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The three degrees of reflection and the limits of modern science

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The classical theory of the three degrees of abstraction : empirical, mathematical and metaphysical, which is associated with the distinction of three corresponding forms of knowledge, is usually considered to be inapplicable to the modern sciences. Are they not mathematical as well as empirical? Do they not, by their method, circumvent metaphysical presuppositions?[*]

The origin of this misunderstanding lies in an inadequate account of the thoroughly mathematical nature of modern science, caused by a one sided interpretation of the notion of abstraction.

Abstraction is usually understood as leaving out of consideration a certain aspect of experience, in order to concentrate on another aspect. This, however, is an ambiguous description, for it leaves undecided whether the latter aspect is considered completely *in itself* or *as* an aspect of the totality of experience. In the latter case abstraction is to be complemented by a motion of thought effecting a *return* to experience in the full sense. And in fact such a complementary motion corresponds to each of the three classical degrees of abstraction. Empirical abstraction, producing general concepts, is complemented by *judgment,* which applies these concepts to the actual contents of experience. Mathematical abstraction, designing ideal structures, is complemented by *experiment,* testing those structures as models for phenomenal domains. Metaphysical abstraction, acknowledging intelligible principles, is complemented by the dialectical motion of philosophical thought, which clarifies reality by the light of these principles. The loops of abstraction and application seem to penetrate deeper beneath the surface of the experienced world as the degree of abstraction becomes higher. This idea may be expressed by using the term 'degrees of reflection' instead of 'degrees of abstraction'.

It is a philosophical problem in itself, how the relationship between the degrees should be understood, but in the present context the image of the widening loops is clear enough. It implies that a higher degree presupposes the lower for its actual performance, but what is 'seen' in a higher degree is only implicitly contained in what is seen in the lower. Language implicitly encompasses structuring of experience, but science explicitly presupposes language. So does

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[*]   See for a more extensive elaboration of this theme [Fleischhacker 1995].

philosophy, but what philosophy *is about* is implicitly contained in science as well as in ordinary language.

It has to be remarked, however, that all three degrees of reflection have their appropriate forms of self-reflection, which find expression in separate disciplines such as classical and mathematical logic, and metaphysics. Conceptual analysis and deductive reasoning as described by classical logic is the self-reflexive form of empirical (conceptual) reflection ; construction of theories of pure mathematics as described by mathematical logic is the self-reflexive form of mathematical (structural) reflection ; philosophical self-account as described by metaphysics is the self-reflexive form of philosophical ('principal') reflection. It is also to be understood that, although in classical philosophy the degrees are exclusively associated with speculative reason, in this new conception all three of them have their own specific mixture of theoretical and practical reason.

The three degrees of reflection will now be briefly characterized according to their role in human thought and practice.

The conceptualization of experience can be considered as a human achievement, developed along with the totality of human culture, and pluriform as culture itself. Yet it is not a free creation, because it depends upon a long line of history, which has guided us towards the present experience of using a meaningful language. We can no longer disentangle sheer accident and deep wisdom within this long process, but we know for certain that it is an intolerable one-sidedness to ascribe the result exclusively to one of these extremes.

In mathematical reflection, however, there is a spirit of freedom and creativity. Experience does not prescribe us how it wants to be structured, although it must really have the property of *structurability,* the ability to be divided meaningfully — in thought or in practice — into a plurality of individual composing parts[1] in such a way that it is indifferent to the nature of the parts whether they are considered *as* parts of the whole or not. This is what traditionally is called quantity, but what is associated here with the notion of *structure* in accordance with the terminology of contemporary mathematics. The creation of — ideal or real — structures is based

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[1]   This is essentially Aristotle's description of *quantity* in *Metaph.* Δ [1020a6].

on implicit knowledge of structurability, which I consider to be the fundamental principle of mathematical reflection.

In philosophical reflection freedom consists precisely in the acknowledgment of the necessity of principles constituting the perspectives in which we can understand experience as meaningful. The second degree of reflection constitutes a clear example of such a perspective, whereas the first is to be regarded as encompassing many of them in an unreflected mixture, the disentangling of which is the aim of linguistic analysis. The task of philosophy is to investigate systematically the constitutive principles of these perspectives in their fundamental coherence and distinctions, and thereby to clarify the world of human experience and practice.

In confrontation with a certain context of experience one perspective can be more clarifying than another, but it is never the only possibility, although it can in certain cases be established as the most adequate in the course of further investigation. The natives of a south sea Island who understood the approaching steamer they saw for the first time under the perspective of life were not quite wrong, but after they had learned more about the technology of steam engines, eventually they had to admit that they had been rather naive in the beginning. The adepts of 'artificial life', on the other hand, who claim that the phenomenon of life is within reach of technical production, overlook that their enterprise would become meaningless as soon as they would claim to have succeeded. For the distinction in perspective between what can be produced externally and what can only produce itself, between lifeless nature and life, would then no longer be valid for them. 'Life' is a perspective which we are never forced to apply, but if we refuse to do so, we miss more than half the meaning of... life.

In the same way structurability constitutes the very fertile perspective of modern scientific thought and practice. It is therefore sometimes said that mathematics functions practically as the metaphysics of modern science, and that modern philosophy can be understood as the attempt to transform mathematical reflection into a satisfactory metaphysical system. In Descartes' metaphysics this is still clearly recognizable. A liberated, purely intellectual subject reconstructs a purely extensive world on the basis of clear and distinct ideas. But the foundation of the system — God as *causa sui*

in a positive sense — remains problematic throughout the whole enterprise of modern metaphysics, and is still problematic in the end, where it has become Hegel's absolute idea.[2] Since then, philosophers have tried to get rid of this problematic foundation, but they did not — with possibly the exception of Husserl — see the beam in their own eye : the enormous paradigmatic influence of mathematical thought on their philosophizing. It is mathematical reflection which promised *certainty* of knowledge in modern times, and in a certain sense really produced it in the form of the body of experimentally established, and mathematically formulated laws of physics. But it did not produce certainty in the metaphysical realm. On the contrary it made this realm the most abused and suspect part of human thought.

First Example of Confusion : Metaphysics

This disastrous effect can be ascribed to the totally different nature of both forms of reflection. This is understandable on the basis of the difference between the underlying degrees of abstraction and their ideal results.

Mathematical abstraction results in structure, which is essentially the possible result of an ideal construction, and therefore contingent. Mathematical structure is grasped by — ideal or real — actualization of an intelligible potency : structurability. This actualization essentially includes arbitrariness. It is true that the conceptuality of the first degree of reflection could also be understood as a construction, but then it would be understood from a mathematical point of view. In common sense itself, we do not experience concepts as the result of construction and we are not aware of any theory in which they could be defined.[3]

Philosophical 'abstraction'[4] on the other hand aims at necessity. Any blending of mathematical and philosophical reflection

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2   See [Hollak 1966].

3   If Wittgenstein's *Philosophical Investigations* convince us of anything, then certainly of this point.

4   The use of the word 'abstraction' in this context is often criticized, because metaphysical investigation is not allowed to consider being in some restricted respect. Although I agree with this conception of metaphysical investigation I maintain the word 'abstraction' for two reasons. The first is, that such a method of investigation must *abstract* from all pre-conceived perspectives,

bears the suggestion that there exist necessary constructions, which is a *contradictio in terminis*. So if metaphysics is identified with such a blending, it can easily be criticized as either absurd or malicious. A construction has definite inner relationships, definite elements and definite properties. All these are definite in this case, because they are the result of *defining* them to be such as they are on the basis of the idea of pure structurability, and this means that there is arbitrariness in them. Principles, on the other hand, are not a *result* of definition, they are on the contrary *presupposed* in any definition. They constitute the perspectives in which we can try to conceptualize or reconstruct experience. Their essential relationships are beyond definition, because they are constitutive for any definition within the perspective constituted by them. Nevertheless, in their implicit form, these relationships are better known than explicitly defined structures. They are implicitly but effectively known to us, and our philosophical attempts to express them explicitly are experienced as highly artificial. They are not axioms, nor 'necessary truths', nor adequately expressible in a judgment or theorem without already presupposing them. We can, however, investigate them philosophically, either in their effect on human experience and practice — which is done in dialectical philosophy —, or in their necessary relationships — which is done in metaphysics. From this it becomes clear that any criticism of metaphysics — or philosophy in general — which reproaches it for structuring or influencing the world in a certain way, is based on confusion of the third and second degree of reflection. On the other hand the idea of the possibility to forge the whole of systematic philosophical reflection into a *system* characterized by a certain structure, is based on the same confusion.[5] Philosophy should be more nimble than that.

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and can therefore be described as *abstraction from (all restrictive kinds of) abstraction*. The second reason is, that metaphysics is in search of what is intelligible for us, and therefore has to abstract from what we know to transcend the power of our intellect.

[5] Cf. [Taureck 1975]. I do not elaborate here on the attempts to 'formalize' dialectical reasoning or philosophical 'argument' in general. An application of mathematical reflection to the way of expressing the results of philosophical reflection may of course be a useful tool in some cases, but aims and tools should not be confused.

Second Example of Confusion : Reductionism

The concept of a system also plays an important role in another area of confusion : the debate between reductionists and anti-reductionists in relation to scientific and technological methods.[6] For human beings there is no such thing as immediate experience. All experience is mediated by language and culture at least, and by theory and reconstruction in the case of scientific experience. Now it is a commonly held claim for modern science and modern technology, that it surpasses common language and common sense in its mediating competence. According to this claim, any namable phenomenon matter, substance, experiential qualities, gestalt, life, intelligence — can be theoretically reconstructed and/or technically simulated. Factual failure to do so in a particular case should in this line of thought be ascribed to restrictions in the state of the art, which are to be overcome sooner or later. Even in this coarse form, this claim is not totally unjustified, as can be understood from the description given of the second degree of reflection. Yet precisely the liberty of reconstruction which is the gain of this degree with respect to the first, is also the source of its limitations. For the 'order of the world' which is implicitly contained in common language, embodies a wisdom which has grown since the origins of human culture. In order to reach the second degree of reflection, it is necessary to abstract from this wisdom as well as from all prejudice contained in common sense, and to 'start anew' with the structuring of the world. At least, that would be the ideal. In reality, science demarcates its disciplines by means of common sense concepts. Why else would physics,

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[6] When introduced by Ludwig von Bertalanffy the notion of 'system' was meant definitely in an anti-reductionist sense (Cf. [Bertalanffy 1973]). Further developments of general system theory, however, have acquired more reductionist tendencies. This is understandable from the fact that from the beginning the aim was to find mathematical methods. This introduced an ambiguity in the notion of a system. On the one hand 'system' simply means 'composite reality', but in system theory it acquired the meaning of a reality which can be described by a set of (partial) differential equations or similar mathematical structure-definitions. This implies a system to be something from which the principles of its ordening can be abstracted mathematically. The attempt to escape from this consequence by speaking of self-creating or autopoietic systems has not been able to remove the mathematical connotation of the system-concept. This makes such expressions sound somewhat self-contradictory nowadays.

chemistry, biology, sociology and psychology be different disciplines? The distinction between their formal objects as well as the definitions of the basic units of measurement in physics, however, are necessarily based upon common sense notions. From the reductionist point of view, these distinctions are regarded as purely conventional and a fundamental distinction between the formal objects of the disciplines is denied. This is in line with the notion that scientific reflection should surpass common sense and liberate itself from its prejudices. The anti-reductionist position, however, claims a deeper meaning for the common sense concepts on which the disciplinary distinctions are based. It is said that they belong to the kind of wisdom which can only be clarified from a philosophical point of view, where such concepts can be shown to refer to irreducible fundamental perspectives. To the reductionists it seems that this argument can only be refuted by denying the existence of such fundamental perspectives, thereby implicitly rejecting the viability of a third degree of reflection. If made explicit, this is of course a metaphysical statement, which leads to the well known paradox of positivism, which must transgress its own rules in order to defend itself. But if reductionism is indeed motivated by the ideal of overcoming the prejudices of common sense, such a positivistic position is completely unnecessary. On the contrary, for who wishes to overcome prejudices should be thankful for yet another powerful means for investigating their contents by reflection. And it is only reflection of the third degree that is able to distinguish between fundamental and conventional perspectives, between wisdom and prejudice.

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