

A CRITIQUE OF DESCARTES AND HEISENBERG

by

Roy A. CLOUSER

In what follows I shall be using the term 'critique' in a way which follows Dooyeweerd's use in his *A New Critique of Theoretical Thought*.¹ This idea of critique is quite unique, and as yet has not had a widespread hearing in North America. For that reason the largest part of this essay will be devoted to explaining and illustrating that idea of critique. After doing so, I shall use Descartes' mind-body dualism and his view of mathematics as examples of positions which run afoul of the critique. And then I shall briefly consider the grounds of Heisenberg's interpretation of the uncertainty principle as an example of the Cartesian view of mathematics, which legacy also violates the critique.

Those who are familiar with Dooyeweerd's critique will have already noticed that I have avoided referring to it with the adjective 'transcendental' as Dooyeweerd himself did. This is because my years of trying to explain his critique to thinkers in the British and American philosophical tradition have convinced me that the term 'transcendental' has such strong associations with Kant that it must be dropped. I've found that once I use that term, my partner in discussion presumes that Dooyeweerd is some sort of subjective idealist, that he is committed to some version of a doctrine of fixed 'categories' of thought, and no doubt maintains a highly problematic cleavage between sensation and conceptualization.

Since all these items are rejected by Dooyeweerd, and since Dooyeweerd believed that although Kant had the right idea in seeking for a transcendental critique he never actually achieved it, it seems unfair to me for anyone to construe Dooyeweerd's critique as a piece of Kantian philosophy. For these reasons I propose that the term 'metatheoretical' be substituted for 'transcendental', and I will attempt to justify this choice in the course of explicating the idea of critique.

To my thinking, the best way to understand what Dooyeweerd meant by critique is to see it as a new criterion for judging theories. This matter of evaluating theories has received a lot of attention in the past twenty years especially in the philosophy of science. A great many books in this field have given lists of criteria employed in the adjudication of competing scientific theories, and there can be little [157] doubt that these same criteria have been employed for competing philosophical theories as well. Among the most frequently cited criteria are logical consistency, explanatory power, public accessibility of evidential data, some sort of testability (where possible), and simplicity. Various authors break these down and explicate them somewhat differently in detail. But there is wide agreement on the general meaning and need for at least the criteria just named.

Now all these traditional criteria are decidedly 'internal' to the theories being judged in a way Dooyeweerd's is not. I mean by this that the criteria named apply to the statements of a single theory or to the comparison of the statements of two or more of them. For example, it is a matter internal to a theory whether its postulates, assumptions, claims and conclusions are mutually consistent. And it is a matter of straight forward comparison whether one theory contains fewer hypotheses than another. And while it is a much more complex comparison to judge respecting explanatory power, it is still an issue which is internal to the theories

¹ Presbyterian & Reformed Publishing Co., Phila., 1955. (4 Vols.) Hereafter referred to as *N.C.* followed by a Roman numeral to indicate volume number and arabic numeral to indicate page number.

involved in that it contrasts the statements deducible from the hypotheses of one theory over against those deducible from the hypotheses of another theory. Moreover, the business of applying these criteria constitutes what we mean by justifying a theory. A theory may be said to be relatively justified if it satisfies these criteria in ways that compare favorably with the ways competing theories satisfy them. And a theory may be said to be over-whelmingly justified if it satisfies these criteria in a way which is clearly superior to its competition as, say, atomic theory presently does in physics.

Now Dooyeweerd's critique, I suggest, should also be thought of as a criterion for theory adjudication, but as one which functions at a *different level* from the traditional criteria. It is this *external* level of operation which is conveyed by the term 'metatheoretical'. For the critique does not evaluate a theory by comparing its statements to one another or its statements to those of another theory. Rather it compares the contents of a theory to activities of the thinker, especially to the 'action' of abstracting which is necessary to the process of scientific and philosophical theory making. Its application, consists in determining whether the questions, hypotheses, entailments or assumptions of a theory are compatible with the very processes of abstraction required to form or justify them. The critique, then, consists in a description of the constant features of the process of abstraction,² and in using these as a criterion for theory evaluation. For if the contents of a theory are incompatible with the processes required to produce or justify them, that theory is unjustifiable in principle no matter how well it may fare by the traditional criteria.

The latter remark is deliberately intended to convey just what it seems to insinuate: a theory can be internally quite consistent, possess explanatory power, have publically accessible evidential data, and come - off well on simplicity. It can, by comparison, look as good or better than its competitors in these respects while still being incompatible [158] with the very processes it takes to produce it! In such cases, applying the traditional criteria may well aid us in understanding the ramifications of a theory and its advantages and disadvantages relative to other theories. But no matter how well a theory can satisfy these traditional criteria, it has not advanced one step toward the justification of the truth of its hypotheses if these are such that they could not be known to be true given the mental operations it takes either to formulate or justify them. This feature of the critique is a second sense in which it deserves to be called 'metatheoretical'. It is at a metalevel to the traditional criteria in that it is not a criterion of justification, but of *justifiability*. Being compatible with the critique will not justify a theory at all. But being incompatible with the critique renders a theory self-defeating and unjustifiable in principle.

The first sense in which this critique was termed 'metatheoretical' was that it compares the statements of a theory not to other statements, but to an activity necessary to the formation or defense of the theory. So it might reasonably be asked whether or not there can be activities of the thinker other than abstracting which also form necessary preconditions to the formation and justifying of theories, 'and which could therefore also function as metatheoretical criteria. The answer to this question surely must be affirmative. There are literally hundreds of activities which are preconditions for theory making, including being born, breathing and eating. The reason these are not singled out for the critique while the features of abstraction are, is simply that their range of application is severely limited: there are no important theories which have ever affirmed or denied that people are born, breathe, or eat. If there were, then such theories could be judged for their compatibility with such activities.

² Dooyeweerd's term for these constant elements is 'the structure of theoretical thought.'

A philosophically important example of a condition other than abstraction being necessary for the production of a statement, and thereby functioning as a metatheoretical criterion for it, is that of Descartes' famous 'cogito'. It is well known that Descartes' search for certainty led him to propose his own existence as the fore-most infallibly certain truth. But as many commentators have since noted, the statement 'I exist,' when asserted self-referentially, does not have any of the characteristics which are traditionally associated with likely candidates for certain truth. 'I exist' is not an axiom, it is not a logical truth, and it does not have a self-contradictory denial. Yet although there seems no good reason to suppose that 'I exist' is a necessary truth, its certainty still has tremendous appeal; it still seems to be an undeniable truth, at least for the one who asserts it of himself.

I believe that the source of this certainty lies in the relation between the denial of 'I exist' and its metatheoretical conditions. That is to say, although the statement 'I do not exist' is not self-contradictory—is not ruled out on solely logical grounds—it is incompatible with one of the conditions it takes to assert it. In this case it is the existence of the thinker which functions as a metatheoretical criterion, ruling out the truth of the assertion 'I do not exist'. Notice, again, that the decisive factor is not the relation of the statement 'I do not exist' to any other statement or set of them. Rather it is the relation of this statement to some event or state of affairs which is a necessary condition for making [159] or justifying the statement. In this case one such condition is incompatible with 'I do not exist,' thus the statement 'I exist' is rendered reliable.³

In the above example, a metatheoretical condition provides grounds for regarding a statement as false and its denial as therefore true. This is a stronger outcome than what Dooyeweerd looks for when he employs the modus operandi of abstraction as the metatheoretical criterion a hypothesis is to be compared to. As has already been asserted, Dooyeweerd held that a hypothesis incompatible with features of abstract thinking would be rendered unjustifiable in principle though it need not thereby be shown to be false. An example of this weaker result of incompatibility with a metatheoretical criterion is the case of determining the temperature of water in a beaker with an ordinary thermometer. For in such a case we insert the thermometer into the water, and doing so may alter its temperature. Thus if an accurate reading of the thermometer yields 68°C, this will not allow us to make a justifiable claim that the temperature of the water prior to the insertion of the thermometer was 68°C. For any such claim will be incompatible with the interference of the measuring process itself. The claim *could* be true, of course; it is just possible that the thermometer did not alter the temperature significantly. But any claim that this is so is incompatible with the activities necessary to arriving at the figure 68°C, so that the claim is self-defeating and unjustifiable in principle.

In the latter example, the way the activity of thermometer insertion is used as a metatheoretical criterion is closely analogous to the way Dooyeweerd employs several pertinent and constant features of abstraction necessary for the production of scientific and philosophical theories as a metatheoretical criterion. For these features are ways in which the very process of abstracting interferes with and alters its abstractum, as the thermometer altered what it was to measure. In particular, Dooyeweerd calls attention to the ways abstracting introduces changes into the relations of the abstractum to the background from which it has been extracted and to the logical functions of the thinker. The consequence of this is that any hypothesis which regards the relations of an abstractum to its background or to the thinker as identical with the relations it had prior to being abstracted, is unjustifiable in

³ Hence the reliability of the cogito cannot be rested on the ground that it is an absolutely simple truth, as Descartes tried to do. It is not simple because it expresses a relation between thinking and existing, and that relation is not an immediate (or even mediate) logical inference. It is that of presupposition.

principle. For there is no way to show that these relations of an abstraction are the same after, as they were prior to, its having been abstracted.

With this much forewarning as to how the critique can be expected to work, let us turn to Dooyeweerd's analysis of those elements of theory making which can function as a criterion. As was already noted, Dooyeweerd's critique begins with an examination of a characteristic which is almost unanimously conceded to be one of the distinguishing marks of scientific-theoretical thinking: [160] namely, that it is abstract.⁴ He does this by contrasting nonabstractive, 'pretheoretical' with abstract, 'theoretical' thinking so as to highlight the characteristic features of abstract thought. The contrast goes like this.

In everyday experience we are directly aware of a host of things, events, etc. I shall call these 'concrete entities'; they are the 'data', the whatever-they-are, which we know by immediate experience rather than by inference. Dooyeweerd terms this direct experience 'pretheoretical' for, as these are the entities about which we raise questions and construct theories, it is plain that we are acquainted with them prior to any attempt to construct theories. In this ordinary, pretheoretical, mode of thought our consciousness ranges freely over a vast array of available data, and we become aware that it has a focal point of attention with respect to them. That is, our consciousness is not at any one moment aware of all within its field with equal clarity. Some things are at the center of our attention, others are at the periphery. The practice of directing this focus of consciousness—of 'paying attention'—is one of the most familiar elements of human experience.

Owing to the varying degrees in which we may focus our attention, it is possible for us to pay only the most superficial heed to some concrete entity. In modern life, with its increasing complexity and proliferation of new devices, we may sometimes become acquainted with something only to the extent of knowing its name and the barest notion of its immediate utility. This is, however, a denatured and starved version of what we generally seek and what more usually occurs. More often than not we attempt to distinguish and notice the prominent and important features of the objects of our experience in the belief that our knowledge of them is directly proportional to the number of their properties with which we become familiar. *In fact, we ordinarily make no distinction between becoming familiar with something and distinguishing its properties; our attention is at once directed to the entity and its properties; or, we may say, to the entity-with-its properties.* Conversely, in noticing the properties of an entity we do not experience them in isolation from the entity, but as properties-of-the-entity. We grasp an entity as a Gestalt, in the continuity of its features.

This is so far the case, that we often have great difficulty describing or defining things even though we are very familiar with them. We can all probably recall, for instance, the frustration of trying to give directions to a location we can easily find, only to discover we can't explain the way to someone else. This is an example of having distinguished the features of something—in this case, the quickest route—so that we recognize them well enough, but having that distinguishing remain such a subsidiary part of the whole experience of the route, that its specific parts were not differentiated sharply enough to be able to enumerate them to another person. Another common example of this is the experience of not being able to give an adequate description of a friend though you unfailingly recognize him yourself. [161] The fact that you have actually distinguished the features of his face could be easily verified by having you construct a good composite likeness using the police method of arranging various

⁴ What follows is a summary and exposition of Dooyeweerd's position as found in the *New Critique* at: I, 34-52, 82-85, 545-566; II, 366-380, 428-434, 466-471; 113,1-53,145.

eyes, noses, mouths, etc. The reason for the difficulty is that in this case too, the features, though distinguished, were so thoroughly integrated in the experience of the whole face that it was difficult to describe them separately. In fact it is commonplace that distinctions may be drawn quickly and then remain implicit in our knowledge of something, so that we know more of it than we can say about it. And while distinctions drawn admit of varying degrees of explicitness, a similar point can be made concerning the activity of distinguishing. Acts of distinguishing are usually such an integral part of experience, that we are not often specifically conscious of them either, unless they require some extra effort owing to an intense curiosity or other hindering circumstances (e.g., we are trying to see through a fog). That the activity of distinguishing should itself go unnoticed is not at all strange. It is often the case that one activity which is performed for the sake of another which is simultaneous to it goes unnoticed at the time. When we read, for instance, we move our eyes across the page in order to see the printed words. This is done for the sake of understanding what is written, so that we may become so absorbed in the meaning of what we are reading that we are quite unconscious of moving our eyes. When this activity is called to our attention, though, we can readily recall having moved our eyes and we may read a few lines more and this time deliberately pay attention to moving them. Now the activity of focusing attention and drawing distinctions in preabstract, pretheoretical experience is analogous to that of moving one's eyes when reading in that it too may be reflectively paid attention, though it is usually ignored. It too, then, may be confirmed by thinking back on past experience and by noticing it accompanying present experience. In fact, it becomes obvious on reflection that paying attention and distinguishing are quite as necessary to reading as is eye movement.

Highlighting these two elements of pretheoretical thought and experience may seem to be belaboring the obvious, but there are some important consequences which they make possible. The first of these concerns the formation of pretheoretical concepts. For, as far as we can tell by reflection, the focusing of attention and the drawing of distinctions are activities involved in the formation of our concepts of the concrete things and events of pretheoretical experience. This involvement appears to be at least that the concept of a thing is a thought-unity (a unity-in-multiplicity) combining the thing's distinguished features, so that distinguishing is a prerequisite for concept formation. Now this point can be seen as having more going for it than reflection alone in that it yields a plausible account of several features of pretheoretical thinking which clearly contrast with abstract, theoretical thinking. For instance, the relative imprecision of pretheoretical concepts may be accounted for in terms of the hasty, rough way pretheoretical distinctions are drawn and then immediately combined so as to form a concept of the object. As we already noted this often results in clearer knowledge of the whole object than of any of the subordinate distinctions combined in the concept. Besides this, [162] the fact that pretheoretical concepts are deliberately made to conform to the concrete things, events, and states of affairs of everyday experience, precludes the sort of conceptual freedom and inventiveness which is a chief characteristic of scientific thinking. Moreover, this close orientation to concrete objects shows why even where our practical concerns with them lead us to draw relatively sharp distinctions, the properties so distinguished are, as we noted earlier, still conceived as properties of the object. The need for drawing a straight line, for example, may lead us to notice the straight edge of a piece of wood, and the property of having a straight edge may remain quite explicit in our concept of that piece of wood. All the same it is still the case that the straightness distinguished remains integrated in the concept of the piece of wood, and is not conceived in isolation from every concrete thing as it is in geometry.

A second important consequence of reflectively analyzing pre-abstractive experience into the activity of focusing attention and the activity of distinguishing and combining of the

properties of concretely experienced entities so as to form concepts of them, is that we may explicitly notice that the distinguishing and combining takes place in conformity to the logical laws of identity, noncontradiction, and excluded middle. The common sense concepts—though often imprecise—are nevertheless logical concepts. People who are not acquainted with any statement of the axioms or techniques of logic still quite regularly draw inferences based upon what is included or excluded from their concepts of things. To be sure, we are not always clear about just what is included or not in an imprecise concept; we have already seen that they frequently contain many properties only implicitly, so that although we may be quite familiar with a thing we may still be unsure when asked concerning some one specific property of it. But even such uncertainty indirectly attests to an intuitive awareness on the part of even the simplest, untutored folk that there are norms for drawing inferences; that it is not true that any inference desired can be legitimately derived from just any information whatever. Even without being self-conscious relative to logical axioms or rules, pretheoretical thinking invariably recognizes that contradictory and certain contrary statements cannot both be true at once. Thus the fact that properties may be contained in a concept only implicitly rendering the concept hazy or leaving us uncertain as to a precise definition, or dubious about some of the inferences it yields, does not detract from the logical character of the distinguishing and combining which produced the concept. Furthermore, pointing out the relative haziness of pretheoretical concepts is not intended to disparage preabstractive thought. It is quite true that the latter does not attain to the precision of abstract, scientific thinking. But precision is not the same thing as accuracy. If, for example, I say that it is 268.5179 meters from my front door to my office, that is a quite precise, but wholly inaccurate statement. The pretheoretical concepts lack the precision afforded by abstraction, but they can be quite accurate enough for our ordinary (nontheoretical) purposes, and there are important senses in which they are more accurate with respect to our dealings with concrete entities than theoretical abstractions are. I may be anticipating too much in [163] these last remarks, but I suspect they are needed in order to head off any possible misunderstanding of the contrast that is being drawn between the two modes of thought. Our point here has been to make it clear that even though pretheoretical concepts are less precise it does not follow that they are any the less logical in character or necessarily less truthful than abstract concepts.

Yet another feature of common sense, prescientific thinking which now gains explicit recognition is the feature of the graded intensity of which our conscious attention is capable. We mentioned earlier that attention has a focal point, and that we may sharpen that focus when making a deliberate effort to concentrate. Now we wish to emphasize that focusing may do more than narrow the scope of attention, it may also intensify attention in the sense of noticing more details more clearly. In fact, it may now appear that the logical distinguishing we've been talking about is a further extension of the same business of sharpening or intensifying attention. When we spoke earlier of pretheoretical concept formation being at least a composite of the focusing of attention and the distinguishing-combining of properties, it was not intended to convey the impression that those two activities were quite different. Let it be clear that what was intended was only to point out that a broader sort of focusing of attention on many entities, on a single whole entity or any of its parts, is accompanied by a simultaneous narrower and more detailed focusing on their properties. So far as what can be known of these processes by reflection goes, then, they appear to be different gradations of the same basic activity, so that their difference is one of degree, not kind.

Now all the features of pretheoretical thought and experience listed above were delineated for the purpose of aiding the contrast with abstract, theoretical thinking. The description of this abstractive mode of thought is also based upon self reflection as was that of pretheoretical

experience and thought. In effect, Dooyeweerd asks us to confirm by our own critical introspection that thinking abstractly requires additional activities on our part to those we noticed operating in pretheoretical thinking.

To begin with, Dooyeweerd uses the term abstract in its original meaning: it literally means to separate something out of something else; to extract something.⁵ Taken together with Dooyeweerd's recognition that there are gradations in the explicitness with which distinctions may be drawn, this suggests that he regards the activity of abstraction as a still further intensification of the focussing of attention which enabled the drawing of distinctions. That is, things, parts of things, and qualities of things, may be distinguished more or less explicitly in ordinary, pretheoretical thought. But to think abstractly is to intensify the level of the focus of attention to the point where some quality is not simply [164] distinguished, but is extracted and isolated by the focus of our attention. In abstract thinking, then, we do not have at the center of attention a concrete thing-with-properties, but instead we make an effort to single out some property itself, conceiving it in isolation from any concrete entity which may exhibit it. In this way attention intensified to a degree which enables abstraction to occur does more than make distinctions possible. It actually modifies what is experienced by breaking apart the Gestalt-entities of pretheoretical experience and disrupting the continuity of properties which those entities exhibit. Needless to say, this abstractive focusing of attention also takes place in subjection to logical principles and is involved in the formation of abstract concepts. In fact, this logical disassociation of the features of things agrees with the literal meaning of the term 'analysis': to analyze something is to mentally pull apart its constituent elements, isolating each so far as possible in the focus of attention.

Here again we find that not only can this description of the process of abstraction be confirmed in reflection, but also by yielding a very plausible accounting of some of the salient facets of theory making. For instance, the process of isolating properties followed by the careful self-conscious way they are then combined in concepts, explains the greater precision of an abstract concept. And since we are then clearer about just what is or is not included in such a concept, we find it easier to be clear about what is entailed or denied by it.⁶ At the same time this characteristic of abstractly formed concepts shows why their contents are easier to state in definitions.⁷ In addition, it also gives a quite plausible account of the greater manipulative control we may exercise in the formation of abstract concepts. For having once isolated properties we may then combine them into concepts in ways we have never pretheoretically experienced them to be combined. Thus we may be inventive of concepts which do not correspond to any entity which exists, or of entities whose existence we postulate. This greater conceptual freedom, the freedom of not being bound to conformity with concrete data, is a characteristic which has long been recognized as distinctive of theoretical thinking. In fact, in current usage, 'theoretical' is often reserved for only those concepts and terms associated with such postulated entities. So it should be stressed here that

⁵ Comp. Donald Williams' 'Mind as a Matter of Fact,' *Review of Metaphysics* Dec., 1959, p. 221:

'...the designation "abstract" derives from the way an aspect or accident of a thing, while partively and positionally it stays embedded in its matrix, becomes also, as the rest of the matrix does not, an element in the distinctive unity of consciousness.'

⁶ Comp. R.L. Aaron's recognition of this difference. 'I may say that I mean by the word "house" a combination of qualities a, b, c, d, each of which is perceived precisely ... But normally I do not use the word this way, I use it vaguely, that is to say, I do not fix the qualities as I did in the above analysis. One important consequence of this is that I am not at all sure where to draw the line on inclusion and exclusion ... the use of such words rests on familiarity with an undifferentiated whole met with frequently in experience, a pattern or Gestalt whose parts have not been analyzed.' *The Theory of Universals*, Oxford University Press, 1952, p. 167.

⁷ Comp. *N. C. I.*, 30:II, 434.

Dooyeweerd uses the term in a wider sense which includes not only postulated entities, but also concepts and terms associated with observed entities if certain of their features are being conceived abstractly. Thus for Dooyeweerd 'theoretical' and 'pretheoretical' do not correspond to 'postulated' and 'observed'. For Dooyeweerd, a theoretical concept is one which is [165] abstract in the requisite way so that it can function in an explanatory theory. And a theoretical term is one which has a theoretical concept for its meaning.

Now the necessity of abstract thinking to the construction of theories is defended by Dooyeweerd in a very specific way. The reason he gives for this claim has to do with the raising of questions to which hypotheses are postulated as answers.⁸ Of course it is quite literally true that there are no answers unless there are questions. So if Dooyeweerd is correct when he contends that the sort of question which leads to a hypothesis as an answer is one which requires the abstract mode of thought, then it would follow that all theory-making has abstract thinking among its necessary conditions. And surely, there is a lot of evidence to make his premise look plausible. The questions we normally associate with science and philosophy are questions which ordinarily require the abstraction of at least several properties and/or laws. In fact many of the most famous scientific puzzles have been concerned with the relations which hold between certain properties of things, and it seems clear that without first mentally isolating those properties we would not be able to pose or answer questions about those relations. In those cases abstraction acts so as to open up the explanatory gaps which hypotheses are designed to fill.

However, although cases which fit Dooyeweerd's claim are numerous enough, it is not clear to me that all cases of posing questions leading to hypotheses involve abstraction. It seems that distinctions drawn at the preabstraction level of thought are often sufficient to allow us to ask questions to which we may then propose hypotheses as answers. For instance, we seem to be able - without abstracting - to wonder why water puts out fire or whether it always does, to raise the question of why leaves fall off trees, or (like Mendel) to wonder why certain pea plants bear rough rather than smooth peas. Clearly the hypotheses proposed to answer such questions involve abstraction, but abstraction does not seem to be required to ask the questions which prompted them. It is regrettable, then, that Dooyeweerd gives the impression that the necessity of abstraction to all sorts of theorizing can be supported solely by its involvement in posing questions. It seems that what has happened here is that after establishing 'theoretical' as a blanket term to cover both philosophical and scientific thinking, Dooyeweerd slips into using it to make a point applicable to ontological theories only. For, given his earlier characterization of ontology, it follows that theories about the inter-relations among aspects could not be constructed until at least two aspects were abstracted.⁹ Now I do not wish to belabor the obvious. It seems likely that people in philosophy and science would be quite willing to concede right off that such theories involve abstract thinking. But since Dooyeweerd has [166] given a defense of the point, and since his reason as it stands is open to counterexamples I see no way around, I want to propose that we expand the reasons for claiming that abstract thinking is necessary to all theoretical thinking. This expansion is, I think, consistent with that Dooyeweerd himself does at other junctures where he seems to regard a theory as requiring abstraction because the hypotheses it proposes include abstractions.¹⁰ The resulting expansion would be that the formation, criticism, or

⁸ Eg., *N.C. I*, 274.

⁹ It is significant, I think, that in making this point Dooyeweerd follows it with statements about abstracting entire aspects and doing ontology. He even speaks of abstraction as necessary to pose 'the theoretical problem' rather than problems of all sorts, and describes the various answers to this problem as theories of reality. *Comp. N. C. I*, 41, 44, 83.

¹⁰ Eg., *N. C. I*, 274.

modification of any explanatory theory requires abstract thinking either because the theory answers a question which abstraction is needed to pose, or because some of the postulates of the theory are either abstractions or presuppose abstractions, or because justifying the hypotheses of the theory would require abstraction. Given this broader statement of Dooyeweerd's claim, I think it clear that no scientific or philosophical theory could fail to be abstract.

Perhaps it would be best just now to pause in this description of abstract-theoretical thinking to clarify just this much of it before going on to the rest. For just as in the case of any other proposal of simple points from which important consequences are supposed to flow, it will surely be subject to much suspicion. So before even completing the description, it may be well to dispel one or two misgivings which may be lurking in the wings, and to consider some illustrations of the distinctions drawn so far.

First, by appealing to our own reflection to confirm this account, Dooyeweerd is not assuming that introspection can give us all we can or would like to know about abstraction, concept formation, or theory construction. Neither is he assuming that all information supplied introspectively must be true. All he is saying at this point is that included among the objects of our direct experience are certain activities of our own which are involved in the processes of becoming acquainted with and forming concepts of what we know. By reflecting on those activities we can become aware of differences among them which typify two ways in which they take place; the one way involved with knowledge of the concrete things of direct experience, and the other involved with abstracting from concrete things. And as there does not appear to be any immediate reason (i.e., anything within our direct experience) to make the differences between these activities appear doubtful, at this stage there is no good reason not to become clear about these activities, to describe their differences, and to regard them as some of the conditions necessary to the production of theories.

But have we got a description of the two modes of thoughts which is sufficiently clear?¹¹ I think that the definition of thought as abstractive at the point where it isolates its objects (properties) from the concrete things which exhibit them, is clear enough for Dooyeweerd's purposes. Let us consider a few examples.

First, take the case of being shown a new car just purchased by a [167] friend. In our common sense, preabstractive (and hence, pretheoretical) awareness of it, the car appears to have a great many properties. Our attention may distinguish more and more of the car's properties the longer we look it over, and the longer our friend has to regale us with a list of its features. If we are in the market for a car ourselves, we may pay more emphatic heed to- the car's cost, while if we are racing buffs we may pay more attention to its speed and handling capabilities. We may, alternatively, be especially interested in its style, color, weight, or what have you. But our preabstractive concept of the car is still of the whole entity; the properties we pay more attention to than others are still conceived as properties of the car. Properties have been distinguished, and some have been emphasized, but as yet none have been abstracted. If, however, our friend in mentioning the weight of the car were to elicit from us a new train of thought, a train of thought in which we no longer paid the focus of our attention to the car or our friend (perhaps he is boring and our attention begins to wander) but to the property of weight itself, then we would have abstracted that property. In considering weight in this way, we would no longer conceive of it only as a property of this car or any other concrete object. Nor would we be conceiving of it only in its experienced connectedness to -a host of other

¹¹ Certain critics have thought the difference is left almost totally obscure! See Frame & Coppes, *The Amsterdam Philosophy, A Preliminary Critique*. Harmony Press, Phillipsburg, N.J. pp. 9, 12, 13.

properties, but - so far as possible - we would also now be conceiving it in isolation from all that is not the property weight. If we were to continue this excursion into abstraction, we might also abstract other properties, such as velocity, mass, density, etc. We might then also try to conceive of specific relations which hold between these properties including laws such as momentum = mass \times velocity, or density = $\frac{\text{mass}}{\text{velocity}}$.

Now I have tried to phrase the foregoing example so as to make it clear that both the activity and the products of abstracting are additions to, not replacements of, the activity and data of preabstractive thought and experience. When we conceive of e.g., weight in isolation by abstracting it we do not thereby cease (pretheoretically) to experience things with weight. Abstraction may put the property weight into conceptual solitary confinement at the same time our loquacious friend and his car remain within our field of consciousness, even though they have slipped to its penumbra. I mention this because some critics have misunderstood Dooyeweerd as supposing that the two modes of thought are mutually exclusive; that a person is either thinking abstractly or concretely but not both at once.¹² 'This would, of course, be a patently impossible position to maintain. It runs contrary to our common experience of doing both at once, and would entail the absurdity that a scientist when abstractly thinking about his work would cease to experience such concrete things as test tubes, graduates, and Bunsen burners, not to mention doors and hallways!

Perhaps it would be well to head off a further misunderstanding also by noting that although Dooyeweerd defines the abstract mode of thinking as that in which the focus of attention is intensified to the [168] point of isolating rather than merely distinguishing, the fact that both modes may be simultaneous often makes it difficult to tell whether a specific concept is an abstract or concrete one. Since people are generally unaware of this very difference, they may shift back and forth between regarding a property in abstraction and regarding it concretely all the while using forms of speech that not only fail to convey, but actually disguise the shift that is going on.

Summing up the critique so far, we can say we have seen Dooyeweerd's appeal to reflection yield the following as distinguishing characteristics of abstraction as that is a necessary condition for theoretical thinking:

- (1) abstraction is an extension and intensification of the process of focusing attention;
- (2) the point at which thought becomes abstractive is where the object of its attention is singled out and isolated from preabstractively experienced things, events or states of affairs;
- (3) the isolating and recombining of abstracted elements is done in accordance with logical principles and is at least part of the process of forming abstract concepts;
- (4) the greater precision of abstract concepts is at least partly due to the explicit isolation of the elements combined in them, as is the greater creativity of theoretical thinking at least partly due to the free recombining of the abstracted elements rather than attempting to combine them in conformity to the way they are experienced in concrete things.

So far as Dooyeweerd is concerned, though, these points are merely preliminary to the real heart of the critique. Their importance is that they pave the way for the reflective recognition that the activity of performing abstraction has introduced new elements into the relations involved in the knowing process. These new elements Dooyeweerd calls (both singly and

¹² Frame and L. Coppes. *Ibid.* p. 6.

collectively) the 'structure of theoretical thought' in order to convey that they are unavoidable conditions of the abstractive modus operandi of thought. These new elements are:

(1) The separation of the abstractum (whatever was abstracted) from its matrix (whatever it was abstracted from).

The point here is that the focusing of attention to the level of abstraction has disrupted the pretheoretically experienced connectedness of the abstractum to its matrix. As a result, the increased clarity and precision of abstract conceptualization is achieved at the price of conceiving it in isolation from - as something over against - its natural (pretheoretical) habitat.

(2) The separation of the logical function of our thought from the abstractum.

The very activity of trying to focus on the abstractum—in a sense, to get closer to it—results in an increased emphasis of its distinctness from the activities attempting to deal with it. Consequently, the abstractum is also conceived as 'over against' our thought as well as its matrix. The connectedness between our logical conceptualizing and what is getting conceptualized is thus also disrupted to the extent that both its possibility and nature become theoretical (philosophical) puzzles.

[169]

(3) The separation of the logical from the remaining functions of our thought.

In abstract thinking, the activities of logical isolating and combining come to the fore and predominate over other aspects of our consciousness. Thus the abstractive function and its logical character comes to be conceived abstractly; its connectedness to the remaining aspects of consciousness is disrupted (becoming a philosophical puzzle) and it too is conceived in isolation and in that sense 'over against' them.

In the brief descriptions given above, I have repeatedly used the expression 'over against' to designate the separateness introduced into knowing in the abstractive mode of thought. I have done this because it is an emphasis Dooyeweerd himself makes and, in fact, invents new terminology to stress. In order to remind us that abstraction has thus modified the relations spoken of, Dooyeweerd restricts the expression 'subject-object relation' to talk about the pretheoretical mode of thought and experience. Whenever he speaks of thought or experience in the abstractive mode, he uses either the English term 'theoretical antithesis' or the German term 'Gegenstand' to designate the new element introduced into the relations involved in abstract thought. Because the term 'gegenstand' means literally what stands over against (widerstand) something else, both- it and 'antithesis' can convey the exaggerated separateness by which abstraction has altered the pretheoretical experience of an object by a subject.¹³

And that brings us to the next major result Dooyeweerd wishes to draw from his description of the operations of abstract thought, namely, the artificiality of the separations it invokes. All this isolating business going on in thought can be reflectively noticed in progress, so there is no excuse for us to fail to recognize it as our own contribution to theoretical thinking. And if we do so, there will be no hope of ever justifying a claim that takes any of the separations

¹³ N.C. 1, 39, 43, 86. Comp. also Whitehead's remarks: 'This... presupposes that the subject-object relation is the fundamental pattern of experience. I agree with this presupposition, but not in the sense in which subject-object is identified with knower-known ... the notion of mere knowledge is a high abstraction, and that conscious discrimination itself is a variable factor only present in the more elaborate occasions of experience.' *Adventures of Ideas*, Mentor Books, N.Y. 1955, pp. 177, 178.

introduced by abstraction to correspond to the actual state of affairs in reality as it is independent of our thought.

Since this point was mentioned and illustrated earlier with the case of inserting the thermometer in water, there is no need to elaborate it here. But there is a need, I think, to clarify a remark Dooyeweerd makes in connection with this point which seems wholly inconsistent with its employment as I have described it. For when giving the thermometer illustration, I made quite a point of saying that Dooyeweerd does not employ the consequences of his critique to establish the truth or falsity of a claim or theory, let alone to establish the indubitable certainty of any proposition (as Descartes tried to do). Instead, Dooyeweerd's purpose, I said, is only to establish the possibility or impossibility of theoretically justifying a hypothesis. But if this is [170] correct, it seems utterly out of character and jarringly dogmatic to have Dooyeweerd declare:

This theoretical antithesis does not correspond to the structure of empirical reality. (N.C. I, 40).

On the face of it, this remark appears to contradict my earlier characterization of the purpose of the critique, and to beg the question against a number of ontologies which have regarded the true nature of reality to be at least partly obscured by pretheoretical experience but discovered in theoretical thought.

However, when we compare this claim to other writings where Dooyeweerd has made the same point, it turns out that it is not so dogmatic after all.¹⁴ Rather, it appears that - as in the case of the term 'theoretical' - having introduced the term 'antithesis' to cover all three artificial separations, Dooyeweerd now uses it to refer to only one of them.¹⁵ For he subsequently makes it clear that it is only a real (and complete) separation of our logical thought from its objects which cannot be the genuine state of affairs. His argument is that if this second antithesis corresponds to reality we would be cut off from, and unable to form a concept of, anything other than our thought itself. But since experiencing and thinking are activities which always take an object—they are always of something¹⁶—and since we can be aware of producing the separation between the poles of the antithesis, it follows from the very fact that we experience and that we form concepts in both theoretical and pretheoretical modes, that the antithesis does not correspond to reality in such a way as to entail solipsism.

This claim then, does constitute an exception to the usual employment of the critique, which is only to establish whether or not a theory is justifiable. But even here it should be noticed that it is not the critique alone (in the sense of the structure of theoretical thinking) on which Dooyeweerd bases his conclusion that solipsism is false. It is only in conjunction with the 'intentional' nature of thought that he thinks the critique can yield this conclusion.

Yet another misunderstanding which should be avoided here is the misconstrual of Dooyeweerd's emphasis on the artificiality of the abstractive relations. This should not be seen as some sort of semi-Bergsonian condemnation of abstract thinking. Dooyeweerd can agree with the following remark of C.I. Lewis' (provided it is restricted to the theoretical mode of thought):

¹⁴ *In the Twilight of Western Thought*, Presbyterian & Reformed Pub. Co., Phila., 1960. p. 12. *Some Transcendental Problems of Theoretical Thought*, Eerdmans Pub. Co. Grand Rapids, 1948, pp. 130-31.

¹⁵ This terminological lapse recurs in later contexts as well as throughout the *New Critique*.

¹⁶ On this point Dooyeweerd clearly accepts the position of Brentano and Husserl that it is impossible to conceive of consciousness except as consciousness of something. *Comp. N. C. I*, 34.

But the condemnation of abstractions is the condemnation of thought itself. Nothing thought can ever comprise is other than some abstraction that cannot exist in isolation ... Only the mystic or those [171] who conceive man would be better off without an upper-brain, have ground for objection to analysis and abstraction.¹⁷

Nevertheless, while not condemning the abstractive processes necessary to theory construction in philosophy and the sciences, Dooyeweerd shows us that there are some real pitfalls which need to be avoided. Put generally, the warning he issues amounts to emphasizing the point Lewis noted but did not emphasize, the point that no abstraction can exist in isolation. To abstract is not in itself to falsify; but, Dooyeweerd stresses, to abstract is to introduce artificial isolations into what is known which can never then be justifiably regarded as nonartificial.

It is significant for our present topic that no sooner has Dooyeweerd sketched out his idea of critique than the first example he gives of its employment is to the Aristotelian theory of mind/body dualism. Dooyeweerd says:

For example the traditional dichotomistic conception of human nature as a composition of a material body with an immortal soul is doubtless connected with the misconception that the antithetic relation in the (abstract mode) of thought answers to reality itself.

Aristotle, in accord with Plato, tried to prove that the theoretical activity of thought (the nous poietikos, i.e., active intellect) in forming logical concepts must be wholly independent of and separated from the organs of the internal body. The active intellect must be separate from the body because it can grasp everything other than itself in logical ... abstraction. The (abstractive) activity of thought is here hypostatized in its logical aspect as an immortal οὐσίᾱ α or substance ...

A direct conclusion is here drawn from the purely intentional (artificial) antithetical structure of (abstract) thought to a real separateness of the logical function from the (other) aspects of the body. (*N.C.* I, 44).

It is not hard to see that this criticism applies with equal force to the Cartesian version of mind/body dualism. If anything, Descartes is even more self conscious than Aristotle about basing his ontological dualism on the assumption that the isolation introduced by abstraction corresponds to an actual state of affairs in reality. In his reply to Mersenne, Descartes maintains that:

... in order to recognize a real distinction between objects it is sufficient for us to conceive one of them clearly apart from the other.¹⁸

In *The Principles of Philosophy* this same claim is asserted again with the addition that in part I, principles LX, LXI, and LXII, Descartes clarifies it by differentiating three sorts of distinctions.¹⁹ Real distinctions, as in the quote above, are abstract concepts that can be formed in complete independence from one another. The fact that this can be done is sufficient to conclude the concepts correspond to 'different substances which exist

¹⁷ *Mind and the World Order*, Dover Publications, N.Y., 1956, p. 55.

¹⁸ *Descartes Selections*. Ed. R. Eaton, Scribners, N.Y., 1953, p. 178.

¹⁹ I take it as obvious that what Descartes calls 'distinction' corresponds to what Dooyeweerd terms 'abstraction'.

independently. By contrast, Modal distinctions are those between properties of substances. The properties [172] can be conceived independently of one another, but not in isolation from some substance. This conceptual dependency is taken as indicative of an ontological dependency so that what is conceived is not a substance. Finally, Descartes admits that there are distinctions which are creations of thought and do not indicate a real state of affairs. These are cases where a substance cannot be conceived apart from a certain property, or one property cannot be conceived in complete isolation from another. There is distinctness between such concepts, then, but it is a relative distinctness, and not a complete isolation, hence it does not correspond to any ontological distinctness.

Relative to the above classification of types of conceptual distinctions, Descartes' dualistic ontology may be seen to rest squarely on two claims. The first is that the relations between concepts correspond to the ontological status of their objects so that complete abstractive isolation of two concepts corresponds to complete ontic independence of what is so conceived rendering the objects so conceived 'substances'. And second, that the concepts of mind and of body qualify, and are (aside from the concept of God) the only ones that qualify, as real distinctions.

Now although there are several ways in which Dooyeweerd's criterion can be applied to these two claims, there is not the space here to develop any one of them completely, let alone all of them. For that reason, I will confine myself simply to a rough sketch of how one of these applications would go.

We begin with the point that the act of abstracting one property or property-kind²⁰ from another, is an act which has logical properties and takes place in subjection to logical laws. For these reasons the product of this activity also has logical properties and is subject to logical laws; put simply, the abstracting results in a logical concept of the abstractum. Thus no conceptual isolation can ever be complete relative to logical properties and laws. When Descartes claims, then, to have a concept of spatial extension in utter isolation from every nonspatial element, he is patently mistaken. We simply cannot form a concept of a spatial magnitude, or of spatial extension in general, in which the abstraction is not in conformity to the law of noncontradiction. And this means that the spatiality conceived has at least the logical property of conforming to that logical law. What Descartes has, then, is a concept which is (at least) partly logical and partly spatial; he has a concept of logically-abstracted-and-conceived-extension, not pure spatial extension. According to his own classification, then, the abstractive isolation of spatial extension from the other kinds of properties exhibited by the objects of preabstractive experience is incomplete, and is a 'distinction created by thought' which does not correspond to any substance. Moreover, the kind of properties that is thus seen to be inseparable from the concept of spatial extension is the very kind which Descartes maintains is mutually exclusive of spatial extension, for it is the very kind of properties and laws which essentially qualifies thinking substance. [173]

But if being spatially extended is tinged with nonspatial properties and laws by the very act of abstract conceptualization, the same can be said for any attempt to get a complete conceptual isolation of pure logic or mathematics in order to conclude that rational thinking characterizes a substance. Consider again the law of noncontradiction. In its classic formulation, it states that nothing can both be and not-be in the same sense at the same time. More recent versions simply put it that a statement cannot be both true and false at once. But either way, it is not possible to understand the law without reference to the nonlogical

²⁰ Dooyeweerd uses the term 'aspect' to denote basic kinds of properties and laws such as physical, spatial, logical, sensory, etc.

properties of things or statements which it governs. For instance both formulations contain implicit reference to the respects in which things or statements cannot simultaneously both be and not be. These respects correspond to nonlogical properties of things in the older formula, while on the newer formula the properties of truth or falsity possessed by statements are properties which - on any construal of truth - involve a relation of the statement to something else such as other statements, a set of beliefs, reality itself, percepts, practical usefulness, ideas in God's mind, etc. Thus the properties of being true or being false are relational, and that member of the relation which renders a statement true or false must have nonlogical properties.

Furthermore, in addition to these implicit references to nonlogical properties, there is also explicit reference to a nonlogical correlate in each formulation of the law. For in each there occurs explicit mention of either things or statements. But a thing is always experienced and conceived as having a multiplicity of kinds of properties and laws true of it, and the same is true of statements. Statements, like things, are uttered or written in a certain space, require a certain physical energy, and involve some sort of marks or sounds which have the nonlogical property of symbolizing entities other than themselves. Besides, in addition to the nonlogical properties just mentioned, each formulation of the law explicitly and necessarily includes reference to temporal simultaneity which is also a nonlogical property.²¹

The upshot of Dooyeweerd's critique, then, is that calling attention to the activity of abstracting necessary to the conceptualization of properties or laws of one kind as over against those of another kind, reveals that the attempt at isolating one law, property or kind of them from another is never completely successful. The isolation is only achieved to a greater degree than that which is possible by the logical distinguishing that goes on in preabstractive thought.²² More precisely, the abstractive isolation can successfully excise a law, property, or kind of them from the concrete data of preabstractive experience which exhibit them, but it cannot also successfully isolate any law, property, or kind of them [174] from all other laws, properties and kinds of them. In this way the critique constitutes a rebuttal of the second of the two claims on which Descartes' dualism rests: neither thinking logically nor being extended in space can be conceived in utter isolation from one another. Hence Descartes' claim that these concepts correspond to ontologically independent substances is left without justification.

I believe it is possible to press the critique against the first of Descartes' claims as well, namely, the claim that the relations between concepts must correspond to the ontological status of what is conceptualized. But, again, there is not the space here to do this in detail. The general direction in which it would go should already be apparent, however, if the isolation of laws, properties, and their kinds from the objects of preabstractive experience is artificial, as is the (incomplete) isolation of laws, properties and their kinds from one another, there is no ground left for Descartes' confidence that the real is rational and the rational is real.

Quite aside from the results of the critique, however, it is apparent that Descartes offered no sufficient ground for this claim. Each time questions skeptical of the correspondence of the

²¹ The same point can be made with respect to so-called logical truths supposed to be true independently of all nonlogical considerations such as the meaning of the symbols used to state them. That such a claim is patently fictive can be seen from a consideration of the logical truth $P \vee \sim P$. This statement may be *false* if P doesn't mean the same in each occurrence so that its truth is not independent of the (nonlogical) meaning of each instance of P.

²² This conclusion is further supported by Dooyeweerd's analysis of the analogical concepts of each law-and-property kind. See *N. C. II*, 168-190.

real and the rational occur to him or are raised by others, Descartes' replies simply assume what is needed to be proven.²³ His confidence on this point appears as an expression of his faith in reason and in the essential rationality of all existence rather than as something which can be rationally justified within his system.

But if Descartes confesses to a faith in reason in general, it is still the case that the highest degree of this faith is reserved by him for what he regards as the epitome of rational clarity, distinctness, and certitude: i.e., mathematics. For the objects of mathematical thought are not only taken by him to be related in reality corresponding to the ways their concepts are related in thought, but he insists that being the object of mathematical thought is itself the sufficient ground for knowing the existence of the object. As Descartes himself put it:

...all things which, generally speaking, are comprehended in the object of pure mathematics, are truly to be recognized as external objects.²⁴

When this last remark is taken together with his insistence that all that is true of external physical objects is what can be mathematically handled of their spatial extension and motion,²⁵ it can easily be seen that Descartes maintains not only that all the mathematically conceivable is 'externally' real, but that all the 'externally' real is mathematically conceivable. [175]

Now this same unjustifiable overestimation of mathematics in relation to reality is to be found, I believe, at the basis of a present-day controversy in physics. As is well known, Heisenberg and others of the Copenhagen school have insisted that the indeterminacy relation between the position and 'momentum' of sub-atomic particles be interpreted as corresponding to reality rather than as limitations on our abilities to measure position and momentum. In this connection, Heisenberg maintains that our ordinary 'classical concepts' do not apply to the disturbed (unmeasured) position when momentum is ascertained, or the disturbed (unmeasured) momentum when position is ascertained: a particle does not have simultaneous position and momentum since these cannot be simultaneously ascertained.²⁶ As Heisenberg admits:

... this is a very strange result, since it seems to indicate that the observation plays a decisive role in the event and that the reality varies, depending on whether we observe it or not.²⁷

What are the assumptions behind this ontical rather than epistemic construal of the indeterminacy between position and momentum? Heisenberg has explicitly rejected the suggestion that this interpretation is positivistic,²⁸ and I believe he is quite right. He does not reject the reality of the unascertained member of the uncertainty relation because it is not open to sensory observation. Rather, he appears to hold it on the Cartesian assumption that

²³ In defending the correspondence between conceiving the thing clearly apart from another and the real distinctness of the things so conceived, Descartes' simply says that no better criterion can be found, and that other proposed criteria 'must be reduced to my criterion to be infallible.' This reply is essentially dogmatic begging the questions as to whether any criterion can be found at all and whether any infallible criterion can be found. (*Descartes*, p. 178-179.)

²⁴ *Descartes*. p. 164.

²⁵ *Principles*, Part II, VIII, XI, XII, XXIII, CXCVIII, CXCIV. Comp. Principle LVIII of Part I, with Principle VIII of Part II.

²⁶ Comp. *Physics and Philosophy*. Harper, N.Y., 1968, pp. 92:

²⁷ *Ibid.* p. 52

²⁸ *Ibid.* p. 145

whatever is real is mathematically calculable! For it would then follow that since simultaneous position and momentum is not what Descartes called an 'object of mathematical thought,' it is not real.

But does Heisenberg commit himself to such a rationalist view of the relation of math to reality? I believe he does. First, he makes it plain that he regards mathematical concepts as more clear, distinct and reliable than any other kind, just as Descartes did. He says:

Any concepts or words which have been formed in the past through the interplay between the world and ourselves are not really sharply defined with respect to their meaning; that is to say, we do not know exactly how far they will help us to find our way in the world ... This is true even of the simplest and most general concepts like 'existence' and 'space and time' ...

The concepts may, however, be sharply defined with regard to their connections. This is actually the fact when the concepts become part of a system of axioms and definitions which can be expressed consistently by a mathematical scheme.²⁹

Moreover, it is apparent that for Heisenberg no less than Descartes, the sharpness of the mathematical concept is connected with their reliability and omnicompetency with respect to the physical world:

... when modern science states that the proton is a certain solution of a fundamental equation of matter it means that we can from this solution deduce mathematically all possible properties of the proton and can check the correctness of the solution by experiments *in every* [176] *detail*.³⁰ (emphases mine)

In fact, where such complete mathematical deductions are not yet possible, Heisenberg does not hesitate to confess his faith in mathematical method in terms which sound very Cartesian:

In modern quantum theory there can be no doubt that the elementary particles will finally also be mathematical forms, but of a much more complicated nature ... Therefore, the mathematical forms that represent the elementary particles will be solutions of some eternal law of motion for matter.³¹

These and other similar statements³² make it clear that Heisenberg indeed subscribes to a version of Descartes' assumption that being the object of mathematical thought is equivalent to being real, confirming that the basis of the Copenhagen interpretation of indeterminacy is the inference (from the Cartesian assumption) that whatever is not mathematically calculable is not real.

Now much could be said concerning this Cartesian legacy in Copenhagen physics from the standpoint of Dooyeweerd's critique. It is possible to show, for example, that the Cartesian view of mathematics involved is self-defeating and thus unjustifiable in principle. But exposing the unjustifiable character of the Cartesian view of mathematics or any other theory has a more far reaching significance for Dooyeweerd. For the ultimate purpose of the critique as Dooyeweerd employs it not only is to show that all theories employ, entail, or presuppose

²⁹ Ibid, p. 92

³⁰ Ibid, p. 74, 75.

³¹ Ibid, p. 71, 72.

³² See also Ibid. pp. 82-83, Contra Einstein, and p. 145.

assumptions which are unjustifiable and which are therefore taken on faith. There is a second component to the project of critique which exposes that the faith necessary to theories is a religious faith.³³ In this way the critique establishes that all theories of philosophy and science are based on some religious faith. So far as Descartes and Heisenberg are concerned, the critique would show that their faith consists of regarding at least the basic truths of mathematics as Divine.

In Heisenberg's case, however, it is perhaps unnecessary to press this claim since he virtually concedes it! In a remarkably candid passage he likens the trust in mathematics exercised by modern physicists to that of the ancient Pythagoreans, and seems to recognize its unprovable and religious character when he says:

If we follow the Pythagorean line of thought we may hope that the fundamental law of motion will turn out as a mathematically simple law, even if its evaluation with respect to the Eigenstates may be very complicated. It is difficult to give any good argument for this hope for simplicity—except the fact that it has hitherto always been possible to write the fundamental equations in physics as simple mathematical forms. This fact fits with the Pythagorean religion and many physicists share their belief in this respect, but no convincing argument has yet been given to show that it must be so.

[177]

³³ This follows from the definition of religion given in *N. C. I*, 55-58. There the essential characteristic of the Divine is maintained to be the possession of absolute self-existence on which humans depend for their existence and destiny.