dependent on the clarification of questions that are more fundamental and goes round in circles until logically prior matters – such as the particularities of “our” representation of space, the concept of number and, lastly, the relationship between arithmetic and geometry, simply acknowledged as a starting point in analytical geometry – are clarified.\(^{37}\) In short, for Husserl, the supposed elevation to a higher level of abstraction is contaminated by presuppositions that imply the intuition of space as a fact that the theory of multiplicities is unable to justify.

Regarding space, there is a logical fact and a psychological fact – such is Husserl’s theoretical decision and his reformulation of the problem.\(^{38}\) The psychological fact pertains to the “origin of space representation” and focuses on the description of spatial intuition and the space of everyday life; the logical fact concerns the mathematical-formal determination, by a theory of multiplicities, of possible forms of “spaces” with diverse topologies and curvatures in which Euclidean space appears only as a particular instance of zero curvature, but is, for Husserl, on the other hand,
constantly presupposed in the construction of non-Euclidean spaces by the set-up of analytic geometry. To the psychological and logical fact a “metaphysical problem” should also be added of whether something “real in a transcendent sense” corresponds to our representation of space. The whole long Husserlian reflection on the issue of space, from the manuscripts of the 1890s to the Crisis of European Sciences, can be integrated into this program. Meanwhile, the threefold nature of the problem, split into a “psychological” problem, a “logical” problem and a “metaphysical” problem, was unified in the program of a phenomenology of the constitution of space. Its levels are as follows:

1. Description of the intuition of space and its strata: the oculo-motor field, the tactile field, and the constitution of the three dimensions in the ich bewege mich phenomenon, a configuration of a directed space that focus on the “here” as a zero point and on the “there.”

2. Geometrization of the intuitive space through the processes of idealization – constitution of ideal objects as the point, the line, the angle, etc. through a process that stems from intuitive givenness and extends to new objectivities no longer given in the original intuitive field; simultaneously, the determination of the metric properties of the geometrized space.

3. Constitution of the “real” space as a homogeneous space within a constitutive doctrine of the res materialis (that rests precisely on the previous strata of the res temporalis and the res extensa).

As Husserl studied the problem in more depth, the second and third aspects took a secondary role in view of the multiple questions raised by the description of intuitive space and by the somatic (leiblich) self-constitution of subjectivity. However, in Husserl, the theoretical configuration of the problem does not tend towards an exclusive concentration on the originary perceptive space, as we find it in Merleau-Ponty, but towards a preliminary description which, based on it, aims at situating the “higher” problems of geometric idealization and constitution of a homogeneous space posited as “real.”

This overall configuration of the problem is clearly present in the manuscripts from the 1890s. The difficult points are the transition between the various levels. And here Husserl, despite the many promising hesitations, is extremely conservative in the
theses he argues for. Firstly, the geometrisation of intuitive space is Euclidean geometry, i.e. an infinite, homogeneous space of zero curvature; secondly, the constitution of real space is obtained in the framework of Euclidean space, through a double process of *iterated transposition* of the “here” (in *Einfühlung*) and *suppression* of any reference system as a simple “subjective” mode of orientation and connection with the spatial. It is this double operation that liberates space as an “*an sich*.” For Husserl, there, therefore, is no such thing as “spaces,” formal and mathematically defined. What we mean by the word “space” is the Euclidean space of our intuition, which can be submitted to a phenomenological analysis revealing its several strata of sense, and showing the operations that accomplish, in the basis of this intuitive space, the higher formalizations of “spaces” in Riemann’s sense.

So, the problem of the 1905 “origin of time” closely follows this theoretical configuration of the space problem. This fact remained ignored by successive generations of scholars for two main reasons. The first is factual: the detailed reworking to which Edith Stein subjected Husserl’s manuscripts, in 1917, erased all traces from the original sketch of the 1905 course. The second reason, however, is of a technical nature. Husserl turned the problem of space intuition into the problem of the somatic self-constitution of subjectivity. In a similar way, the issue of *time-consciousness* was reconverted into the issue of the *temporality of consciousness*. The resulting problems, in particular the constitution of the flow of consciousness and of the experiences as immanent temporal objects, the “longitudinal” intentionality of the flow in which the stream of consciousness constitutes itself, the non-temporal background of “absolute subjectivity” – all these problems, a kind of “archaeology” of subjectivity, addressed by Husserl in a regression to the *Ego* of the living present of the 20s and 30s, exerted such a fascination among the scholars that they lost sight of the fact that the time issue is, from the start, governed by the inquiry on the processes by which an objective time is constituted as an overall correlate of those acts in which time appears intuitively.

The critical edition of 1966 enables, however, the reconstruction of the content of the 1905 *Lectures*. After a confrontation with Brentano’s and Meinong’s doctrines about the constitution of the originary temporal field and the representation of a temporally distributed object, we find in them an exact obverse of the theoretical levels of the space issue. In particular:
1. A description of time intuition or time as it appears in reference to a temporal-object (Zeitobjekt) centred on two leading phenomena: the givenness of flow (the consciousness of succession) and the configuration of the modes of temporal orientation of the present, past and future (a kind of temporal “perspective”). The description of the connection between primal impression, constitutive of the “now,” and the fresh memory (later altered in the retention theory), as well as the relationship between perception and the reproductive acts of recollection, as acts intending the present and the past, build respectively a phenomenological description of the givenness of flow and a time oriented by reference to the zero points of the “present” and the “Jetzt/Soeben” pairing.

2. Determination of the idealizations that act on the given intuitive time and lead to the constitution of an objective time which is, itself, no longer an object of intuition – time as an infinite one-dimensional series, the continuity of this series, the order relationships between temporal points (before-after), their non-symmetry and transitivity as a condition for the definition of a time “direction,” in short, the characterization of time as an “orthoid multiplicity.”

3. The position of a homogeneous, infinite, unified and single time, as time of the world, by iterated transposition and suppression of referentials involving subjective modes of “temporal direction” and “orientation” (the “now”-“present” pair and its derivatives).

This is not the “limited” form of the 1905 issue, but the Husserlian form of the time problem, even after the inflationary explosion of questions about the temporal self-constitution of the flow of consciousness and the Ur-Ich of the lebendige Gegenwart, as ultimate conditions for the constitution of an immanent time as a previous stratum of the experience of the temporal objective. We can thus see that, from the start, the time problem is, like the space problem in its logical and epistemic features, an issue relative to the foundation of the idealizations that command the constitution of an objective time as Naturzeit and Weltzeit, even when, for Husserl, the constitution of an objective, worldly time involves a long mediation through the self-constitution of the immanent temporality of the flow of consciousness and through the inter-subjective constitution of a “common world.”
4 – The constitution of world-time and the time of physics

As we said, the problems concerning the intuition of time and the temporality of consciousness have thus far been almost the only topics of study and critical debate, with a permanent drift towards the important topic of “historicity.” Our proposal is to look the other way and, to finish, focus on the problems of the second and third levels of the tripartition outlined above. As is evident from the earlier considerations, these too are problems of a phenomenology of time. They relate to the constitution of an objective time and the position of this time as a transcendent unity that is the time of the world.

Let us start with the constitution of objective time, i.e. the second level issues. Objective time is not an intuitive given, but the result of a number of idealisations that act upon time intuitions. By ordering Husserl's reflections a little, we can distinguish two series of operations.

1. Constitutive operations of the serial form
   a) To start with, the continuity of the form of time, on the basis of the experience of the reiterated insertion of portions of time between two portions of time. True, the insertion, through recollection, as Husserl shows, is always partial, but the idealisation consists precisely in pushing this possibility to the limit and constituting the time series as a continuum, made up by points and not elements.
   b) The order of time, on the basis of the experience of the non-reversibility of partial intentions that mean a “before” and an “after” (protentions and retentions) until the idealisation of a progression continued into the series of points in time, in which no point in the “before” series is a point in the “after” series. The non-symmetry and transitivity of the relationships between temporal points result from the position of a fixed order, but not yet irreversibility.
   c) Directionality, on the basis of the experience of transit from the future to the past, or the “advance” of the time series, constitutes itself as the ideal form of a linear time which has not only an inner order between its points (the “before” and “after”), but a global direction or a general movement of progression (of the “future”) and regression (of the “past”).
d) Finally, *infinity*: on the basis on the limited character of intuitive time, the awareness is formed of a progression always ideally going forth, though empty, from a past temporal point to the past of that past and from a future point to the future of that future, and thus reiterated indefinitely.

Through idealization processes that surpass the intuitive experience of time at every moment, this results in the figure of an objective time as a linear series of fixed temporal positions. However, this determination of objective time still leaves the image of time as a “knife-edge,” to draw on an oft used analogy, i.e. the image of a time in which, at any given moment, only one point is “real.” This is, therefore, a time guided by a “now,” which is not just any point in the series, but a universal, stationary form, without fixation in the points of time (the points “pass” rather through the “now”). The second type of constitutive operation suppresses this temporal direction, similar to that which organizes intuitive space around a “now” not fixed to any determined spatial position.

2. *Constitutive operations of time as a fixed series*

a) *Through the variations of the modes of givenness* – an *invariant* results from the inter-variation of the forms of temporal orientation, i.e. in the mutation of temporal orientations of the future, the now-present and the past, an invariant which is none of these fluent manners of givenness (*Gegebenheitsweisen*), but the rigidity of a *fixed temporal situation* (*Zeitlage*) which may have various “subjective” givenness modes (past, present, etc.)

b) *Through the transcending of the flowing phenomenon*, a phenomenon that concerns the inter-mutation of the subjective *Gegebenheitsweisen* and not the objective *Zeitlage*, the form of a functional dependency between ordered temporal positions is constituted. This functional dependency is, in the time of nature, the founding form of the causal connection between the reals that “fill” each point in time.

Thus, an objective time is constituted through the homogenisation of temporal points. They are no longer relative to a stationary “now” as an absolute point of orientation, in the same way that the points in space are not relative to an absolute “here.” This constitution of objective time as an homogeneous series of positions without any point of reference sanctions a flagrant spatialization of the phenomenon of
time: every point in the series is from then identical and, for this reason, they are all jointly present insofar as this “present” no longer indicates an intra-temporal position but the idealisation of the “total” series and its position as an objective and rigid series. It is no longer possible to say about it that there is an absolute “now” and, relative to that, an absolute past and a future. Only order relationships between each temporal points subsist, and the whole series is jointly “present” as encompassing the totality of these relationships. The phenomenon of the passage of time is now transmuted into its objective counterpart: in the series of ordered temporal positions, no temporal point switches its determination, none advances or recedes, none is “now” or becomes “past” at any moment. Time is “motionless.” The series is made up of homogeneous units, which have no “subjective” mode of temporal orientation, like the objective spatial continuum that has “points” but is at none of these points a “here.”

This whole dimension of the Husserlian theory on the constitution of objective time was generally kept quiet and its implications, as well as its presuppositions, remained undebated. However, it erupts in many places, particularly in a Bernau manuscript entitled “Objective time and subjective modes of time (direction). Important ontological-temporal axioms.” The text opens up precisely with a major distinction: “We distinguish time itself (and its respective temporal fullness ...) and the modes of time givenness ... .” As regards time “itself,” i.e. time posited qua objective, Husserl continues: “time in itself is not present, will not be nor become. ... Of time in general, as totum, it is valid to say: it is “always” present ... .” Thus, “time and its objects do not flow, they are, and this “are” is fixed.” The phenomenon of flowing, which is the most powerful structure of time intuition, finds its transcendent counterpart in the idea of causal connection. The manuscript goes on: “the temporal flow is not the flow of time but rather of the modes of time givenness and its objects. But do objects not come and go in time? ... Objectively, in fixed time, there are fixed mathematical functions which we call “mathematical causality.” ... The bird flies: a determined temporal extension of objective time is filled in in such and such a way ... . But, in objective time, this filled-in extension is fixed. Moreover, change in objective time must not be mistaken for the “flow” of the givenness modes, in which the temporal “appears” for the subject. The appearance of a change is a constant “flow,” but the objective change is a fixed being, a
fixed temporal extension, filled with temporal fulfilments distributed in such and such a way.”

This concept of the objective time of the world as a rigid series of invariable positions, without transit or passage, in which the fluency phenomenon converts itself in the concept of a functional dependency between the content of fixed temporal points is not only close to what William James named the hypothesis of the “block universe,” but also meets the physical view of time that emerges from relativity and, in particular, from Minkowski's geometry of space-time. In the words of Hermann Weyl, “The objective world simply is, it does not happen. Only for the gaze of my consciousness, crawling upward along the lifeline of my body, does a section of the world come to life as a fleeting image in space which continuously changes in time.” However, the way in which this time of the world, without flow, derives from the intuitive experience of time through a process of idealizations that the phenomenological analysis can show step by step, allows for it to be now exhibited in its transcendental-constitutive genesis and not presented ingenuously, as is usual, as the display of the “deceptive” character of the subjective experience of time as opposed to the “true” physical determination of time.

As is noticeable, this objective time, as a total series, is a time without a subjective mode of givenness. But, as good phenomenological discipline demands, its position as transcendent, as time of the world, must show it as a correlate of an actual consciousness. It is on this final point (regarding the third level problems) that we find the greatest false step of Husserl's phenomenology of time, i.e. its departure towards metaphysical construction, and also the way in which the relativistic theory of time can suggest a correction that might restore the phenomenological mode of analysis to the full strength of its potentialities. In a manuscript, underrated by the critics as well, Husserl argues for the thesis that this objective time, without a subjective mode of givenness, is the correlate of a göttliches Bewusstsein, a “divine consciousness.” The text states:

God’s infinite consciousness embraces all time ‘at once.’ This infinite consciousness is non-temporal. For him [God] there is no past, present, and future. But even for him there is a past, present, and future relative to each point. Time is the form of the infinite consciousness, as infinite adequate perceptual series. From the position of a determinate now, a – n – b, a is past; in relation
to \( a, n \) is future, just as \( b \) is. The divine consciousness is the ideal correlate of objective time and of the objective world and world-evolution.\(^{53}\)

In phenomenology, we must return from what is objectively given to the formations of consciousness, and exhibit the constitutive acts in which this object (as an eidetic type) is meant and eventually presents itself. But here we are drawing the very consciousness for which such a hyperbolic object \textit{would} be given. It is in this sense that Husserl’s considerations about a “divine consciousness,” as “infinite adequate perceptual series,” that would have as their object this infinite time are a blunt metaphysical construction. Thus, the constitution of the time of the world is for Husserl the simple position of this linear series of homogeneous temporal points. This is achieved with the additional involvement of the following two theses that Husserl, in fact, is constantly restating when he addresses the issue:

1. The \textit{simultaneity} of perception and the perceived, in which the belonging of an object to one, \textit{and only one}, “now” is constituted, and, as a result, its univocal location in the objective temporal position that is constituted in this consciousness of “now” is established.

2. The \textit{universality} of each temporal position, given in an impressional “now,” in such a way that, for each temporal position in the “line” of time, there will be a vertical axis into which all events belonging to this same position fit. Thus, all events that do not fit into this axis will necessarily be events belonging to other temporal points of this same line of time. That is, it is as if each temporal position in the line defined a universal system of simultaneities, as if, therefore, a universal clock struck synchronically across the universe and univocally determined relationships of and succession between world-events.

Regarding 1 above, we can always interpret it as a statement about the \textit{Leiblichkeit}, i.e. the \textit{presence} of the perceptual object to the act of perception – “Perception is the apperception through which the object appears as there itself and now present.”\(^{54}\) This is certainly an essential mark of perception as such. The problem arises when we go a step forward and state that the “now” of perception is constitutive of an absolute and objective time-point in a single worldwide time order, which belongs as well to the perceptual act and to the object perceived. The belief in an absolute meaning
of *simultaneity relationships* arises from this. As Weyl puts it, “the belief in the objective meaning [of the concept of simultaneity] rests, originally, in the fact that everyone puts, with full obviousness, the things that he is seeing in the time-point of his perception. So, I expand my time all over the entire universe.”  

As a matter of fact, the situation is not so simple. The velocity of signals connecting an event and an observer is always finite. So the time of the event and the time of the perception can be, and often are, very different. Husserl refers to this situation: “By what right can one say that perception and what is perceived are simultaneous? With respect to objective time – in the naïve attitude – this is not correct, for it is possible that in the perception’s time-point the perceived object no longer exists at all (a star); from this standpoint one will even have to say that the time-points of the perception and the perceived always diverge.”

Indeed, we are aware of this delay in our ordinary experience. We see, for instance, the lightning first, and only a few seconds after can we hear the thunder, but we know that they are caused by the same electric discharge. Nevertheless, we think that, knowing the distance between our observation-point and the event we observe, and the velocity of the signal, we can calculate the time at which the event happened and link it to some previous instant of our time. This operation will give us the objective time-position of the event in a universal time-series. Thus, this will give us a time-determination that will be the *same* for all observers calculating the same time-position at different distances. It was the task of Einstein in his 1905 paper “On Electrodynamics of Moving Bodies” to show that it is not the case that they find always the same time for the event under consideration, even assuming that all observers can calculate accurately with clocks that were synchronized at the origin (i.e., when they were at the same place, before moving away from each other, or when they were all at a distance, but at rest relative to each other). The rejection of a single worldwide time order for all events follows this critique of the naïve concept of simultaneity. The presupposition that underlies Husserl’s treatment of the question is, however, the simultaneity (immediate or with a deferral we can calculate) between an event and the perception of it, and the idea of a fixed and single time-order as objective world-time.

From this, we reach point 2: the *universality* of each temporal position. Husserl himself wrote about it in the text concerning *göttliches Bewusstsein*. In his own words,
In what did the objectivity consist? The unity of the world-now = the unity belonging to a total perception, which embraces all that is now in the manner of a perception of the now. … We will at least have to say that every adequate now-perception posits an absolute now; and, within the group of adequate perceptions, there only exists the possible difference that some component group \( \forall_1 \ldots \forall_1 \) can be united into a single now-perception, just as another group \( \forall_2 \ldots \forall_2 \) can be united [in a different now-perception], while in general the members of different groups are incompatible. When an individual member does belong to different groups, it endures. The different groups themselves form the temporal succession; the nows form a continuous sequence.\(^\text{57}\)

This view of time that Husserl tackles is, undoubtedly, not a phenomenological “evidence,” but rather a construct derived from the Newtonian idea of a universal and absolute time, in the triple sense that it is non-relational, independent from any particular referential and with a fixed metric structure, non-restricted by any material processes.\(^\text{58}\)

Acting on the confines of Husserlian thought on worldly time, it is this concept of transcendent time as universal and absolute that the 1905 theory of special relativity destroyed. Relativistic criticism of the concept of “simultaneity” showed that two events are simultaneous, not universally but in relation to a reference system. If two events \( a \) and \( b \) are simultaneous for a reference frame \( F \), we cannot conclude from this fact that they are also simultaneous “for another reference system moving in relation to the former.”\(^\text{59}\) In few words: simultaneity is not an equivalence relation, i.e., a symmetric, reflexive and transitive relation between events. If two events are simultaneous for an observer \( A \), we cannot deduce that they are also simultaneous for another observer \( B \); moreover, if \( a \) is simultaneous with \( b \), and \( b \) with \( c \), we can conclude that \( a \) and \( c \) are simultaneous for the same reference frame, but we cannot conclude that \( a \) and \( c \) are, in general, simultaneous for any other reference frame moving in relation to the former. In the geometry of Minkowski's light cones, there are indeed world-events (so-called “space-like”) that have no determined temporal relationship with the events situated inside a given light cone (the time-like events). In one word, there is neither a universal “clock” nor a universal “now.” The lesson of special relativity is, therefore, that there is not the time, but times, that these have different rhythms and that the successive order of events is always an order of succession relative to a given referential. Thus, from no
point of view is it possible to speak about a unified and single time of the world as a universal reference frame for all events, i.e. about an absolute time in the three senses mentioned above. On the contrary, the measures of time are always relative to an observer and inter-combine, through Lorentz transformations, not into a universal time that goes beyond and suppresses the observer’s position, but into a space-time invariant that can only be obtained from and within the multiplicity of observers.

This fixation of time on the observer, so crucial to relativity, restores the phenomenological way of thinking and corrects the constructivist deviation of Husserl’s theory of world-time. And this for the following essential reason: relativistic physics suggests that the “time” magnitude is always dependent on the fixation of a point of view (a referential) and on the orderly transformation of points of view into one another. This means, phenomenologically, that objective time does not happen in a worldly time that suppresses the connection with the subjective experience of time but, on the contrary, there is something like an objective time only as long as such a time is rooted in the subjective experience of time, with is definite “point of view” about is own “present,” is own “now” and the phenomenon of “flow.” In short, what Husserl had called “occasionality” of expressions that designate the temporal determinations (the “now,” the “before,” etc.) cannot be surmounted by “fixedly determined” expressions that produce a univocal and universal determination of time relationships. Against the thesis of the Logical Investigations and the 1901 text on the göttliches Bewusstsein, we must say that such a univocal determination does not exist. Time, qua objective, only presents itself within a point of view or a “subjective mode” of orientation. What, in physics, is idealised in the concept of an observer, defined as a stopwatch and ruler, plus a system of coordinates, refers, in its transcendental-constitutive genesis, to the emergence of subjectivity and to an experience of time (and space, or a split of space-time in time and space) that originally constitutes it on the basis of fluency and passage phenomena, centred on the constant givenness of a now and a present. The ultimate lesson is, therefore, that we do not come to the time of physics by suppressing subjectivity, but through a set of connections and transformations between the multiple subjective experiences of time. The determination of the formulae that permit these transformations to be obtained is certainly a task of empirical science. But the thesis that
objectivity only constitutes itself in the passage of subjectivity to an *intersubjective invariant* is something that only a transcendental theory of experience can fully justify.

In general, we can thus see not only the split between intuitive and mathematical time, but also the very processes that transform the former into the latter. Time intuition gives an everlasting *Present* (like the “here” of spatial intuition), and an oriented *Flow*, which is visible not in time itself, but in the content of time, particularly in the phenomena of rest and motion. Looking at those phenomena, we can fix limits, i.e., the (rough) beginning and end of a temporal process. It is this fixing of limits that brings about the concepts of *time-point* and *time-stretch*, which are the bridge-idealisations that lead to mathematical time. As a series of time-points with a fixed relation (earlier-than), and a general direction, the formal properties of time can be exhibited. Namely:

1. For two different time-points $P_A$ and $P_B$, there is always a relation earlier-than, $R(a,b)$, linking those points.
2. If $R(P_A,P_B)$ is valid, then there is always another time-point $P_C$ such that $R(P_A,P_C)$ and $R(P_C,P_B)$ are also valid.
3. If $P_AP_B$ is a time-stretch, then there is a bi-univocal application, point-to-point, of $P_AP_B$ into $P'_AP'_B$, in such a way that no time-point in $P_AP_B$ lacks its counterpart in $P'_AP'_B$ and vice-versa.
4. Every time-series, defined through the properties 1, 2, and 3, is relative to a reference frame in such a way that the multiple time-series (each one referred to its frame) do not coincide, but convert one into the other according to a transformation law.

Property 1 states the possibility of attributing an order to all time-points. Property 2 states the continuity of the time-series. Property 3 is about measurement. Finally, an order and an operation of measurement are always dependent on a system of coordinates and a scale that eventually refers back to an intuitive act of time-orientation. We can also show that relation $R(a,b)$ is non-reflexive, non-symmetrical and transitive. However, what matters here is the way we can pass from the intuitive time of our experience to mathematical time through the leading idealisations of a time-point and a time-stretch, and the selection of a system of coordinates rooted in a time-experience.

Phenomenology enables us, therefore, to gaze at the multiple faces of time. It allows us to look at them not in mutual opposition but in an articulated way. Rather than
opposing a “time of consciousness” and a “physical time” of stopwatches, rather than disqualifying the latter as an “ordinary” concept of time or, inversely, challenging the former as “subjective illusion,” it displays the constitutive processes through which we go from the lived time to a time of the world, disclosing the operations involved as subjective realizations (Leistungen). Actually, there is only one time and there is only one world. Thus, how could there be anything like an insuperable opposition between time “of” consciousness and time “of” natural science? The foundation of the natural and exact sciences by a phenomenological theory of objective constitution is surely very far from being the only task of phenomenology. But it is one of its tasks, and a major one. In this way, we can at last surmount the split between a narrow Positivism, instituted as the “official” philosophy of science, and a phenomenological departure towards the pathos of the “originary,” which loses sight of natural scientific reason, an unfortunate split that has functioned, in our culture, as a kind of intellectual schizophrenia.

5. Une lecture néo-kantienne de la relativité d’Einstein

Plus encore que la phénoménologie, qui était une philosophie naissante au temps des essais de 1905, sur la relativité restreinte, et de 1916, sur la relativité généralisée, la philosophie transcendantale de Kant – un patrimoine intellectuel affermi et renforcé par le néokantisme – a été immédiatement mise en question par le surgissement de la nouvelle physique en ce qui concerne ses présupposés fondamentaux. Moritz Schlick et Hans Reichenbach ont été deux figures majeures en cette confrontation, qui se développe surtout à partir des années vingt du vingtième siècle. La contestation du « synthétique a priori », en tant que principe constitutif de l’objectivité d’expérience, substitué par le principe de la « définition coordinatrice » (thèse originaire de Schlick), lequel permet un empirisme avec des principes constitutifs, mais sans compromis avec l’universalité et l’apodicticité au sens kantien, aussi que bien que l’exhibition des insuffisances de la doctrine kantienne de l’espace et du temps – lesquels, selon Einstein, « auraient perdu l’ultime reste de réalité objective » – surgissent comme les deux axes principaux de cette évaluation négative des capacités de la philosophie critique à incorporer les résultats de la nouvelle physique. « C’est à ce processus de dissolution du
synthétique a priori que nous devrons incorporer la théorie de la relativité, quand nous désirons la juger au point de vue de l’histoire de la philosophie. » Cette affirmation de Reichenbach, en 1949, peut nous donner une idée précise de ce qui a été le centre du débat au début des années vingt.

Dans ce contexte, l’essai de 1921 de Ernst Cassirer (paru presque en même temps que l’essai de Reichenbach\(^4\), intitulé Sur la théorie de la relativité einsteinienne – considérations gnoséologiques,\(^5\) réalise un mouvement en direction opposée. Cassirer y essaie non pas une assimilation des thèses de la nouvelle physique par le kantisme classique, travail qui serait vain, mais plutôt une réélaboration de la philosophie critique, tâchant de montrer comment et en quelle mesure la nouvelle physique représente un approfondissement de quelques thèses fondamentales du classicisme en ce qui concerne la constitution de l’objectivité d’expérience.

A ce propos, la première chose à faire sera de délier la philosophie critique de ses attaches à la physique newtonienne. Si celle-ci représente une phase définitivement dépassée de la connaissance de la réalité physique, la philosophie critique, de son côté, en tant que recherche sur le processus d’objectivation qui pose devant le physicien quelque chose comme une réalité physique donnée dans l’expérience, doit pouvoir survivre au moment de la connaissance de la Nature auquel elle a été temporairement liée et perdurer par delà de lui. En cela se décide l’actualité de la philosophie critique, et c’est justement celle-là, la question fondamentale de l’essai de Cassirer. « Si Kant croyait posséder dans l’œuvre fondamentale de Newton […] quelque chose comme un codex assuré de la « vérité » physique, […] la relation entre philosophie et science exacte qu’il acceptait a changé depuis lors » (p. 5). Les enjeux que, selon Cassirer, signalent l’obsolescence de la physique newtonienne sont « le fait de la géométrie », c’est à dire, le développement, depuis Gauss, des géométries non-eucli diennes et son usage dans la théorie physique par la relativité généralisé ; le « système de la mécanique classique », non seulement réduit à une théorie plus générale, mais aussi outrepassé par le concept de « champ », provenu de la théorie électromagnétique de Faraday et de Maxwell ; et, finalement, la « question de fond » concernant l’ « essence » de l’espace et du temps, la question disputée depuis Leibniz et Clark. « Si Kant ne voulait être autre chose que le systématisateur philosophique de la science newtonienne de la Nature, ne restera, donc, sa doctrine liée aussi au destin de la physique newtonienne, et ne devront
tous les changements qu’elle a souffert agir aussi en retour immédiatement sur la configuration des doctrines fondamentales de la philosophie critique ?

On sait bien que la philosophie kantienne a voulu donner la justification ultime pour chacun de ses aspects de la science mathématique de la Nature, de Newton. L’intuition pure de l’espace, mise à la base de la science géométrique, assure son caractère apriorique (contre certaines affirmations de Newton lui-même), mais la compromet, d’une façon apparemment irrémédiable, avec la géométrie Euclidienne ; les analogies de l’expérience, de l’analytique des principes, suivent et décalquent les trois lois des *Principia Mathematica Philosopha Naturalis* (soit les principes de la conservation de la masse, de la causalité et de l’action réciproque, lesquels répondent aux lois newtoniennes de l’inertie, de la force et de l’égalité de l’action et de la réaction) ; en ce qui regarde la question de l’espace et du temps en tant que tels, si Kant prend des distances soit par rapport à Leibniz soit à Newton avec sa théorie de l’idéalité transcendantale et de la réalité empirique, la thèse selon laquelle l’espace et le temps sont des intuitions pures (ou formes d’intuition) le mène à défendre qu’il s’agit, en premier lieu, de deux représentations séparées, et, de suite, qu’il y a une unité primitive de chacune de ces représentations (en tant que *repraesentatio singularis*), que les espaces et les temps s’obtiennent par limitation de cette représentation unitaire en tant que ces parties, nécessairement coordonnés dans une représentation globale une et unique.

Tous ces aspects sont des points de doctrine relativement auxquels le développement historique des sciences exactes, et de la physique en particulier, a décidé contre les thèses de la *Critique*. Cependant, comme Cassirer le souligne, l’œuvre de Kant n’est pas un compendium de l’état de la science courante à son temps, mais une enquête gnoséologique sur les sources de la connaissance et la constitution de l’objectivité d’expérience, une recherche qui emploie les sciences qui lui sont contemporaines seulement comme un matériel pour ces recherches. « Nous ne connaissons pas « les objets » ; […] nous construisons une connaissance de l’objet. »66 - c’est ce processus ou cette fonction d’objectivation que la critique de la connaissance s’efforce pour mettre en lumière. En ce sens, pour Cassirer, la tâche de la philosophie transcendantale consiste à exhiber les invariantes logiques ultimes, communs à toutes les formes possibles de théories, en tant qu’éléments constitutifs nécessaires. Celle-ci
n’est pas une tâche qui soit réalisable en quelque phase historique de la pensée scientifique. Mais la « fonction objectivante » ou la « loi suprême d’objectivation », que la recherche gnoséologique découvre, doit fonctionner comme une exigence de l’entendement qui fixe une direction pour « le développement continu du système de l’expérience. » Non seulement l’ *a priori* est, donc, une dynamique d’objectivation constamment en devenir, que se réalise imparfaitement et qui s’approfondi en chaque étape de la science de la Nature, mais aussi la division étanche entre science de la Nature et critique de la connaissance s’avère, aux yeux de Cassirer, comme une séparation artificielle. Cassirer l’affirme presque au début de son essai : « un regard attentif sur l’histoire de la physique nous enseigne justement que ces progrès les plus importants ont en général une connexion intime avec des considérations d’ordre gnoséologique. » (p. 6) On peut voir cela chez Galilée, Kepler, Newton, et on peut le voir d’une forme encore plus éclatante a propos de la reformulation einsteinienne du principe de la relativité, parce que Einstein, « en particulier afin de justifier le passage de la relativité restreinte à la générale, s’est appuyé, en première ligne, sur un motif gnoséologique, auquel il a donné une signification décisive, à côté des fondements purement physico empiriques. » (p. 7)

Une lecture « néo-kantienne » de la relativité de Einstein découvre maintenant son programme. Il ne s’agit pas de comparer les thèses de la nouvelle physique avec les thèses kantiennes positives de la *Critique* ou même des *Premiers principes métaphysiques de la science de la nature*, comme si une intégration ou une adaptation était possible ou désirable. Il s’agit, plutôt, de s’engager dans cette zone de confluence entre science de la Nature et gnoséologie à fin de déterminer en quelle mesure la compréhension kantienne de la dynamique d’objectivation, constitutive de l’objectivité d’expérience, est encore suffisamment puissante pour bien comprendre le processus de formation interne des concepts théoriques de la nouvelle physique et des thèses positives qui en dérivent. Telle est la question en laquelle se décide l’*actualité* ou l’*obsolescence* de la philosophie critique de Kant.

6. L’esthétique transcendantale dans un carrefour
Toute la stratégie argumentative de Cassirer se concentre sur les deux points suivants : en premier lieu, présentation du principe de la covariance, de la relativité généralisée, non comme une simple thèse empirique concernant le statut des objets physiques, mais comme un principe synthétique, constitutif, que l’entendement prescrit pour l’interprétation des phénomènes de la Nature ; en deuxième lieu, affaiblissement des thèses de l’esthétique, en distinguant entre théorie transcendantale de l’espace et du temps en tant que méthodes d’objectivation et théorie empirique de l’espace et du temps en tant que grandeurs physiques, cherchant à situer au niveau du problème « empirique » de la métrique les changements que la théorie de la relativité a introduit.

Contre cette interprétation, nous voudrions montrer que le principe de la covariance, que Cassirer reconnaît justement comme le noyau de la théorie relativiste de l’objectivité physique, agit en retour sur la conception kantienne de l’espace et du temps de l’esthétique et demande, par lui seul, une « esthétique transcendantale » de type nouveau, organisée autour de problèmes et d’objectifs différents.

Le principe de la covariance générale – ce que Einstein désigne comme « postulat de la relativité générale » – prescrit que « les lois physiques doivent être d’un type tel qu’elles se peuvent appliquer à des systèmes de référence en toutes sortes de mouvement. » ou, dans une autre formulation, que « les lois de la Nature doivent être exprimées par des équations qui soient valides pour tous les systèmes de coordonnées, c’est à dire, qui soient covariantes relativement à tous les remplacements arbitraires (généralement covariantes). » En un mot, le postulat de la relativité générale, lui-même une généralisation du principe de la relativité restreinte pour systèmes inertiels, déclare que toutes les coordonnées gaussiennes (donc, aussi celles des systèmes accélérés, identifiés à la chute libre des corps dans un champ gravitationnel par le « principe d’équivalence ») de l’espace-temps sont équivalentes pour la formulation des lois de la Nature.

Comme on l’admet communément, la thèse de la covariance suppose que :

1. Les mesures spatiales et temporelles (soit les distances d’espace et de temps entre deux points donnés) des événements ne sont pas invariantes – au contraire, elles dépendent du système de référence arbitrairement choisi et, donc, de la situation particulière de l’observateur (idéalisé en la forme d’un système règle-chronomètre);

3. Aucun objet empirique ne peut être un référentiel absolument privilégié (soit la Terre immobile, le centre de rotation du Soleil ou l’éther), mais tous les référentiels pour les mesures d’espace et de temps se transforment les uns dans les autres et l’unique référence absolue est la loi de transformation elle-même.

Le commentaire de Cassirer est incisif. En paraphrasant Max Planck, il dira que, avec le postulat de la covariance, « l’anthropomorphisme de l’image sensible naturelle du monde, dont le dépassement est la tâche propre de la connaissance physique, a été, ici, poussée en arrière un pas de plus. » (p. 37) Or cela se vérifie justement parce que le postulat de la covariance vient exprimer un concept plus profond d’objectivité, en la pensant non par rapport aux particularités de l’intuition sensible d’un sujet épistémique déterminé, mais par rapport à l’idée de la totalité des points de vue possibles et à ce que, dans la variation arbitraire de ces points de vue, reste cependant invariable. Cet invariant n’est pas un autre point de vue, « absolu », au-delà de la multiplicité des observateurs, une espèce de système de référence privilégié, mais constitue, en revanche, la position d’un réel, en soi-même pleinement déterminé, dont le corrélat épistémique est l’intégral de ces variations possibles (connectés selon une loi de transformation) par rapport à une multiplicité ouvert de tous les référentiels possibles. Il ne s’agit, ici, d’une simple sophistication mathématique des équations qui expriment les lois de la Nature (à laquelle, par exemple, les équations de Newton ne résistent pas). Il s’agit plutôt de la mise en scène d’un concept plus puissant en ce qui concerne ce qu’on doit entendre par objet de la science de la Nature. Ce nouveau concept, s’il nous libère, comme Cassirer le dit, de l’image anthropoforme du monde, construite dans l’élément de la représentation sensible immédiate, est, de l’autre côté, un développement nouveau du principe kantien de l’objectivité en tant que corrélat de « l’unité synthétique » d’un divers d’intuitions possibles. Dans l’interprétation de Cassirer, la covariance répond à l’idée kantienne de l’unité de la Nature, de la détermination univoque – « objet » est, ici, le résultat d’une synthèse que se réalise par rapport à la diversité des observateurs possibles et qui pose comme unité un réel en tant qu’invariant de cette variation. Ce
concept nouveau au sujet de l’objectivité physique ne se rapporte pas à quelque chose d’immédiatement donné dans une expérience empirique particulière, mais il est capable d’exprimer quelque chose comme une loi de la Nature uniquement en faisant varier arbitrairement les coordonnées spatiales et temporelles de l’expérience immédiate et en fixant un invariant en tant que règle de transformation de toutes les coordonnées possibles. En ce sens, comme Cassirer le remarque, qu’une « loi » soit un tel invariant pour toutes les transformations arbitraires de coordonnées, cela est certainement une proposition analytique, mais qu’il y a en général de telles lois, que l’entendement doive chercher la forme de l’invariance pour exprimer une connaissance d’objet, cela est une exigence synthétique, c’est à dire, un principe constitutif que l’entendement prescrit pour l’interprétation des phénomènes naturels – « Nous pouvons seulement désigner comme lois de la Nature, c’est à dire, leur attribuer universalité objective, ces relations dont la forme est indépendante de notre mesure empirique, du choix spécifique des quatre variables x₁ x₂ x₃ x₄ qu’expriment les paramètres d’espace et de temps. En ce sens, le principe de la relativité générale, selon lequel les lois de la Nature ne changent pas par une transformation complètement arbitraire des variables spatio-temporelles, peut être entendu comme une affirmation analytique, comme un éclaircissement de ce que nous devons entendre par une loi « générale » de la Nature – synthétique est, pourtant, l’exigence qu’il doit y avoir, en général, de tels invariants ultimes. » (p. 39)

Disons, cependant, que ce postulat de l’invariance peut seulement être interprété de façon kantienne au prix d’une profonde réinterprétation de Kant lui-même. L’unité de la Nature, ou le principe de la « détermination univoque », surgit en tant que corrélat non pas d’une subjectivité transcendante qui doit opérer la synthèse par rapport à ce que lui est donné dans l’intuition empirique, comme si les mesures d’espace et de temps étaient des données absolues, invariantes pour tout sujet épistémique, à subsumer simplement sous les conditions catégorielles, logiques, de la représentation objective, mais le sujet transcendantal est le lieu de droit pour la formulation de lois qui, en étant généralement covariantes, doivent non seulement faire abstraction de la particularité de l’intuition sensible, mais aussi soumettre dorénavant la forme esthétique elle-même (c’est à dire, la théorie des grandeurs d’espace et de temps) aux exigences logiques de la représentation objective. On ne va pas de l’esthétique à l’analytique ; au contraire, la
théorie des formes esthétiques doit être déjà une fonction de la théorie catégorielle de la pensée objective.

Cette subordination de l’esthétique à la logique transcendantale est, d’ailleurs, une des vertus majeures de l’école de Marburg et un ferme héritage que Cassirer prend de Cohen et de Natorp. Essayons quelques pas en avant, autrement et au-delà de la stratégie purement défensive de Cassirer, bâtie sur la distinction entre enquête transcendantale sur l’espace et le temps pur (celle de Kant) et théorie empirique de la mesure de l’espace et du temps physiques (celle de Einstein), stratégie qui se heurte à l’objection évidente que la théorie kantienne de l’espace et du temps, qui est aussi une théorie de l’espace et du temps en tant que déterminations de l’objet empirique, est inapplicable à la nouvelle physique, organisé autour d’une théorie de l’objectivité physique qui fait appel à une doctrine de l’espace-temps (non de l’espace et du temps) et à la métrique tout à fait nouvelle qui en résulte.

7. Problèmes pour une esthétique

Quelles que soient les lois empiriques que la connaissance de la Nature peut établir, le postulat de la covariance, interprété comme un principe transcendantal constitutif regardant la forme de toute loi possible (la natura formaliter spectata), demande à l’esthétique une théorie de l’espace, du temps et de la détermination spatio-temporelle des phénomènes qui soit compatible avec le principe suivant : bâtir une théorie de l’espace-temps, en tant que grandeur mathématico-physique, tel que les phénomènes empiriques puissent être univoquement localisables pour tout changement arbitraire des coordonnés qui s’enracinent en la position particulière d’un l’observateur. C’est cette localisation univoque des phénomènes qui permettra la forme covariante des lois de l’« entendement. » Le problème de l’esthétique serait, ainsi, le problème (déjà kantien) de l’individuation par rapport à l’espace-temps ou de l’espace-temps en tant que conditions de possibilité de l’individualisation en général.

Cela exigera :

1. Un changement en profondeur des concepts fondamentaux de l’esthétique. On doit, en premier lieu, substituer la théorie kantienne et newtonienne de l’espace et du
temps, laquelle est, en vérité, une théorie de l’espace à travers le temps, par une théorie de l’espace-temps en tant que continuum quadridimensionnel. Kant lui-même a donné quelques pas hésitants dans la direction d’une unité de ces deux représentations. D’un côté, il a soutenu que la représentation de l’espace, en tant que condition du sens externe, est dépendante de la représentation du temps, en tant que forme du sens interne. De l’autre côté, surtout a propos de la « réfutation de l’idéalisme », il a aussi soutenu, par contre, que la détermination de temps (c’est-à-dire, la conscience empiriquement déterminée de ma propre existence) est seulement possible par rapport à un permanent donné dans l’espace. Du croisement de ces deux arguments, qui vont en directions opposées, on sera tenté de conclure qu’espace et temps sont des représentations co-originaires, qui s’impliquent mutuellement. Kant ne suggère pas, cependant, que les représentations de l’espace et du temps s’entremêlent dans la représentation unitaire et seulement concrète de l’espace-temps. La théorie des formes du sens interne et externe offre une origine différente pour chacune de ces représentations. Elles sont séparées – il y a le temps et l’espace, et chacune de ces représentations a une unité propre en tant que représentation singulière. Malgré cela, si on regarde du côté des objets de la Nature, donnés dans une intuition empirique, on voit les déterminations d’espace et de temps se superposer : tout objet dans l’espace est donné à un moment du temps et tout moment du temps est donné par l’entremise d’un objet dans l’espace, d’une façon telle que l’expérience des objets physiques ne nous donne aucunelement l’espace et en plus le temps, mais l’union des deux, c’est-à-dire, quelque chose comme la grandeur une et unique de l’espace-temps. En deuxième lieu, par rapport aux points de l’espace-temps, qui se définissent par des coordonnées spatiales et temporelles, on aura dans le concept d’événement le premier concept concret de l’esthétique. « Evénement » désigne non pas seulement ce que remplit un espace, mais quelque chose qui a lieu ou qui arrive dans l’espace-temps. Afin de donner les coordonnées d’un événement, on doit parler unitairement de sa localisation spatio-temporelle. A propos de ce que remplit l’espace et le temps dans une intuition empirique, Kant parle simplement de Erscheinung, c’est à dire, d’apparition. On doit penser l’apparition comme événement et redéfinir l’esthétique. La théorie des conditions de possibilité de l’intuition d’objets en général deviendra une théorie des conditions de possibilité de la localisation spatio-temporelle univoque des événements pour tout observateur possible.
2. *Une réélaboration de la métrique de l’espace-temps.* On a le concept géométrique de « distance » entre deux points de l’espace. En ce qui concerne la grandeur mathématico-physique (pas simplement « géométrique ») de l’espace-temps, le concept de « distance entre deux points » implique non seulement une valeur différente de zéro pour les variables spatiales, mais aussi une valeur différente de zéro pour la variable temporelle. Si on pense géométriquement la distance entre deux points, on considère tous les points de l’espace comme donnés dans le même instant. Par contre, le concept mathématico-physique d’espace-temps implique que la distance entre deux points soit à la fois spatiale *et* temporelle. En pensant à un parcours unissant deux points de l’espace-temps, nous devrons spécifier, donc, combien d’espace en combien de temps nous permettra d’arriver au deuxième point en partant du premier. On doit, ainsi, parler d’une vitesse (d/t) pour définir la translation d’un point A sur un point B et, en particulier, on peut faire la supposition d’une vitesse maximale, V. Si, au contraire, on admet que V peut s’accroître à l’infini, on arrive au concept d’une connexion entre deux événements à distance dans un temps égal à zéro, c’est-à-dire, on obtient les concepts de simultanéité absolue entre deux événements à distance et d’une connexion qui se fait dans l’instant. En un mot : on arrive aux conjectures de Newton et de Kant. Mais, comme Minkowski l’a bien souligné, la supposition selon laquelle $V = \infty$ est « moins intelligible » que l’hypothèse selon laquelle $V = c$, « c » étant une quantité finie qu’on doit définir expérimentalement. Par ailleurs, les équations de la mécanique de Newton ne sont pas invariantes pour toutes les transformations arbitraires de coordonnées spatio-temporelles. Si, en conformité avec les exigences « logiques » de l’invariance pour les lois de la Nature, on admet la supposition « plus intelligible » selon laquelle la « distance » (on parlera d’« intervalle ») entre points de l’espace-temps implique que V soit finie et la même pour tous les observateurs (en dépit de son état de mouvement relatif), on obtiendra par-là la relativité de la simultanéité et les effets relativistes de la « dilatation » du temps et de la « contraction » de l’espace pour observateurs en mouvement les uns par rapport aux autres. En un mot, on retrouvera la structure mathématique de l’espace-temps de Minkowski.
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1 See Hua X, „Einleitung des Herausgebers,” p. XIV.


Lorentz transformations alter Galileo’s transformations by adding a factor \( \gamma = \left(1 - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \). Thus, their formulation is: \( x' = \gamma(x - vt) \); \( y' = y \); \( z' = z \); \( t' = \gamma(t - \frac{v}{c^2}x) \), supposing that \( x \) is the direction of the movement and \( t \) the proper time in the inertial frame admitted at rest. The equations of special relativity are only valid for systems in rectilinear and uniform motion.

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In fact, for a particle moving at the speed of light, the Lorentz equation “explodes,” gives infinity and ceases to have a determinable physical meaning. This is the infinite result for the proper time of the particle that we have interpreted as “stop” in time to the extent that the decrease in the pace of time can be understood as an inverse function of the increase in speed which tends towards the 0 limit.

“Die Anschauungen über Raum und Zeit, die ich Ihnen entwicklen möchte, sind auf experimentell-physikalismem Boden erwachsen. Darin liegt ihre Stärke. Ihre Tendenz ist eine radikale. Von Stund an sollen Raum für sich und Zeit für sich völlig zu Schatten herabsinken und nur noch eine Art Union der beiden soll Selbständigkeit bewahren.” Hermann Minkowski – „Raum und Zeit.” Conference given at the 80th Congress of German Naturalists and Doctors in Cologne, in September 1908, published in 1909 and re-published many times. We have followed here the edition Das Relativitätsprinzip. (Darmstadt, 1974), pp. 54-71. Let us mention briefly that Minkowski, the first to fully treat the ideas of special relativity mathematically, had been Einstein’s teacher at the Federal Institute of Technology in Zurich.

“Einsteins Umwälzungen betreffen die Formeln, in denen die idealisiert und naiv objektivierte Physis behandelt wird. Aber wie Formeln überhaupt, wie mathematische Objektivierung überhaupt auf dem Untergrund des Lebens und der anschaulichen Umwelt Sinn bekommt, davon erfahren wir nichts, und so reformiert Einstein nicht den Raum und die Zeit, in der sich unser lebendiges Leben abspielt.” Hua VI, p. 343.

The famous statement of Beilage XXVIII of Krisis – „Philosophie als Wissenschaft, als ernstliche, strenge, ja apodiktisch strenge Wissenschaft – die Traum ist ausgeträumt” (Hua VI, p. 509) – does not mean a retraction by Husserl of his philosophical project but rather a bitter view on the misfortunes of German philosophy in 1935.


Somit steht, von diesem Gesichtspunkte aus, die Rationalität der exakten Wissenschaften in einer Reihe mit der Rationalität der ägyptischen Pyramiden.” Hua VI, p. 343.

Diese Ursprungsfrage ist aber auf die primitiven gestaltungen des Zeitbewusstseins gerichtet, in denen die primitiven Differenzen des Zeitlichen sich intuitiv und eigentlich als die originären Quellen aller auf Zeit bezüglichen Evidenzen konstituieren.” Hua X, p. 9.


Husserl’s commentary on page 424 of Sein und Zeit speaks for itself with regard to this profound difference of intention: „Als ob die „vulgäre” Zeitaufassung nicht ihr ursprüngliches Recht hätte, das durch die konstitutive Analyse nicht im mindesten verschwindet.”
The contrast between the diagnostic of “crisis” of the sciences that we find in Husserl is, for this reason, rather different from that that is announced in §3 of *Sein und Zeit*. The word of order is not, here, that of a *foundation* of the sciences in the offerings of the constitutive transcendental subjectivity by return to the founding stratum of *Lebenswelt*, but that of a *refoundation* that leads them openly to *Seinsfrage* (see *Sein und Zeit*, §3, pp. 9-11). Only Psychology needs, for Husserl, an effective refoundation, but this is precisely due to its naturalist approach to transcendental subjectivity.


28 “Der Verfasser ... stellt sich die Aufgabe ... eine Brücke von der Phänomenologie zur heutigen Mathematik und Physik zu schlagen.” Idem, p. 386.


30 In particular, H. von Helmholtz – „Über die thatsächlichen Grundlagen der Geometrie,” in Wissenschaftliche Abhandlungen, II (Leipzig, 1883, pp. 610-617), „Über den Ursprung und die Bedeutung der geometrischen Axiome,” in Vorträge und Reden ((Braunschweig, 1884, pp. 1-34), and „Zählen und Messen erkenntnistheoretisch betrachtet,” in Philosophische Aufsätze. Eduard Zeller zu seinem fünfzigjährigen Doctor-Jubiläum gewidmet (Leipzig, 1887, pp. 15-52), the latter two were in Husserl's private library, and the former was quoted by Husserl in his 1887 dissertation on the concept of number. By the 90th of the XIX century, Husserl was a severe critic of Helmholtz doctrines. Nevertheless, he acknowledges, later on, some merits in Helmholtz positions.


33 „Ich habe mir daher zunächst die Aufgabe gestellt, den Begriff einer mehrfach ausgedehnten Grösse aus allgemeinen Grössenbegriffen zu construiren. Es wird daraus hervorgehen, dass eine mehrfach ausgedehnte Grösse verschiedener Massverhältnisse fähig ist und der Raum also nur einen besonderen Fall einer dreifach ausgedehnten Grösse bildet.” Riemann, o. c., p. 272.

34 On this issue, we have closely followed the overall account of François de Gant – Husserl et Galilée. Sur la crise des sciences européennes (Paris: Vrin, 2004), pp. 155 and following.

35 See, for example, the 1891-2 manuscript of „Mengen und Mannigfaltigkeiten,” Hua XXI, pp. 92-105.

36 „Durch bloss formale Determinationen kommen wir von ... Mannigfaltigkeit niemals zu Raum.” Husserl an Natorp, 14/15-III-1897, Briefwechsel, B. V, p. 54.
Ein vorzügliches Beispiel hierfür bietet uns die berühmte Riemann-Helmholtzchen Raumtheorie. Die Methode, die sie zur Lösung der an die Axiome der Geometrie sich anknüpfenden Prinzipienfragen für ausgezeichnet geeignet hält und auch verwendet, ist die analytisch-rechnernde. Helmholtz rühmt wiederholt als den besonderen Vorzug der analytischen Geometrie, dass sie mit reinen Größenbegriffen rechne und zu ihren Beweisen keine Anschauung brauche. ... Indessen, hier erheben sich alsbald schwere Zweifel. Setzt nicht auch die analytische Methode in der Geometrie gewisse Anschauungstatsachen voraus? ... Beruht denn nicht das bekannte Grund- und Hilfsmittel der analytischen Geometrie ... auf Eigentümlichkeiten unserer Raumvorstellung ...? Es ist offenbar, dass wir nicht etwa im Zirkel geführt werden – wie dies nach meiner Überzeugung bei der Riemann-Helmholtzschen Theorie tatsächlich der Fall ist. ... Das erste ist aber der Begriff der Zahl."

See „Fragen einer Philosophie des Raumes,” Hua XXI, pp. 262 and following, and the planes of the Raumbuch, idem, pp. 402 and following.

The whole Husserlian argument will take the general direction of showing how non-Euclidean geometries already presuppose Euclidean Geometry. It is very likely a mistake, and a mistake in which Husserl is not alone. His contemporaries Alois Riehl (Die philosophische Kritizismus und seine Bedeutung für die positive Wissenschaft, Leipzig, 1879), Cristoph von Sigwart (Logik, vol. 2 “Methodenlehre,” Freiburg, 1893) and Hans Cornelius (Transzendentale Systematik, 1916) were equally wrong.

„Sollen wir nun die Probleme bezeichnen, die in eine Metaphysik des Raumes gehören, so sind etwa folgende: Hat der raum unserer Vorstellung einen metaphysischen Wert, d. h. entspricht ihr in dem etwa zu supponierenden transzendenten Sinn ein Wirkliches oder nicht?.” Hua XXI, p. 266.

„Nennen wir Raum die bekannte Ordnungsform der Erscheinungswelt, so ist natürlich die Rede von „Räumen,” für welche z. B. Das Parallelenaxiom nicht gilt, ein Widersinn.” Hua XVIII, p. 252. This passage from Prolegomena is revised in a letter to Natorp, in which Husserl’s comes closer to the Helmholtz position: „Ich gesteh (gegen meine frühere Überzeugungen) die Möglichkeit anderer Raumanschauungen zu, die zu anderen idealisirten geometrischen Räumen führen und ihres logisches Gefüge in anderen reinen Mannigfaltigkeiten bekunden würden.” Husserl an Natorp, 7-IX-1901, Briefwechsel, B. V, p. 83.

43 Auf diesem Thema vgl. Oskar Becker’s Entwicklung, o. c., S. 457 und folgender.


consciousness of duration and individuality of the subject of duration, with alteration and inalteration; pp. 50-51 – Alteration and objectual unity, ordering of the presentified time in the single time; pp. 52-53 – Inquiry: how are transcendental temporal objects constituted? How is objective time and succession constituted? Return of objective temporality to phenomenological temporality of immanent content; pp. 54-57 – Not found; pp. 58-59-60-61-62 – Constitution of the objective temporal position from the retroaction towards the past, a priori laws of objective time.


47 „Objektive Zeit und subjektive Zeitmodalitäten (Orientierung). Wichtige zeitontologische Axiome.” Hua XXXIII, p. 181.

48 „Wir scheiden die Zeit selbst (und ihre jeweilige Zeitfülle ...) und die Gegebenheitsweisen der Zeit.” Hua XXXIII, p. 181.

49 „Die Zeit in sich selbst ist nicht gegenwärtig und war nicht und wird nicht sein. ... Von der Zeit überhaupt als totum gilt: Sie ist „immer” gegenwärtige ....” Hua XXXIII, p. 181.

50 „Die Zeit und ihre Gegenstände fließen nicht, sie sind und das Sind ist starr.” Hua XXXIII, p. 182.

51 „Der Zeitfluss ist nicht der Fluss der Zeit, sondern der gegebenheitsweisen der Zeit und ihrer Gegenstände. Aber entstehen und vergehen nicht Gegenstände in der Zeit? ... Objektiv in der starren Zeit bestehen starre mathematische Funktionalitäten, die wir „mathematische kausalität” nennen. Der Vogel fliegt: Eine bestimmte Zeitstrecke der objektiven Zeit ist so und so objektive erfüllt .... Aber in die objektiven Zeit ist diese erfüllte Strecke starr. Und Veränderung in der objektiven Zeit darf nicht verwechselt werden mit den „Fluss” der gegebenheitsweisen, in denen jedes Zeitliche für das Subjekt „erscheint.” Die Erscheinung einer Veränderung ist ein ständiger „Fluss,” aber die objektive Veränderung ist ein starres Sein, eine starre Zeitstrecke, ausgefüllt mit so und so verteilen identischen Zeitfüllen.” Hua XXXIII, pp. 182-3. This Husserlian description of objective time is not immediately the constitution of a
time of the world. It is also valid, as the text goes on to add, for immanent time itself: „Das gilt zunächst für die phänomenologische Zeit mit ihren phänomenologischen Vorgängen; ... Aber immer haben, oder vielmehr notwendig, zweierlei: das Sein selbst und die wechselnden und dabei a priori eigentümlich 
gearteten Gegebenheitsmodi dieses objektiven Seins.” Idem, p. 183.

52 “The objective world simply is, it does not happen. Only for the gaze of my consciousness, crawling 
upward along the lifeline of my body, does a section of the world come to life as a fleeting image in space 
which continuously changes in time.” H. Weyl – Philosophy of Mathematics and Natural Science. 

53 „Gottes unendliches Bewusstsein umfasst alle Zeit „zugleich.” Dieses unendliche Bewusstsein ist 
unzeitlich. ... Für ihn gibt es kein Vergangen, Gegenwärtig und Künftig. ... Die Zeit ist die Form des 
unendlichen Bewusstseins, als unendliche adäquate Wahrnehmungsreihe. Von Stande eines bestimmten 
Jetzt a – j – b ist a vergangen, in Relation zu a ist j künftig, ebenso b. Das göttliche Bewusstsein ist das 
ideale Korrelat der objektiven Zeit und der objektiven Welt und Weltentwicklung.” Hua X, p. 175.

54 „Die Wahrnehmung ist die Apperzeption, wodurch der Gegenstand als selbst da und jetzt gegenwärtig 
erscheint.” Hua X, p. 173.

55 „Wie steht es mit der Schichtung, dem Begriffe der Gleichzeitigkeit? Der Glaube an ihre objektive 
Bedeutung beruht ursprünglich zweifellos darauf, dass jedermann mit voller Selbsverständlichkeit die 
Dinge, die er sieht, in den Zeitpunkt ihrer Wahrnehmung setzt. So dehne ich meine Zeit über die ganze 
Welt aus.” Weyl – Philosphie der Mathematik und Naturwissenschaft (München: Oldenbourg Verlag, 

56 „Mit welchem Recht kann man sagen, dass Wahrnehmung und Wahrgenommenes gleichzeitig sind? 
Für die objektive Zeit – in der naiven Einstellung – stimmt es nicht, denn es ist möglich, dass im 
Zeitpunkt der Wahrnehmung das wahrgenommenes Objekt gar nicht mehr existiert (Stern); von diesem 
Standpunkt wird man sogar sagen müssen, dass die Zeitpunkte der Wahrnehmung und des 

57 „Einheit der Welt – Jetzt = Einheit einer Gesamtwahrnehmung, welche alles Jetzt in der Weise der 
Jetztwahrnehmung umfasst. ... Doch wird man sagen müssen: Jede adäquate Jetztwahrnehmung setzt ein 
absolutes Jetzt, und innerhalb der Gruppe adäquater Wahrnehmungen besteht nur der mögliche
Unterschied, dass irgendeine Teilgruppe \( \forall_1 \ldots ;_1 \) in einer einzigen Jetztwahrnehmung vereinbar ist, ebenso \( \forall_2 \ldots ;_2 \) während die Glieder verschiedener Gruppen im allgemeinen unverträglich sind. Wo ein einzelnes Glied verschiedenen Gruppen angehört, da dauert es. Die verschiedenen Gruppen selbst bilden die zeitliche Folge, die Jetzt bilden eine stetige Folge.” Hua X, p. 174.


60 This is, however, the thesis of the First Investigation that invokes the principle of Schrankenlosigkeit der objektiven Vernunft to argue for the thesis of a substitution, ideally possible, of all subjective and occasional expressions by as many fixed and objective expressions. In relation to time (and space), this means that the modes of temporal orientation can be surpassed by univocal determinations of time that are independent from them: „Was in sich fest bestimmt ist, das muss sich objektiv bestimmen lassen, und was sich objektiv bestimmen lässt, das lässt sich, ideal gesprochen, in fest bestimmten Wortbedeutungen ausdrücken. ... Aber von diesem Ideal sind wir unendlich weit entfernt. Man denke nur an die Mangelhaftigkeit der Zeit- und Ortbestimmungen ... Gleichwohl will mir scheinen, das z. B. auch jede Orts- und Zeitbestimmung, der idealen Möglichkeit nach, das Substrat einer ihr zugehörigen Eigenbedeutung werden kann.” Hua XIX/1, pp. 95-9, with text from the first edition.

61 See Kurt Gödel’s claim of phenomenology as the only possible philosophy of mathematics, in the following terms: „Nun gibt es ja heute den Beginn einer Wissenschaft, welche behauptet, eine systematische Methode für eine solche Sinnklärung zu haben, und das ist die von Husserl begründet Phänomenologie” (“The modern development of the foundations of mathematics in the light of philosophy,” 1961, in Kurt Gödel Collected Works, Volume III. Oxford: Oxford University Press, 1985. The text of this quotation is on p.382). Gödel, who freed mathematics from the formalist and logicist programmes
finds in the phenomenological procedure of *Sinnklärung* the way to an effective foundation of mathematics. Husserl’s thinking, which he studied closely from the late 1950s, allowed him to combine two essential things: first, it offered him a sophisticated way to be realistic in respect to mathematical beings, and second, it restored the rights of intuition. Gödel’s views on Einstein’s general theory of relativity, and the philosophy of time, in particular Kant’s, and laterally Husserl’s as well, are another area of crucial interest. It does not, however, fit within the limits of this work.

62 “Between the two [Mach and Kant] remains standing the empiricist view, according to which these constitutive principles are either *hypotheses* or *conventions*; in the first case they are not *a priori* (since they lack apodeicticity), and in the second they are not synthetic. […] A thinker who in general perceives the unavoidability of constitutive principles for scientific experience should not yet on that account be designated a critical philosopher. An empiricist can, for example, very well recognize the presence of such principles; he will only deny that they are synthetic and *a priori* in the sense described above.”


63 “It is this process of a dissolution of the *synthetic a priori* into which we must incorporate the theory of relativity, when we desire to judge it from the viewpoint of the history of philosophy.” Reichenbach – “The Philosophical Significance of the Theory of Relativity”, in *Albert Einstein. Philosopher-Scientist*. La Salle, Illinois: Open Court Publishing Company, 2000 (Third edition), pp. 307-308.


Para Cassirer, tudo se passa como se os “conceitos” (o uso do termo “conceito” é, aqui, plenamente intencional) de espaço e de tempo dessem a base para duas séries de investigações paralelas. A primeira, propriamente transcendental, exporia o espaço e o tempo *puros* enquanto formas universais de objectivação segundo as relações de ordem da sucessão (*Nacheinander*) e da justaposição (*Nebeneinander*). O seu ponto fundamental seria um princípio absolutamente geral relativo às condições que permitem, para o conhecimento, ter algo como um *dado* a submeter às condições lógicas da consciência de objecto: “A coordenação sob o ponto de vista do ser-em-comum e da justaposição, ou sob o ponto de vista da sucessão: isto é o que ele [Kant] entende sob [a designação de] espaço e de tempo enquanto ‘formas da intuição’.” (p. 77) A segunda linha de investigação, de natureza físico-empírica, seria uma “aplicação” do sentido puro desses conceitos às condições empíricas concretas, e determinaria as leis de transformação das medidas espaciais e temporais entre acontecimentos para observadores em qualquer tipo de movimento relativamente uns aos outros (seja uniforme, seja acelerado). Que o teórico do conhecimento “não possa admitir a afirmação de que o sentido de um conceito coincide com a sua aplicação concreta”, que ele deva reconhecer que, “ao contrário, este sentido deve já estar firmemente estabelecido para que qualquer aplicação se possa iniciar” (p. 80), é o que garante, para Cassirer, a independência da teoria transcendental do espaço e do tempo puros, enquanto formas universais de toda experiência possível, relativamente à determinação, toda ela empírica, da métrica do espaço e do tempo *físicos* que as teorias de Newton ou de Einstein estabelecem. A doutrina de Kant fica assim protegida no seu núcleo fundamental, mas ao preço de se tornar quase vazia e inaplicável à nova física.