

KAREN GLOY

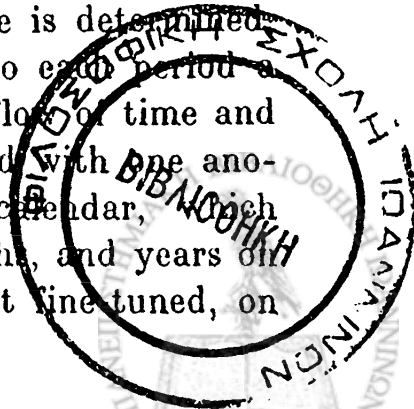
## TIME AND NUMBER

### 1. *Morphology of time*

On the tympanum over the portals of medieval churches, and also in the illustrated manuscripts of the Middle Ages, one frequently sees a globe, symbolizing the universe, and enthroned on it, God as Pantocrator, holding a compass in his right hand to measure the world, and underneath the following bible quotation from *Sapientia* 11, 21:

«But you have put everything in order — with measure, number, and weight».

In later secularized depictions one finds instead of this, the Renaissance master-builder of the world with compass, ruler, protractor, sundial and watergauge, the geometrical forms of which are reflected in the heaven's astronomical constellations, the same way as they are on earth in the buildings of man, so that there is an analogy between the natural and the artificial world. Under «measure» in the *Sapientia*-text the geometric as well as the chronometrical measures are understood. The text thus expresses the total dominion that mathematics holds, with its various disciplines of geometry, chronometry, arithmetics, and proportions as well as weight — over the whole universe. The correlation between spatial and temporal measure and number (weight can be disregarded in this context) referred to here is so characteristic of our Western way of looking at things that it cannot be imagined without it: Time is determined that is to say measured by numbers, by attaching to each period a number in a successive sequence so that the infinite flow of time and the infinite progression of natural numbers correspond with one another. This becomes evident in the divisions of the calendar, loads hours on hours, days on days, months on months, and years on years. This is the same principle of construction, but fine tuned, on



which our clocks are based, where we attach to each rotation of the large hand a consecutive count of one hour, for each rotation of the small hand, one of a minute. As a matter of course, we start with the premise that distances of time, which are periodically repeated over and over again, can be imprinted with the structural characteristics of the linear consecutive numerical progression. This is a result of a long development of mankind in observing and thinking. Especially it calls for a specific understanding of time and numbers, but this comes to mind only rarely, because time has at the beginning nothing to do with numbers in our original psychic experience.

I shall attempt to put in order the various concepts of time under the general theme of the relation between time and numbers, in the form of a morphology constructed of stages, that is to say in a constitutional theory. In doing so, three stages must be distinguished which are stacked one on top of the other, these stages are the result of increasing homogeneity and accuracy: The lowest stage consists of the subjective experience of time, as recorded by psychology and psychiatry. It shows no relation at all to numbers or countability. Built up on this base, there is a time of action taken from practical life, which allows for orientation and topology. This «Gestalt» - theoretical concept of time brings about a first relation to numbers, by means of a different meaning from the one it is commonly understood to have today. Thirdly an uppermost stage, the homogeneous, geometric, mathematical time, which is the base of theoretical studies and the sciences and has an explicit relationship to numbers, namely to the interpretation of the progression of numbers. Moreover, I intend to bring these three levels in relation with already developed time models of the metaphysical, ontological, cosmological, and religious kind: in a first stage, with the time experience of mysticism as encountered in all religions, in a second stage, with the eschatological experience of time, having its origin in the Jewish - Christian culture, and in a third stage with the cyclical time experience, which was formed in the antique cosmology as well as with the linear time, belonging to the modern, Newtonian physics.

## *2. The experience of time*

Usually we think that our subjective, private, inner experience of time is congruent with the objective, public, external time, the



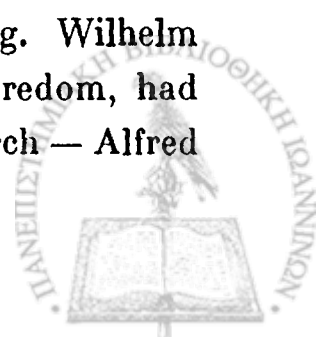
clock or world time We think that even with our eyes closed, in darkened rooms, even in caves, when we are deprived of the perception of the changes between day and night, and when we no longer sense any other rhythms, we perceive an awareness of time which is synchronous with objective, measurable events. Experiments with persons confined underground, however, document the opposite, namely an increasing deviation of the subjective feeling of time from objectively measurable events, and the creation of an individual rhythm.

Moreover, many observations and experiments with mental patients and emotionally disturbed persons, with persons in extreme situations as well as persons under the influence of drugs or poisonous substances, prove that the subjective experience of time and the objective measure of time not only differ significantly from one another, but have in fact nothing at all to do with each other. The experience with persons with psychical ailments also explains the normal, everyday experience of time of the healthy, whereby in the abnormal condition, the outlines of the normal experience are more clearly defined.

The subjective inner experience of time appears in two basic variations: either as a slowing down or as an acceleration, also known as the slow-motion and the quick-motion phenomena. Their extremes are the suspension of time and the widening to space.

The slow-motion or stretching phenomenon of time is known most of all in boredom. It occurs due to a lack of environmental influences, in the absence of interesting encounters, experiences, conversations, or a cessation of diversions. If a speech or a lecture is long-winded, dull or boring, a train journey uninteresting for want of someone to talk to, or a day unfulfilled due to a lack of work or diversion, then time is stretching. Minutes become hours, hours become an eternity, time does not seem to progress. On the contrary, it seems to stand still and drag on endlessly. One fidgets on one's chair, would like to jump up and run away, and because time does not seem to end, one would like to kill time.

Whereas psychological research believed earlier (e.g. Wilhelm Wundt) that the slow-motion of time, as observed in boredom, had its origin in an insufficiency of stimulation, newer research — Alfred



Hoche<sup>1</sup>, Friedrich Panse<sup>2</sup>, Hermann Schmitz<sup>3</sup> — have proved, in many observations, that stow-motion time can also occur despite a wealth of stimulation. This is well known in the case of a candidate failing an examination. In this situation, the candidate is overwhelmed with stimulation. All sorts of thoughts pass through his or her mind, possible solutions negate each other without ever being put in concrete form, the awkward situation does not seem to end, minutes become an eternity for the candidate.

Somewhat similarly, but by far more pleasant, is the situation when a boyfriend impatiently waits for his girlfriend, who is somewhat late for a date — and the minutes turn into an eternity for him.

The opposite phenomenon of slow-motion time is diversion, which is present when one has spent an eventful holiday, has experienced a lot of new impressions during a sight-seeing tour, or met old acquaintances and exchanged stories about one's school days or days as a student. Then one says that time passed in a flash, or one does not know where time went.

The most extreme counter phenomenon to time in slow-motion is the quick-motion of time, as it is known in borderline situations. This phenomenon was first observed by mountain climbers in falls and was confirmed in other extreme situations, such as in airplane crashes, in drownings, in the collapse of buildings during bombing raids, etc.

Characteristic for these situations where a person faces imminent death, is the review of life. Within seconds, or even fractions of seconds, the whole life passes review, and unwinds with tremendous speed, in clear and distinct pictures, in front of the inner eye.

In the event of an aura, the phase preceding an epileptic seizure, such time experiences are also reported. One of the best known descriptions is the so-called Allah legend, which Dostojevsky refers to in his novel «The Idiot» (compare also «The Possessed») which takes place during the course of an epileptic seizure of Count Myshkin. It tells of Mohammed's flight through the dwelling places of Allah. In doing so, he saw all the heavens and all the hells and had

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1. A. Hoche: *Langeweile*, in: *Psychologische Forschung*, Bd. 3 (1923), S. 258-271.

2. F. Panse: *Angst und Schreck in klinisch-psychologischer und sozialmedizinischer Hinsicht*, Stuttgart 1952, p. 121-131 (Ch. 13).

3. H. Schmitz: *System der Philosophie*, Bd. 1, Bonn 1964, p. 354 ff.



90,000 long discourses. When an angel brought him back to his tent, the water in the jar that he had overturned when he left, had not been spilled. The water spilling from the jar provides the objective measure of time as compared with the compressed subjective abundance of the time experience.

The outermost frontiers of time slowing down and time accelerating are the suspension of time (time standing still) and the perpetuation of time, the extension of the instant to the fixed present, to the *nunc stans*. They are linked to existential narrowing and existential expansion, the first in the case of severe depressions and the latter in mania, ecstasy, rapture, and extraordinary religious states. In the case of severe depressions, when only sorrow, despair, unspeakable fear, and hopelessness prevail, when all sinks into a void, when the self becomes petrified, and as a result loses its capability to experience time, there is neither past nor future for the patient, but only emptiness, an endless present. Time stands still, it does not move anymore, it freezes.

In the opposite case, in the so-called congealed mania, in rapture and ecstasy, the cessation of time is combined with an enormous feeling of happiness, with the levitation of the body, with light and brightness, with an immense existential expansion. The present becomes the permanent state of existence; the instant becomes the break-up point into eternity. For this situation, there is a famous literary testimony, namely Goethe's «Faustus». At the end of his life, when Faustus has the vision of a country wrested from the sea, tilled by happy people, he states:

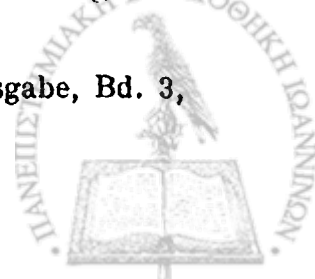
«Im Vorgefühl von solch hohem Glück  
Genieß' ich jetzt den höchsten Augenblick<sup>1</sup>.

(«In anticipation of so much joy, I now enjoy the most supreme of moments»).

Here, the instant as the break - up point into abundance and eternity becomes the Epiphany of the eternal present.

With these last explanations it must have become clearer that the experience of time standing still, in which time widens to space and coincides with it, belongs to the mystic experiences, as they have been sought after and found through different ways and levels of meditation and ecstasy. The *nunc stans* describes the state of enlighten-

1. Faust II, verse 11585 f, in: Goethes Werke, Hamburger Ausgabe, Bd. 3, Hamburg 1949, 6. Aufl. 1962, p. 348.



ment, where all the differences in the world prove to be Maja (Presence) and everything, without exception, is one and simultaneous.

In view of the experiences of time slowing down, time accelerating and time standing still described, one cannot even say that the main characteristics of time are its flowing and its passing, because time and space have a common origin. And even more so, one may not associate numbers and countability with these subjective experiences of time.

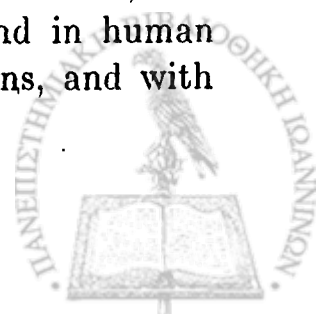
### *3. Time of action*

Distinct from the purely subjective, private experience of time, which can be experienced only by a single person at a certain moment and in a certain situation, and cannot be perceived by another person in the same manner, the time of action is intersubjectively constructed. It infers the combined efforts of many, of a social group — or even of a national entity. It comes to bear whenever a common goal is to be agreed upon or to be realized, e.g. in hunting, fishing, harvesting, in matters of courts, of councils and resolutions, etc.

Here, time is being organized, both with regard to the beginning as well as to the end of an activity.

The two cardinal questions concerning time are thereby answered, namely: «When?» and «How long?» in comparison and by relegation to references. Take the following example: When should the fields be plowed or cultivated, when harvested? When should we meet for deliberations? How long should the meeting last, etc. Answers are given with reference to spring, summer, or autumn, to the quality of the grain, its ripeness, robustness, color, to the position of the sun or the length of the shadows of the sundial, to the specification of all relevant data for decision-making, to the discussion of news, etc.

All these determinations of time presume not only change, but also the recurrence of human and natural events, the day and night rhythms, the changes of the moon, the cycle of the seasons, the process of growing, ripening and decaying in nature and in human life, the human experience with councils and resolutions, and with the settlement of legal proceedings, etc.

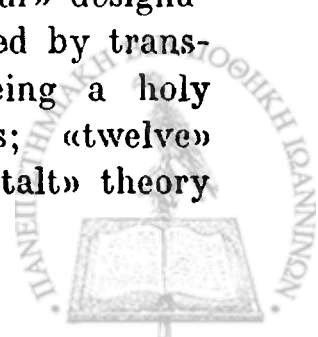


Here, we have to do with individual, though recurrent forms of time, which are connected to concrete events and processes of nature. They have a beginning and an end and a structure determined by them. They are closed, organized in themselves, unmistakable entities of time, formed by action. Like such, they are goal-oriented and purposeful, whereby their intentions, their purposes or aims determine the organization of their realization.

Thanks to the phenomenology of Husserl, Bergson and others, we have become conscious of these forms of time. Based on examples of melodies, sentences, and rhymes Husserl demonstrated that they form structured entities between a beginning and an end, insofar as the beginning, the continuation, and the end are already virtually present. This explains why when a melody like «Hänschen klein» (German folk-song for children) is interrupted, it can be completed, or an incomplete sentence can be finished correctly by anyone. Each part requires the another one and is implicated by it. Based on the structuring of the whole by a form or quality, one also refers to an «over-summation» or a «more-than-and-relation», as opposed to a mere aggregation, as a «stringing together», a mere «and-relation».

The question whether these time forms have anything to do with numbers can only be answered with yes and no. «No» meaning that there is no connection to our current series-theory concept of numbers, as established in the natural sequence of numbers, where every number is like every other number and differs from it only by its respective decimal place in such a manner that an additional homogeneous one is continuously added. The principle of absolute homogeneity and iteration prevails here.

Compared with this series-theory concept of numbers developed by Aristotle, there is an older theory, the so-called «Gestalt» - or «Form» - theory, which also forms part of Plato's theory of the natural sequence of numbers. Here, each number has its own, very specific «form», e.g. «one» being the original principle of numbers; «two» not meaning two identical units, but both together ( $\alpha\mu\varphi\omega$  in Greek); «three» symbolizing the triad of father, mother, and child or the divine Trinity of father, son, and holy ghost; «four» designating the four points of the compass which can be reached by transverse, man-made section or the quadratic; «seven» being a holy number, e.g. seven tribes, seven doors, seven angels; «twelve» the basis of the Dodecagon system, etc. What this «Gestalt» theory



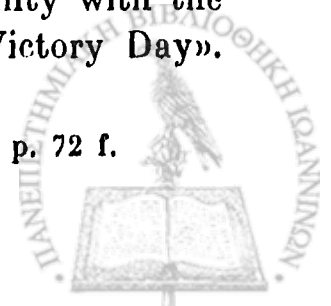
represents is clearly indicated in the example of the number five. Randomly scattered, five points are not immediately recognizable as such, immediately recognizable, however, is the grouping into a certain figure: a dice. The same holds true for the numbers four and six.

Such numbers, as conceived in the «Gestalt» - theory, would be entirely compatible with the form of time, because one could imagine that a certain sequence of events, as a concrete time unit and time entirely made up of parts, would correspond to the «All-being-one» or the concept of totality.

The fact that such forms of time, known as Eschatological time have reached paradigmatic status within the religious context and serve as the time and history models of Judaism and Christianity may be of historical and cultural interest. This holds true of the doctrine of salvation. A beginning and an end determine the Passion and Salvation through Christ, and do not indicate an arbitrary boundary, but a state of grace, an eschaton: The beginning is the divine creation, which, however, succumbed to sin. The end is the divine act of salvation, the willingness of God to redeem fallen creation. So the time between the beginning and the end is organized by both.

The difference between Judaism and Christianity is only manifested in the promised epochal event being transferred into the future (a result of which is Jewish futurism); whereas in Christianity, this event is already realized in principle — if not wholly — with Christ, the incarnation of God, because the ultimate fulfillment will be the coming of the Kingdom of God. The message of salvation describes this interim; this process directed towards the apocalyptic last days, characterized by the apostasy from God as a result of the original sin, and the atonement with Him. The question as to what happens before and after this event is mute, because this self-contained event constitutes the total concept of time and history, and beyond it, there is nothing. From this epochal message of salvation ensue the reason and the structure of the process. All that leads to this outstanding event is preparatory, prophetic, symbolic, is anticipation and premonition, and what happens after it in time is final realization, the coming of the Kingdom of God. O. Cullmann<sup>1</sup> has countered the actual resulting difficulties of Christianity with the interpretation of the eschaton by referring to the «Victory Day».

1. O. Cullmann: *Christus und die Zeit*, Zollikon-Zürich 1946, p. 72 f.





Just as during the course of a war, the decisive battle may be fought long before the actual end of the war, even if the war continues to drag on because of the resistance of the enemy, the decisive event of the redemption may already have occurred — even if the actual realization is yet to come.

It goes without saying that the Soteriological concept of time and history is a doctrine of faith and has nothing to do with the secular world history which is based on the concept of the continuation of time.

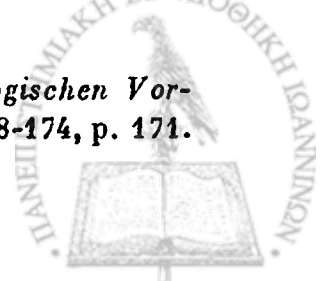
World history is conceivable only as universal history. It is, in principal, arbitrarily classifiable depending on point of view, historical situation, or observer's attitude. It is filled with events, decisions, war and peace, the rise and fall of empires, with personalities of historical significance such as Alexander, Cesar, Napoleon, Stalin, or Hitler. This secular history is criss-crossed with completely different events and personalities, which are solely relevant in the context of the doctrine of salvation, but play no role or a very minor role only, in world history. Whereas from the perspective of world history, Christ is a law-breaker, like any other to have been crucified, from the perspective of faith, he is the Redeemer; and whereas in the context of world history, he is but the founder of a new sect, for the faith he is Kyrios Christos—and Lord of all that comes to pass<sup>1</sup>. The Passion and Salvation of Christ having a closed time form with an alignment to the future, to the eschaton as the culminating point, cannot be simply integrated into the uniform, general world history which is open-ended. The two concepts of time and history are incompatible.

#### 4. *Mathematical time*

Within the framework of a morphology of time, subsequent to the second or middle stage, which is characterized by the form of time, a third, top stage is constituted, namely the homogenized, universal time — or time which can be measured: mathematical time. Mathematical time is realized by homogeneity and iteration, by taking one arbitrary form of time, which is always connected to a certain period of time, and repeating it in an arbitrary fashion. In this

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1. K. Löwith: *Weltgeschichte und Heilsgeschehen. Die theologischen Voraussetzungen der Geschichtsphilosophie*, 4. Aufl. Stuttgart 1953, p. 168-174, p. 171.



way, a single, all-inclusive time evolves, in which the iterative periods of time form the relative parts (segments, distances). Because based on the relativity of each part of the whole, the structure of the whole is repeated (and vice-versa) in each part of the parts; perfect, general homogeneity prevails: In its structure, each part is absolutely identical with the other parts and all parts are, in principle, interchangeable. Time understood this way is primarily of theoretical importance and goes far beyond any practical interest.

It is to this universal, infinite, homogeneous and continuous time that we assign numbers in our current understanding of the sequence theory. This time is arbitrarily divisible — according to the Aristotelian definition

«Divisible, in more divisible parts»<sup>1</sup>.

Each part can be arbitrarily selected and considered as a measure, a measure to which a unit is assigned. The infinite iteration of this measure leads to the infinite mathematical time as well as to the endless sequence of numbers corresponding to it.

Seen from a historical and cultural as well as sociological point of view, rather significant developments of generalizing, abstracting and referral thinking were necessary to realize the concept of mathematical time. Without any doubt, social sophistication and complexity as well as urbanization and commercialization and steadily increasing political and social integration have all contributed to this phenomenon. They all call for constantly broader common terms of reference with continuous classification standards.

The fact that two models of mathematical time have been developed, the first, a cyclical one, symbolized by the circle, which is typical for Greek antiquity and was analyzed by Plato in the *Timaios* and in the *Parmenides*; the second, a linear one, symbolized by the arrow of time, which is characteristic for modern times, most of all for classic Newtonian physics. The difference in the concepts depends on the choice of the measurement of time, which in one case is objective and given by nature, namely the planetary orbits, and in the other is arbitrary, a subjective human measurement. Of course the Platonic view, despite the rotation of time, also takes into account directness and continuity, however, the «Gestalt»-theory aspect of the rotation clearly prevails. And although the Newtonian concept

1. Aristotle: *Physics* 231 b 16: *διαμετρὸν εἰς ἀεὶ διαμετὰ*



of time is also based on the periodicity of the planets, that is to say on the hands of a clock, the continuous succession remains dominant. I would like to present these two concepts of time briefly.

The cyclical concept of time developed by Plato in the *Timaios* and the *Parmenides* is not just a simple description of the structure of time, but a cosmological theory, because it makes a connection between being, becoming, time and number. According to *Timaios* 37 d, time is defined as

[...] μένοντας αἰῶνος ἐν ἐρί κατ' ἀριθμὸν ἰοῦσαν αἰώνιον εἰκόνα

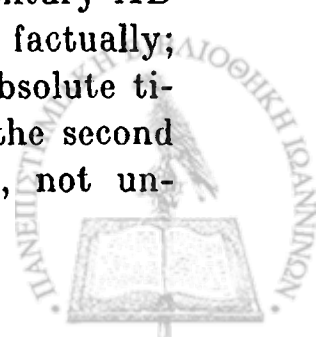
(«as a countable progressive Aionic (eternal) illustration of an Aion (eternal entity) persisting in itself»).

In this context, the definition was taken from the creation of the world mythos, according to which the divine Demiurge formed preconceived matter out of preconceived ideas and — taking pleasure from his work — bestowed time upon it to make it even more similar to the ideal.

The creation of time is meant in a metaphorical sense, because a real creation of time would fall into a time, which, if it were to be created, would again presuppose another time, and so on, ad infinitum. The creation of the cosmos and of the time is therefore only the metaphorical expression of something that has always been in existence.

Although time belongs to the created cosmos, to the world of the senses, which is characterized by creation, transience and change — just like the cosmos which is described as copy of an ideal and thereby is put into the general framework of the relationship between the unchangeable original and the changeable copy — it is in fact time which establishes the similarity in the relationship between the created and the uncreated, eternal original. Just as there are common denominators as well as differences in every relation between the original and the copy, similarly such common denominators and differences must also exist in the relationship of Aion (Eternity) to time. What are they, and what is their meaning?

Regarding the Aion, in Plato's interpretation, two explanations were attempted: one is the *Aeternitas*; the other, the *Sempernitas*. This terminological distinction was developed in the 6th century AD by Olympiodorus Philosophicus and Proclus Diadochus, factually; however, they go back to Plato. The first is meant to be absolute timelessness, a state above time, the exemption from time, the second chronological duration. Both interpretations are, however, not un-



disputed. The following objection is raised towards the first concept: A rigorous transcendence of the Aion, with its non-temporal state, an absolute abyss will be ton open between this and the other world. This abyss would make any relationship and mutuality impossible. The following objection is made towards the second concept: Based on the ever lasting duration the Aion coincides with time as an endless extension and consequently, both would be indistinguishable.

Gernot Böhme shows a way out of this dilemma in his book *Time and Number*<sup>1</sup> in which he does not refer to the post Platonic, but to the pre - Platonic understanding of Aion. Based on historical, philological, and historical investigations of Lackheit, Benveniste, Festugière, and Degani, he draws upon the genesis of the Aion concepts from Homer up to the times of Plato for understanding.

He distinguishes the following three stages:

1. Aion originally means vitality, source, fountain of life, origin, and principle of life.

2. The second meaning of Aion is life, coherence of life, entirety of life.

3. As the relationship of fountain of life to entirety of life represents an implication—explication relation, and metaphorically, is to be compared to the image of source and river, in that the source widens into a river, but still remains the same in it during its entire course. thus is the relation of Aion — Time to be interpreted: The Aion as a compact force explains itself in the cyclical time which represents itself as the totality of past, present and future, corresponding to the entirety of life, childhood, adulthood, and old age.

Time is, however, not only a static image of the Aion, but one in motion, in fact moving in circular motions. Just as the Aion, which belongs to the ideal realm, remains unchangeable in itself — literally the Aion «is» — time belongs to the world in process and therefore is subjected to movement, but to the most ideal of all forms of movement, to the rotation, in which the end of the movement returns to its beginning. The model of this movement is the orbit of the planets.

Because for Plato time can be assigned to each orbit, the function of the planets is that of *ōyava* or tools for measuring time<sup>2</sup>.

1. G. Böhme: *Zeit und Zahl. Studien zur Zeittheorie bei Platon, Aristoteles, Leibniz und Kant*, Frankfurt a. Main 1974, p. 92-98.

2. Plato: *Timaios* 41 e and 42 d.



Because there is not only one orbit, but many — because around the earth, as the center of the cosmos, the moon, the sun, followed by Venus, Mercury, Mars, Jupiter, and Saturn, and finally, the fixed star sky all rotate, and because they all have different rotating speeds, they function as different measures of time: The cycle of day and night is determined by the daily, relative rotation of the fixed star sky around the earth; the month by the orbit of the moon; the year by the orbit of the sun. They can also be put in relation to one another: day to month and month to year, because the planetarium is a system of planets with different orbits and different speeds of rotation. The reconstruction of the initial astronomical position establishes the cosmic year.

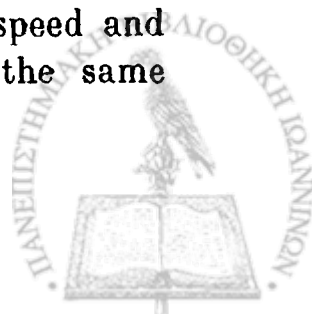
While Plato's theory of time, based on its cyclic nature, is still closely connected to the «Gestalt»-theory, although in its periodicity and in the continuous counting it already forecasts the progression of time and with it the endless numerical progression, the Aristotelian theory of time is closer to the modern, sequence theory, which describes time as linear and directed toward the future, as symbolized by the time arrow. Aristotle's treatise on time in the IV book of *Physics*, chapter 10 to 14, is not primarily about a cosmology, but about measuring time by the reciprocal comparison of time, movement, space, and counting soul. The fact that he defines time as

ἀριθμὸς κινήσεως κατὰ τὸ πρότερον καὶ ὕστερον<sup>1</sup>

(«number in the movement with regard to its sooner and later»), thereby overthrowing Plato's theory, which takes rotation as the measure and number of time, and turning it upside down illustrates his different approach and interest.

For Aristotle as well, there is no time or experience of time without external or internal movement. This is shown in his myth of the Sardinian shepherds who, lacking to notice any movement, cannot experience time. Time implies movement, just as movement implies time in which it can take place. In addition to this, there is space, which is transgressed by movement and passed in time. All three elements: time, movement, and space belong together and mutually measure each other. If Aristotle makes out time as number, that is to say as μέτρον, the basis of movement, then he intends to demonstrate that it can contain more or a less of movement or speed and consequently, more or a less space to travel through. In the same

1. Aristotle: *Physics* 219b 1f.



time a body can move faster or slower: it can travel through more or less space. Like time, space can also serve as a unity of measurement. On the basis of this relativity, it does not care whether one applies to this or that measurement, whether one selects time, a spatial distance, or movement; whether one decides to use an objective or a subjective form of measurement.

The novelty in Newton's theory in modern times, is the fact that he regards time, similar to space, as an absolute universal receptacle to be filled with contents into which all relative time and space can be integrated. As space is endless, homogeneous, and continuous, so is time. It depicts a state of absolute flux («tempus absolutum [...] aequabiliter fluit»<sup>1</sup>) in which every event and every happening has its precise definite place and its relation to others. Space and time are observed from outside, from a point of view outside themselves. This may be connected to the fact that Newton called them the «sensorium of God». It is known that absolute space and absolute time are hypothetical concepts, and not realities as described by Newton in his concept of «antiphenomenal» physics for the justification of the absolute uniform, linear movement. In addition to this, space and time are both universal structures, made different by their content, which prepare Kant's thesis of space and time as forms of the perception of the objects by the subject, as conditions of all phenomena. They consequently become the tools in the hands of man, his means to interpret the universe; like a grid, they are put over the objects, thereby subjecting them to mathematics.

In the end, once again the question as to the nature of time arises: Is time an objective structure, lying in nature itself, or a subjective instrument for the interpretation of the universe? Is it a real experience of life? Because as genuine lifetime, it haunts us existentially and makes us aware of our finite nature and of death. Or is it an unreal construct? Because as the past, it *no longer exists*; as the future is does *not exist yet*; and as the present, as transitus from past to future, it does *not exist either*? It will probably remain an eternal enigma as Thomas Mann ruminated in his reflection on time in *The Magic Mountain*.

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1. I. Newton: *Philosophiae naturalis principia mathematica*, def. VIII, scholium.



«What is time? An enigma, unessential and allmighty. A condition of the phenomenal world, a movement, connected with the existence-of bodies in space and in their movements. Would there be time, if there would be no movement? No movement, no time. Ask [...], and ask again<sup>1</sup>.

You will never get a final answer.

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1. Th. Mann: *Der Zauberberg*, 8. Aufl. Frankfurt a. M. 1965, p. 316  
Ch. 6.



KAREN GLOY

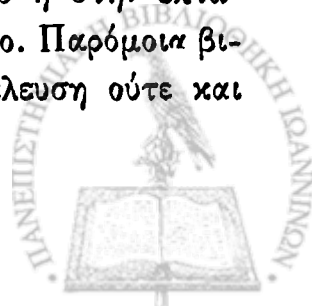
## ΧΡΟΝΟΣ ΚΑΙ ΑΡΙΘΜΟΣ

(Π ε ρ ί λ η ψ η)

Στην ιστορία του ευρωπαϊκού πολιτισμού και του ευρωπαϊκού πνεύματος ο χρόνος και ο αριθμός βρίσκονται σε τόσο στενή σχέση, ώστε ο χρόνος μετρείται με τον αριθμό και η σειρά των αριθμών, που προχωρεί στο άπειρο, μπορεί να απεικονισθεί στον χρόνο που προχωρεί στο άπειρο. Αυτό όμως είναι το αποτέλεσμα μακράς εξέλιξης της ανθρωπότητας και ιδίως μιας ειδικής αντίληψης περί χρόνου και αριθμού. Διότι δεν είναι καθόλου αυτονόητο ότι αυτά τα δύο έχουν κάποια σχέση μεταξύ τους.

Σε αυτήν την μελέτη η σχέση χρόνου και αριθμού εξετάζεται σε τρία επίπεδα: Πρώτον, στο επίπεδο του βιώματος του χρόνου, δεύτερον στο επίπεδο του χρόνου της πράξης, και τρίτον στο επίπεδο του μαθηματικού χρόνου, του συνηθισμένου ωρολογιακού ή κοσμικού χρόνου. Αυτά τα επίπεδα αντιμετωπίζονται στην οπτική της ιστορίας του πολιτισμού και προς αυτά συναρτώνται μοντέλα χρόνου μεταφυσικής, οντολογικής, κοσμολογικής ή θρησκευτικής υφής, τα οποία έχουν διαμορφωθεί κατά την διάρκεια της ιστορίας: Αντιστοίχως, προς το πρώτο επίπεδο συναρτάται η εμπειρία του χρόνου της μυστικής, προς το δεύτερο η εσχατολογική εμπειρία του χρόνου, όπως αυτή είναι γνωστή από τον ιουδαϊκό-χριστιανικό πολιτισμικό κύκλο, και στο τρίτο επίπεδο διάφορες φυσικές θεωρίες του χρόνου τόσο με κυκλική αντίληψη, όπως αυτή κυριάρχησε στην φιλοσοφία του Πλάτωνος κατά την αρχαιότητα, καθώς και με την γραμμική αντίληψη, όπως αυτή είναι γνωστή από την νεώτερη -νευτώνια φυσική.

Στην πρώτη βαθμίδα περιγράφονται τα καθαρώς υποκειμενικά εσωτερικά βιώματά μας περί χρόνου, τα οποία παρουσιάζονται με δύο τρόπους, ως έκταση του χρόνου και ως σύμπτυξη του χρόνου, και που σε ορισμένες περιπτώσεις μπορούν να φθάσουν στην ακινησία του χρόνου ή στην έκτασή του σε αιώνια παρουσία και να συμπέσουν προς τον χώρο. Παρόμοια βιώματα του χρόνου δεν χαρακτηρίζονται από ροή και παρέλευση ούτε και έχουν κάποια σχέση προς τον αριθμό.





Στο δεύτερο επίπεδο εμφανίζεται στο προσκήνιο ο ονομαζόμενος χρόνος της πράξης, ο οποίος παρουσιάζει μια διαρθρωμένη ενότητα χρόνου και ενέργειας-και μπορεί να συσχετισθεί προς τον αριθμό, ωστόσο με μια ειδική αντίληψη περί αριθμού, η οποία είναι σύμφωνη προς την θεωρία της μορφής και πρέπει να διακρίνεται από εκείνην που ανήκει στην θεωρία της σειράς. Οι φαινομενολόγοι Husserl, Sartre, Bergson, Merleau-Ponty διασάφησαν τον χαρακτήρα της με αναφορά κυρίως σε μορφές χρόνου, όπως η μελωδία, η πρόταση, ο στίχος.

Τρίτον: Με την αυξανόμενη τοπολόγηση, μέτρηση και συχνότητα των αυτών ενοτήτων χρόνου ανακύπτει ο μαθηματικός χρόνος, ο οποίος μπορεί να μετατραπεί σε ποσότητα, και συνεπώς έχει σχέση προς την σειρά των αριθμών. Το πρότυπο μπορεί να είναι τόσο η κυκλικότητα όσο και η επανάληψη των κυκλικών περιφορών των πλανητών, κάτι που οδηγεί είτε στην κυκλική αντίληψη περί χρόνου, όπως την βρίσκουμε στον διάλογο *Τιμαιος* του Πλάτωνος, είτε επίσης σε διαστήματα χρόνου, τα οποία καθ' οιονδήποτε τρόπον χωρίζονται και επαναλαμβάνονται, κάτι που οδηγεί στην γραμμική αντίληψη περί χρόνου, όπως αυτή παρουσιάζεται κατά την νεώτερη εποχή στην φυσική του Νεύτωνος.

Μετάφραση από τα Γερμανικά: Γεωργία Αποστολοπούλου

