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Ortega and the Dynamics of Historical Reason

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Abstract: In this essay, José Ortega y Gasset's conception of historical reason is articulated and contrasted with contemporary conceptions expressing the dynamics of reason. Ortega's conception of historical reason is seen as one based on a fundamentally and inclusively historical conception of the *a priori* that is articulated in the context of science and culture. As such, Ortega's conception also connects in an important way to Thomas Kuhn's conception of scientific revolution and his conception of fundamental conceptual changes brought about by scientific revolution. In contrast to Michael Friedman, Charles Taylor, Hubert Dreyfus and many others, I embrace Kuhn's conception and do not take it to involve a commitment to relativism. I argue that Kuhn's conception is based on a reading of structural objectivity and the Copernican revolution that is different from the structural objectivity embraced in the tradition of Bertrand Russell and Rudolf Carnap, as well as Friedman, Taylor, and Dreyfus. Kuhn's conception of the Copernican revolution constitutes the very significance of objects, including mathematical and logical structures, through their dynamic systematic relations, dynamic systematic relations that are not limited to science. This is the structuralism of Immanuel Kant's Copernican revolution as understood by Ernst Cassirer and the Marburg School, as well as by Ortega y Gasset, Karl Jaspers and Martin Heidegger. It is the basis of the conception that these philosophers have of the significance that the Copernican revolution has for metaphysics and for ontology.

Keywords: Ortega y Gasset, José; Friedman, Michael; Kuhn, Thomas S.; Cassirer, Ernst; Weyl, Hermann; Copernican revolution; dynamics of reason.

The expression "the dynamics of reason" is introduced and used by Gerd Buchdahl, a noted historian and philosopher of science who, with respect to the thinkers of the early modern period, has noted the following:

> These authors strike an immensely personal note. Each, more often than not, addresses himself to and argues against some central contention or other of his predecessors. It is like a living dialogue, a dynamic process of continuous debate—not at all some dead textbook formulation.[1]

[1] Gerd Buchdahl, *Metaphysics and the Philosophy of Science: The Classical Origins, Descartes to Kant*, Oxford, UK: Basil Blackwell 1969, p. 4.

The conception of science and philosophy as a "dynamic process of continuous debate" is for Buchdahl what underlies the dynamic process through which laws are instituted and experience is brought into a systematically law-like form, and so the dynamic process of continuous debate is also important to the very dynamics of reason. Buchdahl has in this way brought philosophy together with the philosophy of science as well as with the history of philosophy and of science.

In the last couple of decades, Michael Friedman has appropriated the concept of a dynamics of reason in order to refer to his attempt at describing the process

in which science develops. As part of this project, he also aims to bring together analytic and Continental philosophy as well as C. P. Snow's two cultures (the literary and the scientific one). While I welcome and embrace Michael Friedman's general project, I do see a difficulty in his execution of the project, namely that it ultimately attempts to bring these cultures together under the very assumptions that have generated the apparent schism in the first place.

Michael Friedman and his antecedents in the interpretation of Immanuel Kant and of philosophy more generally, namely Bertrand Russell and Rudolf Carnap, start from a reconstruction of the world in terms of objects and subjects that are fundamentally independent of each other and are connected by objective logical structures that are displayed in the existential commitments of logic and set-theory. At the same time, a fundamentally different, more inclusively dynamic and historically structural approach to logic and philosophy was developed and pursued by Henri Bergson, José Ortega y Gasset, Karl Jaspers, and Ernst Cassirer, each of whom endeavored to understand culture in general, including logic, mathematics, and physics, as well as history, and the humanities, by way of emphasizing the importance of recognizing the systematically structured, historically and naturally situated process of human life. Especially Ortega refers to this more inclusive and more dynamic conception of reason as vital reason and above all as historical reason. In this essay, I concern myself primarily with the historical dimension of Ortega's conception of vital historical reasoning. According to Ortega's perspective, human experiences are not best understood in terms of an abstraction from the comprehensive and systematic background of life and of cultural-historical context, but in terms of being comprehensively invested in the process of human life and of life more generally. Or, as Ortega famously puts it, "I am myself plus my circumstance" (where the "plus" of circumstance is not an add-on but is constitutive of what I make of myself).[2] This systematic relevance to my situation and myself makes of history and indeed all of human culture a system, yet a system that is grounded in what we as human beings, individually and together, do.

[2] José Ortega y Gasset, *Meditations on Quixote*, transl. Evelyn Rugg and Diego Marín, New York, N.Y.: W.W. Norton & Company 1961, p. 45.

Michael Friedman and the Dynamics of Reason

Michael Friedman approaches the dynamics of reason from the standpoint of the historical development of the exact or mathematical sciences. To this end, he adopts a Kantianized and pragmatized version of logical-structural objectivity.[3] Thus he takes the standpoint that intuition and especially the intuition of process has turned out to be a non-starter in understanding the mathematics of space, time, and of the physical world. Once this has been conceded, the irrelevance of Continental and even of Kantian philosophy that is not in the tradition of the logical-structural empiricism of Moritz Schlick, and Rudolf Carnap or the empirical realism of Hans Reichenbach becomes a forgone conclusion. For Friedman, philosophers stand at a kind of crossroads:

> We can either, with Carnap, hold fast to formal logic as the ideal of universal validity and confine ourselves, accordingly, to the philosophy of the mathematical exact sciences, or we can, with Heidegger, cut ourselves off from logic and "exact thinking" generally, with the result that we ultimately renounce the ideal of truly universal validity itself.
>
> If I am not mistaken, it is precisely this dilemma that lies at the heart of the twentieth-century opposition between "analytic" and "continental" philosophical traditions, which thus rests, from a purely philosophical point of view, on the systematic cracks which had meanwhile appeared in the original Kantian architectonic.[4]

On my view, the cracks in the original Kantian architectonic that Friedman diagnoses stem from the Russell-Carnap conception of a narrowly logical structuralism. Individual consciousnesses are taken to have an in principle purely private experience of static objects that are connected together in objective terms by their logical relations; this allows a methodologically solipsistic conception of unchanging objects of purely theoretical understanding with fundamentally external relations to each other; such independence is mitigated by the systematic nature of logical relations. Friedman

[3] Michael Friedman, *Reconsidering Logical Positivism*, New York, NY: Cambridge University Press, 1999. I owe the term "structural objectivity" to Lorraine Daston and Peter Galison, *Objectivity*, Brooklyn, NY: Zone Books 2007, p. 290.

[4] Michael Friedman, *A Parting of the Ways. Carnap, Cassirer, and Heidegger*, Chicago and La Salle, IL: Open Court 2000, p. 91.

is right to point to the communicative rationality of the social community of science and culture. But it is not clear that his conception of logic and of physics and of the exact sciences can truly give human social culture the role that he wants to assign to it. For on his view, only logic and the exact sciences have the kind of universal validity that he demands. It is the claim of the continental mathematicians and philosophers with whom I am concerned in this essay that by confining oneself "to the philosophy of the mathematical exact sciences" in isolation from the rest of culture one misunderstands the very nature of logical and mathematical validity itself. By way of this voluntary methodological delimitation one incorrectly assumes that logical validity stands on its own independent foundation, one that is independent of the social, temporal, and wider cultural-historical dynamic of the agents who are embedded in history and culture. Friedman does want to bring that wider dimension in, but only after the fact of an assumedly universal logical validity.

In Friedman, and almost all contemporary philosophers of logic and mathematics, one can find a fundamentally different conception of and attitude to mathematical intuition and especially to *a priori* intuition than the one that underlies the dynamic structural conception of the systematicity of history and of culture that I take Ortega to defend. Friedman avowedly follows Russell who suggested that one re-interpret Kantian intuition *a priori* in terms of the existential and universal commitments of nested logical quantifiers, thereby, in effect reducing mathematical existence claims and the mathematical infinite to the domain of logic. Friedman explicitly takes over this conception from Russell; for Russell, the rejection of infinitesimals was a result of the work of Karl Weierstrass (the teacher of Cantor) on the foundations of mathematics. From this, Russell drew further conclusions:

> Weierstrass, by strictly banishing all infinitesimals, has at last shown that we live in an unchanging world, and that the arrow [in Zeno's arrow paradox], at every moment of its flight, is truly at rest. The only point where Zeno probably erred was in inferring (if he did infer) that, because there is no change, therefore the world must be in the same state at one time as at another.[5]

Friedman does not argue with Russell that infinitesimals are self-contradictory or that the rejection of infinitesimals leads to a static world. But Friedman does argue that the Newtonian physics-based and fluxion-based and infinitesimal-based conception of the calculus to which Kant is committed is mathematically insufficiently precise; it is limited to smooth curves. Friedman argues that the mathematics of the infinite needs to be grounded instead in multiply nested quantifiers and thus Kant's conception of *a priori* intuition needs to be replaced by a conception that reduces mathematics to logic. There is another alternative that Friedman does not explore, to ground mathematical sequence and sets in *a priori* intuition of infinite iterability; this is the approach taken by Kant, Poincaré, Brouwer, and Weyl, and it was later endorsed by Cassirer and Ortega.

Friedman seems broadly to accept Russell's skepticism about infinitesimals and implicitly accepts Russell's as well as Frege's critique of Hermann Cohen's infinitesimal method. Friedman in effect replaces infinitesimals as flowing quantities (Isaac Newton's fluxions) with static mathematical structures induced, for want of a better word, by the logical procedure of nesting quantifiers.[6] Although Friedman virtually does away with Kantian intuition *a priori*, he takes the interpretation offered by Cassirer and, more generally, by the Marburg School to be "a profound mistake," tending as it does "to minimize or downplay the role of the Kantian faculty of pure intuition."[7] It is important to note that Leibniz's principle of continuity is taken by Cohen, Paul Natorp and Cassirer as a logical principle and process that is taken by them to be intrinsic to and indeed constitutive of all of logic and science; Cohen, Natorp and Cassirer all speak of a "mathematics of becoming":

[5] Bertrand Russell, *The Principles of Mathematics*, London, UK: George Allen and Unwin, Ltd 1903, p. 347.

[6] Michael Friedman, *Kant and the Exact Sciences*, Cambridge, MA: Harvard University Press 1992, pp. 72-80. [Henceforth cited as *KES*] Friedman's sympathy for a Kantian understanding of logical empiricism is well-known and his contributions to this project are important.

[7] Michael Friedman, "Ernst Cassirer and Thomas Kuhn: The Neo-Kantian Tradition in the History and Philosophy of Science," in *Neo-Kantianism in Contemporary Philosophy*, eds. Rudolf A. Makkreel and Sebastian Luft, Bloomington, IN: Indiana University Press 2010, pp. 177–91, here p. 183. [Henceforth cited as *NKT*]

> Leibniz himself—as we were able to follow exactly—was also determined by questions of logical systematics in the grounding of the principle of continuity: but logic itself was to be taken here in the extended and deepened meaning that it had come to have through being filled with the new content of mathematics. Thought thus won its relation to physics and biology and its first application to concrete living actuality. It is therefore not only indefensible as a matter of actual fact, it is also historically mistaken, to think that mathematical rationalism is necessarily in conflict with a developmental-historical worldview. This set of alternatives holds only where mathematics itself—as in Descartes and Spinoza—is essentially determined by a geometric method; it fails in relation to the analysis of the infinite, the mathematics of becoming.[8]

For the Marburg school, Kantian intuition *a priori* is a limit-notion, as is the notion of sensation that constitutes the content of empirical intuition. The re-interpretation by Cohen of *a priori* intuition in terms of logic is primarily a rejection of the myth of the given and of faculty psychology (Wilfrid Sellars' critique of the myth of the given is, in fact, an application of Cassirer's critique with Carnap among its targets).[9]

The starting point for Friedman's reconstruction of Kant's philosophy of geometry is the acceptance of Russell's critique of mathematical intuition. Friedman also accepts Russell's position that Euclidean geometry is fundamental to Kant's conception of the *a priori* intuition of space. Furthermore, Friedman agrees with Russell that it is the inadequacy of non-polyadic term logic that leads Kant to posit the notion of *a priori* intuition to provide a basis for the existence of mathematical structures and objects. Friedman sides with Russell in taking such an appeal to *a priori* intuition to be abortive (*KES* 72-80). But I would argue that he has already declared his allegiance here to the logical structuralism of the logical empiricist tradition and its conception of the role of logic in constituting relations of objectivity. It is already at this point and not by cutting oneself off from logic, as Friedman claims, that continental philosophy and its logical and mathematical fellow travelers part company with the Russell, Frege, Carnap tradition. The disagreement concerns the nature of logic itself and whether it is something fundamentally independent of the social, cultural and historical process of thought.

In fact, logic as *logos* and process of thought is a matter of fundamental concern to Heidegger (as it is to Ortega and to the Marburg School), this is especially so in the years leading up to *Being and Time* and after it. Heidegger was engaged with Natorp's work from the late teens to the death of Natorp in 1924 (as was Ortega but he began this engagement already at the turn of the century); from 1922 to 1924 Heidegger was a colleague of Natorp and had weekly walks and talks with him and was influenced strongly by Natorp's late philosophy. At the same time, Heidegger also began to engage with Cassirer's work (Cassirer's work was known to Ortega even earlier than that and Cassirer was also familiar with Ortega's contributions). And the very Kantian framework of *Being and Time* can be said to have emerged to a considerable extent in virtue of Cassirer's influence and that of Natorp's late work. After reading *PSF* on mythical thought, Heidegger shifts from taking Aristotle as the primary point of reference to taking Kant as the principle frame of reference. The very question of the meaning of being is first articulated by Cassirer in *Kant's Life and Thought* and the significance of time for being is made explicit in volume 2 of *PSF* in the discussion of the different ways in which different cultures relate time to being and becoming, and it is anyway an underlying principle of Cohen's philosophy also as it is presented by Cassirer.[10]

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[8] Ernst Cassirer, *Leibniz' System in seinen wissenschaftlichen Grundlagen*, Marburg, DE: Elwert 1902, p. 422. Hathi Trust access https://babel.hathitrust.org/cgi/pt?id=uc1.32106000052909&view=1up&seq=442. [My translation.]

[9] The rejection of intuition *a priori* is fleeting even in Cohen, but by the time in 1910 that Natorp writes *Die Logischen Grundlagen der exakten Wissenschaften* (Leipzig 1910, 1921), he has in large part given up on Cohen's excision of intuition *a priori*. And even where Cohen gives up on intuition *a priori*, he does not give up on the temporality and continuity of logic. In his earlier *Infinitesimal-Methode*, Cohen is less committed in his critique of intuition. Cassirer has also given up on the rejection of intuition in *The Philosophy of Symbolic Forms* (*PSF*) except insofar as it involves commitment to the myth of the given and to faculty psychology and explicitly affirms the fundamental importance of intuition *a priori* for mathematics under the influence of Weyl in the fourth and only volume of *The Problem of Knowledge* to have been translated into English.

[10] Ernst Cassirer, *Kant's Life and Thought*, transl. James Haden, New Haven, CT: Yale University Press 1981, p. 146. [Henceforth cited as *KLT*]

José Ortega y Gasset and History as a System

Ortega emphasizes the importance of his conception of a vital, life-expressive, historical reason. Ortega does not wish to concede systematicity to abstract logic and science. He argues that the systematicity of science is in fact embedded in the systematicity of the vital reason in terms of which all of our concerns as human beings are to be addressed. Vital reason expresses itself systematically as historical reason. Ortega states: "History is a system, the system of human experiences linked in a single inexorable chain."[11] The systematicity of history reflects the way we as human beings and as living agents, agents living our lives, are embedded in our social, historical, cultural and also our natural context: "Man set outside himself is brought up against himself as reality, as history…his past…is all he has" (*HS* 230). This past includes everything that can be relevant to us as human beings and thus already points in its significance for us to our present and to our future. Ortega continues:

> History is the systematic science of that radical reality, my life. It is therefore a science of the present in the most rigorous and actual sense of the word…The past is in truth the live, active force that sustains our today…The past is not yonder, at the date when it happened, but here in me. The past is I—by which I mean my life. [*HS* 223]

In the chapter on History in his *Essay on Man* Ernst Cassirer argues that Ortega, by rejecting the Greek theory of being and with it the classical theory of man, is guilty of assimilating history to a Heraclitean flux and thus of missing out on the constant features of history.[12] Cassirer responds to Ortega's *History as a System*, rather critically if one considers that the essay was originally a contribution by Ortega to a Festschrift devoted to Cassirer, a criticism that also finds favor with Hermann Weyl, the husband of its translator Helene Weyl. Here I would wish to defend Ortega, although I do think that he tends to exaggerate the element of change to the exclusion of the recognition of the static terms in which we can take things in the abstract. With this proviso, I argue that Ortega takes up the very systematic and dynamic account of history and of what it is to be a human being to which Cassirer and the Marburg School are themselves committed. Therefore the objection that Ortega winds up with a Heraclitean flux seems to be special pleading or at least somewhat uncharitable for a book that like Cassirer's *Essay on Man* ends with a reference to Heraclitus and to his notion of the unification of opposites: "The dissonant is in harmony with itself; the contraries are not mutually exclusive, but interdependent: 'harmony in contrariety, as in the case of the bow and the lyre'" (*EM* 237). Thus, Cassirer writes:

> Life, reality, being, existence are nothing but different terms referring to one and the same fundamental first. These terms do not describe a fixed, rigid, substantial thing. They are to be understood as names of a process. Man is the only being that is not only engaged in this process but who becomes conscious of it...Myth, religion, art...science are nothing other than the different steps made by the human being in his consciousness, in his reflective interpretation of life... Philosophy as the highest and most comprehensive mode of reflection strives to understand them all.[13]

It is Cassirer's own great insight to have understood that the systematicity of history and of all of the manifestations of human culture and of the embeddedness of human life and culture in the process of nature, animal life, and its environment is displayed in the dynamic process through which humans systematically and differentially grasp all of the different kinds of meaning that are relevant in our lives as human beings who are embedded in a natural and cultural cosmos. That process consists, like the spheres of Copernicus, in dynamic patterns of systematic relatedness that are directly connected to one's temporal experience and agency and to the historical process of culture and the temporal process of nature.

Cassirer pounces on Ortega's claim that man has no nature. Cassirer notes a tension between the idea of history as a system and the idea that history is constituted by human beings with no nature other than what human beings have done; however it is not so clear to me that this tension is as pronounced as

[11] José Ortega y Gasset, *History as a System*, transl. Helene Weyl, New York, NY: W.W. Norton & Company 1961, 221. [Henceforth cited as *HS*]

[12] Ernst Cassirer, "An Essay on Man: An Introduction to a Philosophy of Human Culture," in *Ernst Cassirer Werke*, Hamburger Ausgabe, ECW 23, ed. Birgit Recki, Hamburg, DE: Felix Meiner Verlag 2006, p. 185. [Henceforth cited as *EM*]

[13] Ernst Cassirer, "Mythos, Sprache und Kunst," in *Ernst Cassirer, Nachgelassene Manuskripte und Texte (ECN) 07*, eds. Jörn Bohr and Gerald Hartung, Hamburg, DE: Felix Meiner Verlag 2011, p. 183.

Cassirer takes it to be. For one thing, Cassirer himself rejects the traditional conception of human nature as consisting in our being rational animals. It seems to me to be incorrect to regard Cassirer and Ortega as being on different sides in this debate. Ortega's intention is to think of historical reason not as something added to an ahistorical rational conception based in the rational nature of human beings, as so many contemporary philosophers still do. Instead, Ortega proposes to think of historical reason as constituting one's very identity as well as the intrinsic nature of reason itself:

> Hence the expression "historical reason" must be understood in all the rigor of the term: not an extra historical reason which appears to be fulfilled in history, but, literally, a substantive reason constituted by what has happened to man…the revelation of a reality that transcends man's theories and which is himself, the self underlying his theories. [*HS* 218]

Ortega draws on Hermann Weyl, whom he had met in 1921 when Weyl came to Spain with his wife Helene Weyl in the context of public interest in Relativity Theory. Helene became Ortega's German and English translator and a philosophical interlocutor trained in mathematics but also especially in Husserlian phenomenology (they exchanged letters throughout the nineteen-thirties and into the forties until the time of her death). Hermann Weyl was a renowned mathematician, who also made important contributions to general relativity and to quantum mechanics and to philosophy and logic. He had studied with Edmund Husserl in Göttingen and was considerably influenced by Husserl as both his works, *Das Kontinuum* (1918) and *Raum, Zeit, Materie* (1921), indicate; he was also concerned with questions regarding the foundations problem in logic and mathematics and he took up the mantle of Luitzen Brouwer's intuitionism at least in the context of pure mathematics. Weyl never gave up on the demand for an intuitionist basis for logic and for pure mathematics. However, he would argue that mathematics also required richer structures than intuitionism can provide. Offering physical models for non-interpreted systems of axioms could support these structures. In physics, systematic and comprehensive coherence of the kind ideally to be displayed in realizing the aim of a unified field theory was the basis for a claim to truth; thus, for Weyl theoretical coherence paired with observations could yield truth that is not purely mathematical. Hermann Weyl comes very close to articulating an explicit connection between mathematics and historical reason of the kind that would be relevant to Ortega's thesis concerning the systematicity of history as an expression of the temporality of one's agency as a human being when he talks of the "historical decisions" involved in mathematizing as well as in the use of language and the performance of music:

> While Brouwer has made clear to us to what extent the intuitively certain falls short of the mathematically provable, Gödel shows conversely to what extent the intuitively certain goes beyond what (in an arbitrary but fixed formalism) is capable of mathematical proof. The question of the ultimate foundations and the ultimate meaning of mathematics remains open… "Mathematizing" may well be a creative activity of man, like language or music, of primary originality, whose historical decisions defy complete objective rationalization.[14]

Weyl takes there (in agreement with Brouwer) to be something in mathematics that needs to be given intuitively and this constitutes the basis for him of what is certain in mathematics. But the intuitively certain in that sense falls far short of what is provable in a formal system. Like Gödel, Weyl also argues that there are limitations to what is provable in such a formal system. Weyl concludes that one may have to understand mathematics as a kind of creative activity in the history of human thought that cannot be exhausted in the terms of a formal system. Thus, Weyl takes knowledge of logic, mathematics, and phenomenology itself but also the structures corresponding to such knowledge to be fundamentally dynamic in the way that they emerge.

Ortega begins his account of history as a system from the limitations of the mathematical, logical, and physical conception of nature. However, it is misleading to take him to be rejecting such a conception of nature. Instead he wishes to show that this conception of nature is an abstraction from a wider and more inclusive conception of nature embodied in what he calls "vital reason." From Ortega's point of view, the limitations of physical and physicalist explanation leave one with a feeling of being "shipwrecked in the void" and even with a feeling of "panic terror"; the seeming lack of immediate relevance of very sophisticated physics and chemistry to what concerns us in our human choices

[14] Hermann Weyl, "David Hilbert 1862-1943," *Obituary Notices of Fellows of the Royal Society* 4/13 (30 November 1944), 547–553, here p. 550, https://royalsocietypublishing.org/doi/pdf/10.1098/rsbm.1944.0006.

leaves the way open for vital, historical reason: "the collapse of physical reason leaves the way clear for vital, historical reason" (*HS* 183). But such a collapse only applies to physical reason divorced from vital historical reason. Such a divorce is in the end illusory. This is one version of Ortega's critique of physical reason, one that is critical of naturalism (at least, as "naturalism" is often understood, namely in terms of the relations between physical objects taken to exist and have significance for us independently of one's reasoning).

Ortega's take on this material is sometimes, somewhat hyperbolic, which is why Ortega comes in for some criticism from Cassirer and Weyl, but this does not mean that they take him to be fundamentally off the mark. He argues that modern physics has given up on causality and determinism and dissolved the very notion of matter. These ideas are not altogether implausible, but they are also not uncontroversial claims and hence they need some qualification. When it comes to mathematics Ortega's position is on the surface even less convincing. He argues that the continuum leads to contradiction for, according to him, it is both divisible and indivisible. Doubtlessly, there are philosophically deep issues around the nature of the mathematical continuum. The claim that continuity is not exhausted by the discrete and that set theoretical totalities of discrete items lead to contradiction needs all the finesse of a Hermann Weyl in order to be developed and defended against the mainstream view which claims that the real number series exhausts the continuum. Ortega further argues that Brouwer has shown that the law of the excluded middle does not hold and, somewhat worse still, he claims that logic itself has been shown to be irrational by Brouwer (for Brouwer is skeptical of the role of language and symbolic articulation in mathematics):

> the brilliant mathematical logician—the brilliant Dutch mathematician, Brouwer—whose influence in both sciences has been vast, if not the most pervasive, has spoken disdainfully of logic as soi-disant logic. Soi-disant logic! Do you realize the enormity of this? It means quite simply that logic is illogical, that therefore there is no logic. All this I call the earthquake in reason—and the image is no exaggeration.[15]

Brouwer's point is that logic in the sense of an objective pattern of relations that are independent of the temporality of human agency (such as that in which most who are committed to logical structural objectivity believe), is not properly called logic, since it is illusory. Brouwer thinks that logical and mathematical structures are themselves constituted in the ongoing temporal and historical process of human agency in culture. For Brouwer, the law-like sequences and choice sequences more generally that underlie mathematics are not really part of nature itself; choice sequences are freely chosen auxiliary constructions that are adopted as expressions of the continuous temporality that underlies human agency. We form such sequences in order to describe the world successfully and as such they are manifestations of human efforts to impose order on the world as human beings for the purposes of prediction, control, and action.

For Weyl and for Ortega, Brouwer's notion of a choice sequence nicely captures the idea of mathematical structure emerging from our free choices, from temporal becoming and from the continuum nicely, although even a choice sequence determined by law can be free insofar as it is an expression of our universal self-legislation, of the process through which one gives laws to oneself. Ortega is undeniably influenced by some of the strong language that Weyl used in the early twenties in order to characterize the state of mathematics.[16] In the same context Ortega also claims that "the physicists...aren't quite sure what they are doing when they do physics" (*HR* 174 ff). Although its hyperbolic language distorts Ortega's discussion, the

[15] José Ortega y Gasset, *Historical Reason*, transl. Philip W. Silver, New York, NY: W. W. Norton & Company 1984, pp. 174 ff. [Henceforth cited as *HR*]

[16] In a bout of revolutionary enthusiasm, Weyl comes to reject the whole conception of a mathematics based on abstract logical proof, set theory and the set-theoretical construction of the real number series. He saw the whole edifice of analysis as a great fortress that was doomed to fall when he writes in 1921: "So I now abandon my own attempt and join Brouwer. I tried to find solid ground in the impending dissolution of the State of Analysis (which is in preparation, even though still only recognized by few) without forsaking the order upon which it is founded, by carrying out its fundamental principle purely and honestly. And I believe I was successful—as far as this is possible. For this order is in itself untenable, as I have now convinced myself, and Brouwer—that is the revolution!...It is Brouwer to whom we owe the new solution of the continuum problem." Hermann Weyl, "On the New Foundational Crisis of Mathematics," transl. Benito Müller, in *From Brouwer to Hilbert: The Debate on the Foundations of Mathematics in the 1920s*, ed. Paolo Mancosu, New York, NY: Oxford University Press 1999, pp. 86–118.

more significant point is that Ortega wishes to draw on a conception of logic and mathematics developed by Henri Bergson, Brouwer, and Weyl and the Marburg School, as well as by the pragmatists. According to the conception in question, even logic and mathematics are constituted in an essentially continuous temporal and ultimately historical manner that becomes differentiated into discrete entities through the interests of human temporal agency.

Thus, from this point of view there is no logic in the sense of something fundamentally divorced from human agency and human history. Following Husserl and Bergson and later Brouwer, Weyl takes there to be a continuous flow of consciousness and of temporal agency that is prior to anything that is discrete, including numbers and sets, that one, corresponding to one's interests, might be able to discern within that flow:

> The view of a flow consisting of points and, therefore, also dissolving into points turns out to be mistaken: precisely what eludes us is the nature of the continuity, the flowing from point to point; in other words, the secret of how the continually enduring present can continually slip away into the receding past. Each one of us, at every moment, directly experiences the true character of this temporal continuity. But, because of the genuine primitiveness of phenomenal time, we cannot put our experiences into words. So we shall content ourselves with the following description. What I am conscious of is for me both a being-now and, in its essence, something which, with its temporal position, slips away. In this way, there arises the persisting factual extent, something ever new which endures and changes in consciousness.[17]

Weyl later develops the notion of a choice sequence as a way of articulating the structures that emerge from the continuum. Here he draws on Brouwer and his conception of the way in which one as agent interacts with the temporal continuity that underlies one's life process and thus forms structures of all kinds based on interests that are always relative to our agency. Weyl takes the standpoint in mathematics to be characterized by "the tension between being and possibility."[18] In the same paper, he comes back to his claim from 1925 that mathematics in its ultimate ground means that one can only "develop [*entwerfen*] a theoretical image of being against the background of the possible." And thus Weyl insists, "we stand with mathematics at precisely that intersection of boundedness [*Gebundenheit*] and freedom that is itself the essence of being a human being."[19] Similarly, also Martin Heidegger, arguably under the influence of Weyl, grounds the normativity of logic in the manner in which one autonomously commits oneself to principles in and through the temporality of one's agency and the tension that arises between being and possibility:

> Only freedom can be the origin of binding. A basic problem of logic, the lawfulness of thought [*Denken*] reveals itself in its ground as a problem of human existence, as a problem of freedom.[20]

The distinguishing and ordering of objects in time is thus taken to be prior to any collection of objects in sets and, according to Weyl, Heidegger and Cassirer, that ordering is itself taken to be an expression of the normative commitments of one's capacity for socially and temporally and historically mediated agency.[21]

The chasm between the finite and the infinite, apparently filled in by the theory of sets, said Weyl, opened up again into a yawning abyss. The treatment of natural numbers by this theory may be of great value for systematic mathematics but it should not try deceitfully attempt to hide the fact that it is actually founded upon the intuition of repetition and the series of natural numbers. [*TPK* 77]

According to Weyl, "the insight into essence from which universal propositions derive is always founded

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[17] Hermann Weyl, *The Continuum: A Critical Examination of the Foundation of Analysis*, transl. Stephen Pollard and Thomas Bole, Mineola, NY: Dover 1987, pp. 91-2. [Henceforth cited as *TC*]

[18] Hermann Weyl, "Wissenschaft als symbolische Konstruktion des Menschen" (1949), in *Hermann Weyl Gesammelte Abhandlungen IV*, ed. Komaravolu Chandrasekharan, Berlin, DE: Springer 1968, pp. 289-345, here p. 327. [My translation.]

[19] Hermann Weyl, "Die heutige Erkenntnislage in der Mathematik" (1920), in *Hermann Weyl Gesammelte Abhandlungen II*, ed. Komaravolu Chandrasekharan, Berlin, DE: Springer 1968, pp. 510-542, here p. 533. [My translation. Henceforth cited as *DEM*]

[20] Martin Heidegger, *Metaphysische Anfangsgründe der Logik im Ausgang von Leibniz*, Martin Heidegger Gesamtausgabe, Band 26, Frankfurt am Main, DE: Vittorio Klostermann 1978, p. 25. [My translation.]

[21] Ernst Cassirer, *The Problem of Knowledge: Philosophy Science and History since Hegel*, New Haven, CT: Yale University Press 1950, pp. 77-9. [Henceforth cited as *TPK*]

in complete induction, the mathematical Ur-intuition" (*DEM* 533). The sense of intuition that is relevant here has its origins in Poincaré, who attempts to defend Kant and his conception of the synthetic *a priori* status of arithmetic through an appeal to the manner in which one's ability to distinguish numbers is dependent upon one's grasp of the structure of the intuitive continuum, given in one's experience of time.[22]

Neo-Kantians of the Marburg School are initially resistant to that conception based on intuition because members of the school associate intuition with two other notions that they reject, namely with the given and with that which is certain. However, eventually they modify their stance and come to see, too that one can give up on the myth of the given and of certainty without having to give up on intuition. Already from the outset, the Marburg School agrees with these other Continental philosophers and mathematicians in taking the temporal continuum to be a dynamic whole that is prior to any of its parts and not to be composed out of moments or points. The fundamental assumption that they share in common is that the inarticulate or not yet articulated continuum of possibilities is always already presupposed in any articulation. Thus, one cannot understand the discrete on its own in isolation from its context. Logic cannot be understood in isolation from the overall cultural and historical and wider dynamic scientific context of explanation in which it is embedded. It is thus possible to argue (with sophisticated mathematicians and philosophers on one's side) that the notion of intuition and of a dynamic continuum needs to come before the assumption of objects, even before the assumption of the existence of purely logical objects. But the prejudice that Weyl recognizes in both philosophers and mathematicians for an object-based conception nevertheless remains and leads to the dominance of what he calls the "existential" conception that starts from our existential commitments to objects such as sets. It is tempting then to assign to such objects an identity and being that is completely independent of culture, of history and of human life. And it is precisely this conception of logic that also encourages the rejection of Ortega's idea of a systematic pervasiveness of history. Logic, mathematics and science seem to be about something that is completely independent of culture, society and history.

Poincaré, Bergson, Brouwer, Husserl, Weyl, and in his later work also Cassirer, and Ortega all claim that it is in and through one's intuition of the flow of time insofar as it is fundamentally included in the temporality and historicity of one's agency that one has the capacity to distinguish, order, and in principle even to survey collections of objects of whatever size.[23] Thus

[22] In response to the problems besetting the set-theoretical object-oriented conception of logic, each one of them, Poincaré, Bergson, Husserl, Weyl, Brouwer, Cassirer and Ortega propose to go back to an intuition and process-based approach that, so they argue, will allow them to avoid the antinomies generated by an unrestricted approach to quantification over objects that takes the existence of mathematical and other objects for granted. Even before his later personal encounter with Brouwer and his embrace of Brouwer's intuitionism, Weyl was concerned with the paradoxes of set theory and embraced the intuitive basis of complete induction (*TC* 91-2); he was not satisfied with Russell's ramified theory of types or with Ernst Zermelo's axiomatic approach to the problems of impredicativity. Here Weyl was influenced by Poincaré; he would later endorse Poincaré's principle of mathematical induction (together with Brouwer) as the *Ur-intuition*. This *Ur-intuition* provides a synthetic and a priori basis for them to do away with the limitations of Aristotelian syllogistic logic and thus provides the basis upon which mathematical structure can be disclosed in its specificity and its generality.

[23] Heidegger cuts himself off from the logic conception of logical empiricism for he finds it philosophically inadequate. In the 1920s, Heidegger was very up to speed on the latest developments regarding the foundations of logic, mathematics, and physics and regarding the philosophy of the exact sciences. He not only closely studied the works of Natorp and Cassirer of the Marburg School, but he was also familiar with the latest developments concerning the foundations of mathematics and logic; Heidegger had a mentoring relation to Oskar Becker, a trained mathematician who engaged with the work of Brouwer, Weyl as well as Husserl at a very sophisticated level both with respect to philosophy and mathematics. Heidegger became familiar with Weyl's work and that of Brouwer in 1919 or 1920 (if not even earlier) when Becker came to Freiburg and worked primarily with Heidegger but also officially with Husserl, until Heidegger left for Marburg in 1922. Like Weyl also Becker tries to hold onto immediacy and certainty and especially onto the immediacy and certainty of intuition while expanding the scope of mathematics in order to include the standpoint of a non-mortal subject. Upon Heidegger's departure, Becker took over Heidegger's position as Husserl's Assistent. Becker's work of 1923 on the problem of the continuum treated

I take the positions of these philosophers, and I would also even include Kant in this to defend a conception of the a priori that is fundamentally tied to the process of time and of history itself.[24]

It might be maintained that Husserl's notion of science started out as fundamentally static, yet that he was under constant critical pressure from his most important philosophical interlocutor, Paul Natorp, to correct his initially static Platonism in favor of a more dynamic, historically and socially mediated conception of the *a priori* and of science; we can also see Hermann Weyl, another younger mathematical and philosophical interlocutor of Husserl, advancing in the same direction in his thought.

There is an obvious development in Husserl's position from his earlier to his later works, a development to which the crude philosophical conception of the *a priori* and of transcendental philosophy cannot do justice. Husserl moves from a psychologistic account in his *Philosophy of Arithmetic* to a normative Platonic account in the *Logical Investigations* that has, however, initially no place for a robust notion of a subject as something more than a mere neo-Humean bundle of representations. Natorp argues against this view that it cannot account for the bundling of experiences (*Erlebnisse*) on grounds of which one can have an experience at all. This leads Husserl to embrace the notion of a transcendental subject as the basis for the bundling of experiences. Indeed, Husserl takes there to be as many transcendental subjects as there are experiencers (this is posited conjointly with a transcendental super-subject as the result of a process of eidetic variation across all of those experiences and individual transcendental egos). Natorp argues against this conception of the *Ideas* that its notion of experience may still be based on a too static and solipsistic Platonism. The process of giving reasons and asking for them is itself the ultimate ground of explanation. Natorp puts the point nicely in the context of a critical discussion of Husserl's *Ideas* I where he notes Husserl's move to transcendental idealism and away from the neo-Humean bundle theory of consciousness and of the self of the first edition of his *Logical Investigations*, where he is also concerned about a perhaps still too static Platonism:

> The demand for a "ground" [*reason*] is in the end the following: the demand of Cohen's "origin"; which in the end is the expression of an originality that cannot be sidestepped by any theory of thought, thought grounded in itself; "in itself" means and can only mean: in process. Only then is there a truly *independent method* in philosophy.[25]

Further, Natorp especially emphasizes his

Husserl's conception of mathematical intuition from the vantage point of Weyl and Brouwer and also from the one of Husserl's theory of the continuity of time-consciousness. Becker then later took up the problem of foundations in mathematics and the status of existence claims that he published in 1927 in the same volume of Husserl's *Jahrbuch für Philosophie und phänomenologische Forschung* that also contained Heidegger's Sein und Zeit. Oskar Becker, "Mathematische Existenz: Untersuchungen zur Logik und Ontologie mathematischer Phänomene," *Jahrbuch für Philosophie und phänomenologische Forschung* 8 (1927), 439-809. Becker's *Mathematische Existenz* is distinctively influenced by Heidegger's position in the lead up to Being and Time. Heidegger seems to have been influenced by Natorp and Cassirer regarding rejecting Husserl's commitment to the certainty and immediacy of the temporal flow of time-consciousness in favor of a comprehensively systematic and mediated conception of it.

[24] Herman Philipse's interpretation of Husserl and of Heidegger pushes in the opposite direction to the one for which I wish to argue; it represents a widely shared form of analytic continental philosophy that attempts to reconstruct the classics of nineteenth and twentieth centuries philosophy on the basis of the assumptions that analytic philosophy has inherited from Russell, Frege, Carnap and Quine. See Herman Philipse, *Heidegger's Philosophy of Being: A Critical Interpretation*, Princeton, NJ: Princeton University Press 1998, p. 38. Philipse thinks that Heidegger's notion of a regional ontology, for instance, the regional ontology of science, is fundamentally incoherent, since Husserl's own notion of a regional ontology is presupposed by Philipse to be fundamentally static: "Husserl's notion of science is fundamentally static. As soon as the philosophical foundation of a special science has been made explicit by means of a regional ontology, it has been laid once and for all, because it is a priori, and scientific progress can only consist in accumulating empirical results obtained within the conceptual framework of the relevant regional ontology."

[25] Paul Natorp, "Husserl's 'Ideen zu einer reinen Phänomenologie'," *Die Geisteswissenschaften* 1/16 (15. Januar 1914), 420-426, and 1/17 (22. Januar 1914) 448-451, here p. 423. Hathi Trust access https://hdl.handle.net/2027/coo.31924007276086. [My translation. Henceforth cited as *HIP*]

rejection of a static Platonism that does not attempt to ground thought itself in the dynamic process of ideas. For Natorp, Plato's deepest thought is a kinesis of *eide* (process of forms), namely to "liquefy *eide* into the last continuity of thought process" (*HIP* 423). The only truly independent method of philosophy, a method that lies in seeking the ultimate ground of explanation in the process of thought itself, for Natorp "is securely achieved in Plato's deepest discovery: in the discovery of the kinesis of *eide*" (*HIP* 423). Similarly, Cassirer notes, "In the works of Plato's old age the concept of motion even enters into the exposition of the realm of pure ideas—there is a motion of the pure forms themselves."[26] According to Cassirer, it is Plato's position that there is no other access to the world of ideas than through questioning and answering each other in speech. In question and answer the "I" and "the you" must be distinguished, not only for each one to be able to understand the other, but also for each of us to be able to understand ourselves. The thought of one partner is kindled by that of the other and by virtue of their interaction they construct, through the medium of language, a common world of meaning for themselves, a shared world that is only possible because we do not start from methodologically or even more substantially isolated individuals in order then to attempt to bridge the gap between the self and the world. Cassirer rejects the idea that the world of the "I" is a given and finished existence and that one only needs to communicate this givenness to another subject by bridging the divide between persons; for in that case the divide would be an abyss that one could not bridge. The world, the self, the other, numbers, things and organisms are constituted in a process of symbolic significance that is prior to any distinctions that we may draw between them. The distinction between subjects and objects and a conception of subjects only emerge through the give and take with each other mediated by language and our other cultural productions.

Cassirer sketches an account of Copernicus' revolution that resonates throughout Cassirer's work on that topic. Cassirer sees the beginnings of his conception of the dynamic structural systematicity of thought and of being in Copernicus's conception of the dynamic structural systematicity of the solar system (in contrast to the disconnected monster that is pre-Copernican astronomy in Copernicus' understanding of it) and Copernicus regards the role of astronomy and in a certain sense their systematic unification as constituting the highest of the liberal arts.

Reflection on Kant's appropriation of Copernicus's conception allows Cassirer as well as Jaspers and Heidegger and Ortega to connect the problem of the very meaning of being to the dynamically temporal and historical systematic conception of the cosmos pioneered in the Copernican Revolution. Friedman, by contrast, reads Heidegger as rejecting Kant's Copernican Revolution as it is understood by the Marburg School and Neo-Kantian philosophy.[27]

Friedman refers to the neo-Kantianism of the logical empiricism and realism of Russell, Carnap, and Reichenbach in which objects and logical structures are held to be independent of each other yet synthesized with one's sense impressions through being interweaved with them. There is however no mediating in the sense of interweaving to be explained in the Marburg conception or in the one by Ortega or the one by Heidegger since the very idea of real given experiences being interwoven with formal-logical structures is rejected by them. Far from rejecting schematism, Cassirer puts the dynamic schematizing unification of sensible and specific with the universal at the center of his reading of Kant and at the center of his *PSF* in his Introduction to that work as a whole. And far from espousing a static objective structuralism that links subjective real given experiences with objective formal-logical structures, Cassirer takes Kant to have refuted that very conception. Kant is concerned with the very dynamic that gives rise to the subjective as well as to the objective dimensions of experience. And that dynamic structural pattern of relations is taken to be prior to both the subjective and the objective and to be responsible for their very being, that is, to the very being of subjects and objects; this is how Kant is said first to have problematized being itself:

> An ontology asks what being is, in order to show how it comes to be understood, that is, how it is presented and expressed in concepts and cognitions; here [in Kant's first *Critique*], by contrast, the first thing is to establish what the question concerning being in

[26] Ernst Cassirer, "Philosophie der symbolischen Formen. Zweiter Teil. Das mythische Denken," in *Ernst Cassirer Werke, Hamburger Ausgabe, ECW 12*, ed. Birgit Recki, Hamburg, DE: Felix Meiner Verlag 2002, p. 162. [My translation.]

[27] Michael Friedman, *A Parting of the Ways. Carnap, Cassirer, and Heidegger*, Chicago and La Salle, IL: Open Court 2000, pp. 53-4. [Henceforth cited as *FPW*]

> general means. While ontology takes being as the starting point, here being is taken as a problem or a postulate. Whereas heretofore some sort of definite structure of the world of objects was assumed as a secure beginning, and the task consisted simply in showing how this form of objectivity passes over into the form of subjectivity, as in cognition and representation, the demand here is for an explanation of what in general the concept of reality and the claim to objectivity assert before any theory of its transition is propounded. [*KLT* 146]

Heidegger's own question of the meaning of being is one that Cassirer in his book *Kant's Life and Thought* takes Kant to have been the first to raise and to address in terms of a dynamic structuralism. In his book on *Kant and the Problem of Metaphysics* Heidegger himself also deems Kant to have first raised the question of the meaning of being and of metaphysics. Here Cassirer, Jaspers, Heidegger, and Ortega have common and fundamental shared ground, a ground that clearly has been prepared for them by the German idealists and by Bergson and Cohen and by their conception of the relation of being itself to time. That relation of being to time is taken as a constitutive part of Cassirer's own understanding of Kant's Copernican revolution, as well as that of Ortega and Heidegger.

Cassirer's conception of the sense in which science and its "objects" too are relative to culture is something that Kuhn failed fully to recognize in the late nineteen-forties as he read Cassirer with enthusiasm concerning Cassirer's claims about the social and human sciences and with disappointment when it came to the natural sciences. The conception of science, like the overall conception of culture in Cassirer's work, is dynamically structuralist and explicitly formulated in opposition to the positivist picture of relatively isolated perceptual observation data and objects to be interpreted and connected by logical and mathematical theory. Cassirer situates the significance of all science in a dynamic, constantly changing pattern of significance. There is really nothing quasi-positivist, empiricist about Cassirer's conception of science. It is as a function of the dynamic-historical structuralism of his understanding of the Copernican revolution that Cassirer gives historically changing significance even to the number system and the cosmos. The heavens are as culturally dependent for Cassirer and the Marburg School and for Ortega and Jaspers as are the social practices of different cultures, for the unity of science and even of logical structure is not independent of the constantly changing unity that culture has for humans. That is crucial to the reading that the Marburg school gives to science as consisting in the revolving and hence changing observer that must constantly reconstruct the cosmos from its own changing vantage point.

The Marburg school conception of the transcendental has nothing in common with foundationalism, for it precisely denies that there is any fixed foundation to which the *a priori* is attached; the *a priori* manifests itself in the dynamic process of searching for, but never finding the ultimate grounds of inquiry. That conception of a groundless ground in something without being is an important influence in Heidegger's rejection of a static *a priori*. It is an important achievement of Natorp to have helped so-called continental European philosophy to give up on a static conception of science and phenomenology and so to have introduced a dynamic structuralism that becomes fully explicit in his student Cassirer and his interpretation of the Copernican revolution, but also plays an important role in Ortega and Heidegger. The dynamic structuralism of continental philosophy and of its reading of Kant in turn developed into a post-structuralism that even more emphatically rejected the static logical structuralism of Russell, Frege, and Carnap.

Natorp paved the way for the kind of dynamic-systematic conception of historical reason to which Ortega is so deeply committed. The dramatic narrative structure of historical, vital reason systematically constitutes and is constituted by where we live in relation to everything else and where the current generation is now in relation to all generations at other times, both in past as well as in future times. Humans do not have a nature for they define their very being through the decisions in terms of which they relate systematically to the past and to the future and through which they establish the systematic narrative connectedness of history and of their own lives. Our natural and cultural lives are systematically constituted by these relations from which given our distinctive situations we each make of ourselves who we are. It is only in this way that humans have access to the very meaning of being. Different kinds of things emerge, are generated, disclose themselves, in different ways within the historical context that is constituted through the process of becoming (the becoming of science and culture, the *fieri* and *Werde*-factum of Natorp and the Marburg School). Thus, truth as disclosure (to which Ortega already commits himself almost fifteen years

prior to Heidegger, influenced no doubt in this respect by Nicolai Hartmann and Natorp in Marburg) is constitutive of one's relation to one's own being and to that of the world. These relations constitute "my situation and myself" historically and systematically in the process through which one decides the significance that the events of one's life and the events of one's history are to have and the significance that they do have for oneself.

Thomas Kuhn and the Copernican Revolution

Dynamic structuralism is largely immune to the relativist criticisms that are made against it; such criticisms are generally based on taking abstract identity conditions for objects and structures for granted. Such conceptions of structural objectivity presuppose the fundamental distinction between subjects and objects and then asks how they are structurally, objectively, and subjectively related once their existence is taken for granted. Kuhn has become rather infamous among contemporary philosophers for his alleged relativism, a relativism that has been embraced in other quarters; yet neither position is quite right. His conception of the Copernican revolution is nuanced from start to finish. From the first pages of The Copernican Revolution he emphasized that the truly revolutionary character of the Copernican revolution did not emerge until its further development in Kepler and Newton. While Copernicus promised a comprehensively systematic and coherent conception of the universe, it was in truth the initial increased incoherence in the Copernican conception that was the basis of its revolutionary consequences. Kuhn notes,

> the stationary central earth was an essential ingredient of received physical theory...Heliocentric astronomy, which required the earth's motion, was inconsistent with the existing scientific explanation of...terrestrial phenomena. The consistency criterion, by itself, spoke unequivocally for the geocentric tradition.[28]

He has also however appreciated the significance of systematicity:

> Copernicus himself particularly emphasizes [that in] the Ptolemaic system the appearances are not dependent upon the order or the sizes of the planetary spheres. There is no similar freedom in the Copernican system. If all the planets revolve in approximately circular orbits about the sun, then both the order and the relative sizes of the orbits can be determined directly from observation without further assumption.[29]

Yet sometimes he fails properly to emphasize the point: "Diffuseness and continued inaccuracy—these are the two principle characteristics of the monster described by Copernicus" (*KCR* 141). There is a better and deeper candidate for the reason why the Ptolemaic system is for Copernicus a monster; the Ptolemaic system is not really a system at all, but a kind of aggregate of orbits. There is little evidence however of the growing number of epicycles in Pre-Copernican astronomical theory and thus of a need for a new model that Kuhn postulates as the basis for his conception of scientific change. Copernicus brings about a new paradigm by fundamentally rethinking the old one rather than responding primarily to recalcitrant evidence and a degenerating research program.

Copernicus' most fundamental objection to Ptolemaic astronomy is that Ptolemaic astronomy cannot comprehend the cosmos as a dynamic, systematic structural whole that appears differently from our changing standpoints within the solar system. Kepler and later Newton will make great strides in making the conception of a truly systematic physical astronomy that is articulated from the vantage point of a moving earth a reality. This transformation in astronomy is part of a general cultural transformation and its appeal ultimately is aesthetic; but the word "aesthetic" is a somewhat deprecatory way of emphasizing the notion of harmony and symmetry in the Pythagorean tradition to which Copernicus, Kepler and Newton, to which all three, declare their allegiance.

> Though the Revolution's name is singular, the event was plural. Its core was a trans-formation of mathematical astronomy, but it embraced conceptual changes in cosmology, physics, philosophy and religion as well…Though his *De Revolutionibus* consists principally of mathematical formulas, tables and diagrams, it could only be assimilated by men able to create a new physics, a new conception of space, and a new idea of man's relationship to God. [*KCR* vii]

Kuhn took the "most important novelty" of The

[28] Thomas S. Kuhn, "Objectivity, Value Judgment, and Theory Choice," in Thomas S. Kuhn, *The Essential Tension*, Chicago, IL: University of Chicago Press 1977, pp. 320-39, here p. 323.

[29] Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*, Cambridge, MA: Harvard University Press 1957, p. 175. [Henceforth cited as *KCR*]

Copernican Revolution to consist in its ability to "display the Revolution's plurality." With this end in mind, Kuhn "violates the institutionalized boundaries which separate the "audience" for science, from the audience for history or for philosophy (*KCR* vii-viii). In his Foreword, James Conant affirms and emphasizes the pluralism of Kuhn's conception according to which:

> science is but one phase of the creative activities of the Western world that have given us art, literature and music [as such] the approach taken in this book is the approach needed to enable the scientific tradition to take its place alongside the literary tradition in the culture of the United States…he [Kuhn] points the way to the road which must be followed if science is to be assimilated into the culture of our times. [*KCR* xviii]

Copernicus's conception of the moving earth and its role in the systematicity of (the conception of) a solar system radically changes the significance of what it is to be a heavenly body, especially to be a planet. What it means to be a planet changes fundamentally from the Ptolemaic to the Copernican worldview as the earth becomes a planet. The very being and identity of the planets and other celestial and terrestrial bodies comes to be defined for Copernicus by their systematic relations to other planets and other celestial bodies and their dynamic relations to a moving earth. Our standpoint as knowers is now not an earth at the center of things, but rather a moving earth. The very meaning of what it is to be a heavenly body becomes a matter of its systematically changing relations to other heavenly bodies. This expresses a fundamental dynamically structuralist feature implicit in all of science and culture, but especially in modern science and culture. Modern structuralism has roots in the structuralism of the Copernican reconceptualization of the cosmos and of the systematic pattern of signs in terms of which one can and must reconceptualize perceptual information. With Copernicus a theoretical understanding of the world comes to be recognized as the very basis for understanding perception rather than something to be anchored in an independent perception. Each one of these philosophers, Kant, Hegel, Cassirer, Jaspers, Ortega, Heidegger, and Kuhn push this insight even further. But already Kepler and Newton develop a dynamic conception of infinitesimal displacements that are key to their understanding of how the system of the world (and that is especially the world of mathematics) makes a difference in every local change that is literally an integral part of the whole dynamic process.

Especially Kuhn, in part under the influence of Alexander Koyré (himself a former student of Husserl), appropriated early the dynamic structuralism of twentieth century German and French neo-Kantian thought, including the dynamical structural interpretation of the Copernican revolution and of the scientific revolution more generally. Everything is constituted by the structural relations that it has to everything else. Our grasp of these structural relations is dynamic; one always grasps them from one's changing standpoint within the system of relations that is the cosmos as one understands it from one's own vantage point in the dynamic process of culture, history and nature. There is for Kuhn in general a dynamic structure to scientific revolutions that involves a systematic change in the way physical objects and events are understood from the vantage point of a certain theory. The more radically the pattern of systematic relations that constitute things changes for us, the more fundamental is the change in our understanding of what those very things are, and the more fundamental is the change in our understanding of the very meaning of the being of those entities too. Kuhn's dynamic structuralism also inherits the dynamic conception of the *a priori* that can be found in the Marburg School:

> Like the Kantian categories, the lexicon supplies preconditions of possible experience. But lexical categories, unlike their Kantian forebears, can and do change, both with time and with the passage from one community to another. None of those changes, of course, is ever vast. Whether the communities in question are displaced in time or in conceptual space, their lexical structures must overlap in major ways, or there could be no bridgeheads permitting a member of one to acquire the lexicon of the other...Underlying all these processes of differentiation and change, there must, of course, be something permanent, fixed, and stable. But, like Kant's *Ding an sich*, it is ineffable, indescribable, undiscussable. Located outside of space and time, this Kantian source of stability is the whole from which have been fabricated both creatures and their niches, both the "internal" and the "external' worlds."[30]

In the same volume, Kuhn defends a Kantian view more plausibly but without resorting to "things in

[30] Thomas S. Kuhn, "The Road since Structure," in *The Road Since Structure: Philosophical Essays 1970–1993 With an Autobiographical Interview*, eds. James Conant & John Haugeland, Chicago, IL: The University of Chicago Press 2000, pp. 90-104, here p. 104.

themselves" and with the use of categories of the mind that could change with time as the accommodation of language to experience proceeded. He states: "A view of that sort need not, I think, make the world less real."[31]

Cassirer sketches an account of Copernicus' revolution that seems to resonate throughout Kuhn's book on that topic. Cassirer's conception of the sense in which science is relative to culture is something that Kuhn however failed fully to recognize in the late forties when he read Cassirer with enthusiasm concerning Cassirer's claims about the social and human sciences and with disappointment when it came to the natural sciences (*EM* 217). The conception of science, like the overall conception of culture in Cassirer's work, as has been amply demonstrated, is structuralist and explicitly formulated in opposition to the positivist picture of relatively isolated perceptual observation data to be interpreted by theory. Cassirer situates the significance of all science in a dynamic, constantly changing pattern of significance. There is really nothing quasi-positivist, empiricist about Cassirer's conception of science. It is as a function of the dynamic-historical structuralism of his understanding of the Copernican revolution that Cassirer gives historically changing significance even to the number system and the cosmos. That is crucial to the reading that the Marburg school gives to science as the revolving and, hence, constantly changing observer. Following that line of thought in his reading of Kant's three Critiques, Cassirer notes in his lectures on *The Philosophy of Kant* given in America in the 1940s:

> If in this simile [of the revolving spectator] we had to understand the "spectator" as the individual psychological subject...we would immediately [be] reduced to an interpretation of the Kantian system that Kant himself constantly rejects and that he vigorously attacks...But "the spectator" here is not the psychological subject, the "Ich" in opposition to the "Nicht-Ich"—the Ego in opposition to the non-Ego. The true spectator, the proper subject to which Kant refers here, is not soul of man or his individual consciousness but the science which deals with the phenomena of the universe.[32]

Kuhn rejects the culture-independence of the objects of natural science just as he does the culture-independence of the objects of the humanities and the so-called human sciences when he states,

> the gap that I have here described as separating the Greek heavens from our own is the sort that could only have resulted from what I earlier called a scientific revolution. The violence and misrepresentation consequent on describing their heavens in the conceptual vocabulary required to describe our own is an example of what I then called incommensurability. And the shock generated by substituting their conceptual spectacles for our own is the one I ascribed, however inadequately, to their living in a different world. Where the social world of another culture is at issue, we have learned, against our own deep-seated ethnocentric resistance, to take shock for granted. We can, and in my view must, learn to do the same for their natural worlds.[33]
>
> We part company [Taylor and he, Kuhn]…when he [Taylor] insists that, though social concepts shape the world to which they are applied, concepts of the natural world do not. For him [Taylor], but not for me, the heavens are culture independent…The nature of the difference is the same as that which Taylor so brilliantly describes between the social practices of different cultures…No more in the natural than in the human sciences is there some neutral, culture-independent, set of categories within which the population—whether of objects or of action—can be described. [*NHS* 219-20]

One does not need to and cannot anchor one's conception of the heavens in a culturally unmediated direct reference to the external world by means of the terms of science, as Taylor and Dreyfus have proposed against Kuhn in their book *Retrieving Realism*, anymore than one needs to or can anchor a purchase on one's own culture or subculture on some direct reference to the external world. Since we are always already among human beings and dwell in nature, there is no danger of one's losing contact with the external world. Humans need not and cannot embrace the immediate and the given as something completely free of mediation by their concepts and by culture. But it is also a mistake

[31] Thomas S. Kuhn, "Metaphor in Science," in *The Road Since Structure: Philosophical Essays 1970–1993 With an Autobiographical Interview*, eds. James Conant & John Haugeland, Chicago, IL: The University of Chicago Press 2000, pp. 196-207, here p. 207.

[32] Ernst Cassirer, "Vorlesungen und Vorträge zu Kant," in *Ernst Cassirer, Nachgelassene Manuskripte und Texte (ECN) 15*, eds. Christian Möckel, Hamburg, DE: Felix Meiner Verlag 2016, p. 183. [My translation.]

[33] Thomas S. Kuhn, "The Natural and the Human Sciences," in *The Road Since Structure: Philosophical Essays 1970–1993 With an Autobiographical Interview*, eds. James Conant & John Haugeland, Chicago, IL: The University of Chicago Press 2000, pp. 216-23, here p. 221. [Henceforth cited as *NHS*]

to think that nature is itself something separate from culture, just as it is a mistake to think of culture and history as something that is separate from nature. That is the fundamental point of Ortega's conception of vital, historical reason. There are important implications of this for our conception of the universe.

> What is the world, I ask, if it does not include most of the things to which the actual language spoken at a given time refers? Was the earth really a planet in the world of pre-Copernican astronomers who spoke a language in which the features salient to the referent of the term "planet" excluded its attachment to the term earth? Does it obviously make better sense to speak of accommodating language to the world than of accommodating the world to language? Or is the way of talking that creates that distinction itself illusory? Is what we call "the world" perhaps a product of a mutual accommodation between experience and language? [*NHS* 216-7]

The dynamic structural-functional account of identity and significance is the underlying basis for Kuhn's conception of *The Structure of Scientific Revolutions* and that is what makes it seem so threatening to much of contemporary philosophy. Contemporary thought remains mired in a neo-Humean model that cannot recognize the dynamic structuralism of the Copernican revolution or the even more dynamic structuralism that Kant pulls out of Copernicus, Kepler, and Newton and that especially Bergson, Cassirer, Weyl, Heidegger, and Ortega take to be the very basis of one's grip on being as well as on the different conceptions of being.

From a neo-Humean, neo-positivist, empiricist point of view, fundamental changes in science threaten to unmoor humans from perception and the object of perception. Once we focus on systematicity we are pushed away from direct data of perception. But then if we have a conception of logic and logical validity that purports to be independent of cultural and historical context and significance, then logical-structural systematicity threatens to become unmoored from the world. The only answer to that seems to be then an appeal to an immediate and non-mediated causal grip on the world. In the *Prolegomena*, Kant already saw through the hopelessness of such an appeal to the real world and to naïve and scientific realism as a response to Hume. Rather than thinking of the world in terms of a fundamentally static set of objects of perception to which we are connected by static logical and causal relations, one should think of the world as the dynamic place in which we dwell with others including those belonging to other cultures each with their own distinctive perspectives on the one, dynamic, natural and historical world in which we all dwell and that we all share. My circumstances are also always our circumstances to be grasped according to Ortega through our systematic grip on the relevance of the world to what we do both individually and together, in our natural and in our social and historical environment.