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Chinese and European Views

Edited by
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Table of Contents

Preface

Science is one of the most precious dimensions of the cultural heritage of mankind, for which reason it is also one of the most important parts of education. As a learning process for knowledge and character formation, science should not limit its function merely to inheriting the past and satisfying itself with the accumulation of its cultural achievements; on the contrary, it should orient mankind to the future and therefore advance its process of creativity. As a system, not only of verified knowledge but also of the development of human reason, science long has been seen as the hope for man. As an indispensable mode of formation of human reason, science education then bears great hope for the future of mankind.

Though human reason and therefore science contain something universal, they are also culture bound, for reason has diverse modes of expression and realization in different cultures. For example, modern Western science contains something universal, but with Martin Heidegger we should say that it also is a choice made by the Western culture since the time of Parmenides. Should we not agree with Heidegger that Western science is determined by a metaphysical vision of reality focused upon grasping and dominating the beings present to man--the outcome of what Heidegger calls the onto-theo-logical constitution of metaphysics--nevertheless, we should say that this focus was a choice which arbitrarily set aside many other possibilities. In contrast, Chinese traditional science, though it has its weakness in neglecting the scientific rationality concretized in the Western modern science, nevertheless has the advantage of taking into account the holistic and organic relation between man and nature.

If we compare Chinese science with European science, we could say that the rationality of the latter consists in a controlled way of interaction between logico-mathematically formulated theoretical propositions, on the one hand, and empirical experimentation, on the other. But in Chinese traditional science we do not find any attempt to formulate theories in logico-mathematical propositions. Theories in Chinese traditional science were proposed through a speculative insight, grasping the global situation and organic relation between the object in question and its environment. No empirical experimentation was conducted in order to elaborate technically controlled perception. Observation and experimentation were done in traditional Chinese science, not with a view to controlling the perception of the object, but rather to letting things happen in their own way and according to their own nature. We could say, therefore, that instead of modern Western scientific rationality, Chinese tractional science possesses a kind of reasonableness which, in understanding man and the world, refers always to the dimension of totality: the totality of human existence, the totality of nature, and the totality of man's situation in the world.

In saying this, I intend not simply to compare, but to point out that science is culture-bound and that in philosophy of science we need not only to inquire into the structure of theories, the validity of experiments, and the relation between them, but also to philosophize upon the principles implied in the rationalities concretized in different cultures.

In current philosophy of science there is a danger of having nothing to do with what scientists actually do and of having no impact upon them. There is also the danger that current scientific practice seldom reflects at a philosophical level. The separation between philosophy and science is harmful for both. Especially given today's interdisciplinary way of doing science, there is need of a more comprehensive philosophy of science. In this spirit I see new possibilities in the

"realism" a Viennese School which proposes a strategy for relating different scientific disciplines. If each scientific discipline is seen as constructing its own micro-world by its own disciplinary discourse, it could be reasonable sometimes to go out of one's own language and to appropriate other languages in order to see more clearly the limits of one's own micro-world and to reflect upon its principles. This strategy of alienating inter-disciplinarity (sometimes referred to by the awkward neologism, "strangification" after the terms "verification", "falsification," and the like) moving between different micro-worlds seems helpful both for science and philosophy.

Beyond this, I would suggest that a similar process can take place between different cultural worlds. This could be true especially of the philosophy implied in traditional Chinese science, which could offer new light for the future of science. I believe also that a mutual enrichment of Chinese and European sciences could give birth to a new vision of science which will have natural implications for future education.

In a time of radical change, science is also in a process of radical modification. An attitude of coordination among disciplines and cultures--searching for complementarity while respecting differences--is now especially needed in order to reach a more constructive way of doing science and philosophy of science. May this cooperation between Western and Chinese scholars in reflecting upon philosophy of science and education contribute to the great common intellectual enterprise of mankind.

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Introduction

If education is concerned with preparing for life in our environing world, and if science is directed to attaining understanding regarding that world, then science should be a significant component of education in our time. However, Eastern and Western approaches have increasingly questioned that scientific knowledge stands in any simple correspondence to a clearly external and environing world. This can lead to more sophistication in notions of reason and rationality. This is the burden of Part I.

However, understanding science in terms of the life world brings out the extent to which science is a human construct. If guided by well-founded values this enables science to be a constructive force. Bereft of this, however, the result can be a skepticism in which science is only pragmatically related to the world. In this case it provides no guidance, but is only a tool to be used for human purposes, even those seriously misguided and destructive. This is the concern generated by Part II.

Hence, the concern of Part III is to find purpose and direction for thought processes left dangerously adrift by loss of contact with the world. This points to the needs to reestablish the relation of science to reality in its full breadth, from the physical to the human and from the social to the divine, and to reformulate on this basis the character of education in the physical and human sciences, and even in the humanities.

It is not incidental to this endeavor that during this last half century the major cultural development has been the recognition of the dignity of the person. While this may have been more obvious in the fields of values and rights, so central a cultural advance in recent times could not but effect as well the field of science and its philosophy. Thus, in retrospect it seems to have been inevitable that the major conceptions of science, based upon either empiricist or idealist philosophies, would be surpassed by the effort to discover the proper role of persons and then of culture as molding the physical, social and spiritual world in which we live. Some touchstones of this effort as it regards science and its philosophy are the subject matter of the chapters in Part I.

In the West, where empiricism and idealism had rules, science and its content had been seen as identical with nature. Professor Wan-Chuan Fang focuses upon a key step taken by W.V. Quine when he identify the two dogmas of empiricism namely the analytic/synthetic distinction and reductionism, and then showed that neither dogma could be justified. This implied that empiricism itself was an ideology in the sense of a limited view which imposed a reductionism upon science and indeed upon all knowledge. It then became possible and indeed most urgent to open the horizon, at least in principle and initially, to the missing dimensions, particularly to the role of the subject in the constitution of scientific world views. This was done, through the critique of scientific knowledge by Feyerabend and the work of Thomas Kuhn on the role of paradigms and their shifts in the structure of scientific revolutions.

Professor Fang brings this issue into relief by introducing Donald Davidson's claim that the work of Feyerabend and Kuhn introduced a dualism. On the one hand, there was the incommensurable, that is, not inter-translatable, schemes or systems of concepts developed by scientists; on the other hand, there was the neutral or uninterpreted context supplied by nature and waiting to be organized. As it is but a short step from this to the question of the relation between the schemes developed by the sciences and the content of nature which these schemes proposed to interpret, there reemerged the classical issue of subject and object, man and world. For some centuries the attempt was to reduce all to one or to the other. This resulted in the empiricist

reduction of man to matter, on the one hand and in the totalitarian oppression of man by idealism and materialism, on the other. It is time for a basic rethinking, and the daily reminders of this by the environmentalists help us to appreciate the continued urgency of the issue.

Is this question of the relation between schemes and their content to be found in Eastern thought? As this is a matter of well articulated scientific schemes, the answer probably is in the negative. However, there is in Buddhism a particularly strong affirmation of the role of the subject. The paper of Lin Chen Kuo on "The Magic of Consciousness: An Inquiry into the Concept of Object in Yogacara Buddhism" deftly turns the tables by shifting the question from the justification of the subject, as it has been for the half century in the West, to a challenge instead to justify the object. This raises the question of the extent to which the object is a construct of the subject and hence of the way in which this work of the subject can be guided in order to be fruitful in our world.

Vincent Shen responds by following another route, generally connected with H.G. Gadamer. This distinguishes between scientific and hermeneutic reasonableness. He identifies the contribution to be made by scientific rationality with its ability to analyses. In comparison Chinese thought is seen to have both limitations and potentials for a contribution to today's concerns. The limitations include: that it did not develop a technical organization for gathering experience and drawing out its implications; that it did not develop a logico-mathematical structure for discourse (some would relate this to the autographic nature and structure of the Chinese language, in which case a response would require deep cultural adjustment); and that Chinese culture did not develop effective interaction between the empirical and the intellectual levels.

Instead, Chinese culture evolved a quite different and basically more humane concern. This was not for analytic detail regarding particulars, but for a synthetic vision of the whole. In this the human and the self were never peripheral, but always central. Thus Chinese culture should have riches to contribute today to the new hermeneutic concerns, especially for the practice of the human sciences. This points also to the need for a metaphysical and religious context to which Profs. Shen and Hang will return at the end of this volume.

Part II takes a dialectical step emphasizing the constructivist role of the subject and bringing to light problems which result from the recognition of the role of subject in the philosophy of science. The paper of Roland Fischer suggests that science no longer be looked upon as a statement about the world in which we live, but as a process to be carried out. This brings to the fore the importance of argumentation as interweaving reflection and points to the important role of contradiction in critical doubt and questioning.

In this attention to the activity of the scientific thinker, however, something dramatic has happened to the object. The product is no longer a unified science in the sense of offering a unified view of the world as sought by Descartes, nor is it even Carnap's unified science in the sense of cooperation by scientists all of whom are committed to the apply the same method to the study of the same reality. Indeed, truth and reality are no longer spoken about. For Fischer the product of science is a dynamic network of pieces of knowledge, between whose pieces there is potential for connections. But can consistency of argumentation be sustained and have meaning if the work of the subject is detached from reality; indeed if there is no such thing as meaning?

The papers of the Pietschmann and F. Wallner go further still to see science as constructing micro-worlds with no relation except to the life world which ordinary people construct consciously or unconsciously, and in terms of which they live. They acknowledge that there must be something existing in itself or real, but consider it (*Realität*) to be inaccessible to human reason. Hence, they

transfer the meaning of reality to what appears in our everyday experienced life world. On this basis the sciences or perhaps better, scientists construct worlds of ideas or worlds.

Here the problem multiply rapidly, for not only is there no possibility of the consistent argumentation and significant interweaving in which Fischer would see any process that could be called science consisting. More fundamentally there is no basis for the notion of contradiction essential to the sole remaining technique, strangification (developed, it would seem, out of the notion of "falsification"), relocating a scheme in different scientific contexts until its limits are made manifest and its essentials circumscribed. (It was not without reason that the first efforts to establish a scientific approach to reality led rapidly and inevitably to Parmenides' and Aristotle's development of a metaphysics implemented precisely upon the irreducibility of being to nonbeing. One does without this only at one's peril.)

H. Pietschmann approaches this from the point of view of education to the counter-intuitive principle of physics. F. Wallner would reduce science and education to the metaphor of the market in which the scientist is a "player". By ingeniously manipulating different subjectively constituted micro-worlds and their possible relation to the life-world, scientist produce particular insights (small products). If they or others see a practical utility here they can attempt to market this insight. The value of such products of science will be judged not by peers on the basis of established content or in terms of logical interconnections, but by the broad public in terms of relevance of these micro-worlds to the passing needs of the market.

There is here a populist, anti-elitism. It is driven not by knowledge, but by skepticism. Whereas people look for content from the sciences with which to orient their life, Pietschmann and Wallner suggest rather that science education at the university level concentrate first on developing skepticism with regard to such content, and then upon developing marketable products, which is done through developing of micro-worlds and their application. The focus here is not on knowledge and its generation, but upon utility.

Can this make any positive contribution? A number are suggested based upon the possibility that training in the technique of contradiction or alienating inter-disciplinarity might help in generating marketable "small products." But while there is much humility to be learned, could such small outcomes be what the initiators of the project of science had in mind?

In Part III Prof. Tran Van Doan approaches this issue from the perspective of education. He looks into the ideologies of empiricism and idealism. The former by cutting off access to intelligible content directs all attention to method, while the other by focusing upon *a priori* intelligible content divorced from experience seals the mind within unchanging formulae imposed from without by indoctrination. His response to both follows the direction of critical theory and the rational pragmatics of Jürgen Habermas. But in so doing this remains ultimately within the envelop of rationalism and formalism.

Vincent Shen suggests that, rather than face such reductionism as is proposed in Part II, the theory of science needs to take up the related ontological and metaphysical questions. If to avoid these issues science would be forced to so limited and skeptical a goal as in Part II, then the path of reason calls for such ontological and metaphysical investigations. This is the burden of Part III. Vincent Shen shows how this broadening of the role of reason beyond the narrow structures of the enlightenment and a return to the perennial sense of reason might be accomplished, where Chinese philosophy can make essential contributions, and how the inter-translation technique of constructive realism locating ideas in contrasting contexts can serve such East-West comparisons.

If the issue is not to be left as is, with Western science wandering about in search of meaning and Chinese culture in need of help from the physical sciences, then one must ask, as does

Professor Hang in his chapter, why Chinese civilization as a culture has not yet effectively discovered modern science, and why in the past it did not lay the foundations for doing so. Science was developed in the West, rather than in China, he writes, because in a number of internal and external ways it depends upon the notion of a Transcendent. There is need for the conviction, which is provided by the notion of an all-wise and universal Creator, that the universe is rational and that human reason in turn provides access thereto. In this light seeming inconsistencies stimulate intense effort to resolve them intelligibly.

While these elements were present very early on in the Chinese cultural tradition, loss of faith in a just and all-powerful God led to an identification of heaven and the natural course of events. This substituted the Transcendent by the notion of Tao as an impersonal Way. The effect of this as regards science was to leave a vacuum. Since 1919 this has tended to create such a desire for science that human spontaneity has been submerged to a scientific theory of human history. Adequate protection against this will require not only the knowledge contained in a more adequately developed science, but also the redevelopment of its metaphysical and religious contexts.

In a way the results of these investigations are surprising. Theory rather than being impeded by practice, can be enlivened thereby. But in order for this to be so both theory and practice need a metaphysics. But that is only to rediscover through long pilgrimage the distinctive role of wisdom for science. To this crucial discovery the present work makes an original contribution.

George F. McLean

Part I
Science and Human Subjectivity

1.
The Scheme-Content Dualism in Thomas Kuhn

Wan-Chuan Fang

It is a well-known fact that W.V. Quine sees in empiricism two dogmas: the analytic-synthetic distinction, on the one hand, and reductionism, on the other. To these two dogmas Donald Davidson adds a third which he calls scheme-content dualism (TI, 190).[1] One important use of this dualism is to give meaning to conceptual relativism where two incommensurable conceptual schemes are counted as conceptual schemes because they are schemes for the same content. The main concern of this chapter is to see (a) whether Kuhn is committed to a dualism of scheme and content, and if so, what exactly it looks like; (b) how such a dualism leads to conceptual relativism; and finally, (c) how Davidson's general criticism of scheme-content dualism could apply to Kuhn's brand of dualism.

There is no doubt in Davidson's mind that Kuhn is guilty of scheme-content dualism. Commenting on Kuhn's view that "scientists operating in different scientific tradition (within different `paradigms') `work in different worlds'," Davidson says that "Kuhn . . . wants us to think of different observers of the same world who come to it with incommensurable systems of concepts" (TI, 187). According to Davidson, the latter "*suggests* . . . a dualism of total scheme (or language) and *uninterpreted* content" (*ibid*., my emphases). Here Davidson is very careful to say that Kuhn's view suggests a particular form of dualism which involves uninterpreted content. `Incommensurable' is, of course, Kuhn and Feyerabend's word for `not inter-translatable'. The *neutral*content waiting to be organized is supplied by nature.

But is Davidson correct when he comes close to attributing dualism to Kuhn? Immediately before this, Davidson quotes a long passage from Kuhn which seems to suggest that Kuhn denies the existence of neutral or uninterpreted content (TI, 190). This is expressed even more clearly when he repudiates the Western epistemological tradition that posits fixed and neutral data which are susceptible to different interpretations (SSR, 126). Hence, Davidson's attribution of a particular form of scheme-content dualism to Kuhn warrants consideration. The following argues that indeed Kuhn is guilty of such a dualism, but that it is a form of dualism much more akin to that which Davidson finds in Quine than to the one depicted above.

Quine's Scheme-Content Dualism

That the so-called uninterpreted content is not a necessary ingredient of dualism is clear to Davidson: "The scheme-content division can survive even in an environment that shuns . . . the assumption that there can be thoughts or experiences that are free of theory" (MS, 161). Instead, according to him, "what matters [to scheme-content dualism] is that there should be an ultimate source of evidence whose character can be wholly specified without reference to what it is evidence for" (*ibid.*, 162). This kind of dualism is supposed to be found in Quine. Let us go into some of the details.

Davidson takes Quine's dualism of scheme and content to be strongly suggested in Quine's following words:[2]

We can investigate the world, and man as a part of it, and thus find out what *cues* he could have of what goes on around him. Subtracting his cues from his world view, we get men's net

contribution as the difference. This difference marks the extent of men's sovereignty--the domain with which he can revise theory while saving the data (WO, 5).

World view or theory is what Davidson calls scheme, while cues or data are content (MS, 162; MTE, 69). What are cues or data, and what is the relation between scheme and this content so understood, are made clear in Quine's "Epistemology Naturalized" (hereafter EN). The main task of naturalized epistemology is the study of the "relation between the meager input and the torrential output" (EN, 83), the stimulations of one's sensory receptors being the inputs (EN, 75), while the output is a theory or "a description of the three-dimensional external world and its history" (EN, 83).

What remains to be seen is the relation between content and scheme. We may glean from Quine's writings the following answers":

(1) the sensory input or content "*supports* the very physical theory that I am accepting" (QEC, 24; my emphasis):

(2) "society teaches us our physicalistic language by training us to associate various physicalistic sentences directly, in multifarious ways, with irritations of our sensory surfaces" (PR, 253);

(3) "The stimulation of [one's] sensory receptors is all the evidence anybody has had to go on, ultimately, in arriving at his picture of the world." (EN, 75; my emphasis).

Here (2) is concerned with language acquisition, whereas (1) and (3) have to do with theories and their evidence.

Because sensory stimulation by itself is not propositional it can cause one to assent to certain observation sentences (QEC, 25; EN, 85; VITD, 40), which in turn may serve as evidence. The same point is expressed clearly when Quine says that "our only source of information about the external world is through the impact of light rays and molecules upon our sensory surfaces" (NNK, 68).

But conceptual relativism still is not in sight, whereas our purpose here is to search for a form of dualism in Quine's talk of subtracting cues from the world view. Davidson's construal of this talk is, to repeat, that "what matters is that there should be an ultimate source of evidence whose character can be wholly specified without reference to what it is evidence for," or to what goes on around us. It is doubtful that the evidence can be so specified. The difficulty may be glimpsed from Quine's note that "the motivating insight, viz. that we can know external things only through impacts at our nerve endings, is itself based on our general knowledge of the ways of physical objects" (WO, 2). To be prudent we should avoid attributing without reference to what goes on around us.

One way to take Quine's dualism may go like this. We derive our world view from patterns of stimulation in the sense that the latter cause our web of beliefs about the world. But the same patterns of stimulation may occasion quite different world views, though these cues constitute our only source of information about the external world. If, as Quine has it, subtracting these cues from our world view gives us our net contribution, then the cues are data or what are not contributed by us. We may thus take Quine's dualism to be the view that from the same data we may derive quite different world views. In so far as the derived world views might be dramatically different, conceptual relativism would follow.

Another possible construal of Quine's dualism would take `saving the data' as the only constraint for any acceptable world view. That is, one world view is as good as another so long as they are equally good in helping us "to foresee and control the triggering of our sensory receptors in the light of previous triggering of our sensory receptors" (TTP, 1). But this may not lead to the dualism in Quine for which we have been searching unless it is assumed that as world view builders we might come up with dramatically different world views.

Two things should be noted about our way of taking Quine's dualism. First, contrary to Davidson, our version of Quine's dualism is independent of whether there is a way of specifying the data that is independent of what goes on around us. Second, Quine's dualism does not lead automatically to conceptual relativism unless there be added some premise concerning our "conceptual sovereignty". Hence, by itself scheme-content dualism may not be what is to be blamed.

Kuhn's Scheme-Content Dualism

We have noted before that Kuhn's scheme-content dualism is more akin to Quine's than to the one depicted by Davidson. It is time to support this claim. First we want to show that Kuhn denies the existence of the so-called uninterpreted content. What we find in Kuhn that comes closest to the so-called uninterpreted content is what he calls pure percepts (SSR, 127). But pure percepts are not so pure, for if they exist their existence presupposes "a paradigm, taken either from a current scientific theory or from some fraction of everyday discourse" (*ibid*). If pure percepts are not immune from some sort of theoretical underpinning, Kuhn suspects "that scientists are right . . . when they treat oxygen and pendulums . . . as the fundamental ingredients of their immediate experience" (*ibid.*, 127-28). But oxygen and pendulums definitely are not uninterpreted content.

But if there is no uninterpreted content, what else would play the role of content in the dualism? The answer is that stimuli which impinge on us will be the content. In talking about how people who experience communication breakdown because of incommensurable viewpoints may yet have some recourse, Kuhn says that

the stimuli that impinge upon them are the same. So is their general neural apparatus, however differently programmed. Furthermore, except in a small, if all-important, area of experience even their neural programming must be very nearly the same, for they share a history, except the immediate past (*Postscript*, 201).

A differently programmed neural apparatus may process "certain stimuli differently," thus making us see "different things or the same things differently" (RMC, 276). And if the members of two groups have systematically different sensations on receipt of the same stimuli, "they do *in some sense* live in different worlds" (*Postscript*, 193).

According to Kuhn the neural process "is subject to change both through further education and through the discovery of misfits with the environment" (*ibid.*, 196). If we use the word `leading' to cover the two cases then we may simply say that neural process can be changed through learning.

We can readily see from our brief introduction of Kuhn that his position is indeed very similar to that of Quine. For both, retinal imprints or, more generally, stimuli that impinge upon us "are elaborate constructs," and hence not uninterpreted content.

What remains to see is whether they share a view on the connection between sensory stimulation and our world view. We have noted that Quine takes the relation between the two to be that sensory stimulation causes us to assent to certain sentences, that is, causes us to have certain beliefs. Kuhn on the other hand views the relation in terms of our neural apparatus as processors so that we "are processing stimuli" (RMC, 276). This does not show that Quine and Kuhn see the relation differently. For Quine may accept the metaphor that our neural apparatuses are processors and also without contradiction claim that stimuli cause us to have certain beliefs about the world.

How would Kuhn's scheme-content dualism lead to conceptual relativism? What makes us see different things or see things differently and eventually make us dwellers of different worlds are our differently programmed neural apparatus. The reason for the possibility of conceptual relativism would then seem to be the same for both Kuhn and Quine: it all hinges on the possibility that different people might be induced by patterns of stimulation to come up with widely different world views.

Quine's scheme-content dualism as depicted above is obviously a chapter in naturalized epistemology. If so, why does Davidson think that it "cannot be made intelligible and defensible," that it is a dogma that ought to be discarded? (TI, 189) Since Kuhn's dualism is similar to that of Quine, the same question may be asked about Kuhn. What we want to know, at least in outline, is how it would apply to Kuhn or Quine.

What Davidson Would Say about Kuhn's (Or Quine's) Dualism?

We have noted that by itself Kuhn's or Quine's dualism is not something to be blamed, for by itself it does not necessarily lead to conceptual relativism. One way that Kuhn's dualism would lead to conceptual relativism is to assume that differently programmed neural apparatus might yield dramatically different world pictures. If Davidson takes his criticism of scheme-content dualism to be applicable to the present case, it would follow that, supposing he would accept Kuhn's depiction of the causal relation between stimuli and our world views, he would deny the above assumption because, no matter how neural apparatus be differently programmed, they can, as a matter of fact, yield only more or less similar world views? But why would this be so; is it a fact about us as human-machines?

Certainly, when Davidson criticizes Kuhn's dualism, he is not making a point concerning matters of fact. But in order to say what actually he is getting at, we should first note that we used to talk about neural apparatus yielding world views. For our present purpose, however, we may think instead of neural apparatus as a mechanism which takes stimuli as input and spoken sentences as output. These spoken sentences are supposed to express a person's beliefs; when taken collectively, they may be regarded as expressing his world view. What spoken sentences a neural apparatus may have as its output is an empirical fact; no one has the right to decide by *a priori* means which spoken sentences do or do not belong to the output. But whether the output as a collection of spoken sentences constitutes an interpretable whole is not simply an empirical matter.

Thus, Davidson's criticism comes down to this: according to his methodology of interpretation, world views cannot be dramatically different.[3] Kuhn's dualism therefor turns out to be no exception to Davidson's general criticism.[4]

Concluding Remarks

We have shown that some sort of scheme-content dualism can indeed be found in both Kuhn and Quine, but that it has a quite different form from what Davidson takes it to be. The applicability of Davidson's general criticism of scheme-content dualism to it has also been shown.

What needs to be clarified, but what we do not go into here, is how we should take `scheme-content dualism by itself' and what are some of the extra factors that conspire to lead to conceptual dualism. This point may be relevant also to a proper understanding of Davidson general view about conceptual relativism.

Notes

1. For abbreviation of titles of articles or books, see *Reference*.
2. See MTE, 69.
3. For Davidson's methodology of interpretation, one may see various articles in TI.
4. Davidson's general criticism of scheme-content dualism is most completely stated in "On the Very Idea of a Conceptual Scheme", which appears in TI.

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[VITD] "On the Very Idea of a Third Dogma" in W.V. Quine. *Theories and Things*.

[TTP] "Things and Their Place in Theories" in W.V. Quine, *Theories and Things*.

2.

The Magic of Consciousness: An Inquiry into the Concept of Object in Yogacara Buddhism

Lin Chen-Kuo

Vasubandhu, a fifth century Yogacara Buddhist philosopher, claimed that all beings are nothing but the subjective manifestation of consciousness. His philosophy, as known by the label "mind-only" (*citta-matra*) or "consciousness-only" (*vijnanamatra*), was criticized in both Buddhist and non-Buddhist circles. As recorded in the *Vimsatika* (*The Twenty Verses*), a philosophical debate on the issue of whether or not the existence of external objects can be denied might have occurred in Vasubandhu's lifetime. For realists, knowledge cannot be explained if the existence of an external object is not postulated; however, Vasubandhu would call into question that very postulate.

The debate between Vasubandhu and the realists not only was one of the most fascinating episodes in the history of Buddhist philosophy, but now attracts many modern scholars. In the critical attempt to re-examine the whole story, they ask rather whether external objects really are denied in Vasubandhu's philosophy. They contend that what truly concerns Vasubandhu is not to deny the external world, but merely to disclose our misconception about this world. For those scholars, the traditional interpretation of Yogacara philosophy as "idealism", in the sense of denying external objects, truly throws out the baby with the bathwater.[1]

By taking the above ancient and contemporary controversies into consideration this paper attempts to examine a Yogacara concept of object with particular reference to Vasubandhu's two treatises, *Trimsika* (*The Thirty Verses*) and *Vimsatika*.[2] The first two parts of this paper will summarize Vasubandhu's basic ideas of "perception only" and consciousness, and his response to the realist critique. The third part will explain how an object is constituted through a "transformation of consciousness" (*vijnana-parinama*). Then, it will discuss the problem of the certainty of knowledge in the context of Vasubandhu's philosophy. The final part will review Vasubandhu's philosophical task with some critical remarks.

Perception-Only (*Vijnaptimatra*) and the Realist Critique

In the beginning of the *Vimsatika*, Vasubandhu stated his philosophical position as follows: "The three realms (*traidhatuka*) are*vijnapti-matra* (perception-only)." As a central point of controversy, the term *vijnapti-matra* not only was mistreated by Vasubandhu's contemporaries, but also caused trouble for modern scholars. Various renditions of it have been provided, such as "consciousness-only," "ideation-only," "representation-only," "perception-only," etc., but none of them could be of much help without the whole argument being fully articulated. Meanwhile, we need to know only that the term *vijnapti* literally means "proclamation" or "making known," and that the term *matra* means "only."[3] As a compound, *vijnapti-matra* in the present context means "being known or presented [in the consciousness] only."[4] The whole statement means that the entire universe, which consists of the realm of desire (*kamadhatu*), the realm of form (*rupa-dhatu*) and the realm of formlessness (*arupya-dhatu*), are nothing but that which is known or presented within consciousness. "Only" is stressed in order to rule out any external referent or object (*artha*).

This "idealist" statement invited immediate objections from realists:

(1) If perception occurs without referring to an external object, then there could be no determination of space and time. But then why does the perception of a certain thing occur only at a specific time and place, not anytime and anywhere? If perception arises from the consciousness without referring to any external object, then one could perceive, for instance, a table anywhere and anytime. But, in fact, consciousness is not thus arbitrary. Therefore, the existence of an external object is necessarily required for the occurrence of perception.

Vasubandhu replied that in the case of dream a perception does occur at a specific time and place, though this does not correspond to any external object. For example, I had a dream that in the morning I saw Mr. Wang on the corner of a street. In this case time and space are determined even when Mr. Wang is nonexistent.

(2) Realists raised another question: If perception occurs without corresponding to an external object, why is it that many persons present at the specific time and space are able to have the same perception of something? In other words, if the perception depends on the consciousness only and not on the external object at all, then that specific perception could not be manifest to all observers who are present at the same time and place. But this is not the case, for all drivers can see the red light when they stop in front of the traffic light. If this is true, then there must exist a real red light corresponding to the driver's perception.

Vasubandhu replied that common perceptions can occur without referring to an external object because observers share the same structure of consciousness. Vasubandhu gave an example of hell and hungry ghosts (which was popular and suitable for his contemporaries), saying that all hungry ghosts living in hell see the pusriver and the hell-guardians that in fact are nonexistent since they fall into hell because of the maturation (*vipaka*) of the same deeds (*karma*). According to the Buddhist tradition, the world of life-and-death is constituted by the experiences of those who share the same kind of *karma* in the past. Thus the structure of individual consciousnesses is supported by a common past. The Yogacara coined a technical term, *vikapa-vijnana* (maturation-consciousness) to designate this underlying structure of consciousness which results from the maturation of past deeds.

(3) The most striking criticism from realists is the problem of efficacy. If perception in the waking state is the same as that in a dream, so that all perceptions do not correspond to external objects, then why does the thing perceived in the waking state have efficacy whereas that in a dream does not? For instance, the poison and knife in a dream do not possess the function of killing, while in the waking state they do.

In response to this criticism, Vasubandhu did not deny the efficacy of things and actions, but argued that efficacy is exactly prompted by perception-only without necessarily relying on an external object as its cause. A good example is a wet dream in which sexual excitement can be aroused by a sex partner who in fact is nonexistent.

Up to this point, Vasubandhu defended his position quite satisfactorily by arguing that the three pillars of realism, i.e., determination of time and space, indetermination of observers, and efficacy, cannot prove the existence of external objects because they occur also in situations in which no external object exists. Vasubandhu admitted the above three conditions of experience. However, he did not accept the realist's theory, but argued that what is experienced or perceived is perception-only (*vijnapt-matra*).

That Vasubandhu successfully presented counter-arguments to the realist's criticism is not equivalent, however, to saying that his own position is demonstrated. The problem remains. Both

in waking and in dreams we do have a perception of something. How is it possible that "something" does not exist independently of consciousness; or how is it possible that "something" exists as manifested by, and to, consciousness above? The clue to an answer to this question is found in Vasubandhu's doctrine of consciousness.

Vasubandhu's Doctrine of Consciousness

In early Buddhism, consciousness (*vijnana*) is analyzed into six categories: five sense-perceptions (seeing, hearing, smelling, tasting and touch) and mental-perception (*mano-vijnana*).[5] These perceptions arise when the two conditions, sense-faculties (*indriya*) and their respective sense-objects, are present. For instance, a visual perception arises when eyes and something visible (*rupa*) are had; similarly mental perception arises when there is a mind (*mano*) and a mental object (*dharma*). The sum of six perceptions, including sensory and mental perception, are named "consciousness".

As conditions of perception, the five sense-faculties and the five sense-objects have never been examined as to their ontological status, but according to the early Buddhist scriptures they were considered to be real. Now, Yogacara claims that both sense-faculties and sense-objects are merely manifestations (*pratibhasa*) of consciousness: they are merely perception without referring to external objects.[6] How does Yogaraca justify such a deviation from the Buddha's original teaching?

In addition to the sixfold structure of consciousness, Yogacara added two more layers: the store-consciousness (*alaya-vijnana*) and the ego-consciousness (*manas*) so that in total consciousness becomes eightfold. Note that this sort of classification is purely typological and cannot be interpreted literally as meaning that there are eight consciousnesses.

First, let us look at the notion of "store-consciousness" (*alaya-vijnana*). Etymologically the word *alaya* is derived from the verb root *a-li*, meaning "come close to, to settle down upon, to stoop." Thus it means "a house, a dwelling, a receptacle."[7] It also means "clinging" or "that to which one clings." Accordingly, *alaua-vijnana* is usually translated as "storehouse-consciousness" and means a latent consciousness which functions like a storehouse where the "seeds" (*bija*) of the previous actions (*karma*) and cognition are deposited. In this sense, "store-consciousness" is taken as synonym of "consciousness-containing-all-seeds" (*sarvabijakavijnana*).

According to the *Samdhinirmocana-sutra* (*SNS*), a fourth century Yogacara text, the store-consciousness is characterized by two kinds of appropriation (*upadana*): (1) "to sustain" the sense-faculties, and (2) to appropriate the psycholinguistic sediments (*vasana*) which result from the daily discourse.[8] In the *SNS*, the ontological status of body is not doubted, probably because there the doctrine of perception-only has not yet fully developed. But we will see later that in Vasubandhu's philosophy the notion of "body" is nothing but the perception or consciousness of body: the inner consciousness of body is the base of body.

The store-consciousness consists of all sorts of "seeds," a metaphorical notion which needs further exposition. Although the notion of "seed" can be traced back to the *Nikaya* and *Agama* literature, it was directly inherited by the early Yogacara thinkers of the Sautrantika school.[9] They contended that when the action (*karma*) momentarily perished it "perfumes" (*vasana*) the consciousness-stream (*cittasamtana*), creating thereby a special potentiality. This potentiality ripens through a period of the evolution in the consciousness-stream.[10] As a result, through the perfuming of action a "seed" is transformed into a "sprout" and finally turns into a "fruit".

By adopting this mode of metaphorical thinking, the early Yogacarins viewed the store-consciousness as the "container" of all karmic and psycho-linguistic "seed". In given conditions, a "seed" can be actualized and transformed into an object-in-perception which, in turn, by the activities of the other seven consciousnesses, leaves its residual force in the store-consciousness. In the sixfold perceptions there exists a cycle of mutual causation: the object-in-perception results from the actualization of "seed", and conversely the "seeds" result from the perfuming activities of the sixfold perceptions.

But what are "all seeds" in the store-consciousness? Theoretically the notion of "seeds" must be comprehensive enough to account for the formation of all things perceived and experienced. As seen in Asanga's *Mahaynasamgraha*, a Yogacara text written earlier and commented upon by his half brother Vasubandhu, the "seeds" are divided into three categories, (1) those perfumed by discourse (*abhilapavasanabija*), (2) the conception of self (*atmadrstivasanabija*), and (3) the members of becoming (*bhavangavasanabija*).[11] Those of category 2 cause the formation of ego-consciousness, those of category 3 cause rebirth, while those of the first category cause the all perceptions, including sense-objects and their respective sense-organs.[12] For instance, as Vasubandhu explained, a "seed" of "eye" in the store-consciousness serves as the cause of eye, and so does a "seed" of "ear" serve as the cause of ear, and so forth.[13]

"Discourse" is constituted of both nominal and perceptual activities. Nominal activities are directed to the referent (*artha*) by means of sound and words, while perceptual activities make objects manifest to consciousness without utilizing sounds and words. Both are indispensable for daily discourse[14] whose sediments or residuals in the store consciousness are called "seeds".

But how are the "seeds" as sediments of discourse in the store-consciousness transformed into all sorts of sensory and mental perceptions? That is, how is it possible for the Yogacara to claim that the objects of cognition and sense-organs are merely the manifestation (*pratibhasa*) of "seeds"? Vasubandhu attempted to solve this problem by introducing a new notion, i.e., "transformation of consciousness" (*vijnana-parinama*). This became the core of later Yogacara philosophy, though it had not been fully developed philosophically in Vasubandhu's lifetime.[15]

Transformation of Consciousness

In stanza IX of the *Vimsatika*, Vasubandhu utilized the notion of "transformation" to explain how the object of cognition arises:

Perception (*vijnapti*) is born from its own seed (*svabija*) and evolves (*pravatate*) into object-like appearance (*abhasa*). It is in this context that the Sage spoke of the twofold bases of cognition.

In his self-commentary, Vasubandhu explained further:

What does that stanza mean? That which is manifest (*vijnapti*) as the object-like visible (*rupa-pratibhasa*) arises from its own "seed" which, while other conditions are provided, has undergone through transformation (*parinama*) and thereby is differentiated (*visesa*). The Buddha spoke of the "eye" and the "visible" as the bases of cognition with reference to the seed and the object-like visible respectively. In the same way, that which is manifest as the object-like tactile arises from its own "seed" which, while other conditions are provided, has undergone transformation and thus been differentiated. The Buddha spoke the "body" and the "tactile" as the bases of cognition with reference to the seed and the object-like tactile respectively.[16]

In Buddhist philosophy, a sense faculty and a sense object are required for perception to arise. But what do these notions really mean? Can a sense organ, for instance, an eyeball, be taken as the cause of perception, or can we say that an eye sees a table? For Yogacara, the notions of "sense faulty" and "sense object", which had never been doubted, now are called into question.

According to Yogacara, a moment of perception ceases as soon as it arises. This notion of momentariness is essential to understanding Yogacara's concept of perception for between two moments of perception there must exist causal continuity. Since each perception arises and perishes momentarily, their causal continuity can be explained only if a third party exists. The notion of "seed" is introduced here to serve as that third party. Yogacara contended that each perception-moment "perfumes" and leaves its own sediment ("seed") in the store-consciousness which causes the next perception-moment to arise.

Vasubandhu tried to argue here that only the "seeds," as the sediments of the previous discourse and action, are qualified as the cause of the present perception. Rather than saying that "an eye sees a table," this statement should be paraphrased as: the present perception of "table" is caused by the "seed" of the preceding perception of "table". Rather than referring to an external object, the object of perception is transformed from the "seed" which is deposited in the store-consciousness.

To look closer at the notion of "seed," this can be understood analogically as a semiological code which was coded in the past. If certain conditions are provided, these will be decoded and appear on the screen in the form of appearance. Similarly, all perceptions in daily life are nothing but manifestations of those codes which are coded and deposited in the store-consciousness. (Since all codes are genetic and public, the store-consciousness is also genetic and intersubjective.)

This sort of genetic process in which codes are coded and decoded is called "transformation of consciousness" (*vijnanaparinama*). The purpose of Vasubandhu's philosophy is to disclose this indiscernible process of transformation. Vasubandhu further discussed this notion in the *Trimsika*. In its very first stanza, Vasubandhu claimed that whatever are designated as "things" (*dharma*) and "self" (*atman*) are merely transformations of consciousness. In the following 16 stanzas, Vasubandhu proceeded to explain how transformation occurs in each of the three layers of consciousness. By comparison to the opening statement in the *Vimsatika*, we see that in the *Trimsike* Vasubandhu clearly intended to demonstrate the truth of perception-only in light of this new idea of the "transformation of consciousness."

Derived from the root *nam*, meaning "to bend or bow, to subject or submit one's self, to turn towards, i.e., to aim at, to yield or give way," the term *parinama* means the transformation of one's self into something.[17] As a compound, *vijnana-parinama* means that *vijnana* (perception/ consciousness) is characterized essentially by the act of constituting/objectifying something. That "something" is the result of the transformation of that which perceives. Simply put, the object of perception is given (in the sense of "constituted") by perception itself. This process of object constitution is called "transformation".

In stanza 17 of the *Trimsika*, Vasubandhu further clarified the notion of *vijnana-parinama* as synonymous with *vikalpa*(constitution):[18]

The transformation of consciousness is constitution (*vikalpa*). What is constituted (*yad vikalpyate*) does not exist. Therefore, everything is perception-only (*vijnaptimatraka*). (*Trimsika* XVII)

According to Sthiramati's (ca. 470-550) commentary, *vikalpa* or cognitive constitution is the nature of the mind (*citta*) and its mental associates (*caitta*) belonging to all the three realms

(*tridhatuka*). The constructions (*adhyaropita*) of mind are the various forms of objects (*artha-akara*) which do not correspond to external objects[19] but are merely manifestations of "seeds".

In the next stanza, Vasubandhu explained how constitution (*vikalpa*) proceeds:

The consciousness contains all seeds; (its) transformations in such and such ways proceed through mutual influence. From this constitution arises. (*Trimsika* XVIII)

This stanza indicates that the constitution of an object is not transcendentally grounded. All are nothing but transformations of consciousness, occurring through the mutual causation between the store-consciousness ("seeds") and the sixfold perceptions. Depending on the "seeds", perceptions arise; and depending on perceptions, the "seeds" are perfumed. All objects are constituted in the closed circle of mutual causation in consciousness, outside of which no external object can be affirmed.

The Certainty of Knowledge

Let us return again to the problem of the certainty of knowledge. For realists, the doctrine of perception-only has difficulty in explaining away the fact that in daily life we *surely* do, for instance, see and grasp a cup. If there does not exist a cup independent of consciousness, they argued, how can this certainty be justified?

Vasubandhu replied that he did not deny the certainty of knowledge and experience but that he does not agree to postulate external objects as the grounds of that certainty. Vasubandhu asked, how can the existence of an external object independent of consciousness be demonstrated? Obviously, for Vasubandhu, it is the realist's postulation of external objects which needs to be critically examined.

According to the previous analysis, we conclude that the discrepancy between Vasubandhu's and realist's positions lies in their different conceptions of consciousness. For realists, consciousness is like a mirror that correctly reflects things out there. Between the reflection (image) and the object there is a representative relationship. On the contrary, Vasubandhu viewed consciousness as constituting so that being conscious of something is tantamount to constituting and objectifying it: what is constituted (i.e., the object-in-consciousness) reflects that which constitutes (consciousness).

For Vasubandhu, to assert or postulate a corresponding or representative relationship between an object-in-consciousness and an external object is a "perverse view" of consciousness which is intersubjective. In the *Trimsika* and the *Vimsatika*, the store-consciousness is also called "consciousness-in-maturation" (*vipaka-vijnana*) for the store-consciousness results from the maturation of past deeds (*karma*): those who have done the same kind of deeds are born into the same world, and share the same structure of consciousness. Vasubandhu did not mention an *a priori* structure, but he did consider the present consciousness as the embodiment of the past. Due to this intersubjective consciousness, one perceives something in the same way as do the others.

Furthermore, as mentioned above, perception is directly caused by its own "seed" (semiological code) deposited in the store-consciousness. The reason why a certain perception appears in this rather than in another way, is due to the determination of "seed". Since the "seed" is essentially linguistic and conventional. It is due precisely to the linguisticality and conventionality of "seeds" that the certainty of perception is obtained.

What Is the Real?

The last question is, "What is the real for Yogacara?" Though the Yogacara says that all are perception-only, ordinary people do not realize this truth. They name the thing which they perceive, and believe that the named or signified exists "out there". For Yogacara, the signified is mistakenly endowed with ontological status, though in fact it is nonexistent. Confined within, all sorts of nonexistent but signified constitute the world-construction of daily discourse. This discursive world is called "imagined" (*parikalpita*).

But this "imagined" conceals the reality which needs to be disclosed. As a closed system of consciousness in which the object-like appearance arises, this reality is called "dependent" (*paratantra*), meaning that the arising of an object depends on the cause and conditions. The "dependent" is *the* reality, but is defiled and in need of being purified or perfected.

Only if one is detached from the "imagined" and stays in the state of perception-only (*vijnaptimatrata*), realizing that all are nothing but *vijnapti*, is one able to achieve the perfected state (*parinispanna*). The final question is, does one have any knowledge of "external objects" in the perfected state, or are they still denied in this state? For Yogacara, as enlightenment means to stay in the realization of perception-only, i.e., the realization of emptiness, the enlightened one is not supposed to make any assertion about the existence of external objects.

Conclusion

Investigation of the nature of the object has been the focal issue in Vasubandhu's philosophy. Particularly as seen in the debate with realists, this issue is full not only of epistemological significance, but also of soteriological implications. To Vasubandhu, the realist's assertion of external existence obstructs the path of enlightenment and liberation.

Like any form of metaphysics, realism conceals more truth than it can disclose. Vasubandhu argued that object constitution is obscured by realism in the same way that the reality of the "dependent" is concealed by the "imagined". As far as one is directed towards the external world, one will inevitably ignore the subjective construction and fail to see how desire and power are involved in the assertion of external objects. To postulate or assert external objects is equal to making objects for grasping and desiring. For Vasubandhu, then, there is no pure epistemology or pure-science; to claim any sort of pure science or realism is absolute myth.

Notes

1. Alex Wayman was probably the first to challenge the traditional label of Yogacara philosophy as "idealism". See Alex Wayman, "The Yogacara Idealism" (review article), *Philosophy East and West*, 15 (1965), 65-73; "Yogacara and the Buddhist Logicians", *JIABS*, 2 (1979), 65-78.

2. For textual sources, see "References".

3. Franklin Edgerton, *Buddhist Hybrid Sanskrit Grammar and Dictionary*, II, p. 485.

4. For an excellent discussion on this Buddhist technical term, see Bruce Cameron Hall, "The Meaning of *Vijnapti* in Vasubandhu's Concept of Mind", *JIABS*, 9 (1986), 7-23.

5. The term *mano-vijnana* has been rendered in various ways. K.N. Jayatilleke rendered it as "internal perception" or "introspection" in his *Early Buddhist Theory of Knowledge* (1963), p. 436.

Walpola Rahula, another leading scholar in the field of early Buddhism, translated it by "mental consciousness". See his *What the Buddha Taught* (1959), p. 23.

6. *Vimsatika*, IX.

7. Monier Monier-Williams, *A Sanskrit-English Dictionary*, p. 154.

8. *Chieh-shen-mi ching*, T. 16.692.b; Etienne Lamotte, *Samdhinirmocana Sutra: L'Explication des Mysteres* (1935), pp. 55.

9. For a brief history of the notion of "seed", see Chen-Kuo Lin, "The *Samdhinirmocana-Sutra*: A Liberating Hermeneutic," unpublished Ph.D. dissertation (1991), pp. 127-128.

10. See Etienne Lamotte, "Introduction" to *Karmasiddhiprakarana: the Treatise on Action by Vasubandhu*, English translation by Leo M. Pruden (1988), p. 28; Yokoyama Koitsu, "Seshin no Shiki-teinpein," in *Koza Daijobukkyo*, vol. VIII, *Yuishiki Shiso*(1982), 119-120.

11. Asanga, *Mahayanasamgraha*, T. 31.137.b; E. Lamotte (1973), pp. 80-81.

12. See Vasubandhu, *Mahayanasamgrahabhasya*, T. 31.336.c; E. Lamotte (1973), pp. 80-81.

13. Vasubandhu, *Mahayanasamgrahabhasya*, T. 31.336.c.

14. See Wei Tat, *Ch'eng Wei-Shih Lun*, p. 582.

15. For a history of this technical term, see Yokoyama Koitsu, "Seshin no Shike-teinpein".

16. My translation is based on Hsuan-tsang's Chinese translation, but I have consulted also the Sanskrit text and modern translation. See Clarence H. Hamilton, pp. 35-37; Steven Anacker, p. 167; Thomas Kochumuttom, pp. 171-172; and Thomas Wood, p. 9.

17. Monier Monier-Williams, pp. 528, 594.

18. Franklin Edgerton, *Buddhist Hybrid Sanskrit Grammar and Dictionary*, p. 480: *vikalpa*, "(vain) imagining, esp. false discrimination between true and false, real and unreal."

19. Huo t'ao-hui, *An-hui san-shih-wei-shih-shih yuan-tien i-chu (Sthiramati's Commentary on Trimsikavijnapti)* (1980), pp. 111-113.

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3.
Scientific Rationality and Hermeneutic Reasonableness: Implications for Education

Vincent Shen

The contrasting situation between scientific rationality and hermeneutic reasonableness shows not only the relation between natural sciences and human sciences, but also, in some sense, exemplifies the contrast between Western culture and Chinese culture. Scientific rationality, as a well-structured procedural control over phenomena manifested through the interaction between empirical experiments and logico-mathematic formulations, is embodied in Western modern natural science and technology, especially in their success and efficacy for the explanation and technical control natural phenomena. The demand for reasonableness, especially in the hermeneutic activities of the human sciences, requires that the human mind refer to some kind of totality, either that of the experience of our self or that of existence. This is characteristic of Chinese culture and its main systems of thought such as Confucianism, Taoism and Buddhism. Both have their cognitive and their practical implications which must be taken into consideration in the educational process.

Now we are witnessing a deepening world process in which, as F.S.C. Northrop said, "The East and the West are meeting and merging. The epoch which Kipling so aptly described but about which he so falsely prophesied is over."[1] On the other hand, the interaction and the balance between the natural and human sciences is much emphasized in the intellectual milieu and in the educational process. A key to the mutual understanding between Eastern and Western culture and to the formation of a kind of complementarity between natural sciences and human sciences consists in exploiting the nature and dynamism of both scientific rationality and hermeneutic reasonableness. The consequences of this for education will be considered at the end of this article.

Scientific Rationality Compared with Chinese Learning

Cognitively speaking, scientific rationality envisages a systematic broadening of our knowledge through control procedures of circumscribed validity. For example, in the case of the natural sciences, theories are presented either through steps of generalization or as outcomes of creative imagination, and are then extended to new domains of experience. But, since the main theoretical instrument of the natural sciences is theoretical language, the progress of natural sciences depends much upon the construction and development of theories whose validity it is also important to control. This is normally done by the procedures of experimentation which consist of identifying a specific phenomenon in order to gain what K. Popper called either corroboration or falsification of the theory in question.

Since the above procedures are operational in nature, the cognitive side of scientific rationality is very related to its practical side and is deeply involved in action. The formal reasoning and even calculation of the logical structure of theories have transformed the abstract structure of meaning in language, just as operations during experimentation change the organization or state of affairs in space and time. Generally speaking, the practical side of scientific rationality could be analyzed by the mutual relationship between means and end, under the constraint of calculation and experimentation. This kind of rationality could be termed, on the one hand, strategic rationality, when in calculation it envisages logical connections between possible actions. On the other hand,

it could be termed instrumental rationality, when in experimentation it judges the problem of whether one action is rational or not according to the efficiency of a certain means to attain its end.

Generally speaking, the development of Western modern sciences, especially natural sciences, is based on the interaction between scientific theories and controlled experiments, both conceived as human constructs, the one as rational constructs, the other as empirical constructs. On its rational side, modern science is constituted by scientific theories which essentially are logico-mathematically structured propositions. On its empirical side, modern science is characterized by its well-controlled systematic experimentation. Both aspects go hand in hand to serve the advancement of science, but this interaction always must be checked by theoretical deduction and meta-scientific reflection. In his *Critique of Pure Reason*, Kant seems to have grasped well the complementary interaction of these two aspects of modern science:

Without sensibility no object would be given to us, without understanding no object would be thought. Thoughts without content are empty, intuitions without concepts are blind. It is, therefore, just as necessary to make our concepts sensible, that is, to add the object to them in intuition, as to make our intuitions intelligible, that is to bring them under concepts. . . . Only through their union can knowledge arise.[2]

In applying Kant's words to the case of scientific knowledge, the *sensible object* would refer to data gathered through well-controlled experimentation, while the *intelligible concepts* could be understood as constitutive of those logically structured scientific theories. Only their interaction could constitute scientific knowledge as such.

Compared with Western modern science, Chinese traditional science in general seems to be weak or even lacking in scientific rationality. First, it did not have a logico-mathematic structure for theory construction, nor had it ever reflected upon its own linguistic structure to the point of elaborating a system of logic for the formulation and control of its scientific discourse. Mathematics, although highly developed, was used only for describing data, not for formulating theories. Lacking in logical mathematical structures, Chinese quasi-scientific theories were presented principally through intuition and speculative imagination. This might have the advantage of being able to penetrate the totality of life and environment, but it lacked the rigor of logical control.

Second, empirical data in Chinese traditional science were established through detailed but passive observations, with or without the aid of instruments. But it seldom attempted any systematically organized experimentation or any active artificial control of perception. Finally, it did not have a tradition of epistemological reflection and philosophy of science, as was the case of European modern science.

Let us take, for example, the case of Confucianism. Apparently, Confucian learning seems to have emphasized the accumulation of empirical knowledge, on the one hand, and their intelligible unity, on the other. B. Schwarts is correct when he says, "To Confucius knowledge does begin with the empirical cumulative knowledge of masses of particulars, . . . then includes the ability to link these particulars first to one's own experiences and ultimately with the underlying unity that binds this thought together."[3]But further reflection shows that this Confucian conception of interaction between empirical knowledge and its intelligible unity does not constitute a scientific rationality.

First, concerning the empirical side of Confucian learning, Confucius did not have in mind sensible data gathered by technically controlled process. What he stressed consisted rather in the

concrete and factual knowledge of the institutions, the code of behavior, the achievement of an idealized culture (that of the Chou dynasty for example), and the components of the environment of our life. This extended from knowledge of names of birds, animals, and trees to that of the meaning of a religious rite. This empirical knowledge concerns mostly the meaningful world of man rather than the meaningless world of nature, which, in Confucius's eyes, was to be reorganized in terms of codes congenial to human nature rather than being controlled by mere technical processes.

Second, concerning the rational side of Confucian learning, there seemed to be no emphasis on a rigorous logico-mathematical structure for discourse. One thing Confucius did propose which was connected with the rationality of discourse was his emphasis upon correctness of names.[4] This concerned mostly language and its relation to reality, but was not proposed by Confucius as a semantic theory for concerned terms in themselves, but only as used in human speech and actions. Therefore it had some pragmatic significance in the social rather than in the logical arena, for it referred to a social code of behavior, rather than to any concept of definition in the sense of Aristotelian logic.

Mathematics was never considered by Confucians to be the measure of rationality, not to mention taking it as necessary for constructing meaningful discourse. The only exception was perhaps Shao Yung who gave a very high place to number, seen by him as the manifestation of Tao; but this was a metaphysical rather than a scientific position. Anyhow, mathematics was not highly valued in itself, which may be explained by the primacy of a social orientation in Confucianism. As J. Needham suggests, "Mathematics was essential, up to a certain point, for the planning and control of the hydraulic engineering works, but those professing it were likely to remain inferior officials."[5] This explains partly the unimportance of mathematical discourse in Confucianism. A more internal reason might be that mathematics was considered as a technique of calculation and an instrument for organizing and describing empirical data, not as the objective structure of reality and discourse.

Third, concerning the mode of interaction between empirical knowledge and the intelligible ground of its unity, Confucianism did not conceived an interactive relation in the mode of deduction/falsification or induction/verification. For Confucianism, the mode of unity was a kind of mental integration referring to the ultimate ground--Tao--through the process of ethical praxis. Praxis here was not interpreted as the technical application of theories to control concrete natural and social phenomena. It was understood rather as active involvement in the process of realizing what is properly human in the life of an individual and a collectivity. The status of science and technique must be reconsidered in the context of this ethical praxis.

From the above analysis, it becomes clear now that Chinese learning is not scientifically rational, though it is reasonable in an hermeneutic sense. To be scientifically rational, one must control the gathering of empirical data through technical process, formulate theories in logico-mathematical structure and establish their correspondence through interactive processes. But to be reasonable we must refer to the totality of our existence and its meaningful interpretation by human life as a whole. Confucianism and Chinese learning as a whole tried always to be reasonable, while neglecting their potentiality for scientific rationality.

Hermeneutic Reasonableness and the Human Science

Human sciences are hermeneutic in nature; the function of reason found there is that of reasonableness, rather than of rationality. Hermeneutic reasonableness has both cognitive and practical implications.

On its cognitive side, hermeneutic reasonableness concerns the dimension of meaning: the meaning of a literary or artistic work, the meaning of a behavior, the meaning of a social institution, the meaning of a certain culture, etc. The model of this cognitive activity is that understanding and interpretation are universal for mankind in that they could be extended to any form of relationship of man with the totality of the world. In understanding the meaning of a text, we have to refer to the totality of myself and the totality of the relationships I have with the world. In some sense, this has to begin from myself as the subject of my experience and understanding in order to reconstitute the meaning of a text. This echoes Husserl's position that the constitution of meaning refers inevitably to the intentionality of the one who understands.

The basic procedure of hermeneutics consists first of all in positing an interpretive hypothesis and then validating it by the text (or the work, the behavior, etc.) in question. The criteria of this hermeneutic knowledge is not that of falsification, as Popper would suggest, but rather of subjective saturation. In other words, the more an interpretive hypothesis can generate satisfaction in our heart concerning the meaning of a work of art for example, the more acceptable to us is this hypothesis.

On its practical side, hermeneutic reasonableness determines all actions concerned with subjective choice and subjective involvement in meaning, constituting, for example, those concerned with the creation and appreciation of works of art, with the realization and evaluation of moral intention, and even those political actions concerned with deciding the historical orientation of a certain social group.

The above first or cognitive aspect of hermeneutic reasonableness, although it refers to the totality of one's Self and the relation between the Self and the world, is nevertheless quite limited to human-centered orientation. But the second or practical aspect of hermeneutic reasonableness has a more speculative tendency for it concerns more the totality of Being, not limiting itself to the core of human subjectivity, human experience and human meaningfulness. Heidegger's *Seinsdenken* and Whitehead's speculative philosophy are of this kind. They refer to the totality of Being or of cosmic experience in order to reveal the ontological dimension of our meaning constitution. The most typical enterprise of this kind is Whitehead's speculative philosophy, which he defines as follows,

Speculative philosophy is the endeavor to frame a coherent, logical, necessary system of general ideas in terms of which every element of our experience can be interpreted. By this notion of `interpretation' I mean that everything of which we are conscious, as enjoyed, perceived, willed, or thought, shall have the character of a particular instance of the general scheme.[6]

Up to this level hermeneutic reasonableness could be seen as the effort of reason itself to attain an integrated and integral understanding of itself, in which there are not yet the distinctions between theory and praxis, knowledge and action, thought and being, subjectivity and objectivity. On the contrary, all these distinctions must find their justification in this ultimate effort of reason itself and be considered as the self-differentiation of auto-comprehending reason. It is from this integrating and yet original self-comprehension that the most profound movements of Being are

motivated. Starting from here we have the distinction between the cognitive and the practical aspects of reason, but the nature of self-comprehending reasonableness itself is both cognitive and practical.

Hermeneutic reasonableness, therefore, is caught in the tension between the reference to the totality of one's self and the reference to the totality of the realm of existence. On this level, Chinese philosophy is quite similar to Western philosophy in demanding a necessary reference to the totality in order to show the function of reasonableness in human reason. For example, Confucianism insists upon the need to refer to the totality of human existence, whereas Taoism points out the need to escape the "human, all too human" tendency of humanist philosophy and to refer rather to the totality of existence exemplified by the concept of Tao. Let us explain this point in more detail.

First, in contrast to the rationality of modern Western science, Confucianism is a system of reasonable ideas which refers ultimately to the totality of human existence and its realization as the horizon within which the meaning of human actions, and even that of natural phenomena, is to be determined. In the case of classical Confucianism, this system of ideas was constituted essentially of Jen ( ), Yi ( ) and Li ( ). Jen could be seen as the dynamic interconnectedness of one's self with other men, with nature and even with heaven. It is the ultimate ground and the transcendental foundation of men's ethical life. It is our subjectivity as well as our intersubjectivity, and is manifested especially in and through our moral awareness. From Jen, the Confucians derive Yi, which represents moral norms, moral obligations, moral judgements, or sometimes our consciousness of these obligations and even the virtue of acting always according to moral norms. From Yi the Confucians would derive Li which represents the code of behavior, religious and political ceremonies and social institutions.[7]

Both Yi and Li represent the "ought to be" of human existence, whereas Jen represents the Being of human existence. The rule-governedness of human nature is not to be understood in the light of natural laws, nor to be reduced to them. On the contrary, it is to be understood in accordance with the "to be" and the "ought to be" of human beings as expressed in the conceptual framework of Jen, Yi and Li. Even the laws of nature have to be reinterpreted by, and integrated into, the dignity of human nature as defined by these systems of ideas. Arthur F. Wright seems to have grasped this Confucian reasonableness when he says: "Confucianism of all ages viewed the natural and human worlds as an organism made up of multitudinous interconnected parts. . . . But man was the principle agent of both harmony and disharmony."[8]

Confucian reasonableness refers to the totality of the human agent and his or her relation with the world. But it is quite different with Taoism, especially that of Lao Tzu and Chuang Tzu, which is a vehement critique of Confucianism. In the eyes of Taoists, Confucianism emphasizes deliberate actions taken with anthropocentric self-consciousness, and in so doing, it forgets the spontaneity of man and his roots in Tao. Lao Tzu proposes instead a mindless spontaneous creativity springing from Tao itself as the real solution. For him, without Tao's creative support and the spontaneous character of Teh, the Confucian system of transcendental philosophy--which grounded Li in Yi and Yi in Jen--tends to degrade and degenerate.[9] Thus, Taoist reasonableness refers ultimately to the Teh, and to the source of all creativity, the Tao, as representing the totality of all totalities.

Lao Tzu pushed the meaning of Tao to its speculative extreme. The concept of Tao became, thereby, neither the ways followed by human beings, nor the way out of a social, political and even spiritual crisis, but the Way itself, the Ultimate Reality or the Being of all beings. Here the concept of Being differs from the negative connotation it has in Hegel's Logic (mere being-ness), as the

most impoverished ontological determination, robbed of any positive aspect whatsoever. Instead, it represents something like Heidegger's self-manifesting Being. This is not even a concept, because treating Tao as a concept reduces it to a mere conceptual being, or *ens rationis* with ontic status. That is why Lao Tzu said, "The Tao that could be told of is not the eternal Tao; the name that can be named is not the eternal name."[10]

The case of Taoist philosophy shows that reasonableness, as the function of reason understanding itself in reference to the totality of being, is also an exploitation of reason to its limits to attain thereby self-understanding in knowing its own limitation. This is the ontological basis of all spirit of critical reflection. Taoist philosophy, as a philosophy referring to the totality of Being, and Confucianism, as a philosophy referring to the totality of human existence, exemplify two complementary aspects of hermeneutic reasonableness.

Implications for the Educational Process

The basic situation of our times could be characterized as one of dynamic tension between, on the one hand, the overwhelming influence of modern science and technology and the processes of universalization which they promote, and, on the other hand, the awakening of historical consciousness leading toward the uniqueness of each historical tradition and the concern for the meaning of human life. Under this global situation, the educational process, especially at the level of higher education, suffers many serious problems. To a philosopher, the most crucial of the problems appear as follows.

First, with the inevitable process of specialization and the operational character of modern science, scientists tend not to be aware of the philosophical meaning of what they are doing. The rationality of their research activities is not sufficiently understood and self-aware.

Second, under the overwhelming influence of modern science and technology, the human sciences suffer from the disadvantage of being forced to take natural sciences as the model of their scientific character, while having fewer resources for their own self-development and fewer opportunities to influence the public sphere of society.

Third, with the rapidly developing complexity of the problems which humankind now faces, interdisciplinary research and interdisciplinary training are necessary for today's higher education. But the philosophical meaning of the inter-disciplinarity, especially its relation to the function of our reason is not clearly defined.

From the first section above, we know that the operation and development of modern science depend much upon scientific rationality. Scientists must understand that this has both cognitive and practical aspects. Cognitively speaking, scientific rationality is an operationally controlled interaction between the theoretical construct as constituted in a logico-mathematical way and the empirical construct as constituted in the experimentation process. Practically speaking, scientific rationality is both strategic and instrumental in character; its limitations are also determined by this.

Our analysis in the second section seems to indicate that, in the educational process, natural science education must be balanced by education in the human sciences. These are historical in character in the sense that their goal is to achieve self-understanding through the study of textual objects given to us through historical tradition (for example, classical texts). Thus, Confucian, Taoist and Buddhist texts are means by which the Chinese people can come to understand themselves. The implication for education is that, on the one hand, the reading of essential textual objects in one's own cultural tradition, and their correct as well as creative understanding should

constitute an important part of the educational process of each country. On the other hand, since the understanding of, and openness to, other cultural traditions and other ways of existence are essential to the development of reason, the reading of important texts of other cultural traditions also should be properly emphasized in the educational process.

Openness to different cultures and a comparative vision are important for education and even for research activity. This combination of self-understanding and mutual understanding must not be neglected due to a notion of incommensurability, for any one who wants to prove the incommensurability between two traditions or two different texts presupposes thereby that he understands both.

Finally, inter-disciplinarity in its essence aims at better coordination between different levels of rationality and between rationality and reasonableness. Every scientific discipline is involved in either one or both. An individual or a school, in undertaking this kind of coordination, has to realize both scientific rationality and hermeneutic reasonableness, cognitively as well as practically. This is especially important in the teaching process because sometimes interdisciplinary research becomes entangled as each concerned discipline becomes defensive of its own method and rationality. Sometimes too it is difficult to listen to and to understand the jargons of other disciplines. But in coordinated interdisciplinary teaching, each professor should explain clearly to the students the state of the art in his or her own discipline. Comparative work with a common audience helps bring different disciplines into mutual understanding, and thereby contributes to interdisciplinary research.

Today, both in education and in research, we face a common situation. On the one hand, teaching and research in the natural sciences, and even in some hard social sciences, over-emphasize positive knowledge and recognize nothing but scientific rationality. This attitude has bad effects also on teaching and research in the human sciences. On the other hand, research in the meaning of literary works and works of art emphasizes more the subjective meaning/constructing process.

Both activities stand in opposition to such an extent that they constitute a separation as between two cultures. No one is concerned for the dimension of totality in order to prepare better grounds for the coordination of the rationality of the physical sciences and the reasonableness of the human sciences. The reform of education should endeavor to realize in each discipline self-understanding of its rationality, to penetrate through different levels of rationality and reasonableness, and to achieve self-understanding on the part of reason of all its possibilities. The function of reason must not be divided unknowingly, but must be self-understood in both its integrity and its integration.

Notes

1. F.S.C. Northrop, *The Meeting of East and West* (Woodbridge: Ox Bow Press, 1979), p. 4.

2. I. Kant, *Critique of Pure Reason*, B75, A51.

3. B. Schwartz, *The World of Thought in Ancient China* (Cambridge, Mass.: Harvard University Press, 1985), p. 99.

4. "Would it not be necessary to correct names? . . . If names are not correct then one's words will not be in accord (with one's actions). If words are not in accord, then what is to be done cannot be correctly implemented." Lun Yu, XIII, 3.

5. J. Needham, *Science and Civilization in China* (Cambridge: Cambridge University Press), vol. II, p. 30.

6. A.N. Whitehead, *Process and Reality* (New York: The Free Press, 1978), p. 3.

7. Vincent Shen, *The Rebirth of Tradition* (Taipei: Yieh Chiang Press, 1992), pp. 37-39.

8. *Confucianism and Chinese Civilization*, ed. by A.F. Wright (California: Stanford University Press, 1964), p. ix.

9. Vincent Shen, "Tao and Communication: Lao Tzu versus Habermas," in *China and Europe, Yearbook 86* (Leuven: Leuven University Press, 1986), pp. 194-195.

10. Lao Tzu. Chapter 1.

Part II
Constructivism in Science and Science Education

4.
Science, Argumentation and Organization

Roland Fischer

Organization

One of the blind spots of the scientific community is organization. This can have a number of meanings:

- the formal constitution of a university,
- the relationship of science with the state,
- the management of a research project,
- the management of further education,
- the formal modes of communication and cooperation in science,
- the relationship of science and the public,
- the representation and organization of knowledge, etc.

Here, by "organization" I mean not only the product, but especially the shaping of structures and processes.

Scientists dislike organizing principally because it is, in the view of almost all scientists, a prerequisite for science to have a subject matter, whether nature, history, society, computers or so on. In a natural way, this provides a structure for investigating as well as for representing and teaching the resulting knowledge. Secondly, the main criterion for science is truth; this is beyond organization, overcoming even bad management, and lies in the subject matter itself. A third assumption of many scientists is that the individual researcher is able to grasp this truth, and that a good researcher can work even in a bad organization, at least if he has enough freedom.

These beliefs remain strong, even though many results from the sociology and history of science report that the social situation, whether, of society, of science or of the individual scientist, have a strong influence in determining the subject matter, how it is investigated, and what is produced thereby. In other words, they strongly influence what truth is considered to be. Though more and more scientists know this, in their daily work and effective beliefs they give it almost no credit. The same is true even of the researchers who present such results, for often they claim a naive truth for their own results. More importantly, the results remain mostly on a descriptive level of what is and what has been. As there are almost no suggestions on how to organize scientific work, the results are not constructive and therefore are hardly efficient. What is needed is a connection between the sociology of science and its management.

But, of course, this too is not enough, for we need also an adequate epistemology and philosophy of science. The following, based on the concept of argumentation, will present a general definition of science that is partially descriptive and partially normative. It will note some consequences (or suggestions) for organization and at the end will relate this concept of science to the "constructive realism" in Part IV, with which it is compatible but not identical.

Science Is Argumentation

The first point is that science produces something. More patently, this is the texts which appear as books or journals, projects (e.g. in architecture), patents, prototypes, etc. Behind this there are ideas, concepts, theories, algorithms, models and so on which also are produced. On both levels science produces a reality. Some reject this experience in favor of saying that at best science describes reality, for they fear that equal status will be attached to "real" reality and to what science produces.

Nevertheless I chose the word "produces" of four reasons":

- What science produces is so manifold that it requires a very general term.
- For conscious human action it is the description of a "real" reality which is effective, not the "real" reality itself.
- As noted by many epistemologists, the connection between "real" reality and the products of science is not that simple--it is not linear and direct in the sense of a subject-image relation--and therefore the products of science have a certain self-identity.
- There is an important claim of totality in this terminology which may cause fears. But it would be wrong to reduce these fears by reducing the pretension of science. Rather the limitation of science must be done by adequate organization (the simplest form of which is not to give it too much money).

How does science produce reality; what is its method? The answer should be acceptable for all disciplines, for medicine as well as for mathematics, for ethnology as well as for economics, etc. It is that the most general method of science is argumentation. Though, for a beginning, most will accept this terminology, there are immediate critics for whom "argumentation" seems to be very general, not expressing anything, while for others it is too restrictive.

Before proceeding to analyzing the notion of argumentation I would repeat what has been said so far, namely, that science produces reality by argumentation. Even without a further explanation of "argumentation", this statement tells us that there are other possibilities for producing reality which are different from the way science does so. Every craftsman produces reality, e.g., a joiner produces a table, this is even "real" reality, but his method is not, at least primarily one of argumentation. Of course, he has to argue in explaining an offer to a costumer or something to an apprentice, but this is not his main activity. In contrast the main activity of the scientist as such is precisely reasoning or argumentation. In consequence, the product is a network of arguments. This is so not only for fundamental research, but also for more application-oriented products: the arguments must be delivered with the products, or at least subsequently if requested, whereas there is no need for the joiner to do so.

A first set of consequences for the organization of science is that argumentation needs freedom. Therefore, scientific institutions need a certain autonomy. Further, the only way science is allowed (and obliged) to deliver its products to society, especially to students, is also argumentation. Therefore the organization has to secure freedom for both partners in the interaction science-society. "Learners" must have equal rights in the process of teaching and learning.

As argumentation is always addressed to somebody, if the method of science is argumentation then science is communicative. There are other fields of human activity, such as art, which produce reality by communication, but even a commonsense understanding of argumentation allows us to

eliminate science from art. Art is not obliged to argue, whereas science is; an artist creates or presents a work and has an immediate effect. Of course, criticism of art or the history of art is a work of arguing; sometimes artists also engage in these activities, but they need not do this as artists. In contrast, science is principally obliged to argue: to reject a question is not allowed, particularly it is scientifically inadmissible to say that a question is unscientific.

A further clarifying distinction which can be made by the above thesis is that between science and jurisdiction. A judge produces reality by his judgements. Though he has also to argue, finally and especially in the last resort he produces reality because he is the judge, i.e. because of his charge. (There is a similar situation with priests.) If somebody is sentenced to prison, he can argue against the judgment, but he must go to prison. Sometimes the argumentation of scientific experts plays an important role at the court, but the last word is had by the judge.

There are other fields where argumentation is important, but it is science that is restricted to argumentation, which is the only way science can produce reality. Thus, it is not allowed for a scientist to say: since I am an expert, this is so and so and you have to believe me and to act correspondingly. One who does so is not acting as an scientist. A judge is allowed to, indeed he has to say that precisely because I as judge say so and so, you have to go to prison; science, on the other hand, has to renounce such a power.

A further insight from the comparison of science and jurisdiction is that the regulations of jurisdiction, especially the fixing of terms and the stages of appeal, require that a decision be made, whereas the process of science does not secure that a decision be made. Indeed, in principal its process of argumentation without end and its real product is a network of arguments, not a decision; any termination is arbitrary.

A second set of consequences for the organization of science is that there is an inability on the part of (pure) science to make decisions. This is a further reason why science is not good in organization, because to organizes means always to make decisions. Practically, the problem is solved in two ways. First, as scientists are not only scientists, but also people with private wishes, non-scientific opinions, interests, political opinions, etc., they are able to come to decisions. Either one scientist is the head of a department and makes the decisions not as a scientist, but as the head of the department, or there is a certain democracy in the university where the scientists decide by voting. Both ways share the same problem (the first way has many additional problems): how to secure that the decision is good for the development of science, that science is not suppressed, e.g., by personal interests if only non-scientific factors are used in coming to a decision? This may play a role when decisions about qualifications or careers are made. A third method for coming to decisions is to delegate this problem o people outside the scientific system, to administrators or politicians, but this is problematic because of the reasons just mentioned; additionally it comes into conflict with the autonomy postulated above.

Hence, we have a difficult organizational problem. We need autonomy for both scientists and learners. We need decisions, and therefore we need the "environment" of the scientific system, whether the non-scientific part of scientists or people who are not scientists. As pure argumentation does not come to decision, we need democratization. But an interest-oriented, collective will conflicts with knowledge-oriented argumentation. Hence, we need mechanisms to bring all these partially contradicting aspects into a functioning whole. Before this, however, we need consciousness on the part of scientists with regard to this organizational problems which has no simple solution.

Returning now to the definition of science and summing up what has been said to far: science produces reality by argumentation; it is obliged to argue, and is not allowed to reject questions or

to appeal to (its) authority; it has to renounce power. In contrast to other areas where reality is produced with assistance of argumentation, science is restricted to argumentation as its only method; in pure science this leads to argumentation without end.

Argumentation Is Interweaving and Reflection

What then is argumentation as the general method used by all disciplines? Argumentation is interweaving and reflection.

Interweaving

Firstly: the most general form for presenting an argument for a proposition is to establish its connection with something else which is not directly contained in the proposition, such as a passage in the literature, a scientific authority such as Aristotle, an observation, the result of an experiment, a more general proposition which implies the present one, a generally accepted axiom, an analogous situation, etc. In all cases the other with which a connection is established is assumed to be more familiar to the person to whom the argumentation is addressed. This concept of argumentation is more extensive than "logical reasoning", even if observation and experience are added; "rational discourse" too could be interpreted more narrowly, for even "I do not like this" could serve as an argument by establishing a connection with one's own, say, aesthetic emotions.

There are also such other ways as meditation to become convinced of something which cannot be described by the metaphor "interweaving". In meditation "truth" is experienced, by entering more deeply into the proposition, not by establishing connections with other propositions, observations, experiences, etc. Of course, one could say that meditation means to establish a connection with oneself, as with the "argument" "I do not like this," but such a connection would not be explicit and therefore not communicative, whereas if somebody says "I do not like this" I can ask: "Why?"

As already noted, this concept of argumentation is rather comprehensive, containing logical deduction as used in mathematics as well as analogies, reference to observations and experiments in the natural sciences, reference that something functions, e.g., a machine, the citation of parts of a scientific tradition, references to primary, secondary and other sources, etc. Critical cases of argumentation exist when it is not obvious what the connection is, or why the "other" should be an argument for (or against) something. Here one has to explain, which again is done by establishing a connection with something else (a third or perhaps a general rule) where an essential connection and therefore a compelling or at least convincing argument does not exit.

A third set of consequences for the organization of science is that science is a social enterprise. Beyond some small complexity, interweaving cannot be performed by one single person, but is necessarily communicative. One single person cannot be a scientist, though he may be an inventor or an author or a very bright human or an artist; he becomes a scientist by being interwoven into the scientific community, by relating himself to others, and by others referring to him. This, rather than that he knows very much or that he uses a scientifically accepted method, is the essential point.

This can be stated also about the various disciplines of sciences: none of them is scientific by itself, but all become science by being interwoven with other disciplines, at least potentially. It must be possible to establish connections, to refer to other disciplines. In principal this is always

possible, at least if results are published, but by organization it can be fostered to a greater or lesser degree.

More concretely, there are different philosophies for the organization of a university. According to one, there are many departments, e.g., biology, mechanics, history, German literature, etc., each of which are to do good research and teaching. But they have nothing to do with each other except to fight for money, though they have much to do with the corresponding departments in other universities. According to another philosophy the departments must have something to do with each other, e.g., they have to establish a general study program, they have jointly to develop responses to actual societal problems, they have to present themselves jointly vis-a-vis the public. Whichever philosophy is chosen has consequences for organization: the first philosophy would give autonomy to the departments; the second, which is compatible with the concept of argumentation as formulated in the present paper, would give autonomy only to larger complexes of scientific units.

Reflection

To return to argumentation, interweaving does not tell the whole story. As already stated, there is no general rule which tells us that a connection has compelling force. Further, no interweaving is complete; at least we never know how complete an interweaving is for we never can be sure that all (relevant) relationships have been established or that new phenomena providing new arguments for consideration will not arise. The history of science provides an abundance of examples: even in mathematics, a discipline appreciated as most certain, it has occurred again and again that "evident" theorems had to be re-considered and re-formulated, sometimes with specific limitations. It is necessary for argumentation therefore permanently to pose such questions as: which (relevant) connections have not yet been considered; what has been excluded; what is the relevance of the connections which have been establish? I call efforts to deal with questions of this kind "reflection".

Reflection must be done with a view to the whole, but, as already mentioned, "the whole" does not exist in science; no interweaving is complete. Precisely this fact has to be kept in consciousness by reflection which again and again must pose the question: what has not been considered?

Another aspect of reflection is that the acceptance of an argumentation always is a decision, individual or collective, conscious or unconscious. These decisions are influenced by conditions which are not known in their totality. Therefore the process of science has to make efforts to investigate the traces of the decision; this too is reflection. The process of interweaving has to be accompanied by a process of reflection and for this reason decision in science must not be definitive: its argumentation is endless.

Reflection means observing the process of production of reality, asking what has not been considered, looking at the conditions under which it works and how they may influence the product. This can an should be done within science, but it seems necessary to get help in this from outside science, namely, from students, the economy, the media and politics.

A fourth set of consequences for the organization of science is that firstly, the postulate that disciplines must have something to do with each other, which follows from the concept of interweaving, now emphasizes that the disciplines need each other for reflection. Hence, their organization should be shaped in such a way that this is fostered, not hampered. Secondly, science

needs its environment not only for decision-making but also for reflection. Three examples indicate the implications of this, for organization.

First it is necessary to strengthen the students institutionally. Their role as individual consumers is too weak, compared with the organizational power of science. Usually, they are not equal partners, but could become "more equal" if they could organize themselves along the lines of themes, interests--scientific, political, etc. They should be rewarded for doing so, e.g., if they define a project they should get a teacher and other resources.

Secondly the task of providing programmes for further education should be an essential part of what a university has to do, and such programmes should be used for feedback to science. In order to make this possible some should be organized differently than present study programmes: as in strengthening the role of students, one should use the fact that "students" in further education often are organized, for instance as members of a firm, an association, etc. Contracts with organizations interested in further education could yield strong partners for science and could be used for reflection.

Thirdly, the role of the public, represented by the mass media, should be strengthened, not primarily by presenting more results of research in newspapers or television, but in such a way that confrontation with the public--with good journalists--could help reflection. Equally for interaction with students and interested partners in further education programmes this means that science has to offer starting points for reflection, e.g., contradictions. If science presents only an abundance of information, the student or the public has no chance to relate this to their own fundamental views, hence science has no chance to learn from them. Science has the task of presenting again and again the fundamental questions, and it must provide an opportunity to its environment to observe science dealing with these questions.

Argumentation Needs Contradiction

As argumentation is interweaving and reflection, no argumentation is complete, but always contains decisions. Reflection is the way to discover these deficiencies and decisions. The motor for this process of interweaving and reflection is contradiction. This is an old principle of science, well-known as skepticism, criticism, the duty to doubt, etc. It is necessary for science to provide space for contradiction--even within itself--which can refer to observed data, interpretation and theories, axioms, and even to science as a whole: all must be possible. In some sense, contradiction complements interweaving. The latter establishes connections and builds a network, thus giving security. In contrast, contradiction separates, destroys connections, and makes one feel insecure, which of course is a starting point for new connections.

In one sense, the general postulate of stressing, or at least making room for, contradiction could be said to be fulfilled for we have freedom of thought and speech, everybody can say what he likes, and especially everybody can contradict. Attack and defence, thesis and antithesis are central elements of the process of science. Skepticism with regard to unproved statements, the permanent examination of methods and results--all these are aspects of contradiction in the system of science.

However, and this is the point here, whereas the principle of contradiction is indeed realized as individual freedom, it has almost no influence in the organization of science. The organization of science, that of both scientific knowledge and cooperation among scientists, has to be free of contradictions. We postulate both that the final result of research, a grand theory published in

monographs, etc., is free of contradictions, and equally that the hierarchical organization of universities, based on the principle that those with more competence in an established science have more power, suppresses contradictions or makes them inefficient by reducing them to mere differences between disciplines. (A good method for avoiding contradictions is to invent a new special discipline.)

Certainly the hierarchical contradiction-avoiding form of organization has been relativized within the last 20-30 years in Western Europe by introducing some elements of democracy within universities, offering rights of co-determination to assistants and students. But these measures have no constitutive influence on the process of science itself. Indeed, one must doubt whether anybody ever thought that they should have, since the co-determination is designed to be "graduated according to qualification". This means that especially with respect to questions of science in the narrower sense, e.g. research, the regulations provided for the predominance of more competent persons, i.e. persons who as a rule do not stand against established science. Were the principle of contradiction to be regarded as really serious, then for basic questions of science rather than for its details, non-scientists would have to be involved in the process of argumentation.

A consequence of the fact that the principle of contradiction is not a principle of organization of science, is that contradiction in science is of small dimension, even essentially individualized. Usually it is individuals or at best small groups which bear contradiction; there is no organization of contradiction which could have a chance against the large organization of science. Thereby contradiction in science has been tamed into serving as merely a method used in small groups. Even more, one can say that small-dimensioned contradiction, expressed through a skeptical attitude with regard to colleagues and through academic fault-seeking, prevents contradiction of larger dimension, which presumes the possibility of solidarity.

A psychological excursion: Non-organized contradiction of small dimension and realized by individuals has more of a chance because it causes less fear. Though contradiction always causes fear, if the form is kept, i.e., if the organization is not touched, the contradiction can be endured. Also a contradiction of small dimension is processed within communication between a few people, which always takes place on different levels so that the objective as well as the emotional aspects can be taken into account. Except for murder no contradiction among a few people is total; the context of interconnection softens many problems. This may suggest that in introducing the principle of contradiction at a larger scale it could be worthwhile to organize systematically different fields of communication such as informal spaces, parties, joint travel, etc.

Another set of consequences for the organization of science concerns suggestions as to how the principle of contradiction could be anchored organizationally in science:

- Dialectical constitutions. There should be created a structure for appeal of contradiction in the constitution of each scientific organization. Like "democracy" or "truth", contradiction should be given a positive image. This, of course, cannot be attained by mere legislation; educational activities, for instance, are necessary. One consequence of such a principle could be that in arguing for concrete measures, such as team-teaching or anti-researching (see the following) one could appeal to this principle.

- Establishing anti-activities. Larger enterprises, say a research project or the foundation of an institute, could be accompanied by an anti-enterprise whose task would be to process the contradictions to the larger enterprise. Its formal principle could be that a fixed proportion of the amount of money provided for some (e.g., high-tech) research must be provided for critical research with respect to that same topic.

Variable size of contradiction. One factor which keeps contradiction small is the organizational, mostly bureaucratic, control applied to science by the state with the intent that the system should be free in content. In contrast the size of organizational control should itself be consciously controlled according to experiments in organization. As the main parameters for control are time and money, an institute or a scientific project could be equipped with money for some time without detailed regulations for organization. This would require generally not a massive government control organization, but only a proportionately small organization to control and evaluate the process. The larger the enterprise the larger the organization for evaluating success. Some enterprises will be of such size that their success can be evaluated only through a process of permanent communication with the scientific or general public.

- Fostering groups. As already mentioned, as in present science contradiction is supported by individuals this yields only small contradictions. Hence, there is need to foster group activities in science and to give them legal status. By this is meant not groups with elected members and charged with fixed rules and tasks, but groups arising informally which are given the meas for action. Both groups should be fostered and should have some rights. Similarly, the termination of groups should be facilitated.

The Product of Science

Regarding the definition of science, it has been developed thusfar that science is the (collective) production of a reality by argumentation, that is by interweaving and reflection. The motor of this process is contradiction; the product of this process is an "interwoven reality with questions". This then is neither a unified science offering a uniform view of the world, nor is it the mere coexistence of different constructions of reality, nor is it something static. The "interwoven reality with questions" is a dynamic network of pieces of knowledge, between which there are potentials for connections which consist primarily in such questions as: what has the one to do with the other; what do they have in common, which are the similarities, differences and contradictions; and which alternative arrangements (of knowledge) are imaginable? Such questions belong systematically to the product of science.

Such a view differs from a unified science, which as a rule would be thought to be hierarchical, as can be seen in the schemes for scientific libraries. In a unified science there would exist general super-sciences and special subsciences. For such a network of pieces of knowledge a restricted concept of argumentation, that of deduction, would be appropriate.

The term "production of reality", and still more the term "construction of reality", point to the role of freedom in this process, but do not mean that the constructions of science are arbitrary, for interweavings have to be established. It is there that the "real reality" becomes involved as our constructions are related thereto by experiments, experience, machines, etc. which do or do not function; in this sense constructions founder upon "real reality". The "real reality" becomes involved in the process of science partly by the fact that constructions already exist which have not so far been wrecked on real reality and which can be interwoven with new constructions. Thus, the everyday view of things is a limit to the freedom for construction. For instance, physics is not allowed to state that during the night all bodies become free of gravity. When it does state something that is in contradiction of everyday experience, e.g., that the acceleration of all falling bodies is equal, it has to explain this.

Small Products--The Relationship with Constructive Realism

Fritz Wallner describes the activities of most scientists as the constructing of micro-worlds or models, i.e., limited constructions according to five rules, whose main criterion for success is that they must function in some sense. These micro-worlds can be theories about nature or society, machines, concepts, etc. As soon as these constructions are published, they become common property and are dealt with by other scientists who work out application, the public, etc. (They can be thought of as elements of World 3 in the sense of Sir Karl Popper.)

In contrast to the above description of the product of science as an "interwoven reality with questions" Wallner points to the "small products", or the pieces of knowledge to be interwoven as elements of the process of science. Whereas the above description of science begins with science as a whole, Wallner starts with science as divided into small groups or even individual researchers. Thus he separates science as a set of disciplines and sub-disciplines, on the one hand, and overall science with which he is concerned, on the other.

The "small products" are limited: they have no claim to totality or to be interwoven with everything else. Thus, they can be presented, or in some sense sold, to colleagues or some public; others can inspect and investigate them, join them together with other products, change them, etc. The presupposition for this is a certain stability of these small products--in contrast to a "dynamic network". The main cause of this stability is that usually they are materialized primarily in the form of a text or, more generally, represented through media, the most general medium being language, though mathematical symbolism or the special techniques of the disciplines also are media in this sense. As these media are more general constructs with an higher degree of stability, the small products derive stability therefrom.

A further phenomenon related to products being represented by media that they have a kind of self-reliance. Often they are more than the producer realizes. Often the producer does not know all the implications or attributes of the product, but as soon as it is "thrown" onto the "market" others discover what he or she has not seen or do something with it that the producer did not intend: it is a common good. That we do not know everything about our products has to do also with the fact that we have no total knowledge of the media by which they are represented.

A final aspect of the process of production of the small products is that often there are general rules called methods and special aims which remain fixed during this process and serve as criteria for judging the quality of the products. These production processes and small products are interrelated through being offered on the market of science, where others take them, produce new small products, etc.

Though one could say that this is the process argumentation, i.e. of interweaving and reflection, defined in the above definition of science, as it really takes place today this process is not sufficient. Firstly, the concentration on small products prevents the production of large products--and "products" of reflection, for instance, would be large products. Secondly, as every scientist must produce new products as quickly as possible he is prevented from really dealing with the products of others. Thirdly, the producers are interested in finding buyers, but it suffices to have some buyers; it is not necessary to come into contact with scientists far away with regard to contents and methods. Therefore the same channels of exchange are used repeatedly and the process of interweaving, reflection and contradiction is essentially shortened. Lastly, nobody is really responsible for this process; it is delegated to a kind of "invisible brain" of the scientific community analogous to Adam Smith's "invisible hand" of the market.

Here constructive realism in the sense of Fritz Wallner states that while it is, of course, appropriate, for scientists or small groups of scientists to create their "small" products according to the principle of division of labor--and partially in competition with each other--the common responsibility for reflection or interpretation is indivisible and must be given more effort. The main method he suggests is to put the small products into a different or strange context in order to investigate them. This, of course, could be successful only if there are corresponding organizational measures. Here it is necessary to distinguish between what is or can be done by individuals or small groups and what is the collective responsibility and how this can be fulfilled. This is a strategic difference that the above, working in terms of the concept of argumentation, does not take into account.

The formulations of Wallner can be used also to shed light upon some discussions about science and the university which today have political relevance. Some see interpretation as primarily the task not of the scientific community, but of the outside consumers of science: students, enterprises, the government, the public, etc. The small products, appropriately prepared, have to be delivered to a market outside the system of science, and there prove effective, become used or not, applied, etc. In this process they are interpreted, to use the above metaphor, by the "invisible brain" of an enlarged market. Some say that study programmes and journalism are the places of inter-disciplinarity today. Some proposals for the organizational reform of universities are grounded on this philosophy, namely, that scientists should deliver good small products, and that the task of their evaluation, interweaving and reflection is the responsibility of a market whose participants are primarily outside the scientific system.

It is the thrust of the main body of this paper, however, that such a "market" approach would not be sufficient. To be sure, as stated above, the scientific system is unable to do the job alone and needs its environment for reflection and decision. But it is insufficient to delegate this task to an invisible brain, whether of a market of scientists or of an enlarged market. Though this delegation sometimes is called euphemistically "democratic" or "pluralistic", it seriously limits the quality and efficiency of the performance of the task of orienting society as well as science.

As already stated, the aim must not be a unified science set up by some super-scientists, but a dynamic network of pieces of knowledge. Those not only co-exist and often are misunderstood mutually, but essentially require awareness of connections and contradictions. For this there is need of adequate organization within science and for cooperation with the environment. In sum, there is no natural limit for what we are allowed to think or must think about, with the rest being delegated to some "invisible brain".

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5.
Constructive Realism and Education in Physics

Herbert Pietschmann

Problems of Physics Education

Among concerned physicists it is common knowledge that education in physics has almost no effect at all levels of learning. From many thorough studies of this fact, let us select one that is typical and examine it in some detail.[1] We are concerned, not so much with the technicalities of the studies, as with the typical answers given to a sampling of questions in physics.

- To the question, “In a thunderstorm, why is there lightening and thunder?” most people were of the opinion that it is due to friction between clouds.
- The origin of wind most frequently was traced back to the rotation of the earth or the motion of oceanic water.
- The fact that it is cold in December in our region was believed to stem from a greater distance of the earth from the sun.
- The magnetic force attracting nails made of iron was thought to be due to special conditions during the production process of the magnet.

The list could be prolonged indefinitely. It is not unfair to state, that even after more than 300 years of Galilean physics, the general view of people today remains closer to Aristotelian physics, though the latter is no longer being taught in school. The appreciable effort of universities to train physics teachers and their efforts, in turn, to transmit their knowledge to the general public seems to be in vain. Much thought has been given to this fact and a vast literature on teaching has been accumulated, but the results do not live up to expectations. It seems time then to ask on a more fundamental level why this is so and what can be done to change the situation at its root, rather than simply to make a surface or cosmetic effort.

The goal of this chapter is to show that the cause of this astounding phenomenon is an erroneous epistemological concept. The attitude of physics education must be changed in its foundation, namely, in its concept of "truth" and "reality", in order to be able to transport the meaning and the content of physical laws into our general picture of the world and therefore to integrate physics into culture--a goal yet to be achieved.

A Basic Misunderstanding Regarding Laws of Nature

It is claimed often since the 17th century that physics is a method for discovering the true laws of nature and thus to provide a correct description of our world, or at least its material aspects. Let us, for the moment, accept that point of view and examine its consequences in just two typical examples. According to Aristotelian physics, heavy objects fall to earth faster than do light objects and the force required to move an object is proportional to the velocity of that object. But since Galileo and Newton we "know" that all bodies fall to earth equally fast and that the force necessary to move an object is proportional to its acceleration.

If a pupil points to the observation that from any tree fruit fall faster than leaves and that you get more tired from riding a bicycle faster over a distance than from the acceleration at the start, we explain that this is due to the resistance of the air and the friction within the bicycle (and the tires). These "secondary effects" blur the picture and prevent us from directly observing the true and basic laws of nature. If we added these effects of friction and resistance, we could more or less also describe the more complicated phenomena occurring in our real world--such is the usual argument.

Suppose the pupil insists and wants to know whether the physical laws apply to our real work or only to some fictitious invention. We are probably tempted to point to the great achievements of technology such as airplanes or moon rockets to "prove" that, of course, physical laws have definite consequence within our real world.

The problem becomes even more urgent when we move on to modern physics where the notion of the "model" arises, for example the model of the atom. Unless their pupils are not interested anyway and simply accept what they are told, most teachers are faced with a dichotomy. The interested pupil sooner or later will want to know whether a model describes reality or not. No answer at all can be given, for if it is "yes", then why is it called "model" and why do we have to neglect so may aspects of "reality", and if it is "no", then how is it that we can build a reactor (or even a bomb) on the basis of a model that is not connected to reality?

A teacher unable to grasp the origin of this dichotomy will create the impression that physics is a queer subject, for either it deals with fictitious models and does not pay attention to the real world, or it holds the childish belief that its very simplified models in fact picture the complexity of our world. As neither attitude is that of mature science, the very effort to teach physics may support the dangerous opinion that the influence of science and technology in our society is due not to its intrinsic importance but rather to a sheer power play of lobbies and some industrial interests.

In this way, physics education sometimes achieves the opposite of its goals, even when no obvious mistakes or failures can be uncovered in its day-to-day operation.

Finally, when it comes to questions of physics such as those above, the average pupil will turn to "obvious" answers which come to mind without ever remembering that something pertinent to these questions has been taught in his or her physics courses.

Let us return to the above questions. Obviously, the answers are taken not from "physical models" or even from laws of nature, but rather from analogies with previous experience. Probably, most people have seen sparks originating from collisions between hard objects or from friction of brakes on railway carriages and by analogy claim the same phenomenon for lightning. Similarly, most people have experienced intense heat from hot objects as long as they were close, but when they withdrew the temperature fell notably: hence, the analogy for the low temperature in December.

The error is not the argumentation by analogy, which plays a very important role in physics! To give but one example, let me quote from a paper delivered on the occasion of the 50 year jubilee of Yukawa's Meson Theory. Herbert Fröhlich writes, "It was in this year that Yukawa conceived the novel idea that a field must exist that carries this interaction, in analogy to the electromagnetic field."[2]

But argumentation in physics is never mere analogy and even this is not the main difference. The basic misunderstanding stems from the fact that pupils draw analogies from observation and/or experience, i.e. from occurrences in their own lives or what seems to be the "real world" (notice that Yukawa took his analogy from another physical theory, namely electrodynamics). In so doing,

and perhaps without realizing it, the pupils identify the physical description of a phenomenon with their "reality". Since they remember (at least subconsciously or emotionally) that this identification does not work, they simply forget the content of what they learned in physics courses and draw direct analogies between two phenomena, both of which they believe to be subject to physical description.

Life-World and Micro-World

The theory of constructive realism does not use the terms "real world" or "true description" at all. It does not deny the existence of reality, but insists that there is no direct access to it. Hence talk about "nature", "reality", "the world" or the like always refer to a construction. These constructions are not completely arbitrary, however, for they can contradict reality, in which case they have to be "improved" to eliminate the contradiction.

What usually is referred to as the "real world", i.e. the world we experience in our daily life, is termed the "life-world".[3] It too is a construction, but it is a very complex phenomenon since it results from the elimination of two contradictions to reality, which show up as false predictions or accidents, even catastrophes.[4] A typical example is the calendar, which in the 16th century no longer agreed with the natural seasons. The contradiction was eliminated by the introduction of the new calendar in 1582 by Pope Gregory XIII in most of Catholic countries. Since they were in contradiction with reality, even the Protestant parts of Europe followed suit in 1699. But this took more than a century!

This brings us to the second kind of contradiction occurring in the life-world, that is, between different constructions! This kind shows up as conflicts, powerplays, even wars of extinction. The fact, that it took so long for the Protestant countries to follow the new calendar proclaimed by the Pope, shows clearly that the distinction between the two categories of contradiction is not very obvious in the life-world, which is precisely the reason why physics cannot aim at a re-construction of the life-world. As Werner Heisenberg once put it: physics deals with those statements about the world, with which everybody must necessarily agree! If unanimous agreement cannot be achieved eventually, it is simply not physics.[5] (Quantum Mechanics may be an exception.)

The great achievement of the "New Science" born in the 17th century was the renunciation of a description of the life-world. The laws of a falling body are valid in a vacuum, not in the life-world. Whereas the notion of a "model" often is used in modern physics, constructive realism uses the term "micro-world"; there is an important difference. The "model" for freely falling bodies is described by a "point mass" under the influence of gravitational force. (Of course, it presupposes such other "models" as the axioms of Newton). In other words, this model assumes a "universe" in which there is absolutely nothing but gravitational force and one single "point mass". Likewise, the model of the hydrogen atom assumes a "universe" in which there is absolutely nothing but a single electron under the influence of a Coulomb force. Not even photons are allowed in this "universe", or we could not solve exactly the basic time-independent Schrödinger equation.

One can proceed to complicate the model, and in this way achieve greater accuracy of prediction, but losing thereby the power to solve exactly (i.e. one has to use perturbation expansions). If the Coulomb force is replaced by a proton of finite mass the model still can be solved exactly. But as soon as we add radiation, spin or relativistic corrections, approximate solutions are the best we can achieve. Thus, physics as taught at universities distinguishes between theoretical and experimental physics. Theoretical physics teaches the multitude of models, together

with the ingenious methods of solving the basic equations in order to derive predictions; experimental physics is supposed to describe the methods and tools for actually doing experiments.

A micro-world, however, is neither of these nor both together, but a very subtle construction which contains:

1) the theoretical model,
2) the experimental conditions for support or refutation of the model, and
3) the connection between the micro-world and the life-world, for actual experiments are always carried out in the life-world, but tell us about the micro-world.

What we learn about the micro-world can be used in turn to restructure the life-world, which is the reason that technological achievements are appealed to as a "proof" for reality as mentioned in section 2. A micro-world is completely devoid of any aspects which could lead to contradictions of the second category present in life-world. Though their remnants may be felt in the sometimes fervent and ridiculous fights about units, normalization, metric or symbols used by different schools of authors, these fights are superficial for there is always a complete one-to-one correspondence between different formal approaches. Thus, on the occasion of the 60th birthday of Max Planck, Albert Einstein said:

Mankind searches to shape a simplified and distinct picture of the world in an adequate way and in so doing to overcome the world of experience by replacing it with that picture. . . . He transfers the center of his emotional life into that picture and its formation to search for rest and steadiness which he cannot find in the all too narrow circle of whirling and personal experience.

Contradictions to Reality

A very subtle aspect of science is its negative relation to reality. Reality can never be reached directly, but contradictions of reality may appear in our constructions.

Within logic, we learn that a contradiction is possible only between statements. This is the problem of "basic" or "protocol" statements much discussed in epistemology.[7] How, then, can we observe contradictions of reality?

Let us begin with the example of the 16th century calendar. In the life-world, contradictions of the second category are eliminated by agreement (whether forced or voluntary). Agreement is reached by consent, i.e. by verbal expression. Thus, if there is agreement that spring has come, though the calendar says otherwise, then a contradiction to reality has been agreed upon! However, because micro-worlds do not allow contradictions of the second category, they have implicitly to contain a mechanism to determine contradictions to reality other than by agreement. Here the keywords are "quantification" and "reproducability", the definitions of a physical experiment.

Let us clarify this by means of an example. In the late 60s, the micro-worlds of electrodynamics and "weak interaction physics" were unified. A new micro-world was created, "electroweak interactions" or the "unified model" of those interactions: the basic equations[8] (i.e. the so-called "Lagrangian") are often referred to as the "Standard Model" and represent what we could call a "model". But there was a crucial prediction, namely, the existence of new kinds of particles (the charged W-boson and the neutral Z-boson) at exactly prescribed mass values! Measurable quantities given in numbers are the crucial link between the micro-world and life-world, on the one hand, and allow for the discovery of contradictions to reality, on the other hand.

Thus, the micro-world of electroweak interactions also suggests particular test experiments, that is to say, certain action in the life-world whose result is again a number which can be compared to the prediction and thus either support or rule out the underlying model.

However, all that is contained in the micro-world is the possibility (or suggestion) to aim at the wanted numbers, whereas the experiment itself has to be done in the life-world. Hence, usually there is disagreement as to the best way actually to carry it out. An experimental physicist is a person who knows what kind of actions have to be taken in the lifeworld so that the result is a number which can be compared to the prediction. These actions are by no means unique! Some are cheap, but more indirect (such as precisely measuring certain atomic spectra), others are more expensive (such as building a big accelerator) but directly yield the wanted numbers.

This is the point at which reproducability enters in a crucial way. It requires not only that repetition of the same experiment yield similar quantitative numbers, but moreover that totally different paths towards the same number (such as the two mentioned above) finally agree numerically. Thus, in the lifeworld very different actions may be undertaken, but the sufficient reason for doing so is founded in the relevant micro-world. Only when there is numerical agreement between the results of these experiments (different chains of actions in the lifeworld) and yet a disagreement on the number predicted by the model can we speak of a contradiction between the micro-world and reality.

It is quite obvious also that this description is a quite abstract generalization, for we know all too well that complicated chains of actions do not always produce the same result, even when we deal with such relatively simple, man made objects as starting an engine or riding a bicycle. Therefore, the question of whether different experiments yield the same result (or even what the result is) is one of agreement among experts and cannot "objectively" be answered.[9] Because the extraction of a number from a chain of actions is by no means trivial it is not required (and cannot be!) that numbers perfectly agree.

Any number extracted from an experiment is meaningful if so-called "errorbars" are added. "Experimental errors" are of two kinds: statistical and systematic (they are frequently given separately in that order). Statistical errors stem from the fact that even the identical repetition of a chain of actions in the lifeworld never produces identical numbers. (Statistical errorbars indicate the probability of 2/3 that the "intersubjective" number lies within the error limits).

Systematic errors are the unavoidable gap between the lifeworld and the micro-world. The often referred to "chain of actions" is done in the lifeworld, but it is invented from the micro-world. Therefore, a number of limiting procedures has to be carried out in order to extract the resulting number (for example, in a free fall experiment, the density of air can be varied for extrapolation to perfect vacuum. In "measuring" the mass value of the above mentioned particles, the energy of the accelerator has to be set exactly (which is only possible up to another error!) It is very important to know that the published "result" of an experiment is never the actually measured number because many corrections due to this "gap" between lifeworld and micro-world have to be applied.

To illustrate this subtle procedure by our example, let me quote the numbers given in the original literature for the masses of particles W and Z from both theoretical prediction and experimental result.

M_w (theor) = 80 G_eV M_w (exp) = (79,91 ± 0.39) G_eV at Fermilab
(USA)
(80,49 ± 0.37) G_eV at Cernlab
(Europe)

M_z (theor) = 91 G_eV M_z (exp) = (91,175 ± 0.021) G_eV

Theoretical predictions can be refined to agree fully with experimental results.

Consequences for Education in Physics

In view of all this it is quite obvious that physics "teaching" cannot be done in the form of a "transfer of knowledge" from teacher to pupil. When it is tried, the result is harmful, as shown in the first section above. For what should this "knowledge" be? If it should be the "laws of nature", we have seen that they do not make any sense whatsoever when they are applied directly in the lifeworld.

Unless the student of physics understands at least in some way the subtle difference between the lifeworld and the micro-world and the ingenious inventions to find out about contradictions of the latter with reality, there is no way even to transfer a remote idea of what it is all about. How can this goal be reached? Certainly not by traditional memorizing and repetition for the sake of a test or examination.

Let me then attempt to paint an idealized picture of teaching physics, being well aware that the lifeworld is not as simple-minded as my invention. Understanding in physics proceeds only via the discovery of one's false notions. Here "false" is meant with respect to a micro-world, not within the lifeworld, as can be inferred from the examples in the first section above. The role of the educator is thus to represent the micro-world which is yet unknown to the pupils. But he or she should not simply explain that world to them, but must find ways to uncover false notions.

Teaching the aerodynamic paraoxon can be used as an example. Traditionally, one would explain Bernoulli's equation in some way and afterwards infer from it that an air current blown between two sheets of paper will narrow the gap instead of widening it, as could be naively expected. Doing the "experiment" (which in this case requires only two sheets of paper usually is taken as "proof" for Bernoulli's equation.

I will suggest the opposite approach, that is, in the very beginning to ask the opinion of pupils (and hope that they are divided into "wideners" and "narrowers"). I would then let them argue, and would support the weaker group, not necessarily the correct answer. When most of the important arguments had been issued, I would do the "experiment" to show which answer is correct, not because the teacher tells them, but because the experiment has decided the issue.

Next I would ask them whether they can recall some effects which may be similar or analogous (roofs blown off houses vertically, not in the wind direction; skis on racks of cars, laundry on a line going above the horizontal when the wind blows, the flying of airplanes, etc.). Some examples may be truly analogous within the micro-world (such as those above); others may only seem so in the lifeworld (such as the answers of the first section above).

Finally, a thorough discussion of these examples should give the pupils a feeling for the difference between the lifeworld and the micro-world. Bernoulli's equation should come in the end as a sort of summary, not as a starting point.

One goal of physics education must be achieved: the affective acceptance that it is completely meaningless to give a number as a result of a measurement without giving at the same time its errors. A possible example to get this across could be a comparison between gauged and ungauged speedometers in cases; another would be the scales for personal weight since they differ enough to show an explicit error. Many of our measuring instruments in the lifeworld have reached a precision which hides the error behind the last given decimal. Most thermometers for measuring

body temperature fulfill this condition, but weather thermometers usually do not, in particular since their reading depends very much on the location of the instrument (systematic error).

If physics education could achieve just a little insight into these exciting differences, I would gladly forego the wealth of formulae and statements now often taught in physics. However, a prerequisite for this is a new education of physics teachers at the university level, for I fear that many physics teachers--though knowledgeable in the "material"--have gained little understanding of these basic facts during their own education.

Notes

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7. For example K. Popper, *Logik der Forschung* (4th ed.; Tübingen: J. Mohr Verl., 1971).

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6.
Constructivism and Alienating Interdisciplinarity: Its Educational Consequences

Fritz Wallner

The Development and Evolution of Constructivism in Science

There are various sources for the development of the ideas of constructive realism which come from the disciplines of philosophy as well as of the natural sciences. Thus, it does not stand in a particular philosophical tradition; its character and value are based upon establishing relations between very different sources and content. Some elements which served to stimulate its development include the ideas of Ludwig Wittgerstein with regard to the sciences and the experience of interdisciplinary cooperation and research in the natural sciences. Discussing and investigating the process of science surfaced the implicit, and in most cases unspoken, needs of scientists and sciences.

Another very important experience was the collapse of the philosophy of science with respect to its normative claims. On the one hand, it seems clear that reflection in the philosophy of science is deficient if it merely describes the processes of science; on the other hand, in recent decades it has been becoming increasingly unclear how normative claims can be legitimized in the context of the sciences. This uncertainty in the philosophy of science led scientists not only to feel neither understood nor in charge of the philosophy of science, but to turn to metaphysical philosophy or even to irrational ideas.

This must be seen in the context both of the development of the natural sciences in the last decades and of the inadequate response to this by modern epistemology. Modern technologies, especially the use of modern computer technology in the process of research, accelerated the trend to instrumentalism (which can be found in the basic structure of the natural sciences). That is, without having given up the claim to definite and objective knowledge, this claim has been increasingly circumvented and replaced by functional relations. This implies a great need for explanation, which, however, remained generally unspoken because it did not have direct influence upon the development of research. As the natural sciences minimize the claim to recognize the world, the area of irrational exploration (that is, areas not constructed on the basis of abstract technical or mathematical reason) continuously increases.

In many cases this has the consequence that irrational strategies of explanation (i.e. strategies not legitimized on basis of [mathematical] reason) make use of results or elements of the natural sciences. This can have unpleasant or even dangerous consequences when such explanations are used as normative. In the face of this dichotomy between contexts which can be mastered (mathematically) and other explanations, the claims of Western science are abandoned. (This, of course, could have been implicit in the structure of science for a long time--Heidegger pointed out that Western science was erroneous in principle). In response, constructive realism attempts to save scientific knowledge by a new interpretation of its procedure, understanding it as a specific form of the results of action. In this context, the instrumentalism of science is not an alien element, but the great integrator.

First, let us discuss alternative approaches in modern epistemology and the philosophy of science which manifest an increasing alienation from the natural sciences. Naturalistic, especially

evolutionary, epistemologies take into explicit consideration the knowledge of the natural sciences, as Kant implicitly had done. In most cases, however, it remains unclear in these epistemologies what argumentative role is played by these disciplinary results.

We are assuming that cognitive science is a continuation of naturalistic epistemologies. It is interdisciplinary in structure, but as yet there exists no theory making clear the methods of cooperation of different disciplines. As a result it is impossible rationally to execute interdisciplinary cooperation. The effect is a strange ambivalence.

For example, the use of computers increases the possibility of hiding methodological difficulties, for it often hides the possibility of controlling the relevance and plausibility of data, whereas in the manual manipulation of data the inadequacy of the method used is clarified in discussions with other disciplines. By making complex theories explicit, computers ignore or at least are not primarily interested in a critique of the method applied. For instance in the orthodox AI approach, the question of functioning has a higher priority than the question of understanding and basic knowledge. For this reason, cognitive science often is in danger of being dominated by an instrumentalistic approach in which the higher priority is to perfect the processes of cognition, while the basic problems of cognition are completely ignored.

Another aim of this approach is to develop a methodology of cognitive science as interdisciplinary cooperation between various disciplines all taking part in the discussion of basic problems concerning, for instance, what is knowledge, what is language, what is knowledge representation, etc. An answer for these questions is very important, because, if we want to investigate the process of science, we must have at least an idea of, e.g. what we understand by knowledge or how this is represented in the disciplines, etc. The following will search for new paradigms in cognitive science, as well as in the philosophy of science.

Structure and Method of Alienating Interdisciplinarity

A response to the above must be positioned, on the one hand, between methodology and ontology and, on the other hand, between a naturalistic epistemology and a theory of action. In investigating methodological rules as instructions for acting, and thus criticizing the methodologies of the single disciplines in the context of theories of action, a constructive theory must develop ontological concepts from the result of naturalistic epistemologies and also reveal the implicit ontologies of the results of single disciplines.

The Concept of Transfer or Translation Between Contexts

Compared to classical metaphysical theories or to this century's philosophies of science there is here neither implicit nor explicit reference to a meta-level; this is replaced by methodological action or process. This is a set of strategies having in common the transfer of one logical system of propositions from their original context into another so that the system is judged out of context. This process cannot be planned in advance, because it lacks all metatheoretical standardization. Rather it represents a game with different contexts, multiple changes between which make possible new insights, perspectives and views regarding the structure of the set of propositions. Looking at contexts in which the systems of propositions become absurd we are enabled to perceive the implicit assumptions and considerations of this system.[1]

One could think, for instance, of orthodox Artificial Intelligence being dislocated in the context of the humanities. This would make clear the insufficiency of the (in most cases

unreflectedly) applied methods of computer science (i.e. mathematical logic, etc.) for modeling or even better for understanding cognitive processes. One could consider the models in cognitive psychology which make use of the symbolic processing paradigm of Artificial Intelligence (e.g. J.R. Anderson).[2] Before such a dislocation scientists either ignore the results pretending that they are "not relevant or adequate", or they try to look for an alternative approach which, of course, is more uncomfortable than the first case.

One should distinguish three types of such dislocation or alienating interdisciplinarity (*Verfremdende Interdisciplinarität*) or "strangification": linguistic, ontological and pragmatic. The process of excluding contexts in which a system of statements becomes absurd is a first mode of the dislocation. This manifests the implicit assumptions and the domain of application of a system of statements without having to fall back upon metatheoretical standardization. Talk at meta-levels is not ruled out, but is seen rather as an example for strategies of dislocation.

Applying a system or set of methods of one discipline to a very different discipline is the ontological type of this process: for instance, the application of hermeneutical procedures to the natural sciences or of gestalt perception to biology at the limits of the application of quantitative methods. Conversely, the introduction of quantitative methods in the humanities does not render them move exact, but makes clear the phenomena and structures which can not be quantified.

A pragmatic form of this process is the attempt of psychology as a humanistic discipline to quantify intelligent behavior. This manifests naiveté regarding the work of the natural scientists and their methods which are too simple to quantify or even to estimate such a complex phenomenon as human intelligence. As it is not only the method, but also the scientists and their assumptions which must be analyzed, this is a third kind of alienating interdisciplinarity which concerns the social and organizational context of scientists.

This attempt at what has been termed a constructive type of realism is not ontological; rather it is methodologically motivated. It abandons the search of traditional European epistemologies for complete insight and substitutes a methodological aim, which in turn requires meta-theoretical legitimation.

Two Types of Reality

"Avoid the mixing of `Realität' and `Wirklichkeit'!" In German there exist two words for `reality': "Wirklichkeit" (environment), the world we are living in, and which is presupposed to, our perceptions and life processes; and "Realistät" (reality), our cognitive world which is the result of a process of construction.[3] In contrast to Kant's distinction between "Ding-an-sich" and human knowledge, this stresses instead the distinction between reality as the world we are living with as environment and reality as the world constructed by knowledge.

Making use of the strategies of alternating contexts, alienating interdisciplinarity offers a better understanding of reality: though environment cannot be understood, we can gain control over it by our constructions of reality, for we can understand only what we have constructed. The distinction between reality and environment does not relativize our knowledge, but avoids surrendering ourselves to the success of our constructs in the environment.

An implication is that in organizing the process of research we distinguish between that which is instrumental and whose criterion is "working well" and the construction of reality which claims to impart knowledge.

One of the greatest errors in European history was to consider normative the empirical success of constructed knowledge; such an hypostatization of empiricism can be based only in arbitrary

ideological assumptions. Rather we must not lose sight of the constructive character of the empirical, which means that empirical control of theoretical constructs amounts to no more than the comparison of two different constructs in our cognitive reality. This is not to abandon the relation to the environing reality, though this is indirect. For in comparing two different constructs of reality we test not reality directly, but the extent to which it escapes the correlations of our constructs. Thus, empirical control can be a useful alternation of contexts.

Educational Consequences

The above understanding of science has many consequences for styles, content and organization of education.

Style

Traditional educational theory presented a choice between three styles or strategies: authoritarian, liberal and laissez-faire. The choice presupposed insight into human nature which, in turn, entailed extensive irrationalism or even worse: pseudo-rationalism. But such a choice between styles is neither possible nor necessary, for the style is determined by the area in which the student should be educated. In constructing scientific micro-worlds education is a type of training and, therefore an authoritarian style is most effective. Interpretation and self-interpretation can be learned only through a liberal strategy because here it is training in specific strategies; for instance in hermeneutic strategies free application is needed. For learning the central strategy of interpretation, alternation of context, an alienating interdisciplinarity, a laissez-faire style is best. By taking the lead from the specific educational area it is possible to avoid the misuse of scientific education, for its style is based on its goal, not on an ideology.

Content

A radical change in the content or goal of education is also implied. The traditional goal of education in the sciences was to develop a picture of the world in order to gain freedom in our decision making. In view of the above, however, developing a picture of the world seems meaningless, while gaining freedom in decision making appears as an irrational ideology.

On the one hand, the old conviction that science describes the world can no longer be defended. Moreover, this thesis leads to a doubling of the world and to such pseudo-questions as the ontological status of a natural law or whether natural laws existed before they were formulated. On the other hand, the notion of science as a basis for guiding freedom to a better world must be classified as an irrational ideology, for the conviction that the special sciences are able to elaborate piece by piece a picture of the world must be abandoned.

Hence, the new goals of education with respect to the sciences must be able to handle and understand scientific products for making choices between desirable and undesirable micro-worlds: or, with Paul Feyerabend[4] we would say that students should be enabled to use science in a way that most closely agrees with the values and aims of the society they have chosen for themselves.

In view of these goals we must differentiate between training and education. The first is instruction for a specific job and is not discussed in this paper. Education is a more general term including training, but beside this leading to formation (*Bildung*) as developing the ability to

manage life by using the available knowledge. In view of the first part of this chapter it should be noted that micro-worlds, as the immediate results of scientific activity, are not knowledge. There is need to link them up to the whole of human understanding, i.e., to the horizon of language which expresses the respective culture.

For this goal education at the high school level must be totally changed. Instead of being given a mediocre and superficial acquaintance with many scientific results (micro-worlds), students must first be trained by a few examples as to how micro-worlds are constructed with respect to the history of science, the logic of their structure, and their scientific application. But more important than this is education on how to understand the interpretations of the micro-worlds, how to modify the given interpretations, and even how to invent new ones (though this latter usually should be reserved to university education).

University education must have a totally different structure, for it is training for a job. The educational part of the study must not be understood as a mere addition to job-related training. It would be wrong to educate one to be a physicist, historian or teacher in literature simply by general philosophy of science, history of philosophy or aesthetics. For one must learn to handle and to understand the natural, human and cultural output of one's science. Thus one must learn how to discover, establish and restrict the possible applications of the products of his science. This requires interdisciplinary practice and clear rational information about the values of the society in which one lives.

Interdisciplinarity cannot be taught theoretically but requires organization. Also some theoretical information is needed for alternating contexts. Therefore the educational part, which should accompany the scientific study from the beginning, should have three sections:

a) The first section, besides history of science and, according to the circumstances some comparative theory, should contain the aims and values of one's society with regard to science. Often this can be done indirectly with helpful examples on how science works in different historical, political and cultural environments. It is important, moreover, to clarify what happens if a scientific context is implanted in a totally different society.

b) In the second section the student must take part in transferring and translating the results of one's own science to other sciences.

c) In the third section different interpretations of micro-worlds must be studied and, at least for the doctoral degree, a new interpretation of a micro-world must be developed. For this undertaking theoretical and practical experience in alternating contexts is useful.

The Reorganization of the University

The traditional university is structured according to the conviction that the sum (*universitas*) of the theoretical sciences delivers the knowledge which is available for mankind in the respective fields. But as most scientists have long recognized, the sum of the sciences does not generate knowledge, but rather constitutes an immense and incalculable bundle of propositions with different objects which can be connected only arbitrarily.

What does one do in such a puzzling situation? If nothing is done then the huge science/industry will go its own way, organizing itself without consciousness so that all communication, beyond technical cooperation, will be lost. Powerful linguistic systems as parts of single sciences produce new linguistic products which escape the overview of the scientists. For

the formalized languages follow the fundamental character of languages as self-organizing and creating new linguistic systems.

Whereas ordinary language always refers these new systems to everyday practice, in formalized language this direct and continuing touch with the human action is lost. Linguistic formalization generalizes a specific type or aspects of human activity and by abstraction loses touch with other types or aspects of human action. Therefore, for formal language, in contrast to ordinary language, the modification and renewal of the respective language--activity--relations is blocked, for if these relations are changed the respective formal language loses its instrumental character. This would be to move from the field of technology to that of poetry understood as an opening of one's the relations in one's language--activity--relation. Thus, ordinary a computer-program could become a poem.

To control this development, first we must be clear that in this case every general effort must fail. Therefore the contemporary university organization, with its generalized structures and restriction to merely abstract cooperation with the society, must fail.

In this situation some modified version of the Platonic principle that kings and philosophers should be one could be formulated: the scientific specialists must be representatives of society with respect to their special science, and the scientific community must become aware that it can influence scientific development only by being involved in the efforts of alternative is either to be ruled by an uncontrolled development of the standard of contemporary life as well as the level of therefore the loss of a wide range of possible human activities. (The ecological movement is correct in its diagnosis of the problem, but very often wrong in its remedies.)

We must abandon the old metaphysical conviction that there is a final and general knowledge. Removing irrational hopes and looking at how science really works, we must constitute a new concept of scientific knowledge as intellectual freedom with respect to functioning mechanisms.

As a type of definition, every word is important here. "Intellectual" means that the man is able to describe functioning mechanisms in his own way. Different choices can be made for didactic reasons, reasons of beauty, and so on. As understood by Hegel, "freedom" has a substantive meaning, i.e. among all possible choices only those are free which change the mechanisms. Therefore to be expert in handling the mechanisms is a precondition of intellectual freedom and in consequence of scientific knowledge.

This may seem a very restrictive definition of scientific knowledge, but not if we keep in mind that we cannot aspire to any generality or totality for scientific knowledge. For all totalities and generalities regarding scientific results or procedures are arbitrarily (not freely) elected, and therefore cannot be considered to be scientific knowledge.

A correct formulation for this concept of scientific knowledge would be that to have understood a few micro-worlds is to have grasped the possibilities of scientific knowledge, which means to have entered into scientific knowledge. Scientific knowledge is a specific type of human activity, taught, developed and increased for over 200 years in Europe. It cannot be learned in totality because it is an open system. On the contrary, it suffices to be instructed by examples in order to understand, that is, to preform this type of activity.

What are the consequences for university reorganization? Students, researchers and teachers must acquire the possibility to learn free choices regarding single micro-worlds. In view of this, they must have the opportunity to learn the different strategies of resituating a micro-world, which strategies can be related to different operational (not classificatory) levels of understanding micro-worlds.

One level is logical. The structure of a micro-world can be replaced by another structure which fulfills at least the same goals. Of course, this requires scientific ingenuity and in this sense Albert Einstein understood classical mechanics better than did Sir Isaac Newton himself. But serious critics too have a better insight, even if they are not able to replace the criticized micro-world by a new one. Of course, these criticisms cannot be judged until a respective micro-world is invented, and in this sense Leibniz and Mach had a good understanding of the Newtonian micro-world.

A second level is linguistic: the level of translation, by which, for example, Immanuel Kant obtained his understanding of the mechanics.

A third level is that of application, where understanding can be gained from failure as well as success. Examples here are the use of mechanics not only for engineering, but for physiological and psychological explanation. In experiencing applicability, as in recognizing inapplicability, freedom is gained regarding the micro-world. Other levels are related to society, culture in general, poetry and so on.

What specifically does this mean for university structures? The traditional divisions in the universities should be replaced by units with a small staff: a chief who could be in the place of the traditional "professor", one or two assistants, and one or two secretaries. These units originate from the appointment of the professor, who is appointed to a general discipline rather than to a precisely delineated subdivision. He should have restricted teaching obligations in order to leave opportunity to establish research programs.

Beside these units there should be a large pool of young "researchers", with the duty to cooperate in a research program of their choice. Under specific conditions they could become leaders of research programs, which would be a first step toward becoming a professor. The students should take part in research programs beginning from the second part of their study, and should be obliged to choose at least three research programs during their study. The definition of their degree would depend on the distinctive field of their research. They should also write a thesis which would be judged by the extent to which it makes at least one of the research programs understandable in the technical sense described above.

Such a university structure would have at least two advantages: it would apply the principles of self-regulation and it would enable learning intellectual freedom in the above sense.

Notes

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3. F. Wallner and Thesen zu Maturana, "Eine Aufforderung zum Widerspruch", Research Report, Dept. of Epistemology and Cognitive Science, University of Vienna, IWTF-ECS-89-2.

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Part III
Metaphysics and Science

7.
Quo Vadis Educatio Confuciana?
Towards a New Understanding of Education

Tran Van Doan

Introduction

The crisis of Chinese education is no longer a myth, even if the authorities try to conceal it. Their noisy, interminable discussions about solutions to the present crisis in education contradict their ideology. Nowadays, the call for a radical change of educational system no longer belongs only to radical intellectuals. Even bureaucrats who make educational policy in the atmosphere of the Ministry of Education begin to show concern for present education. Paradoxically, they are the most "noisy" advocates for a change of the present educational system. The example of Lee K. Y.'s Singaporean government, which pushes for a more traditional education, has been taken as a model for Taiwan. Bureaucrats begin to discover the disaster of an overemphasized technological education through the Singapore policy rather than by a thorough examination of their Taiwanese system.

Nowadays, we discuss fervently the need to return to our roots, namely, to our Confucian ideology, and we seem to be as certain about its positive value as we have been confident about technology. Intellectuals, caught in the fever of nostalgia about a lost ideology, appear to be willing to go along with the bureaucrats. Even if they still cast doubt upon the claims of Lee or the Confucian scholars, they are generous in giving the green to experiments with such "new" ideological education. To them, it is better to try to change than to sit idle and cry in the darkness of the black hole of present education.

Whether Confucianism could be effective in solving the present crisis seems irrelevant to our bureaucrats because they believe in it as certainly as they believed in Marxism or in *The Three Principles of the People* of Dr. Sun Yat-sen. Their main concern is how to get it done, and as quickly as possible.

Our doubt concerning Confucian education comes not from its obsolescence which is visible in our history, but from its ideological, dogmatic and reactionary character. Our point in this chapter is that the illusion of the effectiveness of Confucian education is born rather from an unfortunate misunderstanding of the nature of education, which is mistakenly identified with the method used by our educators. Thus, as long as the objective of education is still unclear, any diagnosis or remedy proposed for its problems must be futile. Moreover, we would insist that the methods of diagnosing and solving the problems themselves are insufficient so long as the problem or the concept of the illness remains wrongly understood.[1] The symptoms of educational crisis, discovered and analyzed by our specialists, would be of little use if these symptoms themselves are falsely conceived.[2]Aware of this fact, we will be content with an elaboration of the problem of understanding the so-called crisis of education. We avoid, though do not shy away from, the question of a remedial solution which we consider as premature and outside our capacity.

The misunderstanding of our educational crisis comes first from a misunderstanding of the objective of education, and secondly from a misuse of, or better an overconfidence, in a certain method. Such misunderstanding and over-confidence in the method are the product of what we identify as ideology. Hence, in order to deal with the problem adequately we shall adopt the radical

reduction of Edmund Husserl[3] in doubting any kind of definition of education or its methods. To be more precise, we are not allowed to take for granted:

- A simple analysis or description of the symptom of the illness in education. The data provided from experience or natural facts need to be understood; they are not neutral as the empiricists believe. Human experiences are not transcendental in the Kantian sense, but relative and historical.
- A subjective, ideological interpretation of the cause of the illness because such an interpretation is motivated rather by fixed, a-historical ideas, class sentiment, or class interests. The Confucianist explanation of the crisis in terms of non-congruence to their moral codes, and the nationalist interpretation of the illness in terms of failure to fulfil the required patriotic codes, are both prototypes of subjective and ideological education.
- The myth of mechanical organism (of the behaviorists), according to which the crisis in education is a biological fact as natural as action and reaction, stimulus and response.

Such a misunderstanding is notoriously embraced by empiricists and idealists respectively. We challenge their views by arguing that such methods are insufficient to cope with an education which deals primarily with human development in a changing and growing society, namely with the cognitive and the practical, pragmatic and the teleological, the self-conscious and the communicative. This means that here we opt for an integral education by not resting on a certain facet of being human. The mistakes of both empiricist and idealist, as Hegel and especially Marx, as their followers have rightly noted, lie precisely in their concentration upon a certain facet and on a certain stage of being human. Their diagnosis is thus not quite false if the human person is conceived as a thing, external and immobile, a-historical and a-social, which, like a stone, could be objectively observed and analyzed. Consequently, their remedial proposals may be effective for the education of such a static man. The fact, however, of an historical and social, sentimental and rational, developing and utopian person contradicts their understanding of the human person, and consequently reveals their solutions to human problems to be incomplete and dangerous.

Thus, the main theme of this chapter will be centered on the crisis of understanding itself. Tentatively, we adopt critical theory, not as a unique method, but as a guideline to throw more light upon the crisis of education.[4]

Of course, we do not naively reject the empirical analysis or the impact of ideology. We are aware of its function and its limit in understanding the problem. This chapter consists of three main sections: the first and the second are a condensed review of some prevalent modes of understanding in education, tacitly accepted as the standard by empiricist and idealist respectively, while the final section will deal precisely with the problematics of what our educators call educational crisis from the point of view of critical theory.

Empiricism and Education

Dealing with the problematics of understanding demands a treatment of both the scope and the method of understanding. Hence, to understand the crisis of education, we must examine its objective and methods.

Here, we begin with some prevalent definitions of education adopted by most of our educators. We treat them as hypotheses which need to be carefully and analytically reexamined. We will then single out the main mistakes that may be responsible for what we understand as the crisis.

If education is understood as a right method to transform children into a kind of model predetermined by the adult society, by the state or the Church, then the question would be for which kind of method and which sort of model are we searching. Consequently, the crisis of education could be seen from two aspects: that of method and that of objectives. In the first case one comes from the belief that the right method determines the right path of education; in the second case it is the objective of education which dictates its method. Thus, the aim of the educators who believe in the first solution is to work out an adequate method, which could be empirical or rational. To those who happen to take the second solution, the task is to refine the objective of education.

Let us take the example of Confucian education to clarify our point. The objective of Confucian education is *Chun-tzu*, i.e. a man who possesses virtues of loyalty, fidelity, sincerity, frugality, benevolence, filial piety, etc.[5] (*Analects*, 1:2, 8, 14; 2:11, 13; 4:5, 24). For Confucian educators, its method ought be the right way to educate the children in these virtues. The methods of "learning by heart", "obedience" and even such forceful means as laws and punishment are those most praised. Thus, for them, the educational crisis is synonymous with a crisis of method and a lack of the above virtues.

If, in contrast, education is understood as a simple tool or instrument which the children need to develop themselves into whatever they want to become, and if the objective of education is optional rather than conventional, then the crisis of education is limited to the mere aspect of technique. Liberal education opts for such an understanding of education: it is meaningless to set an objective for education; we should concentrate rather on the work of refining the technique than on responding to an ideal objective for education.

We may produce a litany of similar definitions of education based either on its objective or method,[6] or on both. They will be of little use for our purpose for such definitions are insufficient or biased from the very outset because they are constructed (or mentally constituted) on a misconception of human nature or on false ideology. To prove our thesis, we will examine first the objectives of education implicit in the first definition to see whether such objectives could be regarded as true, and how they are constructed. We will discover first a dangerous confusion in the object and the objective of education in such definitions, and secondly that there is an artificial identity of its method and objective.

The Object of Education

Actually, the object of education is educated children: students rather than ideals. As often as not, the one to be educated is bypassed or simply ignored; he or she is regarded as a simple object instead of being the real subject. Consequently, the one being educated is denied an active role in shaping his or her life, and is destined or forced to accept the ideal or model predetermined by society. In a word, the educated is no longer the object and subject of education, but plays only an auxiliary role in the game of education by going along to reach the objective, i.e. the ideal model. In both definitions, nowhere do we find an active role for the educated. Mistakenly we take either the ideal or the method to be the objective of education, and lapse into confusion between its object and objective. Such a mistake comes from a rather feudal or patriarchal ideology, according to which it is the absolute power of the father (the clan chief, the king) which determines the fate of the subordinate. The subordinate, the sons, are simply the product, existing at the whim of the father or the chief.

The Objective of Education

As we have observed in both definitions of education, our educators have take either the ideal or the method to be the objective of education.[7] In order to avoid unnecessary ambiguity, we will replace the word "objective" with the word "goal" or "scope". In the first definition it is the goal which dictates the course of education, while in the second it is the method which is the ultimate objective in the mind of educators.

The Goal of Education: In Confucian education, the model of *Chun-tzu* (superior man) is the ultimate goal of education, while in the present education of Taiwan it is the patriotic heroes. Of course, we discover similar ideas in other educational systems: the model of the saint in Christianity, the ideal of the socialist in socialism, or of the free man in liberalism, etc.

In all these models, one observes a common character: they are *a priori* or predetermined; their specific characteristics are artificially, externally constructed. Tacitly, or often forcefully and violently, we accept them without comprehension or consent. In the case of Confucian education, we are taught to be loyal, blindly obedient to the king or the superior without an understanding why we should do so. In the case of liberal education, one demands that children have the right of self-development without considering the scope of development. In both cases, the demand of an ideal is often unrealistic, if not illusory. This unreality or at least impracticality has not yet been subjected to critique.

The Method of Education: The liberal, in order to avoid the absurd demand of an unreal model, has proposed either a vague idea of freedom and self-development, or in most cases has chosen method as the objective of education. Examples of such a view are found in policies in Taiwan reflecting belief that an improvement in the method either of examinations or of teaching could solve the crisis of present education. In Singapore, the commission of education, nominated directly by the government with plenipotentiary power to decide the policy and plan the future of education, has opted for method as the legitimate goal of education. Education means education for correct thinking, for science, and recently, for good behaviour or moral living. Curiously, hardly any effort is directed toward redefining education. In acknowledging the obsolescence of the present method of teaching and learning (didactics), the government chooses an easy path of shifting all mistakes to the problem of method, and thereby reduces the business of education to simply training in method. Again, the method of education is reduced to a mere aspect of technique.

Before we deal directly with their mistakes in the next section, we think, it is necessary to make some remarks on the unreality of both conservatives and liberals regarding the objective of education.

First, if the goal of education is predetermined, one has to justify the reason for such a determination. The educator may resort to the authority of God, of Nature, or simply of the King; he may prove that such a goal is historically or scientifically constructed, or he may simply take it for granted. To rely on authority is to find shelter in ideology, whatever it may be. In such a case, the ideology has to be proven to be the right and not the wrong one, but the difficulty lies exactly in the dogmatism of ideology which makes any test impossible. A theistic ideology can be as rigid and authoritative as its naturalistic or scientific counterpart, and justification means confirmation rather than proof.

Second, due to the untestability of such a goal, it would be nonsense to talk about crisis in terms of conformity to the goal. The educational crisis has to be located in other aspects, namely, the ability, capacity and willingness of the educated to follow the goal. One explains the educational crisis in terms of lack of will or incapacity of the educated. Actually, the educator is partly right, but in most cases he simply begs the question. The point is whether as a limited and still immature human being the one being educated could have the capacity to perform the noble, ideal rules set by an absolute agent (God) or by an utopian (absolute) ruler, or whether he could be measured in the terms of a natural event as seen by a scientifically-minded educator. The answer seems to be in the negative, exactly because such standards for education are external, neutral and, in most aspects, impractical.

Third, if one carefully examines the goal of education, one may discover a hidden interest in its process of construction. The virtues of obedience, loyalty and fidelity benefit primarily the rulers and not necessarily the educated or the subordinated. Love of the leader is intended to increase the power of the leader; it is not for the benefit of the ruled.

Fourth, even if the goal of education is noble, and for the educated, as seen in Confucianism and Christianity, one still can doubt its effectiveness. The contrast between the invariable goal and the changing man indicates clearly some alienation between the goal and human beings: how can an invariable standard dictate to a changing subject?

Fifth, with regard to the problematics of method, one may simply raise a question concerning the relation between ends and means: could one develop method without setting a goal? How could we know the right method without a calculation of the effectiveness of the method on the goal? Max Weber's excellent treatment of the inseparable relation between means and ends proves that a belief merely in method is rather naive, if not dangerous.[8]

Idealism and Education

In this section, we shall take a step further in examining two prevalent views and methods of education: those of empiricists and idealists, respectively. We will not, however, delve into the details of the problematics of methodology as have many educators from normal universities.[9] We have brought up this issue elsewhere[10] and do not need to repeat it here. The main point in this section will be by means of critique to reveal the deterministic and ideological nature of the educational views held by both empiricists and idealists alike.

The Myth of Objectivism in Education

There are two main tenets of empiricism: first, everyone being educated is primarily an object which can be observed, studied and tested; second, the law of education, generated from the general law of nature, has to be constructed on an objective and causal foundation. Consequently, a successful policy of education has to be built on what we name objectivity. We will go through their arguments and see whether the myth of objectivism could save us from crisis.

In blaming present education as unscientific, and in severely criticizing conservative education as purely subjective, empirical educators seek a scientific, objective education. Their main points and arguments are based on the concept of science and objectivity which in their mind are identical. To be scientific, one needs first to treat the educated not as a single, particular subject, but as an object, which, like other objects, can be observed. Second, what we can study from the object is not the object itself but its phenomena, or external appearances such as behaviors and reactions. Third, in locating the most frequent and least frequent phenomena, one could divide the "regular" from the "nonregular" and the "irregular" phenomena. Fourth, one observes among the

"regulars" some common traits which can explain the difference between the "regular" and others, and which can explain the existence of the "regular". Fifth, one goes a further step to establish the law of relationship among the "regulars" based on these common traits. Such laws are objective in the sense that they can satisfactorily explain and predict behavior (phenomena) in most cases. Finally, the empiricist educator will apply the above steps to study the "object" (i.e. the educated), and to work out laws of education.

Actually, in treating man as an external, neutral object like a stone, in reducing human activities to simple actions and reactions (when they collide), and consequently in believing that one can establish causal laws explaining human actions and can educate by such laws, the empiricist educator has committed a double mistake: that of ideological objectivism, and that of a naive understanding of science.

To take human beings as external, physical objects which could be studied with the help of natural science, the empiricists have taken scientism or objectivism as their ideology. Such an ideology claims that:

- knowledge is synthetic and that synthetic knowledge is constructed upon sensory experiences;
- all sensory experiences are observed and repeated;
- meaning is grounded in observation;
- concepts and their generation only represent the particulars from which they are abstracted; consequently, conceptual entities do not exist in themselves, but are mere concepts;
- sciences are unified according to the methodology of the natural sciences; and
- values are not facts, and hence cannot be given as such in sensory experiences.[11]

Deduced from the premise of scientism, any theory of education which claims to be objective or scientific must be built on these tenets. To educators who take objectivism for granted and follow its regulations, all is restricted to the area of methodology. They adopt the Wittgensteinian dictum "About that which one cannot speak, one must remain silent" (Wovon man nicht sprechen kann, daruber muss man schweigen),[12] and apply it to education:

The correct method in philosophy would really be the following: to say nothing except what can be said, i.e. propositions of natural science, namely, something that has nothing to do with philosophy; then, whenever someone wanted to say something metaphysical, to demonstrate to him that he had failed to give a meaning to certain signs in his propositions.[13]

One just needs to replace the word "philosophy" with that of "education" to understand what the empiricist educator thinks of and does with education. In this context, the method employed in education is empirical and the business of the educator is to teach the educated the proper use of such a method. One refuses to discuss the problematic of the purpose of education which appears nonsensical, metaphysical. In a stroke, this reduces all educational objectives to the single one of methodology.

It is not difficult to point out the mistake of the empiricist. We agree with Karl Popper who would have rejected such an understanding of education, which he called the myth of objectivism.[14] Though we regard Popper's critique as being of great help to dismiss the myth of objectivism, and though such a problem is appropriate in a study of education, we will leave it, together with the problem of application of neutral standards to human beings, for further

discussion. Here, we would like to concentrate on the extravagant claim that the business of education is restricted to methodological training.

Our very first question about our knowledge of appropriateness in methodology raises not only the complexity of the process of intellect construction, but also the relation between means and ends. First, the empiricist may claim that the rightness of a method is measured by its conformity to the standards of natural science, and that the right method would produce desirable results. Such a claim is in fact based on a metavalidity of the criteria of natural science. The scientific criteria are transcendental in the sense of being beyond space and time. They are always correct.

However, our question is not directed to the rightness or wrongness of scientific criteria, but to the role of the agent who recognizes and uses them. He is supposed to possess them prior to constructing some method. Immanuel Kant explains the human experiences of such knowledge in terms of a synthetic a priori process,[15] while David Hume and the rest of empiricists explain them in terms of psychological association.[16] Both explanations are insufficient in the sense that they simplify and objectify human experiences. Both Kant and Hume treat experiences as simple facts or data which one can isolate in a single unit, and which could be accumulated. They forget that experiences reveal only what has happened or not happened; as such, what they take as internal or scientific knowledge is only historical knowledge. The difference between data (given existents), facta (phenomena which have happened) and happening phenomena has not been explored by them; as a result their explanation is restrictively based on data (existents), and as such is misguided or onesided.

Second, both Kant and Hume are convinced of a kind of universal experience that they identify as mathematical or physical. To them, such experiences are certain; they provide a solid basis for constructing other knowledge.

Here, both Kant and Hume leave aside an important fact of the subjective role in experiencing. Experience is "experienced" by a certain subject. Thus, one has to properly deal with the subject as E. Husserl has rightly proposed in *The Cartesian Meditations*. Here, experience is constructed in terms of *Erlebniss*, and the *solipsistic ego* is understood in terms of transcendental subject. We follow Husserl, and especially Heidegger of *Sein und Zeit* in insisting on an ontological analysis of the existential subject.

We would begin with a radical doubt about Kant's construction of the transcendental ego. We would enquire not only into the appearances (*facta*) of the subject, but also into the state of appearing by posing questions and reducing (*epoche*) its nonessential features. This is what happens if the subject is falsely observed, or if it is in a state of illusion, or if it is determined by a certain ideological belief or education? How could we warrant that man is not influenced by his milieu or by his feelings? Similarly, we know a great deal about the fact that any experience is primarily particular and atomistic. To construct universal and regular experiences is both possible and impossible. It is possible in the case of data (suppose that all experiences are like stones, chairs, i.e. invariable, unrelated things). It is, however, impossible in the case of *facta* and especially happening phenomena. Any fact (*factum*) is a fact because it happened, or was done, or constructed. Of course, it could not happen by itself, and so the role of the subject comes to the fore. Thus, we can say that an experience (from *facta*) is rather subjective, and it thus cannot be detached from one's life-world. We cannot think of individuals in terms of general laws only if we leave unanswered the question of the impossibility or possibility of universalization of individual experiences.

Third, as a consequence, experiences understood as *Erlebniss* always point to certain relationships (between the subject and the object, the subject and other subjects, the subject and his physical and intellectual world). We understand someone or something in terms of his or its relationship to us. We experience love, fear or loss, not from the object alone, but from the subject-object relationship. The experience of love comes precisely from this relationship. The language of "we love and are loved" expresses an intersubjective experience which is born in the act of love of the agents (subject and object). The empiricist prefers to put aside this important aspect of relationship in his genetic construction of experience.

The impossibility of having absolute experiences points to the problem of absolute criteria of human science, and consequently the collapse of the myth of objectivity in human science. The positivist tries to correct the idea of the empiricist by taking a more radical stand. To him, only criteria of natural science could serve as the foundation deciding the rightness of method. We have no doubt about the quasi-universal characteristics of natural science, but we have reservations about its claim of absolute correctness and especially its extravagant claim of universal application in human life.

On the one hand, the birth of quantum physics does not wipe out Newton's mechanism. It rather shows its insufficiency in explaining the phenomenon of quantification, and more interestingly, the impact of milieu on quantity. Similarly, we witness the fact that modern mathematics has relativised the Euclidian system.[17] On the other hand, the naive belief in a universal application of the criteria of natural science has crumbled even at the first stage of rationalism. Kant's skepticism regarding the practicality of his categorical imperatives is no longer a secret.

Our point is simple; as long as we cannot transform ourselves into a kind of robot, any dream of having absolute criteria remains a dream. This claim is solidified by human objections to being disformed into robots. It would be the end of humanity.

Now we proceed directly to the second part of our question about knowledge of a method by discussing the means/ends relation. The empiricist claims the monopoly of method or the means, and bypasses the end which he considers metaphysical, or nonsensical, just because of its unprovable existence. It is true to some extent that the goal does not concretely exist. The ideal of*Chun-tzu* in the *Analects*, or sainthood in Christianity remains mostly ideal and is not necessarily existential; the model person in idealist education remains both vague and unrealisable.

However, not all purposes are unrealisable or abstract. In daily life, our action is always oriented toward a certain purpose: we eat not simply because of mechanistic reaction from our stomach, and we speak to friends not because of organistic demand but for a certain purpose, say, to communicate something, to be understood, etc. In most cases observed from our actions, we discover that it is not the means that exist beforehand, but the purpose or the ends which stimulate the birth of method. Let us take the example of eating to clarify our point: Suppose that we are hungry and there is available only some raw food. In order to satisfy our need, we have to discover one or other way to transform the uneatable into the eatable. We discover here culinary method. In the first stage, the empiricist may explain the act of eating as a simple reaction to the stimulus of stomach, but he is unable to explain why and how man discovers fire, instruments of cooking, and cooking methods. Here, we follow Weber's excellent critique of R. Stammler's empirical approach.[18] In the Postscript to the *Essay on Stammler's "Refutation" of the Materialist Conception of History*, Weber dismisses Stammler's claim that there is "only one kind of scientific knowledge of concrete phenomena", namely causal knowledge (which is empirical object).[19]

It is quite obvious that this sleight of hand is made possible in the following way. The unsuspecting reader learns that "the rule presents itself as independent of the motive, which the person has for following it." However this point remains obscure. In one kind of case, we--the inquirers--are engaged in a "dogmatic" inquiry. Therefore we regard the "rule" as having ideal axiological validity, and we bracket or abstract the actual motivation of the actor. In the other kind of case, however, we are concerned with empirical knowledge. Actual men are included among the objects of our knowledge. By instituting a rule, they attempt to achieve an actual "goal". And in general, with varying degrees of certainty, they really succeed. Stammler, in order to insure that his scholastic obscurities will remain utterly impenetrable, personifies the "law of nature" and represents it as parallel to the "precept" (Stammler, p. 100). They are distinguished in the following way. The purpose of the "precept" is to "constitute" a certain collective life. The purpose of the "law of nature", therefore, is to "cognitively (sic!) constitute" empirical regularity as "the unity of phenomena". The idea of a rule which "wants, means, or intends" something is at least a logically possible metaphor. In this context, of course, it is absolutely impermissible. However the idea of a rule that "thinks" or performs" acts of cognition" is utterly absurd.

Actually, Weber does not object to empirical science which he takes as the model for sociology. He insists on the inseparability of ends and means. In his view, to understand a fact, one needs to go beyond its mere appearance; one needs to grasp its meaning. And to understand the meaning (which man gives to his act) is to understand his intention.[20] Similarly, and developed from Weber's idea, Alfred Schutz describes human action in terms of the agent's intention: "The project is the intended act imagined as already accomplished, the in-order-to motive is the future state of affairs to be realized by the projected action."[21]

We take up the issue brought up by Weber and Schutz and insist that, the concept of method is neither *a priori* nor independent from human interest, and therefore, from the ends. We measure method by calculating its effectiveness in reaching the purpose or the set goal. We rationalize method not only by taking the criteria of natural science, but much more by upgrading the effectiveness of the set goal. Applying this to education, we may judge the scientific character of a method from its effectiveness: a successful education is an education which fulfills the set-purpose (set either by educator, parents or society). Of course, the nobility, or the soundness of such a purpose is still in debate. But, the fact is that, without a set purpose, it is almost impossible to determine the soundness of method.

Another fatal mistake of the empiricist educator should to be mentioned, though briefly; namely, a misunderstanding of human nature. First, conceiving the one to be educated as an external object, is to regard one as a static, i.e. non developing, thing. As a corollary, a static method is designed in order to deal with such a static thing. If the person is nondeveloping, then the method of handling him or her should be invariable. The educator commits a further mistake of regarding whatever is universal to be unchanging, and therefore, scientific. Thus, the scientific claim of method is built basically on a misunderstanding of human nature.

The studies of Jean Piaget[22] and Lawrence Kohlberg on human psychology, and the genetic studies by biologists all show the person to be developing, either in stages as Piaget demonstrated or interruptedly as Darwin showed. Actually, we know that, not only that the human person is developing, but even that our interests are in an accumulating and transforming process. That is to say, the purpose of our action is not fixed but increasing, and consequently so is the discovery of new method.

Second, by taking method as the sole criterion to judge the effectiveness of education, the educator lapses into a fundamental mistake of logic: how can he know the effectiveness without a knowledge of the purpose of education. The effectiveness of education is seen not in method, but in the agent who responds to such a method. The mechanism of method does violate the free will of the educated.

The Myth of Idealism and Subjectivism

In opposition to the empiricist educator, the idealist tends to understand education as a mere business of training subordinates, employees, i.e. to transform them into exactly what he has designed. The idealist could be objective (in the sense that he follows positivist, logical thinking) or subjective. But, at bottom, he is as much dogmatic as ideological. Let us look at the basic doctrine of idealist education.

First, there exists some *a priori* or transcendental model or standard which is an absolute and perfect essence. Such a model could be created either by God or by society. The model of Christian education is man-god, free of sin and bearing the image of God himself; the Confucian model is *Chun-tzu*, a super and perfect product of feudal society.

Second, such a model is the ultimate purpose of man and society, and therefore the aim of education.

Third, the model must be universal in the sense that it is invariable. It presupposes the common and noble desire of mankind: to become perfect.

Therefore, the main duty of the educator consists first in discovering the virtues found in the model man which are sanctified as moral principles, and then in educating in all these virtues. Success or failure of education is measured from the degree of response of the educated and from his performance of these virtues. To be more precise, the educator has to work out a table of moral principles or cognitive virtues that he may call *categorical imperatives* (Kant), or *golden rules* (Confucius). Such a work is not quite easy because he has to deduce or extract from the model the essential features which determine the model person. In the case of Confucius, he has to examine various prominent figures in different states and history, from Kings Yao and Schwen to national heroes, to find their common traits such as loyalty, benevolence, fidelity, obedience, righteousness, that can be identified as virtues. In Christian education, these virtues are built after the model of God. Thus, sainthood (innocence, sinlessness), belief, trustworthiness, charity and justice are its main virtues.

Only after having built these virtues and regarding them as the objectives of education, does the educator begin to think of the methodological problem. He will try different methods, and change them as long as the virtues are not fully acquired and practiced by the educated. Thus, to him, method serves no more or no less than as an instrument or a technique to obtain the set, fixed goal. As such, method plays only an auxiliary, and not the decisive role as noted with empirical educators. The method of the idealist could be scientific, objective, subjective, or even illusory. He may take the stick and carrot policy as his method. He may follow the art of love, or he may use various methods at the same time. Only his objectives are invariable.

In this context, he understands the crisis of education in terms of effectiveness of method, and more importantly, of the human factor. We will seriously take the second view that regards the human factor as the decisive factor explaining the education crisis: The idealist educator tries to explain the failure of education in the weakness or stupidity of the one to be educated. He blames the environment (society) for weakening the will of the educated. He shifts all mistakes on the

shoulders of others, but not on his own. More interestingly, he never questions the correctness or validity of moral principles and pays little attention to the real object of education, i.e. the one being educated.

Our main argument against such a view is based on the very human reality of the human inability and incapacity to fully follow such noble and perfect principles.

It is true that people are weak and limited; it is also true that they are easily influenced by their environment; and it is very true that they are motivated by interests. As such, people need to be, as the educator argues, transformed into strong, independent, and social persons. Such an argument is based on a metaphysical claim that the objective of education is the ideal man and of a misreading of human nature as static. Consequently, all we need are the noble principles which we take as the objectives of our education. In this sense, it is quite plausible to identify the objective with the object itself.

It seems that such an argument looks very promising if we take the premise to be true, and if we take the object (the one to be educated) to be the objective of education. The point is, such a premise has to be proven, and such an identification should be justified. It is quite easy to prove the falseness of such a premise as well as the confusion of such an artificial identification. By posing here the question of human capacity for following ideal principles we have in our mind a more basic question of human nature, and consequently, of human problems. What would a man be were he stripped of all his human characteristics, or became a sort of god? As a man, could he match the divine, the ideal, the perfect?

The difference between man and God, the normal and the ideal, the finite and the infinite is so great that man could never perform the duty of the absolute, ideal God. Such an argument is neither apologetic, not purely Nietzschean. In no case is it a defense of weakness, but rather a matter of fact of humanity. Let us take Piaget's study to prove our point. Piaget's study of the psychological and mental development of the child gives some clues to human nature: it is neither determined *a priori*, nor externally or automatically constructed. It is developing, and the factors explaining its development are so complex and total that we cannot reduce them to a single metaphysical principle.[23] One may doubt Piaget's explication of human development in stages, but one cannot refute the fact of the development of mankind. One need not be an Hegelian to discover the permanence of change in human history.

Since in the next section we will return to the thesis of both the empiricists and the idealists in our treatment of the crisis of education (by using critical theory), a few words are in order here with regard to their understanding of the education crisis. We share their view that our present education is in crisis, from the most visible aspects such as the crisis of method, to the most invisible facets such as that of human nature. However, we understand crisis not in a single aspect of education, but in its total relational (communicative) aspect. We do not consider crisis as something abnormal in the sense of decadence or failure or sin, but as a necessary step in human development.

Moreover, we conceive development both in terms of horizontal and vertical, quantitative and qualitative growth. To be more clear, crisis is possible only in and from human contact with different worlds and their paradigms in human intercourse. Thus, crisis is most visible in human dealings with the interests of classes, races, or individuals, and in our struggle to solve problems. Such crisis takes the form of conflict among ideologies, between the real and the ideal, the profane and the sacred.

Critical Theory and the Crisis of Education

Critical Theory and Crisis-Understanding

Critical theory is the oldest and the most sought after method by scientist and philosopher. The Greek mathematicians and philosophers discovered it as the most useful tool for sharpening thinking and for seeking truth. The Chinese sages employed it to work out a primitive form of pragmatism, and the Indians refined it to develop metaphysical systems. It is however developed fully only with Hegel and especially with Marx; finally, it became a kind of ideology with the Frankfurt School.[24]

In order to grasp the incompleteness of empirical and rational method, we need to look back at the critical method used in these theories, and then at Hegel's contribution, and finally at Marx's revision of Hegel's idea.

To empiricists what we can observe is the external object. But to distinguish the true from the false object, one has to develop criteria which do not come from the subject but from the object itself. Critical method consists in the work of observing phenomena, of distinguishing the regular from irregular, and from the work of constructing causal laws which can satisfactorily explain phenomena.

To idealists, critical method is synonymous with reflection. The thinking subject is subjected to rigorous critique. To him, the untruth comes rather from the unconscious, or alienated subject.

Kant might be the first philosopher who did not agree with either the empiricist or the idealist. To him, to remain on either subject or object alone is insufficient to discover truth. Thus, he worked out a model of categories with which, he believed, one can discover truth from untruth. The necessary conditions, as he claimed, are based on the model of arithmetic which is not conditioned by either subject or object. Thus, critical method centers on the work of applying these categories in judgment.[25]Unfortunately, these necessary conditions are transcendental in the sense that they are external and beyond our normal reach. As such, they can hardly deal with flexible and developing human activities.

It was Hegel who saw the impracticality of Kantianism. To Hegel, Kant failed to discover the Archimedean point and thus did not push through the promised Copernican revolution.[26] The Archimedean point is neither the subject, nor the object, nor the external necessary conditions. It is the point of relation between the subject and the object. To Hegel, it is the work of elaborating the law of relation which occupies the most important place. He claimed to have found such a law, i.e. the logic of history, with which he could explain and predict each historical stage.

In Marx's eyes, Hegel regretfully did not know the importance of his discovery of the point of relation.[27] He saw only a logical and abstract relation, and not the real one. Marx promoted critique as a sacred duty, and declared the need to transform critique into praxis.[28] To be more precise, one has to look at the relation between subject and object, subject and subject, subject and nature, subject and idea just to see whether such relation is normal or correct. More important, Marx proposed to understand human nature from basic economic interests from which one can judge what is normal in an alienated relation.

The members of the Frankfurt School developed further Marx's arts of critique, but with the exception of Jürgen Habermas, they remain in the first stage of critique that Marx himself wanted to overcome. It is true that Marx saw in the relation built by capitalist, feudal society a certain abnormality, but he did not rest in critique like those fellows of the Frankfurt School.[29] He wanted to build a normal (or "scientific", in Louis Althusser's version) relation, that is, an equal and just

relation based on the principle: "from each according to his ability, to each according to his needs".[30]

The difficulty which Marx did not foresee is that there is no measure or criteria to determine human needs and capacity. But Marx's miscalculation of human needs and capacity comes from his misunderstanding of human nature: man is social, and as such, is measured by the totality of society. Actually, Marx did not go through the most obvious consequence of his logic: if one is known by one's relation to others (to nature, to other fellow-humans) and by one's own power (labor), then in accordance with one's creative labor one's relations must be increasing. Thus, Marx contradicted his view of developing man and his critique appears hypocritical. Habermas appears to have found such a mistake in Marx when Habermas proposes to drop Marx's utopian principle of communism, and replaces it with the principle of communication based on a linguistic model. The point that we find helpful in this for an understanding of the educational crisis is that the communicative, linguistic model can be used to study the abnormality of relations,[31] and consequently, of our education. We can also approach Marx's interpretation of human conflicts from the point of view of human interests.

Thus, the strong point of Marx's and Habermas' critical theory which surpasses that of previous philosophers appears first in their emphasis on human relations, which are constructed mostly from human interests (economic in Marx and total in Habermas), and then in their effort to work out a certain law of relation (equality of needs and capacity in Marx, communicative rules in Habermas). There follow further explanations of the genetic process of human relations, and with this of human interests their problems, that are necessary for an understanding of human nature.

First, suppose that, like Robinson Crusoe, one is alone, living on an isolated island with no relation to other human beings. In this case, there is a double relationship: to the subject and to nature (environment). The relationship to the subject is relatively simple in the sense that it is less in terms of quantity and quality than between the subject (conscious or unconscious) and one's body which is expressed in physical and biological needs. The second relation is between subject and subject (oneself in the case of a conscious subject) and is expressed in the act of reflection upon the subject him or herself (though, in Marx's view, such a relation is difficult for an isolated, a-social person). The third and one more visible relation is between the subject and his or her environment which is seen in one's feelings of fear, respect, wonder, hate, dominating and love or in one's actions of worshiping, cultivating or running away from, or destroying nature.

Second, supposing that one lives in a small rural, family-oriented and primitive society, one's relation is more complex; his needs as well as his capacity increase in proportion to the increasing level of relationships. Now, he has not only a certain relation to himself (his body, his soul), or to nature (his environment), but to others (parents, children, spouse, friends, and superiors, both political, cultural and religious). One has to follow certain norms to preserve each relation; he has developed certain feelings and he has needs to sustain such relations. One can easily detect that such relations determine his social status and even his nature.

Third, if one lives in a global, super-technical and rich cultural society the relations are so complex that one can hardly know how they work and what is its kind. We can say that toward different objects and different subjects, or at different levels of the same subject, one develops different relations. One cannot reduce all these relations to a single spiritual relation as did Hegel, or economic relation as Marx believed.[32]

The Genesis of Relation and Human Interests

In analyzing the forms of relation, one discovers beneath the surface of each relation certain kind of activities which are oriented toward certain kind of interests (in Habermas' division, there are at least three general kinds of interests: the cognitive, the practical and the emancipatory).[33]

In our sketch of three different men who live in different milieus and histories, we discover a manifoldness of relation. Each person possesses many relations depending on their objects, interests and activities. Thus, we may formulate the relation in accordance with its objects, human interests, and activities:

- relations vary according to different objects (or subjects in the case of self-consciousness).
- relations take their different forms depending on its ends (cognitive, practical, aesthetical, emancipatory etc).
- relations have different structures in accordance with human activities (problem-solving, satisfaction, enjoyment, control, fear, love).

Let us take Robinson Crusoe, the a-social man, as an example in order to clarify our point. Crusoe first faces his body, and discovers that he is cold, hungry, thirsty, menaced. Such phenomena are conscious to him because he has a need to satisfy and to protect his body; and more clearly, because his body urges him to do so. Thus, we can say that Crusoe discovers his body not because of an idea of body, but because of his relation to his own body through its needs and their satisfaction. The discovery of the relation to body is mutual and reciprocal. He discovers his body because of the body's needs, and at the same time the body's needs make one conscious of the presence of his body. Such a relation is not single in the sense that the subject may face many objects at the same time.

The expression "Robinson Crusoe feels menaced, lonely, exhausted, thirsty and hungry" says that Crusoe faces many objects at the same time, and therefore has as many relations as he has encountered with objects. He feels menaced because of his relation to the outer world (nature, event, catastrophe), lonely because he has no subject to communicate with, thirsty because of a physical need of water.

To satisfy his needs, he has to resort to a certain activity: drinking to satisfy thirst, eating to still hunger, looking for a partner in order to suppress loneliness, or even violence to eliminate fear.

The manifoldness of relation is thus implicit in the manifoldness of objects (or subjects) and activities. However, not all activities, not all human needs and therefore not all relations are normal. Some relations tend to distort human nature, some just hinder human development. Some are artificial while others fulfil only a part of human nature. The task of critical theory is to distinguish the normal from the abnormal, the right from the wrong. But how could we do so without some prior knowledge of wrongness and correctness. Should we rely on some metaphysical criteria that the idealist has adopted. The critical theoretician would not commit the mistake of either the idealist or the empiricist. He has to work out some criteria which do not bear any metaphysical traits, and which do not rest on simple empirical data. Before we expose the main criteria which most critical theoreticians have taken, we wish to make our point clearer by taking the cosmopolitan person as an example.

The cosmopolitan is much more complicated than Robinson Crusoe. He or she has a great deal of activities (present, or developing) because of his or her multidimensional relations to a

nonspecific number of objects. The complexity of relations is due not only to the manifoldness of encountered objects, but also to one's background, spoken languages, and unlimited interests (which are born during the process of encounter or relation). Among these relations, one could find some that are normal (in the sense of the common practice in a cultural milieu), and others that are not normal (new, or uncommon to such a society), some that are acceptable and others unacceptable, some that are comprehensible and others incomprehensible, etc.

On the one hand, from one's relations, we can discover a certain number of encountered objects, activities and interests. On the other hand, we can also know or predict one's newly developing relations from one's actual activities in dealing with certain objects or in satisfying interests. In this sense, we can say that the degree of complexity of the relation of the cosmopolitan could be measured or predicted if we knew his or her activities and encountered objects; further, we may foresee his or her activities if we are sure of his or her interests. In this context, we can say, what we understand from human beings is from their relations to certain objects, and what we discover from relations is human activities.

Taking a step further, we can understand human activities only if we grasp human interests. Interests, however, are not *a priori*; they are born from human encounter with other objects or with man himself. The genesis of interests, relations, and activities lies in a reciprocal process, as *mutatis mutandis* they act upon each other.

We would go a further step to claim that human crises can be seen primarily in human relations. We understand crisis as something abnormal, unacceptable, or a defect in an abnormal relation. The main point to be discussed is how we know or judge normal relations, and how we can establish a causal law which links normal activities with normal relations. Only if this point is cleared up can we talk about a crisis, or the educational crisis in particular. Thus, we return to the primary question of how we know, i.e. how could we have some criteria to make a judgment on normality or abnormality.

Suppose that Robinson Crusoe feels hungry; the first thing that comes to his mind is to seize upon something to still his hunger. Such an action is called normal in the sense that everyone would do the same thing if he or she is involved in the same hunger. Thus, we may say that a man is sick if he does not react the same way as do others in the same case. In this case, to still hunger is a normal act springing up from normal relations between body needs and the subject.

Let us replace Robinson Crusoe with a certain Mr. Schmidt, who happens to occupy an important place in the British House of Commons. Mr. Schmidt is hungry too, but he is sitting now in the House. Would he take out some bread to still his hunger in such a case? He would certainly think twice before doing so. He may take a sharp look to be sure if there is someone about, say, a journalist, television cameraman, colleague. In each case, he would act differently: he would eat the bread comfortably if no one were there: he would rather suffer hunger when the media world is watching him; or he would discretely crunch it without disturbing his colleagues because he is sure that they would do the same. We may judge him as a wise man, a normal man because he performs the normal or required thing that everyone, in a normal situation, would do.

In the case of Mr. Schmidt, one observes that he has more relations, and more activities than did Robinson Crusoe; and that it is the relation (to the media world, to his colleagues or to himself) that determines the normalcy of his action. Here, normalcy refers to whatever is taken as common by both the subject and other subjects, or by the subject and the object, as seen in Robinson Crusoe. Crisis arises when this normal relation is distorted.

Let us return to the case of Mr. Schmidt. One discovers in him at least three visible kinds of reaction which result from three different relations: the relation between the subject and the subject

(himself), the relation between the subject and objects (his body, his needs, bread), and the relation between the subject and other subjects (colleagues, media world, observers). In each relation, a certain act is normal or legal; other acts may be a normal or illegal. It could be normal but illegal, or legal but abnormal.

We have carefully to examine each act in each relation. The first act of stilling hunger is quite normal in the first and second relations: satisfying the need of body, of the subject. However, it could offend others in the House and thus be "abnormal" or in some cases illegal (as in a sub-way). This means that normalcy in certain relations is not automatically implicit in other relations, or normalcy in other relations is not translated into normalcy in certain relations. But to accept that there would be different standards of normalcy in different relations is to admit a certain relativism in norms and standards of behaviors. As such, norms would be meaningless for the business of critique, because each relation has its own standards which other relations cannot criticize. We are plunged into chaos.

Let us examine the three relations of Mr. Schmidt to see whether there is some common value or standard among them which can dissolve their conflicts. One discovers that, stilling hunger is the most fundamental activity; it could be temporarily suppressed but not completely abolished. Mr. Schmidt, due to required etiquettes of the House and consequently for fear of being exposed to scandal if he violates them, would choose an insignificant physical suffering. But what if he could no longer stand the hunger during an hour of voting which required his presence? In this case, he would prefer a less grave or minor offense (eating) over the major one (not voting), and he has reasons to justify his act. The House and journalists would not blame him for such an insignificant offense, because it has no political consequence. This example points out an interesting order of needs and, consequently, a scale of values: the most needed weigh more in value than the less needed, and, therefore, a response is more justified. Deductively, from such an analysis one could state that the most important relation, i.e. the one directly and vitally linked to human survival, has legitimacy and establishes criteria of normalcy.

However, suppose that, it is during the election period, and suppose that the British lay much more emphasis on moral values and etiquette (as seen among the Chinese); and suppose that the election is vital for Mr. Schmidt. In this case, he has to think twice before taking a piece of bread in the House. He would rather suffer hunger, content with sipping water, than offend the public. He would prefer to be carried into the hospital than to leave the House. Here, one finds that the relation between the subject and other subjects (voters) dictates his behaviors. Again, such a relation is justified by a certain ideology. Could we say that such a relation is normal because it is important to Mr. Schmidt, and that every politician like him would do the same in such a case? We confront now the dilemma of orders: which kind of orders, the biological or the ideological (ethical, religious, political) prevails? Could we take the ethical standard to judge the biological, the subjective to criticize the objective or vice-versa?

Critical theory does not claim to possess a table of absolute criteria or categories like Kant, nor (with the exception of Habermas) does it want to build one because such a claim contradicts human nature. However, it proposes to study human nature from the point of view of human relational, mediating activities. It wants to examine the forms of human relation to see if they are properly constructed and whether they function. It claims to contribute something to human understanding by eliminating the alienated forms of relations born in inauthentic activities and influenced by reified ideologies or cultures.

In a word, it limits itself in the work of critique. It follows Marx's intention (which was abandoned by orthodox Marxism): "We do not anticipate the world dogmatically, but rather wish

to find the new world through the criticism of the old."[34] For our purpose, we will sort out its main tenets and apply them in our critique of present education. Like Marx, we wish to deepen our understanding of the education crisis through criticism, though we will not stop short on it. As seen in our above presentation, one could draw a picture of critical theory by tracing the following characteristics:

- Critical theory demands a throughout examination of what we take for granted (i.e. what we regard as normal relations).
- It urges radical reflection on the world of objects which influences relations.
- It concentrates on the mediating point or relation between the subject and the world, not on the object (empiricism) or the subject (idealism) alone.
- It explores the possible consequences of human activities based on human relations, with which it tries to reconstruct morals, laws, etc.
- It warns us of the danger of any kind of ideology, including technology, arts or mass culture.[35]

In other words, critical theory contests the view of both empiricists and idealists which it dismisses as ideological. But what it could offer is only a litany of critiques, which most observers, including Habermas, view as too negative.[36]

- It criticizes any false view of human nature.
- It unmasks and criticizes the hidden ideologies which dictate or dominate our understanding of human nature.
- It objects to the methodological domination in natural science which distorts an authentic understanding of human science.
- It rejects any kind of structure which may help to reorganize or reconstruct some form of domination such as Nazism, Communism or Fascism.
- It opposes all kinds of alienated culture, which it suspects as ideology, such as mass culture or instrumental culture.

In a word, it tries to reveal the hidden danger of any form of activities or structures which may cause human beings a certain alienation or reification.

Since our aim is restricted to the application of critical theory to education, we will refrain from further explanation or any comment irrelevant to our task. It is sufficient to say that critical theory is far from perfect, and its negative performance would encourage other forms of ideology, the worse being anarchism or nihilism. Habermas himself feels that he has to build another version of critical theory, one that could be called scientific or quasi-scientific and could contribute to human understanding. The model he seeks is based on a linguistic model with language games as the transcendental rules established by human beings themselves.[37]

Let us take critical theory at its best, namely its critique of ideology, and examine the crisis of our present education.

Our present education is constructed on our understanding of human nature, which understanding often, if not always, is dictated by our culture. Of course, culture is the crystallized quintessence of a long tradition and history which expresses the spirit or the commonality of a folk. Such a spirit is known through accepted values, or through the means that protect values

(laws, morals). Thus, we recognize a certain culture in its expressive forms (arts, music, poetry, language, morals, customs).

However, the spirit of a folk may be in change due to the ups and downs of history, contact with external or foreign values, or revolution. Thus, with change, cultures vary, take different forms, or transform themselves. Because our education is often dictated by a certain form, in a certain historical period and by a certain class, it is our duty to examine whether our education is built in accordance with our culture understood in terms of human commonality.

As regards Chinese culture, one thinks immediately of its three most powerful currents of thought: Confucianism, Buddhism and Taoism, which quite rightly are described and accepted as the most expressive forms of Chinese culture. Hence, it seems fully justified to build our education on this foundation.

To critical theoreticians such a justification is in question. One needs to rethink it and, more radically, one has to think even of its authenticity, fruitfulness, validity and legitimacy. One has to go beyond its superficial form and structure to the most fundamental, ontological question of how its fruitfulness, validity, legitimacy come into being, and how they disappear or are transformed in the historical current. The following is our attempt to delve into the problematics of culture and consequently of education.

First, one discovers a very disturbing thing in our education: it is mostly based on Confucianism, and not on all three Chinese currents as the logic of culture would require; most of the disciplines, doctrines and even methods are Confucian. Second, though there are many Confucian schools (with different outlooks and methods such as neo-Confucianism and modern Confucianism), our education has taken only the orthodox school's doctrines and method and left other schools out of consideration. Third, though orthodox Confucianism was chosen to be the backbone of education, not all but only the doctrines which were compatible to the ruling class or the regime were selected. Fourth, against the wish of Confucius, and the spirit of Confucianism, our education prefers violence over the principle of *Jen* or benevolence as its method.

Our critique will focus on the abnormal, i.e. on the uncommon traits in education, to dig up the hidden ideology. The disturbing phenomena of our education being based fundamentally on orthodox Confucianism and not on all three main currents or on neo-Confucianism could be better explained in the context of human interests and power: the need of education (for the sake of which) and the power of dictating its policy are primarily guided by the interests of the ruling class (monarchy). That means, the problematics, or the abnormal of education can be grasped when the question of class interests and of power come to fore and is fully investigated. Thus, one needs only to take a critical look in historical records to see how education was designed and executed.

History reveals that education came to its bureaucratic form not under Confucius (who preferred private education with a strong emphasis on experiments and practical life, and who understood education as a kind of art helping the educated to become a sage), but under the rulers of the Han-dynasty who conceived of it as an instrument to consolidate power (or to seize power), and to protect their own interests. In the *Great Learning*, Confucius advocated a study, free of selfish interests[38]: "The Way of learning to be great consists in manifesting clear character, loving the people and abiding in the highest good"). In contrast, our present education, coming down from that of the Han lays great importance on serving the state, loyalty to the ruler, and loving the "nation".[39]

Chinese history clearly records that with the Han dynasty, Confucianism was taken to be the sole backbone of education at the expense of other schools of thought. This was done with a certain purpose, namely, to train bureaucrats. It follows logically that only those who were trained as

Confucians could become officials, i.e. could be within reach of power. It was also evident that education is nothing but a method for protecting the ruling monarchy. Hence, there was no doubt about their reason for choosing Confucianism as the ideology of education: they were not for its humanism, but rather for its dogmatism and authoritarianism as Han Feitzu candidly and proudly admitted. Here, we can understand the rulers' preference of orthodox Confucianism over neo-Confucianism, their insistence on its legal power rather than upon its moral effectiveness.

The second, no less disturbing, enigma is that if culture is understood as the common expression of a folk, and if it is their spirit, then why is our culture monopolized by orthodox Confucianism and by the rulers, i.e. the minority who live in indifference to, if not seclusively far from, the people? Particularly, if education is based on such a culture, is it helpful for the ordinary people? The fact that our culture is often identified with certain forms of thought (Confucianism), of arts (of the noble, aristocrats, monarchs) or of morals (of Confucianism) shows that it is born in and from the world of the rulers. We may ask, how such a culture could represent the spirit of those who are ruled, oppressed?

It is more stranger to note, however, that the ruled, the oppressed, the abandoned have embraced such a culture without a second thought. They regard it as their soul, of which they are proud. Such a culture is now stimulating the folk; it is, as Marx observed, the preferred or loved opium of the people.[40]

We would not follow Marx to reject such a culture, but pose instead a more serious question: if it is not from the people, how could it be loved by them? Our question applies also to the problematic of education: could an education based on class ideology be taken by other classes for granted? How could Confucianism be taken as the sole education ideology without opposition from ordinary people?

It is with this point that we take a position distant from Marx and critical theoreticians. The ordinary people take Confucian education for granted not because of partisanship, but because of its seductive promise in solving their problems. Therefore, like the rulers, they conceive of education as an effective instrument, but unlike the former (who want to protect their own interests), they want to be within reach of power by means of education. They consider it as the best means for problem solving. It is wished for not as pure knowledge, but precisely for its "power knowledge".

Since culture is dictated by the rulers, and since education is the only instrument that is available and within the reach of ordinary people, it is taken to be the criteria to measure success, to solve social problems. It becomes *de facto* a social value which serves as the yard stick of life. At the same time, it plays the role of a necessary condition determining human fate, to free man from poverty, humiliation and oppression. Education thus deforms itself into a kind of ideology.

The education promoted by orthodox Confucianism has its merits and failures depending on which purposes it takes, on which methods it adopts, and on the kind of ideology with which it identifies.

Concluding Remarks

As stated at the very beginning of this chapter, our aim is restricted to the problematics of understanding the crisis of education. Though this chapter does not point out a guideline (as did Habermas), it has shown that the crisis of education could be seen neither from the point of view of method, nor from idealist speculation alone. It proposed to tackle the problem from the perspective of human relations and from mediating activities as is done by critical theory.

However, it does not claim that such a way of dealing with the problem is adequate. Indeed, we confess that such an extravagant claim would be as short-sighted as those advocated by the empiricists and idealists, and attacked by critical theory. Actually, we see empirical method as well as speculative reasoning as helpful and complementary to critical theory. Not consenting to critical theory's radical objection to any form of ideology, we demand a full awareness of the danger of any kind or form of ideology, be it scientism, positivism, Marxism, empiricism, idealism, or rationalism. It is necessary to be aware of their seductive effects which, even with ears plugged and eyes blindfolded, we can hardly resist.

Hence, while against critical theory, we venture to claim that the problematics of present education, are born in and from: (1) the conflict of interests which are symbolized by, and abstracted from, in the conflict of ideologies by the classes; (2) the conflict between existing values and newly emerging values which are expressed in new activities, new needs and new relations; (3) the conflict of newly adopted methods of understanding and solving problems; and (4) the conflict between the ideal and the real or the practical in understanding problems and effectively dealing with human problems.

Consequently, the main focus of education would be: (1) a thorough understanding of human relations and human activities; (2) a genuine search for possible solutions to the problems arising from the conflict of, in, and from such relations; (3) flexible methods helping the educated to be conscious of human relations, conflicts, and possible solutions; and finally, (4) helping the educated to develop the capacity to discover and deal with emerging problems.

Notes

1. Cf. Lynn Payer, *Medicine Culture* (New York: Holt, l988). See also Jurgen Habermas, *Legitimation Crisis*, trans. Th. McCarthy (Boston: Beacon Press, 1975), pp. 22-49. John S. Brubacher, *A History of the Problems of Education*, (1947). William Boyd, *The History of Western Education* (London: Black, 1954).

2. Jurgen Habermas, *Legitimation Crisis* (Boston: Beacon, 1975), p. 1-2.

3. Edmund Husserl, *Ideen*, vol. 1 (1913), in *Husserliana III*, ed. Walter Biemel, pp. 33, 56.; vol. 2 (1952)--in *Husserliana IV*, ed. Karl Schuhmann, p. 245

4. Tran Van Doan, " Devaluation and Evaluation: The Case of Confucian Values", in *The World of Community in Post-IndustrialSociety*, vol. 3, (Seoul Olympiad, 1988; Seoul: Wooseok, l989), chapter IV, pp.216-228, chap. 4.

5. *The Analects*, l:2,8,14; 2:ll,13; 4:5,24 ff).

6. See, e.g., *The Contemporary Currents in Education*, ed. Institut of Education, Nat. Taiwan Normal University (Taipei, 1988).

7. Cf. Albert Chao, "On Education", in *Proceedings*, *Philosophical Foundation for Moral Education*, (Taipei: Fujen U.P., 1985), pp. 44-48. For further reading: R. Muhlbauer, *Der Begriff "Bildung" in der Gegenwartspadagogik* (1965).

8. Max Weber, *Economy and Society* (Berkeley: University of California Press, 1968), vol. l, chap. l.

9. See the series on Education published by the Institut of Education, Nat. Taiwan Normal University (Taipei: Normal University Press, 1983 ff.); also Yang Shen-keng, *Theory, Hermeneutics and Praxis* (Taipei: Normal U.P., l988), pp. 5-14.

10. Tran van Doan, "Philosophical Education in Taiwan", in *Towards the Education in XXI Century* (Taipei: Tamkang University, 1990).

11. Richard Bernstein, *Beyond Objectivism and Relativism* (Philadelphia: P.U.P., 1983), p. 32. Mary Hesse: *In Defense of Objectivity* (London: Oxford, 1973), p. 170-71 (cited by Bernstein, op. cit). See also Karl Popper, "The Logic of the Social Sciences", in *The Positivist Dispute in German Sociology* (London, 1977), pp. 90-91. Max Horkheimer, *Kritische Theorie*, II, p. 280. Jürgen Habermas, *Knowledge and Human Interests* (Boston: Beacon, 1971), p. 117. Albrect Wellmer, *Critical Theory of Society* (New York: Herder and Herder, 1971), pp. 15-30. Peter Winch, *The Idea of a Social Science and Its Relation to Philosophy*, (London: Routledge and Paul, 1958).

12. Ludwig Wittgenstein, *Tractatus logico-philosophicus* (New York: Harcourt, 1922), 7:17.

13. Ludwig Wittgenstein, *ibidem*, 6.53a.

14. Karl Popper, "The Logic of the Social Sciences", p. 91.

15. Immanuel Kant, *Kritik der reinen Vernunft* (Hamburg: Felix Meiner, 1974), part 2.

16. David Hume, *A Treatise of Human Nature* (Oxford: Clarendon, 1978), part l, p. 13ff.

17. Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), pp. 100-101.

18. Max Weber, *Critique of Stammler* (New York: Free Press, 1977), p. 50. Rudolf Stammler, *The Historical Materialist Conception of Economy and Law: A Socio-philosophical Investigation* (1906), p. 368.

19. M. Weber, *op. cit.*, p. 100.

20. M. Weber, *The Interpretation of Social Reality*, ed. J.E.T. Eldridge (New York: Scribner, 1980), p. 28.

21. M. Weber,"The Social World and the Theory of Action", in D. Braybrooke, p. 60; quoted by Eldridge, *op. cit.*, p. 30.

22. Cf. Jean Piaget, *The Child and Reality: Problems of Genetic Psychology* (New York: Grossman, 1973). Lawrence Kohlberg,*The Psychology of Moral Development* (San Francisco: Harper and Row, 1984).

23. Jean Piaget, *Introduction à l'epistemologie genetique*, 3 vols. (Paris: P.U.F., 1960 ff).

24. Cf. Tran Van Doan, "A Critico-historical Analysis of Critical Theory", unpublished paper, London, 1990. To be sure, the Frankfurt School is not the but discoverers innovators of critical theory. The medial or relational point always has been the proud discovery of geometricians. Hegel, Marx, and prior to Hegel, J.J. Rousseau (1712-78) had advocated a similar idea. In *Emile*, Rousseau was pushing for an education based on learning-by-doing, and on motivation through interests rather than coercion. Similarly, John Dewey (1859-1952), shortly before the birth of the Frankfurt School, believed that all fruitful thinking rises from a problem situation in which man must choose from among a number of alternatives. Cf. John Donohue, "Pedagogy", in *Sacramentum Mundi* (New York: Herder and Herder, 1968-1970), vol. II, p. 221.

25. See for example Kant's *Third Critique*, *Kritik der Urteilskraft*, (Hamburg, 1924/1968).

26. F.W. Hegel, *Phanomenologie des Geistes*, in *Hegels Werke* (Frankfurt, 1970 ff.), vol. 3.

27. Karl Marx, *Die deutsche Ideologie*, in *Marx-Engels Werke* (Berlin, 1956 ff) vol. 3, 31.

28. Karl Marx, *Thesen uber Feuerbach*, MEW, vol. 3.

29. Max Horkheimer and Theodor Adorno, *Dialektik der Aufklarung* (1944; Frankfurt, 1969). Jurgen Habermas, *Theory of Communicative Action*, vol. 2, trans. Th. McCarthy (Boston: Beacon Press, 1987), p. 119 ff. See also Richard Bernstein, *Beyond Objectivism and Relativism*, op. cit., p. 43

30. Karl Marx, *Manifest der kommunistischen Partei* (1847-48), MEW, vol. 4, p. 475.

31. See for example Habermas' reappraisal of Marxism: *Zur Rekonstruktion deshistorischen Materialismus* (Frankfurt, 1976).

32. See Popper's critique of Hegel and Marx in *The Open Society and Its Enemies* (1944); (New York: Harper and Row, 1963), chaps. 12 and 13 respectively.

33. J. Habermas, *Knowledge and Human Interests* (1968), Appendix (1971).

34. Marx in a letter to Ruge, in *The Writings of the Young Marx on Philosophy and Society* (New York: Doubleday, 1967), p. 212.

35. Max Horkheimer, *Kritische Theorie* (Engl. version) *Selected Essays*, trans. J. O'Connell (New York, 1972).

36. Cf. Gunther Rohrmoser, *Das Elend der kritischen Theorie* (Freiburg, 1970).

37. J. Habermas, *Theory of Communicative Action* or earlier in *Knowledge and Human Interests*, *op. cit.*, part 2, chap. 5, 6 and 7.

38. *The Great Learning*, chap. l.

39. Tong K.M., *Educational Ideas of Confucius* (Youth Books, 1970); also Douglas C. Smith, "The Confucian Legacy in Taiwan Pedagogics" in *Proceedings of the International Symposium on Confucianism and The Modern World* (Taipei, 1987), p. 1401.

40. Marx, *Critique of Hegel's Philosophy of Right*.

8.
Confucianism, Taoism and Constructive Realism

Vincent Shen

Introduction

In order to understand science in a global context, that is, in respect to both philosophy and culture, it may be of interest to consider some philosophical theses which have emerged from a Western view of science and science education through the eyes of the two oldest Chinese philosophies, Confucianism and Taoism. By "response", I mean a way of conducting what I call "language appropriation,"[1] or, in other words, a way of translating the language of ones discipline into the language of another discipline, that is, from one micro-world to another micro-world. This could be termed alienating inter-disciplinarily (*Verfremdende Interdisciplinarität*), or "strangification" in the neologism of "constructive realism". But here this is taken not only as between interdisciplinary micro-worlds, but between different cultural worlds.

On the one hand, constructive realism[2] is based upon the European tradition of philosophy of science from Kant. Since the decline of logical positivism, it was proposed in Vienna as applicable to the domain of the philosophy of science. For my part, I see the process of translating languages between worlds as potentially helpful also in the domain of inter-cultural understanding. On the other hand, Confucianism and Taoism are two schools of philosophy developed in the context of Chinese culture. What I am going to do here is to take Confucianism and Taoism from their original context in Chinese culture, in order to conduct a philosophical reflection on constructive realism. In doing this I am trying to enlarge the strategy of translating languages from its original application to scientific micro-worlds, to the larger domain of cultural worlds. But in this I will retain the same spirit of conducting reflection by changing the cognitive contexts. The philosophical principle implicit in both micro-world and cultural-world translation is that we cannot fully understand ourselves except by placing ourselves to the context of other world and understanding others first.

I will not enter here into the details of both Confucianism and Taoism, except when they are relevant for my philosophical reflection on constructive realism. I must point out also that when I speak of Confucianism and Taoism, I do not envisage them as they were in the history of Chinese philosophy. They are presented here as already creatively interpreted through my appropriation of both Western and Chinese philosophical languages.[3]

There exists a long tradition of interpretation both in Confucianism and Taoism in which creative interpretations were considered as a way of philosophical development. Therefore I will place my interpretation of Confucianism and Taoism within the context of my philosophy of contrast, putting them into a confrontation with such contemporary Western philosophies as structuralism, phenomenology, hermeneutics, critical theory and constructive realism, as my way of developing them.

Generally speaking, we can characterize both Confucianism and Taoism as systems of philosophy with practical orientations. Confucianism emphasizes more the philosophy of man and moral philosophy, and is less interested in metaphysical speculations. Taoism emphasizes more the philosophy of nature, and is intensely interested in metaphysical meditations, especially concerning ontology and cosmology; it is critical of the anthropocentrism, human values and ethical norms contained in Confucianism. On the other hand, constructive realism has been

proposed, up to now, as an approach in philosophy of science, with epistemological as well as social interests. Its development into a system of philosophy is still to be desired.

Therefore, the moment we try to conduct a translation of language between Confucianism, Taoism and constructive realism their difference and mutual need appear. On the one hand, Confucianism and Taoism do not have their philosophy of science, though their philosophy of knowledge in general is quite well developed. In this perspective, constructive realism, with its origin in European philosophy of science, is quite helpful in developing Chinese theories of knowledge into a philosophy of science. On the other hand, constructive realism, which is limited to philosophy of science, needs to be measured also in the context of general philosophy; it can also be translated into the context of other cultures; otherwise some of its potentialities would be neglected and remain unrealized. Here, some philosophical principles of both Confucianism and Taoism would be very helpful.

In the following, I will first present briefly the philosophical positions of constructive realism. Then I will conduct some reflections upon them one by one referring to the philosophical resources of both Confucianism and Taoism.

Philosophical Positions of Constructive Realism

Constructive realism, as conceived by Fritz Wallner and his Viennese colleagues, is a recent philosophical alternative to Logical Positivism which denied any meaning to metaphysical discourse and refused to talk about reality. Instead, constructive realism considers it inevitable to talk about reality. The first concern of constructive realism is therefore to respond to this fatal lack in logical positivism by taking into account the truth contained in Wittgensteins philosophy of language in his *Tractatus Logico-Philosophicus*, namely, that we can speak about reality only in language, and therefore that there is no need of meta-language.[4]Besides, constructive realism also assimilates Wittgensteins position in the *Philosophical Investigations* that to each language game there corresponds a form of life (*Lebensformen*).[5] Together these problematics give birth to a theory of two types of reality.

The second concern of constructive realism is to envisage the need of an epistemological strategy in present day interdisciplinary research. For social as well as epistemological reasons, interdisciplinary research work now has become indispensable in science. But up to now there is no epistemologically well founded strategy for the organization and self-understanding of interdisciplinary research. Out of this concern, constructive realism proposes a strategy of translation.

The third concern of constructive realism is to develop an understanding of science based upon an inside knowledge of what scientists really are doing and which can react properly to the need for action in the environment. Very often philosophy of science neglects the practice of scientists, so that the results of their research have no impact upon scientists. Constructive realism maintains that a philosophy of science should base its discourse on the actual practice of scientists and be able to guide their practical actions. Such practical concern leads to a pragmatic view of science.

To sum up, there are three essential positions in constructive realism:

First, the theory of two types of reality, which distinguish between *Wirklichkeit* and *Realität*; the one represents the reality itself, the other represents constructed reality.

Second, the strategy of translation of languages ("strangification") for interdisciplinary research work. This is of three kinds: linguistic, sociological and ontological.

Third, a pragmatic vision of science and its role in the society.

In the following, I will explain each position point by point and in the meanwhile conduct my reflection upon each position by referring to the philosophy of Confucianism and Taoism.

Theory of Reality

Constructive Realism distinguishes *Wirklichkeit* from *Realität*. *Wirklichkeit* represents reality itself, whereas *Realität* represents a constructed reality. This distinction reminds us of the Kantian distinction between *Ding an sich* (the thing itself) and phenomena, but without presupposing Kants transcendental philosophy which posits the correspondence of *Ding an sich* to a transcendental ego. But like Kants *Ding an sich*, *Wirklichkeit* according to constructive realism is unknowable. What is knowable is the micro-worlds constructed by our scientific as well as non-scientific experiences and languages. Although unknowable, *Wirklichkeit* is posited by constructive realism as the environment (*Umwelt*) in which we live and practice science. This environment is identified with the life-world; no conceptual distinction is made by constructive realism between these two concepts.

On the other hand, *Realität* is seen as the sum total of micro-worlds. The idea of a micro-world comes to constructive realism as a philosophical consequence of Wittgensteins thesis that we can speak about reality only with our language and that to each language game corresponds a form of life. The term "micro-world" is therefore invented by constructive realism to designate the reality constructed by different kinds of language. But Constructive Realism supposes that there is a sum total of all micro-worlds which could be named the "*Realität*".

The theory of two types of reality constitutes an ontology in constructive realism. The distinction it makes between *Wirklichkeit*and *Realität* has the following consequences:

1. Philosophical discussions about reality itself and about question such as whether reality itself is knowable or not does not bring us any new knowledge. It suffices to posit a reality itself.

2. In this situation, we had better address one to another and to interact one with another through the strategy of translation; this brings us new knowledge about other micro-worlds and help to construct together the Realität.

3. Thus, the theory of two types of reality offers an ontological foundation for the strategy of translation or alienating interdisciplinary, and encourages it. This strategy of translation (strangification) will be analyzed in the next section. Now, we will reflect upon this theory in terms of Taoism and Confucianism.

Taoism

Apparently speaking, Taoism seems to accept the distinction between reality itself and a constructed reality. Lao Tzu said, "Tao could be said, but that which is already said about Tao is not the Eternal Tao."[6] The distinction between Tao and the said seems to confirm the distinction between reality itself and constructed reality. But, in Taoism, this distinction is not posited for negation of the epistemological status of micro-world. It is rather posited, on the one hand, to point out the necessity of tracing back the origin of those micro-worlds to Tao, the creative resource of

all knowledge and action. On the other hand, this distinction points out the insufficiency of all languages. In this perspective, Taoism is quite different from constructive realism.

Compared with the ontology of two types of reality in constructive realism, Taoist ontology is much richer in philosophical meaning. Tao is a spontaneous creative Being Itself which gives birth to all beings through the process of self-manifestation and self-differentiation. But there is an ontological difference between Tao, the self-manifesting Being Itself, and beings. If we say Tao equals what is said, then in that moment Tao becomes a "being said" (or loosely a conceptual being), not Being Itself. Although Tao is understandable, its understandability does not equal an ability to be spoken; thereby Taoism sets a limit to our language. Where Wittgensteins thesis, "that which cannot be said should be kept in silence", is interpreted by constructive realism as positing a constructed reality in language and the denying of all meta-language, Taoism would add the thesis that what should be kept in silence is still understandable; it is not to be "said", but is rather to be "shown".

Tao manifests itself in Nature, which is a spontaneous process not to be determined by human beings technical intervention. Human beings are considered by Taoism as only part of nature. Their ontological status is like plants, animals and others beings in nature; "all are taken to be sons of the same Mother Tao. This vision of human being and nature is quite different from modern science and technology.

In modern times, science defines nature as the totality of phenomena to be explained and predicted by natural laws; technology treats nature as the totality of material resources to be manipulated and transformed by technical process. The consequence of this concept of nature is that ecological disequilibrium, pollution and other environmental problems now become ever more serious and even menace human existence.

Taoism teaches us how to respect the spontaneous process of nature. The knowledge by human beings should be constructed in such wise as to unfold the spontaneous dynamism of nature.[7] We should avoid human centered or even egocentric constructions of knowledge. This position is more ecological and tends to construct knowledge and the *Umwelt* in a natural way. To sum up, we can reformulate Taoist propositions in the following manner:

1. Tao, as Reality Itself, nature as the manifestation of Tao, and human beings in nature, all three are co-related and co-natural.
2. Tao, as co-natural to human beings, is understandable to human beings through a cognitive procedure worthy of Tao.
3. What we understand should not be considered equal to what is said.
4. Human beings should be aware of the limit of their language and keep their mind open to the spontaneous dynamism of nature.
5. A human being should construct his or her knowledge and life-world, not according to the structural constraint of his or her language, but according to the rhythmic manifestations of nature.
6. The micro-worlds, as constructed by different languages, should not be identified with the life-world, which is partly constructed by human beings and partly constructs itself spontaneously with the rhythm of nature. Neither micro-worlds nor life-world could be identified with Tao, which is Reality Itself.

Confucianism

Confucianism is an open humanism, which takes the human being as the center of cosmos. Nevertheless Confucianism is also open to the dynamism of nature. This openness is based on the fact that human beings are interconnected to others, to nature and to Heaven. This interconnectedness, which Confucianism expresses by the term "Jen", serves as the ontological foundation of the understandability of reality itself and the possibility of communication. Based upon this interconnectedness, human beings could have a sympathetic understanding of other human persons, of nature and even of Heaven.

Confucian philosophy of language is quite different from that of Taoism, which looks at language from the negative perspective and underlines the limits of language. On the contrary, Confucianism would take language in its positive aspect. According to it, language, as human linguistic construction of reality, should also be seen as a mode of manifestation of *Wirklichkeit*. This could be achieved through semantic correctness and sincerity of purpose; the same is true of science and technology. Contrary to the Taoist critique, Confucianism would look at science and technology as capable of being integrated into the process of constructing a humanized world. The process of human intervention into the process of nature is seen by Confucianism as humankinds participation in, and assistance to, the creative transformation of Heaven and Earth.

Confucianism emphasizes therefore the process of human construction of the Life-world, which should be to the better and not to the worse. But what is the criterium for judging the better construction from the worse? Confucianism would say that the criterium lies in the principle that the human construction of the *Lebenswelt* should participate in the creative rhythm of heaven and earth, but not dominate it. Therefore Confucianism distinguishes participative construction from dominative construction. Human construction of the life-world should be participative one, not dominative.

To sum up, we could say that a Confucian reflection upon the theory of two types of reality could be expressed in the following propositions:

1. There is universal relatedness and co-naturality between human beings, nature and Heaven which serve as the ontological foundation for the understandability of *Wirklichkeit*, for human construction of knowledge about reality, and also for translation and communication.
2. reality itself is understandable through sympathetic understanding based upon the interconnectedness of human beings with other beings, by which there is a tacit understandable content liable to be expressed through language.
3. Since there might be better as well as worse constructions of the life-world, depending on whether the construction is participative or dominative, life-world should not be identified with *Umwelt* (which is identified with *Wirklichkeit* by constructive realism).
4. Life-world is to be considered partially as a human construction, and partially as emerging spontaneously from the dynamism of reality itself.
5. It could be suggested that the theory of two types of reality be modified into a theory of three levels of reality: reality itself, constructed reality and life-world.

Interdisciplinary Translation as a Strategy of Interdisciplinary Practice

In order to envisage the need of an epistemological strategy for interdisciplinary research work in science, constructive realism has proposed the act of going out of ones own cognitive context

into the context of others (which it terms "strangification"). For example, we could take the propositions of our most cherished findings from one discipline and put them into the context of another discipline, translating them into the language of that discipline. Doing this, we can make our own propositions understandable to another discipline. This translation of our propositions means their universalization, which bestows more value on the knowledge contained therein. If the translation does not succeed, this indicates the lack of universalizability of these propositions. This calls us to check over the methodology and principles by which I conduct research work in my own discipline, which requires reflecting on ones own discipline.

Translation between disciplines, being a strategy for interdisciplinary research, has the following functions: first, it helps each micro-world to understand the other; second, by translating between disciplines we can reflect on the methodology and principles of our own discipline; third, through such translation we can correlate different micro-worlds into a coherent *Realität*. In other words, inter-translation is a strategy of interdisciplinary work by which different disciplines can coordinate for a common construction of *Realität*.

This is not limited only to micro-worlds, but can be conducted also between different cultural worlds. We make our own world understandable to others by translating our language into that of others; correspondingly, we learn also from others language. Such inter-translation is therefore a kind of what I call, more generally, "language appropriation". By strangification, we appropriate others languages not only to translate and thereby make understandable our own language, but also to enrich it by the same token.

We find two cases of language appropriation in contemporary Chinese philosophy, the neo-Confucians such as Mou Tzong-san and Tang Chün-yi appropriate the philosophical language of German Idealism; and the Chinese neo-Scholastics appropriate neo-Thomistic philosophical language. Both have the intention of articulating Chinese philosophy in a philosophical language understandable to Western philosophical traditions. By the same act of language appropriation they also make German Idealism and neo-Thomism understandable to Chinese philosophy.

Such inter-translation (or strangification) is a very useful strategy not only for different scientific disciplines, but also for different parties in communication, for example, different political parties, different ideological settings, different schools of philosophy, different cultural worlds, etc.

This is more feasible and fruitful than Habermas concept of "communicative action". Habermas communicative action is a process of argumentation in which the proposition-for and proposition-against, by way of *Begründung*, search for a consensus in a higher proposition acceptable to both parties. Habermas proceeds on the supposition of an ideal situation of communication with understandability, truth, sincerity and legitimacy. Unfortunately, in the actual world of communication, very often there occurs either total conflict or compromise, without any real consensus. Habermasian argumentation tends to fail if in the process of *Begründung* and in the act of searching for consensus, there is no effort at translation for then there will be no real mutual understanding and no self-reflection during the process of argumentation. Therefore, inter-translation as proposed by constructive realism could be seen as prerequisite for any successful communication and coordination.

According to constructive realism, there are three types of inter-translation or alienating inter-disciplinary: the first is linguistic, by which we translate one language from the context of one particular discipline into the language of another discipline to see whether it works or becomes absurd thereby. If the latter, reflection must be undertaken concerning the methodology and principles by which one has established the first language.

The second is pragmatic, by which we draw science from one social and organizational context, to put it into another social and organizational context in order to make clear its pragmatic implications and to enlarge its social and organizational possibilities.

The third is ontological, which, according to Fritz Wallner, is the movement by which we transfer from one micro-world to another.

I consider both linguistic and pragmatic inter-translation well articulated, very useful and pertinent in interdisciplinary research work as well as in the communication process in general. But constructive realism does not yet have any clear articulation of the meaning of ontological inter-translation. The fact of moving from one micro-world to another does not by that mere fact become ontological. In Heideggers terms, it is still ontic, not ontological. In order to make clear the meaning of authentic ontological inter-translation clear, we can refer to Confucianism and Taoism as follows.

Confucianism: From the Confucian point of view, the fact that we can enter into other worlds (micro-worlds or cultural worlds) presupposes that there are some ontological relations existing between them. In other words, Confucianism would ask about the ontological condition of possibility which renders feasible and legitimate the act of inter-translation as well as the communication and self-reflection it makes possible. The Confucian answer to this question is that it is the inter-connectedness and co-naturality between them, a kind of ontological relation, which makes inter-translation possible. Confucianism even takes a further step to say that, upon the interconnectedness and co-naturality of human beings with each other, with nature and even with Heaven, there could be a sympathetic mutual understanding one with another. In other words, for Confucianism, inter-translation presupposes human sympathetic interconnectedness.

We need not even go so far, in a philosophy of science, as to assume the existence of this sympathetic interconnectedness between human beings or between human beings and other beings; it is still legitimate and necessary to ask the question about the ontological condition of possibility of inter-translation. In positing the existence of a "sympathetic interconnectedness" as an ontological condition of possibility of translation Confucianism has elevated it to the ontological level. According to Confucianism, there is ontological inter-translation based upon our sympathetic interconnectedness with others.

Taoism: From the Taoist point of view, in order to know another world through inter-translation, it is not enough to appropriate other language and to translate our language into other language. It is necessary also to communicate with reality itself and to enlarge our knowledge of it. In Lao Tzus word, "Having grasped the Mother (Tao, reality itself), you can thereby know the sons (beings, micro-world); Having known the sons, you should return again to the Mother."[8] Here Taoism posits an ontological detour to the *Wirklichkeit* as condition *sine qua non* for the act of inter-translation into other worlds (micro-world and cultural world). Since the reality itself is understandable, the ontological detour is thereby made possible.

We will not go into the details of those epistemological operations, negative as well as positive. In terms of Lao Tzu, we understand *Wirklichkeit* by the process of a "retracing regard", an act of intuition of essence in returning to Tao. The process of formation of our experience is therefore seen by Taoism as a process back and forth between the act of interacting with beings (sons) and the act of returning to Tao (the Mother). The act of returning to reality itself and communicating with it is therefore considered by Taoism as enriching through inter-translation with other micro-worlds. This ontological detour to reality itself bestows an ontological dimension

to inter-translation. When this is done with an ontological detour, it becomes thereby an ontological inter-translation. We can represent the ontological detour in the following figure:

M1
Wirklichkeit

M2

Realität

M1: Micro-world 1
M2: Micro-world 2
Direction of ontological detour

This concept of an ontological detour can be very suggestive for constructive realism. In doing inter-translation between micro-worlds sometimes another micro-world and its language are not easily accessible and here an ontological detour to reality itself is very helpful. In order to understand in an easier way a treatise on music, that of Adornos *Philosophie der neuen Musik* for example, it would be better to listen to the music of Schönberg and Stravinsky. In order to a understand a treatise on sociology, it is helpful to look at the social phenomenon in question. In order to understand a particular scientific treatise on nature, it is better to experience once more nature itself. The ontological detour, will not only render more easy the language and the accessibility of another micro-world, but can also serve as a remedy to the limit of language, which is essential to the Taoist philosophy of language.

3. Inter-translation between micro-world does not by itself clarify the ontological situation of different micro-worlds in relation one to another. By the mere act of inter-translation we cannot figure out their ontological status in a possible synthesis of *Realität*. But, according to a paradigm of contrast which has its historical background in the philosophical wisdom of Confucianism and Taoism, they are in a situation of contrast. In other words, in the act of inter-translation and in the act of constructing Realität, those disciplines and their micro-worlds are different, but at the same time complementary. This ontological situation renders necessary the act of inter-translation and makes it possible. Being based upon this ontological situation of contrast it is thereby an ontological inter-translation. Hence, the status of disciplines and micro-worlds in the resulting construction of Realität could also be defined by the philosophy of contrast.

Constructive Realism, a Pragmatic Vision of Science

In order to connect the enterprise of philosophy of science with the actual activities of scientists and to determine the role of science in the social and physical reality, constructive realism maintains a pragmatic vision of science. This means that, for constructive realism, the construction of a micro-world by scientific activities offers us a new possibility of action and is judged by this criteria. "As soon as they are invented, they offer new possibilities of activity; in this sense they are real. We could convert this argumentation: If they did not open new possibilities of action, they would not be scientific inventions."[9]

This pragmatist vision of science is sound and helpful for the understanding of both the activities and the function of science. "Pragmatism" means a way of thinking which attaches itself to the dimension of human action.

But, in our philosophical reflection, two questions might be asked of this pragmatic vision of science.

First, what is the criteria of action in science?

Second, in addition to understanding science, whence comes the ideal incentive for the development of science?

Concerning the first question, we can think of the following criteria.

1. *The criteria of efficiency* We can judge actions in science according to their efficiency in bringing out the desired end. Although this is important for measuring science, it falls under the category of instrumental rationality. In the case of modern Western science and technology, the excessive and abusive use of instrumental rationality has led to mans exploitative domination over nature and society. This is against the intention of conserving and constructing a better life-world.

2. The ethical criteria This means a criteria which refer to ethical norms of action and to the ethical responsibility of human beings. This is the kind of criteria that Confucianism would emphasize. According to Confucianism, three ethical norms are most important for human action.

- First, action should be conducted in such a way that it leads to the fulfillment of human potentiality.
- Second, action should be conducted in such a way that it leads to the unfolding of the object acted upon or under scientific investigation.
- Third, action should be conducted in such a way that it leads to the harmonization of relationships between one human being and other human beings, between human beings and nature.

3. Ontological criteria Both constructive realism and Confucianism, in the eyes of Taoism, are too human-centered. In Nietzsches terms, they are "human, much too human". Taoism, on the other hand, is more natural-centered, but with an ontological foundation. This means that for Taoism, human action should be situated in the cosmic process; it should be conducted in such a way that it is not human-centered, but situated in the global context of nature and Being. In other words, action should be conducted with respect for the dynamism of nature and serve for the manifestation of Tao, reality itself. In this way, there is no particular action. Compared with any ontic and dominative action, it is rather a kind of non-action, but by which nothing is left undone.

Concerning the second question, constructive realisms pragmatic vision of science is sound in helping us understand the activities of science, yet it offers no ideal incentives for the development of science.

Today, the world is full of all kinds of pragmatisms. More urgent problems such as ecological crises, economic profit, management, joblessness, etc., need more efficient actions. A worldwide pragmatic spirit is now also having its corrosive effect in the domain of science. For example, some theoretical or pure research in the natural and human social sciences are now being neglected and sacrificed by such secular pragmatism.

Of course, constructive realism is not a kind of secular pragmatism. It is pragmatism in the sense that it emphasizes the dimension of action in science. But since constructive realism

emphasizes also the role of reflection in the construction of knowledge, it should include in itself also a certain detachment from action in order to reflect. Reflection demands always some detachment from action. Although the notion of *theoria* in Greek philosophy is now gone for good, since science is now always related in its essence to action, I would call for a new spirit of *theoria* for this world menaced by nihilism. Not a *theoria* which quests for knowledge for knowledges own sake, but *theoria* as reflexive self-understanding of action, that is, a *theoria* in intimate interaction with action.

Science seems now to be losing its ideality; it has no long term goal for development. Science needs to renew ideals such as truth to serve as idealizing incentives for its own development. Otherwise, science is falling more and more into the darkness of nihilism, in which human beings have no ideal values for existence and hence life becomes meaningless. To help humankind get through this nihilist valley of darkness, constructive realism should take up such rich spiritual resources of Western philosophy and Eastern philosophy as Taoism and Confucianism in order to work out, besides the pragmatic aspect of science, the ideal dimension of the future development of science and society.

Conclusion

As I have presented elsewhere,[10] the paradigm of contrast is based upon the philosophical wisdom of both Confucianism and Taoism. This wisdom is best illustrated in the traditional representation of the Great Ultimate, Tai Chi, which is the common philosophical background of both Confucianism and Taoism. I develop it into a paradigm of contrast, which is constituted of structural contrast and dynamic contrast, both of which are also in global contrast interaction. On the one hand, "structural contrast" is constituted of interacting elements, different but related, opposing yet complementary. On the other hand, "dynamic contrast" is constituted of moments characterized by continuity and discontinuity, sedimentation of the past and creation of future novelty. Both are in a global contrasting movement so as to constitute the structure and the dynamism of history. With this paradigm of contrast in mind, we can propose the following propositions as conclusions to this essay on Confucianism, Taoism and constructive realism:

Concerning the Theory of Two Types of Reality

Proposition 1. Reality itself (*Wirklichkeit*) and Constructed Reality (*Realität*) are different but complementary, continuous yet discontinuous one with another, and they have to be mediated by the construction of life-world.

Proposition 2. The construction of life-world (*Lebenswelt*) in the process of time, which serves as the mediation between reality itself and constructed reality, should take into account the contrast tension between the two types of reality; this leads to a better, not a worse, construction.

Concerning the Strategy of Inter-translation Between micro-world

Proposition 3. Inter-translation presupposes that different micro-worlds constructed by various disciplinary languages are different yet complementary one with another, and therefore render possible and necessary the act of translation between them.

Proposition 4. Besides linguistic and pragmatic inter-translation, ontological inter-translation which bases itself either on the ontological relation between different worlds or is effected through an ontological detour to reality itself, is also necessary and feasible.

Proposition 5. In interdisciplinary research work, no individual discipline should dominate other disciplines in constructing*Realität*. Nevertheless, guiding disciplines and subsidiary disciplines are required in the construction of a specific aspect of reality. Different and contrasting disciplines exist which can be coordinated for a synthetic construction of *Realität*.

Concerning the pragmatic visions of science

Proposition 6. Both scientific action and ethical action belong, although in a contrasting way, to human action in the life-world.

Proposition 7. Human action, although it is to be integrated into the cosmic process, is nevertheless in a contrasting relation with the latter, that is, they are different yet complementary, continuous but also discontinuous one with another.

Proposition 8. Finally, theory and action are also in a contrasting situation. In order not to let action in science be secularized and become the servant of the optimization of economic profit, science should not be too pragmatic. The spirit of *theoria*, not the one in Greek philosophy searching knowledge for knowledges sake, but the spirit which sets up theoretical ideals for the development and the self-understanding of science, should be renewed today.

Proposition 9. With the renewal of this spirit of *theoria*, science would not fall in the darkness of nihilism. On the contrary, in moving by contrasting theory and action science will progress in self-understanding. Together with other ideal values offered by different cultures, it could eventually lead human beings beyond the dark valley of nihilism to the light of truth.

Notes

1. Vincent Shen, "Creativity as Synthesis of Contrasting Wisdoms: An Interpretation of Chinese Philosophy in Taiwan since 1949," *Philosophy East & West*, 43 (1993), 279-287.

2. For introductions to Constructive Realism, see Fritz Wallner, *Acht Vorlesungen über den Konstruktiven Realismus*, (Vienna: Vienna University Press, 1992), pp. 96; Fritz Wallner, Joseph Schimmer and Markus Costazza, eds, *Grenzziehungen zum Konstruktiven Realismus* (Vienna, Vienna University Press, 1993), pp. 236.

3. For Example, "What I have Done Regarding Confucianism" in *The Rebirth of Tradition* (Taipei: Yeh-Chiang, 1992), pp. 207.

4. This is how I interpret the last sentence of Wittgenstein's *Tractatus*, "That which can not be said should be kept in silence."

5. L. Wittgenstein, *Logical Investigations* (Oxford: Blackwell, 1968), p. 11.

6. Lao Tzu, *Tao Teh Ching*, ch. 1.

7. Vincent Shen, "Annäherung an das Taoistishe Verständnis von Wissenschaft. Die Episetemologie des Lao Tses und Tscuang Tses," in Fritz Wallner, Joseph Scimmer, eds, *Grenzziehungen zum Konstruktiven Realismus* (Wien: WUV-Univ., 1993), S. 183-199.

8. Lao Tzu, *Tao Teh Ching*, ch. 52.

9. Fritz Wallner, *Aspects of Constructive Realism* (Vienna: Braumüller, 1994), p. 14.

10. Vincent Shen, "Method, History and Contrast, Introduction to the Philosophy of Contrast," in *Essays in Contemporary Philosophy* (Taipei: Lih-ming Press, 1985), pp. 1-28, also my "Attempting Paradigm of Contrast," paper presented in the Annual Conference of International Association of Communication, 1985, Honolulu, Hawaii.

9.
Why Chinese Civilization Has Not Discovered Modern Sciences

Thaddeus T'ui-Chieh Hang

As every civilization is shaped differently, it is neither necessary nor possible that each people develop all aspects of human civilization. Nevertheless, on account of the practical consequences for future developments in China and on account of the enormous prestige of modern science, this question of why Chinese civilization has not discovered modern science is often asked by the Chinese, as well as by such foreigners as Carl Gustav Jung in his foreword to the "I Ching."[1] Recently, probably because of a lessening of attention to Marxism-Leninism, there is much discussion about the relation of Chinese to Western culture, especially in mainland China. Of course, modern science continues to constitute one of the foci of discussion. The intent of this paper is to assess some related discussions in mainland China and to provide some complementary ideas which could be useful especially in the field of education.

Recent Contributions from Mainland China

Chen Xuanling ( ) translated J.P. Sartre's *L'être et le neant* (the Chinese edition of which was published first in the China mainland and then in Taiwan) and studied in Paris. In "On the Question of Transcendence in China," he claims that the principles of democracy and science are rooted in the belief in Christian civilization in the existence of a transcendent God as the origin and last end of mankind. Even today, though belief in God is no longer alive in the minds of many Western men and women, the notion of some ideal beyond reach which serves as a transcendent end is still much alive. Chen claims, however, that there is no idea of a transcendent being in traditional Chinese culture and that there are no idealists in China. Because there is no such thing as a passionate search for a "transcendent" ideal in traditional China, the Chinese not only are unable to discover modern sciences or democracy, but in fact find difficulty even in learning about them from Western civilization.[2]

Chen's criticism of Chinese culture has its merit in stressing the importance of the ideal. But this is at best only one of the factors in answering the question as to why Chinese civilization has not discovered modern sciences. With regard to the role of Christianity, astrophysicist Fang Lizhi sent an article, "Religion and Science," to a friend in Hong Kong (published in November, 1990).[3] He did not deny unhappy conflicts between religion and science in Europe, but points out the positive influence of Christianity upon modern sciences. According to him, while Chinese astronomers were more interested with extraordinary and irregular appearances in the heavens, the Western astronomers took pains to explain these irregular appearances, because as Christians they believed that the whole universe was created by one intelligent God. They readily accepted the Aristotelian presuppositions that everything is intelligible and that there is uniformity in the universe. Fang thinks that Chinese Taoists also believe in the uniformity of nature because the "Tao-te-ching" says, "Tao begets two, two begets three, three begets ten thousand things," but that unfortunately Taoism never constituted the dominant current in China.[4]

This role of Christianity in modern sciences was pointed out by Joseph Needham:

If the conception of a single `personal' creator deity is firmly held (`liberating the mind', as one of the Fathers said, `from the tyranny of ten thousand tyrants'), the nature of Nature is as much an

indication of God's rationality as is the nature of Man. . . . Europe had perhaps no parallel to the Confucian phenomenon, the refusal to look at Nature, and hence no parallel to the Taoist phenomenon, the disinclination to trust reason and logic[5]

It is true that Taoists distrust reason and knowledge, but Fang's opinion seems not to be quite accurate when he asserts that Taoists believe in the uniformity of the universe. Instead, Taoists readily admit as normal anything prodigious. For Chuang-tze, for instance, there was no difficulty in believing that Ch'ing-ning (?) produces the leopard, which produces the horse, which, in turn, produces human beings ( ).[6] For him the Tao is unfathomable, indeed everything is possible through Tao's power. Thus Wang Ch'ung, who criticized Confucius and Mencius mercilessly, could not critique the pretended prodigies from the reign of the saintly Han-emperors which prodigies were simply "the spontaneity of the heavenly Tao" ( ).[7]

In the congress organized by the University of Munich (July 22-26, 1991, Tutzing), He Zhao-wu (Ts'ing-hua University, Beijing) read a paper on the "Chinese Intellectual Tradition and Modern Science" which was more comprehensive than any previous attempts. First, he did not adopt the Marxism dogma, still spread widely among mainland scholars, that the productive forces in China were seriously restrained by the old productive relations, for such inadequate explications are circular.

Rather, he noted that the emergence of modern science during the Renaissance required specific social and intellectual prerequisites, including: (1) that the interest of the dominant social class be in urgent need of sciences; and (2) that science be encouraged by the existing social and political orders so as to be capable of drawing most of the best minds to its cause. Unhappily, the only avenue open for an intellectual in traditional China was promotion through becoming an official with the so-called eight-legged compositions.

Among the intellectual prerequisites for the development of science, Professor He cited: (1) an idea of the universal laws in Nature; (2) systematic experimentation; and (3) a mathematical model for constructing a scientific theory. However, in China there was never an idea of natural law (here he invokes the authority of Joseph Needham). China had some preliminary ideas with regard to experiments and mathematical models, but did not develop them.

Moreover, Professor He sees three contrasts in the specific cultural background of China and the West: (1) From its outset Western culture was intellectualistic and sought knowledge for its own sake, whereas Chinese culture primarily sought virtuous action; (2) while as a religious faith Christianity is incompatible with reason, as a search for the infinite it is akin to the spirit of science; (3) moreover, Professor He contends that atomism and mechanicism are prerequisites for modern science, but that neither existed in China.

He also raises the following question: If China never had any contact with the West, would Chinese civilization ever have found modern sciences by herself? Though Professor He does not answer this question directly, he agrees with Joseph Needham that in the future the sciences may become holistic and organismic as did Chinese philosophy. But, as *natura non facit saltum*, he thinks that science in China must first develop in a Western, mechanistic manner, for science in China cannot undergo any abrupt change.

Though, on the whole Professor He's presentation is comprehensive and correct, some points seem rather questionable. First as regards an alleged incompatibility between Christian faith and reason, though there have been conflicts between some theologians and scientists on account of human failures on both sides,[8] the question is so complex that to assert an incompatibility is too

simplistic. Second and more importantly, is it true that no idea of universal laws of Nature existed in China? These two questions will be the concern of the next part of this paper.

Related Notions for Educational Practice in Chinese Cultural Regions

The Perception of Science as Antithetic to Religion

After the May Fourth cultural movement of 1919 China decisively took the path toward modernization. This was of Western origin, but it was perceived in a one-sided way as anti-traditionalist and anti-religious. While the Chinese tradition has come once again to be treated with honor, the anti-religious spirit still persists. This is especially so in speaking about the scientific spirit which routinely is inculcated in our schools in terms of overcoming superstition, with which religion very often is equated. This mentality is manifest when Professor He affirms the incompatibility between Christian faith and reason which reflects an inveterate anti-religious bias. This is all the more regrettable with respect to Christianity, because in part the discovery of modern sciences is indebted to Christianity. This not only is admitted by Fan Lizhi and Joseph Needham,[9] but also has been brought to light in recent studies.

As one of such studies shows, Twelfth Century Christian Europe, which first instituted universities in the modern sense, had great confidence in the progress of science. Thus Adelhard of Bath wrote about "*Quaestiones naturales*" at the beginning of twelfth century:

I do not detract from the power of God, for all that exists does so from him and by means of His power. However, this is not to say that nature itself is chaotic, irrational, or made up of discrete elements. Therefore it is possible for men to achieve an understanding of this rational order inherent in nature, an understanding as complete as the extent that human knowledge (*scientia*) progresses. . . . Consequently, since we do not turn pale before our present state of ignorance about nature, let us return then, to the method of reason.[10]

This reflects the outlook of Europeans in the Twelfth Century, namely, that since God is supremely rational, men might properly assume that nature as His creation obeys logical principles.

The discovery of modern sciences during the Renaissance is thus a logical continuation of the progress of human knowledge, as Adelhard of Bath at his time already recognized. In 1612 Thomas Tymme wrote that "the Almighty Creator of the Heavens and the Earth . . . hath set before our eyes two most principal books: the one of nature, the other of his written Word." For an author such as Tymme, science and the observation of nature were a form of divine service: in a real sense natural research was a quest for God.[11] The same was affirmed by the followers of Paracelsus although they rejected what they called the "logico-mathematical method". But those who turned to quantification might also have referred to the Biblical words that God had created "all things in number, weight and measure."[12]

Certainly, it was no wonder that in 1638 Galileo Galilei could write the famous volume on "Mathematical Discourses and Demonstrations Concerning Two New Sciences". For Galileo, who experienced some difficulties in his relationship with the theologians of his time, there was no difficulty in believing the world to be the work of God.[13] By the Eighteenth Century science at last was established as "Newtonian" in that it was experimental and was characterized by quantification and the use of mathematical abstraction in the description and clarification of natural phenomena.

This being the historical fact, there is no ground for affirming that modern sciences are incompatible with religious or Christian faith, and in education everything untrue should be carefully avoided.

Ancient Chinese Recognition of Laws of Nature

Professor He thinks that the ancient Chinese had no idea of natural laws. In this he probably follows Joseph Needham, who stated, "The de-personalization of God in ancient Chinese thought took place so early and went so far that the conception of a divine celestial lawgiver imposing ordinances on non-human Nature never developed."[15]

Since I have already discussed this theme extensively elsewhere,[16] here it is enough to give a resume. According to Hung-fan, in an historical document written well before the birth of Confucius, there are nine categories of the Great Norm (the literal meaning of "Hung-fan"):

- The first and fourth describe the order of Nature concerning the five necessary means of human subsistence (water, fire, wood, metal, and earth) and the heavenly phenomena (the year, the month, the day, the stars, planets, zodiacal signs, and the calendaric calculations).
- The third, fifth and sixth categories are rules of political life.
- The seventh deals with divination.
- The second enumerates five ethical norms and the eighth tells how the ethical and natural orders belong together.
- The last category describes forms of happiness and misfortunes to which every human being is subject.

It is noteworthy that the first and the fourth categories of the *Great Norm* concern the order of Nature; they are the laws of Nature. Moreover, all nine categories are said to derive their existence from Ti or T'ien whom the ancient Chinese, since the times of the Oracle Bones at about 1324-1123 B.C., unanimously and consistently believed to be the supreme ruler over all natural and human orders.[17]

If this be the case, why did not the ancient Chinese endeavor to make further research about specific laws of Nature. As I hinted in the article cited above, this probably was because the Chinese subsequently lost their faith in a just and mighty God in heaven and identified the natural course of events with heaven itself. By disconnecting nature's autonomous functioning from the divine will, the "heavenly way" ( ) was emptied of any implication of a transcendent God.[18] Finally the Tao-te-ching introduced the conception of a universal and impersonal "Way", the "Tao" ( ) or the "internal dictates" of everything.[19] As Needham states, "The Taoist philosophers did not trust the reason, but believed in the random character of natural events and thus did not have the fervent zeal of Christian researchers to read the book written by God."

The Danger of Ideological Scientism for Any True Scientific Spirit

In China the ideology of scientism came almost at the same time as modern sciences themselves. As D.W.Y. Kwok says rightly in his study on "Scientism in Chinese Thought 1900-1959", scientism assumes in general that all aspects of the universe are knowable through the methods of science. Moreover, it has the tendency to use the respectability of science in areas having little bearing on science itself. Because, at the time of the Opium War (1839-42), the

weakness of China was perceived as a weakness in technology, the desire for national growth always was associated with the learning of science and technology. Since the May Fourth cultural movement, the ideology of scientism has been firmly established in China and, through Ch'en Tu-hsiu, Hu Shih, Ting Wen-Chiang and others, influenced practically all Chinese intellectuals.[20] This influence remains quite alive.

Paradoxically, this overconfidence in science is damaging to the true spirit of science. This can be seen by a concrete example of the decision of the seventh People's Congress of China in 1992 to construct the big dam of San-hsia, in spite of many momentous counter-arguments. Though the voices of dissent can be silenced, not the voices of Nature, for *Natura non vincitur nisi obediatur*. Hence, it is more scientific--and also much safer--to allow all voices to be heard rather than to listen only to those voices one is happy to hear. Sen-hsia is a typical but fateful case, where the ideology of scientism deafens people. Both Carnap and Popper seem guilty of scientism in laying down an experimental standard (of verifiability or falsifiability) for all philosophical rationality.

The eagerness of all Chinese peoples to promote science and technology is good.[21] But real scientific progress has nothing to do with the ideology of scientism; on the contrary it is a serious obstacle to true progress. It would be more modest, more humane and more true to see modern science as man's artificial construction of a micro-world for a definite purpose.

Notes

1. C.G. Jung, *Psychology and Religion: West and East*, translated by R.F. Hull (New York: Pantheon Books, 1958), p. 590.

2. , 1990/4.

Chen Xuanlian, "Zur Frage der Transzendenz in China", *China heute*, IX (1990), s. 73-76.

3. , 1990.11.1 ( ), p. 20-21.

4. Joseph Needham, *Science and Civilization in China*, vol. 2, *History of Scientific Thought* (London: Cambridge University Press, 1956), p. 163.

5. Chuang Tzu, *Chuang Tzu, Mystic, Moralist, and Social Reformer*, translated from Chinese by Herbert A. Giles (2d ed., rev.; Shanghai: Kelly and Walsh, 1926), chapter 18, pp. 214-215.

6.

7.

8. Juan Casanovas, "An Evaluation of Galileo's Case" in *Matteo Ricci: International Conference on Religion and Culture*, Fujen Catholic University, Hsinchuang, Taipei, March 27-28, 1992.

9. Joseph Needham, *Science and Civilization in China*, vol. 2, p. 163.

10. Tina Stiefel, *The Intellectual Revolution in Twelfth Century Europe* (London & Sydney: Croom Helm, 1985), pp. 44-45.

11. Allen G. Debus, *Man and Nature in the Renaissance* (Cambridge: Cambridge University Press, 1988), p. 14.

12. *Op. cit.*, p. 23.

13. *Op. cit.*, pp. 109-115, 96.

14. *Op. cit.*, p. 141.

15. Joseph Needham, pp. 79-580.

16. Thaddeus T'ui-chieh Hang, "The Historical and Philosophical Import of Hung-fan," *The Asian Journal of Philosophy*, I (1987), 1-16.

17.
18.
19. Joseph Needham, p. 582.
20. D.W.Y. Kwok, *Scientism in Chinese Thought, 1900-1950* (New Haven: Yale University Press, 1965).
21. T.B. Tang, *Science and Technology in China* (London: Longman, 1984).

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In the search to respond to the urgent and increasing needs of human life science must play a crucial role. However, if poorly conceived in a way that excludes the role of human subjectivity, freedom and creativity, the role of the human person can be reduced to that of a calculator or automation resulting in a dehumanized world.

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