Chapter 9
"Demonstrations", Not "Deductions": Walter Dubislav on Transcendental Arguments

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Well known examples of transcendental arguments, like Aristotle's defense of the principle of contradiction, Descartes' cogito argument, and Kant's transcendental deduction of the categories, vary in many respects. Yet, while these lines of reasoning depend on quite different presuppositions, and have various argumentative scopes and force, they all share an important feature. Specifically, they are supposed to overcome skeptical doubts without exceeding the bounds of justifiable discursive commitments. It is on this basis that Strawson claimed, that if Kant's concept of transcendental deduction were freed from its association with idealism then it would be coherent to claim that the mere possibility of certain experiences should be held to depend upon a set of necessary conditions (Strawson 1959, 1966, 40). But, despite such maneuvers, the question of if and how transcendental arguments can be thought to be sound has not been settled yet. For, influential opposition to this brand of argumentation has emerged from scholars such as B. Stroud, who maintained that the idea of necessary conditions of possible experience stands in contradiction to the transcendentalists' declaration that they are not presupposing the truth of the propositions entailing these necessary conditions (Stroud 1968; Stern 1999; Schaper and Vossenkuhl 1989; Niquet 1999). The skeptic's point is that merely believing that a proposition which entails necessary conditions of possible experience, is true, provides a warrant for accepting the presuppositions underlying experience. As such, transcendental arguments are said not to stand up to skeptical doubt.

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At the same time these skeptical doubts are part of a moderate version of skepticism, which does not involve a complete rejection of sensible inter-subjective communication. For instance, it does not imply that "meaning" is a senseless expression and so forth. But, the skeptic can and will maintain that the conditions of possible experience, established via transcendental argumentation, may not necessarily be true. Thus, from the argument that a proposition S entails an essential condition of possible experience, it does not follow that S is true. For this result follows when one merely believes S to be true.

Stroud's objection is interesting because it doesn't question the form or validity of transcendental arguments. Nor does it reject the endeavor of seeking out the necessary conditions of possible experience. Rather, it only takes aim at the persuasive force of transcendental argumentation. For example, suppose you manage to state a valid transcendental argument, meant to justify the claim that a universal law of causation ("The same causes are related to the same effects under the same conditions") is a condition of possible experience (not as a condition of "nature" as the very object of that experience in fact). As such, you are able to explain what you mean when speaking of the conditions of "possible experience". What have you really gained? The use of transcendental arguments in philosophy presupposes the worth of a special kind of reasoning that draws upon the relation between conceptual content and the theoretical commitments implied by the practice of justifying experience. What is more, it holds that form of reasoning up as the means by which to identify the foundations of our actual experience. As such, transcendentally justified propositions are portrayed as being imbued with the very same persuasive force as immediately self-evident axioms. However, in Stroud's opinion this approach involves a verificationist gap, since transcendental arguments only establish the reasonability of beliefs and not the truth of propositions.

It is important to note that Stroud's criticism is open to counter objections. For example, one might ask if it makes any difference to share necessarily held beliefs with others, or to share the knowledge with others that a proposition must be true. However, such counter objections force their proponents to make many new assumptions. For instance, relying upon the idea of necessarily held beliefs requires one to construe the realm of human beliefs such that it is possible to make a clear cut distinction between the beliefs we necessarily have, and share with others, and our private beliefs. Now, this statement clearly amounts to a construction of the common ground of human experience as a set of necessarily held beliefs. As such, it seems that in order to raise this sort of objection, one would have to accept some strong version of transcendental idealism, i.e. a system of transcendental deductions in the sense of Fichte's "Wissenschaftslehre" or Schelling's "System des transcendentalen Idealismus".

On top of the problem of fairly stating transcendental arguments, one would also have to ascribe consistency and completeness to your set of transcendental deductions. Here a new problem, regarding how to justify this much stronger additional claim, emerges. For their part, German Idealists couldn't help themselves in reintroducing the concept of intellectual intuition (*intellektuelle Anschauung*) at this point. For, in doing so, they were able to ground their systems in self-evident

appreciations of the construing mind. Whereas, Kant, having abandoned intellectual intuitionism from critical philosophy, took a different approach. For him, transcendental arguments must amount to logically valid pieces of argumentation, that are not based on intuition. At the same time, they must be strong enough to justify our knowledge by reference to our everyday and scientific experiences.

It's worthwhile to reflect on the criteria of justification that Kant commits himself to on this front. He holds the adequacy of our statements to be grounded in the terms of experience. Thus, the problem of adequacy arises, according to Kant, insofar as we necessarily make use of non-empirical expressions like "space", "time" and "causality" to make sense of our experiences. Accordingly he refers to the transcendental deduction of forms of perception and the categories as "an indispensable requirement" of theoretical reason, because these concepts are related to objects without any support from the senses. Since they also are synthetic concepts, with a meaning which cannot be figured out by analyzing content, we need a special form of argumentation in order to prove their adequacy or aptness at informing us about the world, as it appears to us. As such, assessments of adequacy are not made according to an appreciation of things in themselves, but to the categories in relation to appearances.

Dubislav's criticism of transcendental deduction is widely neglected in the contemporary debate on this subject. However, it is of special interest here because of its proof-theoretic approach to the subject. In his small treatise "On the Methodology of Criticism" (*Zur Methodenlehre des Kritizismus*) Dubislav gives an account of transcendental deduction by way of comparison to mathematical proofs. Treating Kant's transcendental deductions as a type of argument (*Begründung*) within a general theory of proof, Dubislav erects a theoretical framework by reference to which he can discuss the assertive force of transcendental arguments. In this manner, he took aim at the primary concern underlying Stroud's objection. Thus, Dubislav, drawing on the account of J.F. Fries and his followers up to L. Nelson, arrives at the conclusion that the case of transcendental deduction can be stated in an unobjectionable way. Specifically, he held that argumentative force of transcendental arguments should be held not to be a matter of logical proof. Rather, it should be understood to be a matter of a weaker type of demonstration (*Aufweisung*). As a result it seems inappropriate to supply a constitutional theory of experience on the basis of fundamental judgments (*Grundurteile*) founded on transcendental deductions.

Given this approach, Dubislav can recognize the value of transcendental arguments as being possessed of this limited scope, and at the same time avoid transcendental idealism as a constitutional theory of (possible) experience. After a short survey of Dubislav's theory, we'll address the question of what role such limited transcendental arguments play within the formalist philosophy of mathematics and natural science, especially against the background they have in Dubislav's account. With an eye to these considerations, I will argue that formalism is vitally interested in transcendental arguments as a means of attacking the notorious problem of the adequacy the formalist axiomatic construction of scientific disciplines.

9.1 Philosophical and Mathematical Method

Dubislav starts from the presumption that the difficulties of Kant's conception of transcendental deduction are the results of problems in Kant's general ideas about basic concepts, axioms and proofs in mathematics.

Mathematics, in Kant's view, depends upon a set of basic assumptions (*System von Grundvoraussetzungen*), which are understood to be self-evident truths, neither open to, nor in need of, justification. What is more, these truths entail nonempty basic concepts (*Grundbegriffe*), whose referentiality is supposed to be self-evident on the basis of pure perception (*reine Anschauung*) (Dubislav 1929, 6f.). On the other hand, in philosophy, intuitively accessible axioms are lacking. In their stead, a regressive method of gaining basic propositions by analyzing conceptual content is supplied. With regard to mathematics again, Kant's view is that advances are made by the progressive determination of concepts starting from basic concepts, as they are contained in fundamental axioms. As such, mathematical method is therefore "dogmatic". Though, not in the pejorative sense pertaining to rational psychology and those other branches of metaphysics whose concepts are obtained deductively without correspondence to possible experience, but in the sense of deductive, logical valid reasoning from true assumptions to true conclusions. A "doctrine" according to Kant, means a theory with the force needed to be accepted by every rational being as soon as it is understood. Thus, whereas mathematical theories are "doctrines", philosophical methods are, in Kant's view, analytic, in the sense that they extract content from conceptual expressions. For example, the notion of "spatial extension" from that of "body". Furthermore, they are regressive in the sense that they start from more specified content and arrive at more general conceptual expressions. Basic concepts, thus, are universal concepts. Fundamental truths (*Grundsätze*) are true propositions consisting of expressions referring to the different fields of human cognition: namely, to pure intuition as the field of mathematical knowledge, to empirical perception as the field of natural science, and to everyday experience with its basic universal concepts, like "change", "cause" and "effect". Kant supplies an example of a fundamental truth of all possible experience within the "Second Analogy of Experience", where he states: "All Change happens in accordance with the law of connection of causes with effects" (Kant, *Critique of Pure Reason*, B 233).

Dubislav gives a criticism of Kant's account of fundamental truths attacking the underlying idea of axioms borrowed from Kant's philosophy of mathematics.

In Kant's view, the core of scientific justification is, Dubislav argues, mathematical proof within an axiomatic theory. According to this account we trust in axioms when they fulfill two conditions: they must be necessarily true, and they must contain nonempty conceptual and referential expressions. Now, regressively established fundamental truths in philosophy, as measured by the same criteria of scientific justification, would deserve exactly the same unquestionable assent if and only if they were to follow from self-evident true nonempty propositions according to logically valid rules. Just as propositions obtained by derivation are true if and

only if the propositions they are derived from are true and nonempty, which is the reason why—besides rules of valid reasoning—we need axioms as fundamental judgments in mathematics (in Kant’s view), the fundamental propositions derived by conceptual analysis in philosophy are true if and only if the judgments from which they are extracted (by what means we will have to see) are true propositions containing nonempty referential and conceptual expressions obtained according to valid rules of derivation.

Not surprisingly, Dubislav launches a fundamental attack on the underlying assumptions concerning the “content” of mathematical concepts as Kant conceived of them, and on his idea of mathematical method as determining concepts by “construction”. A more extended version of his account of Kant’s philosophy of mathematics is given in his own work on that subject (Dubislav 1932). The first point of discussion therein concerns pure intuition (*reine Anschauung*) as the faculty of the mind involving mathematical construction (Dubislav 1932, 51). The objection that Kant didn’t offer sufficient reasons to ascribe this faculty to humans doesn’t carry too much weight on its own. However, in connection with the objection that the idea that geometry and arithmetic must depend on pure perception because they refer to exactly one object each—space as the very form of outer, time as the form of inner sense—it leads to consequences inconsistent with modern physics.

In fact, before Dubislav, Kant’s theories of space and time had lead Kurt Grelling and Reichenbach to break with Kantianism more generally (Peckhaus 1994). The former rebelled against the Neo-Friesian School based on the work of Leonard Nelson (Nelson and Grelling 1974). While the latter, after having proposed a Kantian approach to the distribution of probabilities in his dissertation paper, had turned away from Kant after he dwelt more thoroughly on relativity theory (Reichenbach 1916, 1920).

The fact that Dubislav, as a formalist, did not accept the fundamental claims of Kant’s philosophy of mathematics is not surprising. The interesting question is what caused him to refer to the work of Kant at all. In the course of his criticism Dubislav gives an important hint as to his motivations on this point.

Kant’s ideas about scientific method are “irreconcilably” opposed to modern scientific method. This conflict is deepened and broadened, because Kant bases the pure intuition of space and time, as well as the categories, on the vested rights of reason set out in the fundamental propositions (*Grundsätze*). The problem with this move is that the corresponding basic judgments are closely related to axioms, in the sense Kant deploys with regard to mathematical theory: true propositions that can’t be subjected to a test. Hence, they are neither subject to confirmation nor refutation. Rather, as Dubislav points out, within his former paper on critical method, they are demonstrated (*aufgezeigt*) via the use of the infamous (*berühmt berüchtigte*) transcendental method (Dubislav 1932, 52f.). We may conclude, therefore, that the question of transcendental deduction, in Dubislav’s view, is not to be solved in isolation from methodological questions. As such, Kant’s concept of science depends on a view of axioms that, according to Dubislav, has been overcome by formalism. Accordingly, the question of what transcendental deductions, or in a broader sense transcendental arguments (as we will see, Dubislav doesn’t conceive

of them as deductions), are supposed to be turns into the question how such an argument can be freed from the environment of scientific concepts and criteria of justification in which Kant embedded it.

9.2 How Are Ground Judgments to Be Justified?

Unlike later accounts of Kant's deductions, Dubislav completely neglects its references to legal practice. Kant explicitly introduces his concept of deduction by reference to the distinction between the question of stating the case (quid facti) and the question of justifying the judgment (quid iuris) in court. Presumably, Dubislav takes these statements to be nothing but metaphorical elucidations of a method that has to be formulated in logical terms only. At an interpretive level, it is surely questionable that he simply dismisses all the comments that Kant provides on the deductions as irrelevant to the question how a deduction is to be formulated. Indeed, he calls Kant's comments on this topic subtle or even captious (*spitzfindig*), and thinks of them as being formulated in a roundabout way. As a result, he doesn't grant that Kant provides anything like a reliable theory of transcendental deduction. Dubislav arrives at this opinion via the assumption that Kant, like himself, must have accepted the generally recognized division of forms of reasoning (*Begründungen*). On this understanding, there is deductive reasoning, which is held to be a matter of logically sound inferences. Second, there are empirical demonstrations, including incomplete inductions, which are to be tested by observation and experiment. Third, there are calculations of probabilities, including statistical inference. Finally, there can be lines of reasoning which combine any these types, such as one might find to be at play within any number of scientific explanations (Dubislav 1929, 18f).

Following Bolzano, Dubsilav categorizes these different forms of reasoning by the measure of assent they are thought to demand with regard to a given conclusion (which is to be understood as an assertion (*Behauptung*) bearing a truth value). According to this line of thought, an argument (*Begründung*) is an operation supplying a conclusion with at least some assertive force. In the case of a logically valid inference, the assertive force is absolute, hence providing for a state of certainty. Whereas, the other forms of argumentation only provide for the conditional acceptance of an assertion. For instance, when calculating probabilities in cases of rational choice, the assertive force of the argument, should be expressed by a quantitative degree of assent. (Bolzano 1989, 126ff., 1992, 81ff.) In the case of incomplete inductions, which in Dubislav's view are conclusions drawn by analogy, assent can't be measured quantitatively and has to be estimated by the power of judgment. Against this background the problem of transcendental deduction turns into a simple question: if we consider the four forms of reasoning to be complete, to which of these forms is transcendental reasoning is to be reduced?

When speaking of "transcendental deductions", Kant seems to be subject to a certain theoretical prejudice. Specifically, he appears to hold that transcendental arguments must supply absolute assertive force and thereby count as valid deductions.

This is due to the fact that the grounds of judgments are not axioms in the Kantian sense, for we do not have immediate access to, or certainty of, that content. The problem of transcendental deductions only arises because the grounds of judgments are supposed to have the epistemological status of axioms even though they are not.

Convinced that Kant does not provide an answer to this problem, Dubislav turned to Fries' analysis of transcendental deductions, which takes the word “deduction” in a proof-theoretic sense. Fries analysis of these arguments differs significantly from Kant's, both with respect to its underlying assumptions and with regard to its account of the logical structure of this sort of reasoning. Therefore, it is important to note that, in what follows, references to transcendental deduction in the Kantian sense will be referred to as “transcendental deduction (K)”. Whereas, Fries' version shall be referred to as “transcendental deduction (F)”. Analogously, a demonstration (Aufweisung) in the Kantian sense will be referred to as a “demonstration (K)”, while Fries' concept of demonstration shall be indicated by the term “demonstration (F)”.

Following Fries, Dubislav accepts the following analysis of the concept of transcendental deduction: Let U be a “basic judgment”, which is the expression of a fundamental proposition in human experience. S(U) is an empirical psychological judgment, telling, us that U expresses a true proposition immediately (intuitively) evident to any rational being who makes use of concepts entailed in U. In Fries' view, as accepted by Dubislav, U does not rest on S(U), which solely is a second order statement about U. Accordingly Dubislav concedes that a transcendental deduction (F) is a fair reconstruction of a transcendental deduction (K). For, Fries' version allows one to state a transcendental deduction (K) as a form of proof:

The task now, is to consider just what to make of this analysis. Dubislav argues that Fries implicitly accepts a necessary validity condition which says that a transcendental deduction (F) is valid only if the empirical-inductive derivation of S(U) is valid and doesn't make use of U. But how can this condition to be fulfilled? Since his early writings, Fries admitted that, in many cases, available derivations of ground judgments are obviously circular. Hence, in such circumstances, valid transcendental deductions (F) are beyond our reach. Thus, the question arises of whether a Friesian transcendentalist can avoid the Humean trap, which says that experience simply presupposes experience and therefore cannot be justified by way of sound argumentation?

If we take a look at the transcendental deduction (F) of the ground judgment of causality, the Kantian version states that the same causes are followed by the same effects (which is not to be confused with the Leibnizian principle of causality, which tells us that nothing exists unless sufficient causes effectuate its existence). Now, Dubislav agrees with Fries on the assumption that, in their everyday practices, humans behave as if the ground judgment of causality were a self-evident truth. However, such a demonstration (F) of this ground judgment doesn't seem to satisfy the conditions of a justification, in the sense of a transcendental deduction (K). Therefore Fries recurs on his idea of inductive evidence supporting not immediately the ground judgment of causality but its immediate intuitive evidence, which is an unconscious (“dark”) acceptance of the content expressed in the ground judgment.

From this account of transcendental deduction (F), Dubislav derives his main objection against the idea that transcendental arguments are a form of valid deductive reasoning. Specifically, in order to prove U by transcendental deduction (F), the grounds for S(U) must be drawn from everyday experience. Therefore, it remains unclear why a transcendental deduction (F) should have lead to a stronger measure of assent than a regressive demonstration (F) which has the same (small) argumentative force as an empirical deduction (K): "Denn weder durch die Deduktion noch durch die Aufweisung werden die betreffenden Einsichten ihrerseits irgendwie begründet" (Because neither by deduction, nor by demonstration the concerning insights are in any way validated) (Dubislav 1929, 34). As such, Dubislav held that Kant's attempt to deduce the categories of experience does not take him any further than the empirical deductions he criticized within the work of Locke and Hume (Dubislav 1929, 9).

9.3 Formalism and Transcendental Idealism: The Question of Time

Next, it will be shown that Dubislav, drawing on considerations put forward by Fries and Nelson, tried to overcome the framework of Kant's transcendental philosophy that informed the work of both of those scholars. As has been shown above, according to Dubislav and Reichenbach, Kant's theories of space and time, as given a priori forms of perception (*Anschauung*), and his understanding of causality, do not fit with the theory of relativity that governs modern physics. Now, the question arises of how this result is related to formalism, understood as a way to conceive of axiomatic systems. Formalism refers to the idea of founding natural science and psychology as structural sciences (*Strukturwissenschaften*). As such, it reduces scientific disciplines to a few basic relations that do without synthetic a priori judgments. Reduced to its logical structure, a theory allows of various interpretations. An interpretation is the application of a theory to a sphere of objects. Kantian transcendentalism, on the contrary, implies foundationalism. Any possible object belongs to one coherent sphere of appearances, constituted by the pure intuitions of space and time and a limited set of categories. In what follows, it will be suggested that the reason that formalism emerged from considerations within modern natural science (especially quantum physics) regards the fact that the question of adequacy of empirical theories that was addressed by the transcendental deductions can't be stated in a way that makes sense anymore. As a consequence there seems to be no place for transcendental deductions in scientific method anymore.

In order to make this point clear, it is helpful to take a look at the transcendental deduction of time. In accordance with Leibniz, Kant maintained a theory of time based on the concept of causality. As such, Kant's transcendental deduction of time, in the "Transcendental Aesthetics", aims at a justification of time perception that

speaks to the directedness of that phenomenon. However, the idea that time has a direction, that is so fundamental to the psychology of our everyday experience, is incompatible with the way that time is conceived within modern physics. Indeed, even Kant was well aware of the fact, that from the succession of our perceptions, it doesn't follow that time must be directed from the past to the future. Rather, the psychological order of experience only shows, "that in the imagination one thing is earlier, another later, but not that one state of the experienced object procedes another" (*daß meine Imagination eines vorher, das andere nachher setze, nicht daß im Objekte der eine Zustand vor dem anderen vorhergehe*) (Kant, *Critique of Pure Reason*, B 233). Kant connects the psychological order of imagination with the concept of causation and holds a causal theory of time. The idea behind the causal theory of time is that causation constitutes a directed time order, such that an "arrow of time" is constitutive of human experience. Even within Newtonian physics, it is inappropriate however to think of time as being generally directed. For, the basic equations of classical mechanics by no means imply that motion is irreversible. As such, Reichenbach, observed that the "between"-relation is a reversible property of time that is invariant for a reversal of time direction. Accordingly, he maintained that the laws of mechanics do contain information about temporal relations, but not about the direction of processes determined by these relations: "Neither the laws of mechanics nor mechanical observables give us a direction of time, unless such a direction has been defined previously by reference to some irreversible process" (Reichenbach 1956, 35).

Nevertheless the causality-based theory of time had some merits. For, not every natural process is reversible. After all, since the nineteenth century, the study of thermodynamics has called the general time-symmetry of natural processes into question. Changes in temperature, pressure, or the bulk of bodies and gases seem to be irreversible, and are treated as such at the macro-level of physical observation (Kornwachs 2001, 32f.). With this in mind, it is clear that the concept of entropy allows one to assign a very high probability to certain a state of affairs as the irreversible result of a process. For instance, the regular distribution of ink molecules over a surface of water is highly probable, when compared to the likelihood of their being concentrated within a limited area of such a surface. Probable inference is not the same as deductive reasoning, insofar the conclusion of any probable inference is a probability statement, which must not be true. Therefore C.F. von Weizäcker objected that Boltzmann's solution is based on an invalid inference from a non-deterministic to a deterministic assertion about the future (Von Weizsäcker 1939, 274ff.).

What can be said in favor of the Kantian approach is that nothing like a physical explanation of the direction of time is available. Thus, prima facie, it makes sense to search for a philosophical solution. As a starting point, one can note that space and time have been the basis for theories of motion since antiquity. Indeed, Aristotle denied the reality of time and thought of it as a measure or quantity of movement with respect to different states of affairs of the things given to us in perception. While the idea of uniformly flowing, objective time occurs only as an unquestioned assumption in classical mechanics (Newton 1999, 408). After Einstein criticized

absolute time as a variable independent from the objects and motions subject to physical investigation, the question of time became even more demanding (Einstein 1905). Following Einstein, A. Minkowski understood time as being related to the relative velocity of an inertial system and, thus, integrated it as a bound variable in the space-time continuum (Minkowski 1909). However, to conclude that physics was "temporalized" by these considerations seems disproportionate (Zimmerli and Sandbothe 2007, 8ff.). In fact, it even remains unclear if the normal meaning of the word "direction" is implied within the talk of "time dimensions" (Böhme 1966, 105). In this vein, K. Gödel remarked that time still was thought of as a reversible and symmetrical structure with strong analogies to the concept of space (Zimmerli and Sandbothe 2007, 9f.).

As Reichenbach and C.F. von Weizäcker have pointed out, it was quantum theory that is forced to give up the general concept of time as a reversible flow (Von Weizsäcker 1992). For, the motion of electrons can't be described with respect to spatio-temporal trajectories that fully determine the past and the future (under the assumption that a complete description of the presence is available). As such, the Schrödinger Equation measures the wave function that describes the motion of the quantum object. Thus, while the underlying conception of motion is deterministic and reversible, it only allows us to make statistical statements about the future distribution of quantum objects. On this understanding, the future is thought of as a sphere of possibilities not fully determined by the past. Accordingly, the observer or the measurement device registers which of these possibilities is actually realized. The idea of separating the subjective attitude of the observer, which is bound to the irreversibility of time, from the objective process, which is supposed to be reversible, amounts to something of a working solution. For, the fundamental question, of whether time has to be conceived of as being reversible or not, is left open (Zimmerli and Sandbothe 2007, 10ff.).

Dubislav aims at a formalist constitution of experience that does not depend upon synthetic a priori judgments about the structure of nature. In his "Philosophy of Mathematics" Dubislav clearly supports Hilbert's formalism, whom he considers to be his teacher, against Frege's logicism and Brouwer's intuitionism. As he states:

> In the face of the successes of formalism [...] at the one hand and considering the difficulties and ideological burdens that logicism and intuitionism have to bear each in it's own way only on the ground of formalism it seems to be possible to transfer pure logic and pure mathematics in the condition Gauss has referred to, as we mentioned in the beginning. (Dubislav 1932, 48).

In his "Natural Philosophy", this amounts to an analysis of time which maintains that, besides a set of definitions and axioms determining the way our statements about time are related to one another, i.e. relations like "before", "after", "at the same time", a series of conventions must be acknowledged that enable us to relate logical structures to our perception of time. Specifically the conventions dealing with time-measuring, especially with regard to its scale, unit and zero-point. For example, the congruence of two intervals measured at the same place must be determined by a convention about the counting of periodically returning events (Dubislav 1933, 147).

Alongside these initial moves towards a formalist account of time, which also draws on conventionalism, Dubislav launched a severe attack on the Kantian theory of time as a pure form of perception. In particular, he completely rejected the idea that theory of space and time is considered to be independent from the results of natural science. This rejection also extended to the, later, Neo-Kantian shape that Cassirer gave to this notion, implying that Kant’s original idea must be transferred into a formal conceptual framework of valid a priori relations (Dubislav 1933, 141). Accordingly, Dubislav maintains that formal structures do determine content, but that content, at least in natural science, always has to be empirically testable in relation to measurable or observable facts.

Finally, we now have to ask how this result fits in with Dubislav’s treatment of transcendental arguments, which consists of the suggestion that transcendental arguments should not be rejected outright, but cannot plausibly be portrayed as valid deductions. In his “Philosophy of Mathematics”, Dubislav elucidated the method of formalizing a scientific discipline in three steps (Dubislav 1932, 12ff.). First, all the statements of the discipline are to be stated in a complete deductive chain of reasoning. In this process all non-logical assumptions are to be made explicit. Furthermore, the introduction of concepts is to be carried out by derivation from a set of fundamental concepts (*Grundbegriffe*). On this basis, all statements of a given discipline are to be divided between a class of axioms and a class of theorems. For, the complete reduction of the theorems to the axioms and definitions allows one “to take a formalist stand”. That is, the given discipline can no longer be conceived of as a system of truths deduced from the basic concepts and axioms, but, rather, must be understood to express a network (*Netzwerk*) of conceptual relations. The third and last operation of formalization consists in the representation of the network with the means of the logical calculus (basically Dubislav thinks of classical propositional and predicate logic with identity, referring to it as “the calculus”; he also draws on type theory).

If we take a look at the role definitions play within the process of formalization, we have to distinguish between substitution instructions (*Substitutionsvorschriften*) and assignment instructions (*Zuordnungsvorschriften*). Dubislav thinks of the substitution instructions as arbitrary stipulations without any impact on the interpretation of the system. In fact, the question of how to interpret a model in the formalist view depends on the choice of certain assignment instructions According to Dubislav the assignment instructions have the same character as arbitrary stipulations (for a criticism of this view based on the idea that definitions are guided by interests compare Gabriel 1972, 53–55). But here the question of the correct determination of concepts by other concepts touches upon the question of an adequate interpretation of a system. For, how can we determine whether a relational network represents anything or not? Evidently, the question of adequacy can’t be answered through deference to the internal logic of the system. As such, the method of stipulations enabling reductions comes to an end. For instance, to answer the question (to use the famous analogy of a formal system with a railroad map which can be found in Carnap) if the railroad map adequately represents the railroad network, it is not sufficient to know the relations between the junctions on

the map. What we want to know is if the map is applicable to the real network. What the transcendentalists' point of view comes down to, in this case, is the idea that we cannot think of a real network unless we conceive of it in terms of a consistent set of relations between junction points. Therefore, in some practical sense we might say that the concept of a consistent set of relations is necessary for the possibility of the experience of a network. This does not mean that a specific set of relations that we use within our everyday thinking—for instance, the relations between Berlin, Leipzig and Munich as junction points—can never be falsified by experience. For, the set taking Munich to be in between Leipzig and Berlin is, in fact, is falsified by experience. However, it will not be possible to falsify the requirement of a consistent set of relations. For, using the railway example, in referring to a railroad network we are already conceiving of it in terms of such a consistent set. Thus, transcendental arguments are needed to show which propositions ought to be acknowledged as a priori true, although not invulnerable, in making use of a system of propositions and concepts. We may conclude therefore that within the formalist framework transcendental arguments, understood in the weaker sense of demonstrations (F) (*Aufweisungen*), are of vital importance to the question of adequacy and this result might partly explain Dubislav's strong concern with transcendental arguments after all.

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Walter Dubislav in 1931 in Berlin (by Willy Römer)