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# COGNITION AND VOLITION

## A Contribution to a Cybernetic Theory of Subjectivity

### Preamble

It seems to be beyond controversy that the novel science of Cybernetics involves the problem of subjectivity. If we speak of memory, intelligence and decision making in connection with machines we associate traits which, according to a very long and deeply founded tradition, belong to the domain of a so-called psyche, with the problem of computer design.

Philosophy and the humanities have dealt with the phenomenon of subjectivity for a long time. And these disciplines have always stressed the point that the problem of what religious thinkers call a soul cannot be treated with the methods of natural science and that all technical methods – we have known so far – are totally incommensurate with the character of spiritual manifestations. Especially memory was always considered an essential element of human spirituality. We have only to recall the role which Plato's anamnesis plays in the intellectual tradition of Western civilization.

The last decades of scientific development, however, have contradicted the prejudice that the faculties of intelligence, memory and decision-making belong entirely in the sphere of "subjective" life. It has been shown that certain processes of subjectivity which 50 years ago were still judged "transnatural" could be imitated by computing machines. So far, so good. Nevertheless, there is little awareness in cybernetic circles that the modest results which have so far been obtained by cybernetic techniques have raised a problem for which no answer has been found as yet because the problem itself has not been clearly recognized. Today we are facing the question: is the beginning dehumanisation and despiritualisation of the subjective faculties of living systems a superficial corrective process which merely chips off a few mechanical characteristics which were mistakenly connected with the subjective side of reality and which actually belong within the objective range of being or does Cybernetics aim at a basic revision of our traditional world concept which has been dividing reality into a natural and a supernatural sphere?

In the case that we deal only with a short period of corrective measures which do not touch the fundamental antithesis of the physical and the spiritual and of the basic relation between subject and object we may be satisfied with present cybernetic methods and the present paper of this author will then constitute a futile and superfluous effort. On the other hand, if the emergence of Cybernetics is to be taken as a symptom

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that we are at the eve of a total revolution of our traditional scientific world concept – a concept which looks at our world into an irreconcilable duality of form and matter, of meaningful information and physical energy, of subject and of object, and finally of theoretical reason and pragmatic will – then the present scientific methods employed in Cybernetics are woefully inadequate. They are totally insufficient because they are designed on the assumption that this classic duality which is mirrored in the general division between natural sciences and the humanities or moral sciences is still valid.[1]

However, no serious attempt has been made so far in Cybernetics to develop a general logical and mathematical theory of subjective life where life is not judged to be in its very core a supernatural phenomenon but treats it as an extension of physical events into patterns of an almost unimaginably high complexity.

As long as life is looked at as a supernatural essence the world the scientist deals with is a basically subjectless universe. And the very same rational methods which Western science has developed for the analysis of such a universe are now naively applied to a problem of a totally heterogeneous nature, namely to unravel the code of a universe which is an inextricable fusion of subject and object and where, according to a paper by Warren S. McCulloch of the year 1956 [2], we may design ethical robots, because a moral decision can be shown to be a direct extension of a physical event into structural patterns which are redundant from the viewpoint of mere physics but are nevertheless essential for the contact between subject and object. If we use our traditional logical and mathematical methods developed against the background of a cosmology which considered subjectivity as supernatural, totally extramundane and irrational to deal with subjective life as a self-referential process of nature and fully rational, this is approximately on the same level as if we asked the automakers in Detroit to use their tools to manufacture symphonies.

Cybernetics is now called upon to assist in solving social and political problems. So far the results have been more than disappointing. This will not change till we have developed methods germane to the problem of subjective life. When the Greeks developed their scientific methods – which, as far as the basic assumptions are concerned, are still ours – they did so within a conceptual ontological frame which radically excluded subjectivity. And they were well aware that their methods were only meaningful within this frame. The modern cyberneticist uses these very same methods but outside their legitimate frame. The result is that if analogues of subjective processes are designed into computer hardware the cyberneticist is consciously or unconsciously trying to make them as lifeless as possible. His methodical ideal is to unmask subjective processes of life as merely lifeless objective events instead of trying to retain as much as possible of their transphysical complexity. Hence the neglect of transclassical logic and the lack of interest in the theory of dialectics – the only praiseworthy exception being the work of Prof. Hector C. Sabelli of the Medical School in Chicago, if we ignore for the time being the cultivation of dialectic theory in the Eastern countries.

Since the present author is vigorously opposed to the prevailing methodological aim of total re-objectivation of life processes the following analysis of the fundamental relation between subjectivity as cognition and subjectivity as active volition is intended to be a contribution to a cybernetic theory of Life.

## Part I

The problem of the antithesis of Reason and Will is as old as the spiritual history of mankind. There is an elementary knowledge, quickly acquired by the human intellect, that the happenings which take place in our Universe belong to two – as it seems – exactly opposite categories. We believe that we are able to distinguish quite clearly, on the one hand, impersonal objective events which take place in the realm of inanimate things and which are triggered by physical causes and, on the other hand, subjectively motivated actions of living organisms which appear to have a peculiar spontaneity. The manifestations or results of a subjective Will we call decisions. And although we cannot clearly say what the difference is between the causal connections which link the data of objectivity together and a driving will and a decision which emanates from it, thinkers have insisted since ancient times that there must be a fundamental difference.

A tradition of long standing says that the objective side of the Universe is fully determined by causality, but that living systems, although they also are partly determined by a strict nexus of cause and effect, have in addition a domain within which they seem to be undetermined and free. An inanimate object is wholly identical with itself and represents an unbroken contexture. For this very reason it is exclusively a product of determining causes. A living system, on the other hand, represents – according to the tradition and functionally speaking – a profound ontological duality. It is a system of contemplative cognizance as well as a source of active volition. In its cognitive capacity it is determined by its environment insofar as it can only recognize what there is – including its own fantasies and its own errors. As volition, on the other hand, it maintains a certain independence from its environment. It can change its environmental conditions within limits and negate the influences which the world presses upon it. This fundamental distinction between theoretical reason and pragmatic will is associated with antithetic pairs of other categories of which we shall name only a few. On the side of theoretical reason belong such concepts as observation, order, necessity and objective truth. Associated with pragmatic will, however, are the ideas of the Good, of Hope, of Purpose and of Personal Autonomy.

The human mind had hardly made these distinctions when the question arose: what is first in reality and has ontological primacy? Is it the object and connected with it theoretical reason, or the subject as the impersonation of will and as the activator of creative decisions? In the story of the Creation all existence is the result of the unfathomable Will of God. The world comes forth from Him, not as a logical or physical necessity but as a manifestation of a primordial decision that is groundless and deeper than all reason. This is the doctrine of the Primary of Will.

If we turn from the report of the Creation in the first Chapter of Genesis to the Gospel of St. John we learn, however, that not the will but reason is the primordial source of Reality. Because there we read: "In the beginning was the Word: and the Word was with God: and God was the Word."

We encounter the same ambiguous attitude toward the problem of the mutual relation between Will and Reason in the philosophy of Plato. On the one hand we learn through the mouth of Socrates that knowledge determines the will and that sin is basically nothing but theoretical error. On the other hand, in such dialogues as the *Philebos* or the *Republic* the point is stressed that the Idea of the Good is the highest, the very first and

the most general and the everything else (including Reason) derives from it. Finally, it is also possible to extricate from the work of Plato the ontological theorem that Reason and Will are dialectically speaking identical and that there is no primacy of either of it. This ultimate position comes very much to the fore in the latest period of Plato's thoughts, when he tried to connect his doctrine of ideas with the Pythagorean number theory equating the Idea of the Good with the Oneness of Being in general and hence with the arithmetical number 1. It is irrelevant whether Plato succeeded or not. At any rate, Plato's attempt was – seen against the background of the early development of Western Science – premature and therefore bound to be ineffective. The whole history of philosophy and scientific thought testifies to it, because the issues of the primacy of Reason or Will was never decided and the controversy oscillated for more than 2000 years between opposite solutions. Whenever a thinker proclaimed the primacy of Reason and the primordial rank of objective thingness some opponent was capable of demolishing such theory and asserting the primacy of Will and the primordiate ontological status of subjective decision. However, after having accomplished this the advocate of the primacy of Will suffered in turn the same fate of being refuted with the most convincing arguments and the pendulum swung back to the first position.

The controversy culminated the first time in the historic confrontation between Christian religion and Greek science. Taken as a whole the intellectual tradition of the Greeks decidedly favored the primacy of Reason and consequently a concept of the Universe that was basically rational and totally resolvable in terms of objectivity. In Christianity, however, the idea prevailed that the world had been created out of Nothingness by the inscrutable Will of God, the Father, and Reason or the Logos took second place and was personified by the Son.

A new confrontation took place in the rivalry of Thomism and Scotism during the high Middle Ages. According to Thomas the Will is determined by the knowledge of the Good, and the intellect is the *supreme motor* of the psyche. In contradicting Thomism Henry of Ghent, Duns Scotus and Occam argued that, if the Will receives its motoric impulses by Ideas and by the Intellect, it loses its basic character of contingency and its "power to the contrary". In order to be capable of genuine decisions the Will must be the "movens per se". A will can be sovereign only if it is not determined by the dictates of reason.

For Thomas even the Divine Will must be subservient to the Divine Wisdom which is its indisputable master. But Duns Scotus insists that God created the Universe as a manifestation of his absolute arbitrary will and if it had been his decision he might have endowed it with exactly the opposite properties. One of the most poignant formulation of this controversy is offered by Frances of Mayro who posed the question: Was God, when he created the world, bound by the laws of logic which limited his omnipotence or are these laws and their validity an expression of an arbitrary decision and he might as well have decided on different laws to be valid? On the ethical side Occam amended the argument by musing whether God might have decided that what we have learned to call sin might be the true content of the moral law of goodness.

That the controversy was never decided in favor of one or the other side since each party advanced equally valid and equally refutable arguments – is drastically demonstrated by the fact, that the issue turns up a third time at the highest level of

philosophy in the difference between Kant's and Hegel's metaphysical attitudes. For Kant there can be no doubt that philosophy has to insist on the primacy of Will and the absolute sovereignty of free decision (Categorical Imperative). Reason, according to Kant, cannot dominate the will because it is limited by an intrinsic weakness of built-in fallacies, the so-called "transcendental illusion". These fallacies are not a result of human incompetence and blundering but belong to the innate character of theoretical thought.

This metaphysical weakness of Reason is denied by Hegel, the philosopher of "Panlogism". The Will as the adversary of Reason has its highest manifestation in the realm of the "objective spirit" (objektiver Geist), i.e. in Law Morality and State. But above the objective spirit reigns the absolute spirit which is the self-reference of a Reason that is a law unto itself.

We shall not follow the further vagaries of the issue which has remained an unsolved problem. up to the present time and which must remain unresolved within the frame of the classic concepts of the world. For, as long as reality is subdivided into a natural and a supernatural sector, the problem cannot disappear. Subjectivity itself is then divided into a natural and a supernatural component.

If a problem is raised again and again and no solution can be found it is wise not to ask what separates the proponents of opposite viewpoints but to ask: what do they have in common? Because this is the point where the source of the disagreement must lie! And no matter how much Greek scientists and religious thinkers of the early Christian era, or Thomists and Scotists and finally Kant and Hegel may disagree about the solution, there has been a marvelous agreement among the contending parties about the way to pose the problem. Neither side has ever doubted that Will and Reason are two distinct spiritual faculties of the subject than can be separately identified and put into opposition to each other like two warring leaders who meet on a battlefield with the aim to defeat the adversary. It has never occurred to the proponents of either side that they might not have anything worth while to fight about.

Occasionally, very occasionally, a timid doubt was voiced in the history of philosophy about the legitimacy of the problem; but such doubts remained without serious consequence because during the classic period of philosophy and science no tools were available to develop a theory which denied the assumption that Will and Reason are two capacities of the Mind, separate and independently operating.

This, however, is the position which we are going to take. Our Thesis will be: Will and Reason are the very same activity of the Mind, but seen from two different viewpoints. Or – to put it differently – Reason and Will or theoretical reflection on one hand and contingent decision on the other are only reciprocal manifestations of one and the same ontological configuration that is produced by the fact that a living system goes through constantly changing attitudes toward its environment. There is no thought unless it is constantly supported by a will to think. And there can be no act of volition unless there is a theoretical perception of something that will serve as motivation for the will.

A will that wills nothing but itself would have no objective that could trigger it into action; and a thought that is a mere mental image without a volitional process which produces and maintains it is equally inconceivable.



Under the circumstances it is understandable that we have as yet no scientific theory of decision making. If the will cannot be treated as a separate capacity and does not exist as such, there is no way to develop a separate theory for it and its mechanism of decision making. But, so the contradicting argument goes, we do have a theory of thinking which was originally conceived by Aristotle and developed and refined up to the present day. The answer to this argument is that it perpetuates a colossal mistake. We do *not* have a theory of the mechanism of thinking. If we had one we could have built computers with hetero-reference and self-reference that think like us long ago. But our present computers are only auto-referential. They have no awareness of the difference between their so-called thought processes and what these processes semantically refer to. In other words, they are not capable of hetero-reference, let alone self-reference. This is the best proof that we are still incapable to develop an exact theory of the process of thinking. What we have only acquired during the course of western scientific history is a mere theory of the *contents* or *results* of thinking, but not of the active thought process itself. To mistake our present day logic for a theory of the mechanism of thinking is about on the same level as if we confused our furniture with the movers who have placed it in our new apartment. So far all attempts to discover the laws of the subjective event which we call theoretical reflection have failed. And they failed for the very same reason why we never succeeded to develop a theory of will and decision making: because Will and Reason are not two independently operating capacities. They constitute a single faculty of subjectivity which, however, may assume contrary aspects under reversed ontological conditions.

Since the classic approach to identify cognition and volition separately in a closed unit of individual subjectivity has failed we shall approach the problem from a different side. We shall assume that the phenomenon of subjectivity, as manifested by thought processes and decision making, cannot be looked for inside the skin of an individual living body – be that animal or man. We propose instead the following theorem:

*Subjectivity is a phenomenon distributed over the dialectic antithesis of the Ego as the subjective subject and the Thou as the objective subject, both of them having a common mediating environment.*

If we try to describe the situation from the viewpoint of a neutral observer we may say that we are aware of our own subjectivity by self-reference. In this self-reflective mental attitude one's own ego appears as a merely passive entity. We are aware of it in the sense of a pseudo-object, because all action which we ascribe to the living subjectivity is now absorbed in the self-referential process which has taken such "inward" direction. Thus the personal ego appears to our self-reflection as a *passive* object toward which our *active* attention is directed. One's own self is – so to speak – a "soul thing". However, if we turn from self-reference to hetero-reference and direct our attention toward our environment we meet subjectivity again, this time in the shape of the other ego, the Thou. But the Thou is not a soul thing to us, only the specific body the Thou is in liaison with presents itself to us as a thing. In our environment the category of thingness refers to physical objects only. The subjectivity in the shape of a Thou is conceivable to us and observable exclusively as the manifestation of an event which we may, in contraposition to the objective events which take place between inanimate things, call a volitional event as the expression of a subjective will which is not ours and which is totally inaccessible to us. What gives the Thou its peculiar

ontological position is that it has a physical location in our environment insofar as it must appear as an animated organic body occupying a specific place in time and space. On the other hand, it resists identification with this body which is reachable by methods of classic natural science and remains, as inner subjectivity, totally unreachable. In this respect it does not belong to our environment because by environment we mean something which is in principle within our reach, even if there are practical obstacles which may keep us away from certain parts of the environmental world. What gives this situation, however, an additional aspect of intricacy is the fact that we cannot rest satisfied with the simple formula that the subjective subject – which means our own ego – appears in a *mental* environment as an object of thought and the objective subject, the Thou, in a *physical* environment as a manifestation of will in the shape of decisions. In other words we cannot be satisfied with the primitive formula that our personal ego appears as the source of cognition and the alter ego as the font of decisions. We know very well that our own ego must also be considered as a main spring of decision and that no Thou could manifest itself as a decision making entity unless this process of deciding is motivated and directed by thought.

The key to the problem lies in the relation both versions of subjectivity have to the non-subjective environment and in our awareness that the I as the subjective subject forms with any Thou as the objective subject an exchange relation. Although everyone of us from his own viewpoint is the subjective Ego and any other subject is an objective Thou the situation is reversed from the viewpoint of any Thou. Seen from there all of us who claim to be subjective egos are demoted to the objective subjectivity of the Thou and located in an environment which is not ours – it only overlaps it – but belongs to the specific Thou who has taken up the role of the observer of us. This all of us know! And it means that the division which separates our personal subjectivity from the subjectivity which is mediated to us by our environment is – structurally speaking – only a replica of the division which we are aware of in our own selves as being the simultaneous source of cognitive concepts and volitive decisions. In other words: the brain as the organ of subjective awareness repeats within itself the relation between I and Thou as mediated by a physical environment. For this reason we shall, for the rest of this paper, ignore the existence of the Thou in our environment and assume for the time being and for the purpose of simplification a somewhat solipsistic attitude. We shall assume that there is only a solitary subject which finds itself the lonely living inhabitant of an otherwise lifeless cosmos. Even this epistemological attitude represents some progress compared with the traditional classic viewpoint where an observer maps a Universe which is totally devoid of Life – because he has excluded even himself.

After we have reached this point it is high time to reflect upon the question how the preceding ontological analysis could be relevant for brain research. There are two ways in which brain research can proceed. We can look at the brain as a mere physical piece of matter consisting of approximately 50 billion neurons and we can investigate how nature has constructed these neurons and how they arrest and transmit messages and store information. This is, of course, a legitimate procedure and it goes without saying that it is eminently necessary to proceed in this direction. However, this method has its limits. With the techniques available in this field of research it is, on principle, impossible to cross the borderline between objective events and subjective awareness. All research and analysis started in a given contexture is unavoidably and

unconditionally confined to the very contexture in which it started its moves. But objectivity and subjectivity are discontextural.

Moreover, there is a technical difficulty. The description of a neural system has to rely heavily on combinatorial analysis. But the number of neurons which are required to produce mental events is so high that combinatorial analysis will fail us in very relevant respects: it can be shown that, when we make the transition from the object to the subject, the neural system must display some properties which can only be described by recursive procedures. But these methods will not carry us far enough. We shall give one example: It is highly probable that the borderline between subjectivity and objectivity has some arithmetical relation to the maxima of the Stirling numbers of the second kind. If we ask for this maximum we want to know for which  $k$  at a particular  $n$  the value of  $S(n,k)$  has a maximum.

This question can, for the time being, be answered up to the value  $n = 95$ . Beyond that number only estimates are possible. But to describe the mutual relation of subjectivity and objectivity adequately  $n$  would have to assume the value of 10 billion. And even that would probably not be enough because with 10 billion we refer only to the nerve cells of the brain and not to the additional nerve cells of the body.

In other words: there are not only theoretical but also practical reasons why research in the neural system of the brain will never reveal how the brain contributes to the solution of the riddle of subjectivity. However, there is another way to approach the problem. Instead of working uphill from the neuron level we may ask: what is the highest achievement of the brain? In other words: what mental world concept does it produce? We can describe this world concept in semantic and structural terms and work down from there posing the question: how must a brain be organized in order to yield such images with their peculiar semantic significance. This types of investigation has hardly started, but it is as important and necessary as the other one. Part I of this essay was meant to lead the attention of the scientist in this direction and the following Part II will demonstrate how we can show by this method the basic link between subjectivity as cognition and subjectivity as a volitive process.

## Part II

Since we are now purposely ignoring the problem of the Thou we discard within the frame of the present paper one of the strongest hints that subjectivity is an essential part of any environment. We let this question rest for the time being because the subjectivity of the Thou is not our subjectivity which emerges in self-reference. The Thou is always a product of hetero-reference, and it is our aim to show that even the subjectivity of the personal ego – apart from our knowledge about other subjects – is not something which is, so to speak, enclosed within an individual personality but is distributed over a living system *and* its environment.

The relation of a personal self to its environment may, according to everybody's experience, assume two basic aspects. Either the influence of the environment will be so overpowering that the self cannot help but conform and adapt to the forces which press upon it from the outside. On the other hand, the state of the environment may be such that it remains neutral with regard to the needs of the living system which it envelops.



In the first case there is no way in which the subjectivity of a living organism can exert itself as a process of decision making. It can only passively register the messages it receives from the outside and when it tries to describe its environmental world and its own position in it, it must do so in terms of physical causality and concomitant logical necessity. This means that the changing states of the subject will assume cognitive character and will be describable in terms of theoretical reason, the laws of which are dictated by the objective existence of the world as it is.

However, if we assume that the relation between a living system and its environment enters a state in which the environmental world does not positively influence the subjectivity which it harbors, then the subjectivity itself, in order to overcome this indifference, and in order to maintain its characteristics of Life, cannot help but enter into an active role. It is important to say that it must assume an active role and not only: it may be active. This is a basic criterion that separates inanimate from living matter. If in a specific case the world does not exert an observable positive influence on an entity which it envelops and the entity in question remains inactive we are inclined to assume that we are confronted by a case of mere indeterminacy which seems sometimes to occur within the domain of subjectless objectivity. However, if a system is structured in such a way that its own inner organization forces it to react positively to the neutrality of the environment by an act of self-determination, then we speak of a living system of subjectivity.

The point is that the world as an ontological totality, namely system or systems plus environment, is always fully determined. But the causal nexus may seemingly run into two directions. It may either start in the environment and propagate itself into the system to which it is environmental or it may give the appearance to have its starting point inside the subjectivity of a living system and carry over from there into the environment. In this second case the classic tradition speaks of the Freedom of Will. A semblance of partial indeterminacy of Reality appears only if we take a one-sided epistemological view of the world as a subjectless contexture of objectivity. This is exactly what the classical tradition of natural science has done and by following it to its ultimate consequences it has arrived at the theory of quantum mechanics where Heisenberg's principle of uncertainty has demonstrated a certain measure of indeterminacy in the description of the isolated object.

At this juncture it is necessary to point out that it would not be proper to talk of two chains of causality, one originating in the object inanimate and the other in the anima, insofar as all systems of Life have originally emerged from the very environment from which they have screened themselves off. The fact is that there is only one chain of causality originating from and spreading through the environmental world and being reflected back into the environment through the medium of the living system. But the law of determinacy expresses itself in two distinct modalities. We must distinguish between irreflexive and reflected causality. What we mean is that the chain of causality, by its passage through a living system, suffers a radical change of character. When Arnold Gehlen wrote his "Theorie der Willensfreiheit" (A Theory of the Freedom of Will) in the early '30s he drew attention to two basic facts about the volitive aspects of subjectivity. First – and here he followed the example of Leibniz – he argued that the freedom of will should never be interpreted as lack of causal determination in the physical sense but that it means a positive plus of determination engendered by the

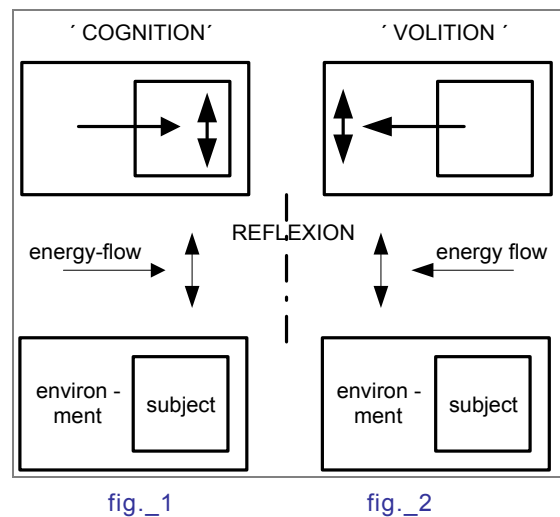
living system and added to the physical conditions of the object. But Gehlen went even deeper into the problem by showing that freedom is never a matter of the materiality of the event but of its structural form. What will happen according to the physical conditions of the world as objectivity will come to pass anyhow as determined by irreflexive causality. There is no escape from it. The event per se cannot be avoided but its form is capable of modification. To put it differently: if we observe two events in the world and we say that one is an objective happening, exclusively determined by environmental physical causes, and the other event is a "spontaneous action" triggered by a free will we can only mean that both events, fully determined as far as objective causality goes, nevertheless differ – and differ considerably with regard to their structural form. A volitive action of a so-called subject involves a much higher structural complexity than we can observe in the so-called physical irreflexive causality in the object. But let us make no mistake about it – a process of volition is as causally determined as an avalanche that thunders down a mountain slope. What has produced the myth of a totally undetermined will is the fact that the transfer of causality from the object to the mechanism of subjectivity adds so much in structural richness to the causal nexus that it has the appearance that a totally new force emerged which seems to be utterly different from the chains of determination which links all objects together. We stated above that the world as a totality of object plus subject is fully determined, although if we look at the *isolated* object its determination does not seem to be complete, but there is determination. On the other hand if we look at the *isolated* subject its freedom or absence of determination does not seem to be total, but still there is freedom. However, if we assume that reality as an integration of objectivity *and* subjectivity is fully determined we might explain the situation by saying that the causality of the objective contexture of the Universe takes a feedback loop through subjectivity back into the environment. Yet we have to be very careful in making such a statement because the feedback we are referring to is of much higher structural complexity than what we observe as feedback in physical systems. The idea of feedback which we have entertained so far in computer theory does not involve the specific change in structural form which causality suffers when it passes through a system of subjectivity.

Since a volitive system needs an image of the world in order to make decisions and produce actions based on such decisions we may call the alleged freedom of will an "image-induced" causality. The objective causality of environment without such feedback through a volitive system is imageless. Since the classic tradition of science recognizes only the type of causality which is not filtered through an image it was unavoidable that the myth of a subjective power originated. A power which acts in a completely undetermined way, independent of and even contrary to, the causal nexus of the physical Universe. But let us repeat: unless we resort to mysticism which has no place in science, free will cannot be called lack of determination but is actually a plus of formal determining factors on the basis of increased structural complexity of the event. These factors must be added to the determining data of the subjectless Universe of classic tradition and after we have done so we will be entitled to say that the total of reality as the integration of subject and object is fully determined and as such a legitimate object of scientific inquiry and cybernetic design.

The classic concept of the Universe contains – ontologically speaking – black holes in the structure of reality which were scantily filled out by the products of a theory which claimed that our physical Universe is engulfed in a supernatural world penetrating this vale of tears occasionally and produces the aforementioned black holes of irrationality and of total absence of determination.

We pointed out above that the distinction between inanimate matter and living organisms is to be found in the criterion that a living system is inevitably forced to act in a situation where its behavior cannot be fully dictated by the environment. We shall now give the reason why such a duality of subjective attitudes may occur. An environment will always dominate a system of subjectivity in situations where the former displays a higher structural complexity than the system acted upon. However, there are other situations where the relation between a living system and its environment is characterized by the fact that the environment – as far as it concerns the subject – displays less structural complexity than the subjectivity which faces it. This means that, if we want to describe the possible attitudes subjective activity can assume with regard to the world which surrounds it, we have to contend with two inverse hierarchical (ordered) relations. In one case the outside world is on the apex of the hierarchy and rules unconditionally over the subject and in the reverse hierarchical relation the subject is sovereign and reigns supreme over the object. It is obvious that in the first case subjectivity will appear to us as a cognitive system. In the other it will manifest itself as volition. Our figures\_1 and \_2 may help to illustrate the mutual relations between subjectivity as cognition and subjectivity as volition. They are structurally speaking – mirror images of each other. It only should not be forgotten that the two figures refer to a solitary subjectivity and not to the distribution of cognition and volition over an uncountable number of centers of subjectivity.

In figure\_1 we have drawn a rectangle which contains a square and inside the square a double-headed arrow. A second arrow points from the rectangle into the square. In figure\_2 we have drawn the same rectangle and square, only the position and the direction of the arrows are now changed. The single-headed arrow now points from the square into the rectangle and towards the double-headed arrow which is now located in the larger oblong figure. Figure\_1 represents in a very simple manner the relation of a subject to its environment if its life manifests itself as a cognitive system. In other words: Figure\_1 refers to the pattern of Thought based on the perception of an outside world. In figure\_2 the same system of subjectivity determines its relation to the environment in the form of decisions. It acts, not as a reasoning entity bound by laws of logic, but as a relatively spontaneous mechanism of volition. The one-headed arrow indicates the direction of the volition and the flow of image-induced causality. In figure\_1 the environment represented by the rectangle causes an event inside the cognitive system. In Figure\_2 the volition produces an event in the outside



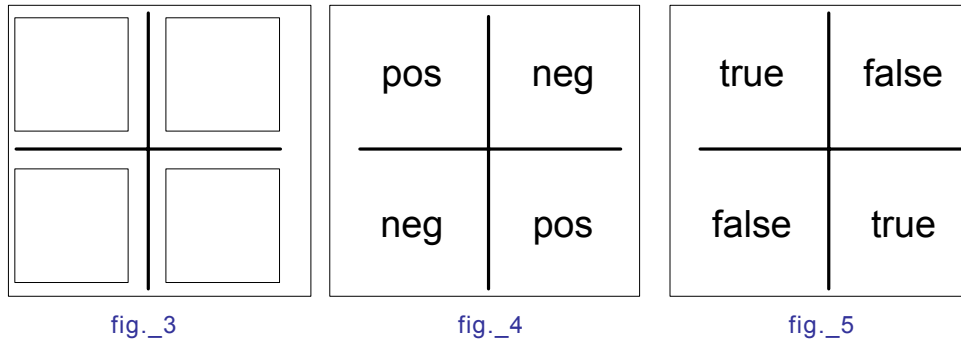
world. The choice of our symbols is not quite fortuitous. The double-headed arrows indicate that the inverse flow of the events always heads for a structural configuration which is symmetrical, ambivalent and implies a duality, in short an exchange relation. The single-headed arrows signify a unidirectional order. Our two figures show that the mutual relations of a cognition and a volition with regard to their environment are exactly inverse.

It goes without saying that figure\_1 and figure\_2 represent an abstract separation of the interlocking mechanisms of cognition and volition. In reality there is, of course, a constant interplay between the two and it goes without saying that one of them cannot operate without being continuously supported by the other. There is no thought without an essential admixture of volition and vice versa volition without an intrinsic component of theoretical awareness would be totally blind. For the time being, however, we shall ignore this necessary interplay and describe the functions of reason and will in the state of their artificial isolation which is depicted by our separate figures. Figure\_1 represents essentially the ancient eidola theory of cognition as conceived by Democritus. According to him all things send tiny messages to the mind. These messages have the shape of infinitely small copies of the objects which we perceive; these copies or minute replicas of things enter our theoretical consciousness and in this way we are aware of the shape and of all other properties of the objects in the universe. It is highly significant that this eidola theory which found much acclaim in antiquity interprets the process of cognizance as one in which the cognitive system remains essentially passive. The Democritic subject of cognition requires hardly any activity since it does not receive a chaotic mass of sensations out of which it has to form by its own efforts mental images. According to Democritus these images are already preformed in the environment by the objects themselves. This environmental process is projected into the cognitive system and the latter has not to add anything to it. To use a modern analogy: The cognitive sector of the mind behaves like the screen in a movie theatre onto which the projector throws the images created by a film; the screen contributes nothing to the film, it merely reflects passively what is thrown onto it.

It is, of course, impossible to subscribe nowadays fully to this ancient image theory. But it contains undoubtedly an important element of truth insofar as it implies that the relation between the cognitive attitude of subjectivity and the environment is an asymmetrical or ordered relation in which the environment plays the dominant part. Cognition implies a hierarchy as an ordered relation of matter and form in which the world dictates to the mind what there is and the cognitive system has no choice but to accept the facts and to submit to them. This attitude of submissive Reason, when the latter is faced by the factual state of the world, is so deeply ingrained in us that scientists have always felt outraged by the remark of a famous philosopher who, after being told that his assumed facts were untrue is reported to have said: So much the worse for the facts!

It should be kept in mind that the relation between subject and object is always non-symmetrical and therefore an expression of a hierarchical order, whereas the relations between objects – by rigidly excluding subjectivity – always boil down to symmetry relations. It has frequently been pointed out that the laws of physics are expressions of a symmetry and wherever physicists encounter asymmetries they look for compensating phenomena which will reconstitute the lost symmetry. It can safely be

said that a Universe which is completely devoid of the slightest trace of subjectivity will with regard to structure always be perfectly symmetrical. And the description of such a Universe is the scientific ideal the classic tradition of science has been striving after. It follows that two-valued logic which governs the laws of Nature as a contexture of mere objectivity is based on a symmetrical exchange relation as represented in figure\_3. This abstract structural pattern should not be confused with the classic Table of Position and Negation as is frequently done.



Figure\_4 stands for the negational Table of two-valued logic. Both Tables represent the same structural pattern of a mutual exchange relation, but the crucial difference is that in the first case we have a mere symmetry relation whereas in the second case this symmetry is burdened by a value occupancy of positive and negative. Mapping the relation of positive and negative onto the symmetrical pattern of mutual exchange means that, for the specific case of classic two-valued logic, position and negation should be considered strictly symmetrical and should subjectively be interpretable as the logical antitheses of true and false as written down in figure\_5.

But it should always be kept in mind that the figures\_3, \_4 and \_5 are, epistemologically speaking, not identical. What the figures\_4 and \_5 have in common with figure\_3 is that they all represent symmetrical exchange relations. But the value occupancy of fig.\_4 tells us additionally that, if position and negation are mapped onto figure\_3, then negation will conditionally assume a symmetry relation with position. But only in this specific case! It can be shown – as the present author has done in previous publications – that the relation of position and negation can also be asymmetrically interpreted because it is possible to increase the number of negation's whereas position remains always a solitary value. Figure\_5 then indicates that, if and only if the condition of figure\_4 is accepted, then it will be possible to interpret the relation of positive and negative as the antithesis of True and False.

It was necessary to point out these distinctions between the mere structure of a symmetrical exchange relation and its two aspects of possible value-occupancy to forestall the mistake that, when we continue to speak about mutual exchange relations, we refer to value-occupancies in the sense of fig.\_5, unless we say so expressly.

We shall now return to our discussion of figure\_1 which sketches the basic situation of a single cognitive system in its environment. We shall continue to neglect the fact that there may be other cognitive systems with different centers of subjectivity. It is obvious that any system of reason – no matter whether it operates from the basis of our own or of an alien subjectivity – is not solely describable in terms of ordered relations but that



it must also incorporate exchange relations. And in a cognitive situation we have to look for the latter, not in the environment but within the confines of the cognitive system itself – in its mental (conceptual) space, so to speak. The exchange, in fact, provides the most elementary structural basis for all cognitive processes because it can be occupied by logical values as the Table of Negation in any textbook of elementary logic shows.

Unfortunately not even one of the modern treatises of elementary logic gives any explanation of the ontological significance of the classic Table of Negation. We shall try to fill this gap. Objective Being as a totally subjectless (irreflexive) contexture is one-valued. Nothing can be said about it but that it is. In contrast to it we find that the logic which is expected to map the structure of objective Being is two-valued. The reason for this difference is that mapping is a process and one cannot describe the mental movement and change which such a process involves by a single value. A minimum of two values is necessary. On the other hand, there should not be more than two. Because if, let us say, three values were at our disposal – which means one position and two negations – then the relation between position and negation in general would be an ordered one. Only if we have a position and one single total negation the relation between the two will form a symmetrical exchange. And exactly this is required if we want to provide the opportunity for a process where assertion can be replaced by negation and negation transformed into assertion. If the relation between position and negation were an ordered one, as is the case in many-valued systems, then our logic could not describe the ever changing relation between the various contents of thought. An ordered relation describes what is. Which means that many-valued systems are formalized ontologies and not descriptions of subjective processes of thought or cognition. It is this indifference against the ontological significance of Tables of Negation which renders cyberneticists so helpless when facing systems of many-valued logic, and which has so far prohibited the application of trans-classic logic to computer design. The cognitive mind is a living system only as long as the subjectivity of its reasoning is suspended between the two poles of a symmetrical exchange relation. This relation provides the freedom to err, a freedom which the mere object does not have. And it is the fact that all living subjectivity is cognitively based on the total symmetry between position and negation which makes the connection between cognition and that which is recognized something more than the plain causal nexus which Democritus' theory of knowledge suggests.

But in order to map its environment the subjectivity requires the chance to express also the hierarchical relation between itself and its environment. This is what makes the theory of classic logic (as distinct from a mere logical calculus) so extremely difficult because its symmetry laws mean implicitly much more than they expressly state. What they expressly state is the formal structure of subjectless objectivity mapped in a conceptual space. What they indirectly and latently also imply is the dependency of the cognitive system on its environment. But this relation is only implied and not expressed and, in fact, not positively expressible – in the laws of two-valued logic. Thus we observe a fundamental insufficiency in this logic: it cannot bridge the chasm between form and content. For the classic tradition the relation between form and content or matter appears to be hierarchical. It points to the distinction between subject and object. This tradition tells us that subjectivity is form and objectivity matter. But the image of the world that cognition maps within its mental space does not reflect in its symmetry

structure any essential imbalance between form and matter. Cognition implies subjective or logical symmetry. This is why we have placed a double-headed arrow inside the square of fig. 1 as a symbol of symmetrical exchange. Everything inside the cognitive domain of consciousness – no matter whether intrinsically asymmetrical or not – is pressed into the Procrustean bed of symmetry.

However, a living system finds itself in an additional position relative to its environment, where it behaves not cognitively, but as a volitive mechanism. In the volitive situation the messages sent by the environment and telling the mind that things are so and so (and that the mind should behave accordingly) have become totally irrelevant. Figure\_2 refers to this situation in which a system of subjectivity does not behave cognitively relative to the environment but with subjective volition. This is the point where the issue of Free Will enters our analysis of the relation between subject and object. What we have drawn in fig. 2 has been illustrated in the Middle Ages by an amusing mental experiment usually referred to as the story of Buridan's Ass. John Buridan, once rector of the University at Paris and co-founder of the University of Vienna, argued that, if an ass were placed equidistantly between two bundles of hay of absolutely equal attractiveness and all other conditions to choose either bundle were precisely equal, then according to the theory of determinism the animal would have to starve to death. Because if every event in the world were completely determined by its conditions the ass would be incapable of even moving its head towards the one or the other bundle – let alone to eat from one of them. But common sense and experience tell us that the ass will not starve but start feeding from one or the other hay bundle. The conclusion is that under the given conditions the ass must have freedom of choice. As a living system it cannot be totally determined by its environment. This the animal demonstrates by making a decision of its own. Which means, according to the classic theory of determination, the ass must be capable of acting from lack of objective determination.

It is interesting to know that Buridan himself remained personally undecided between determinism and indeterminism.

The idea of a volitive action of a living system springing from a lack of determination in this physical world is only possible if we accept the ancient tradition that the soul is a citizen of a supernatural world which dwells only temporarily in the physical cosmos and, if it does so, it carries with it its powers of spontaneity which have their roots in those transcendent regions of the spiritual. If we discard this concept, then the idea of a volitive action of a living system which arises from a mere lack of physical determination is inconceivable. If we look at the problem from the cybernetic viewpoint that the Universe is aware of itself, not as a totality in the sense of pan-psychism but aware of itself in certain preferred localities with a highly complex structure, then we may say – without resorting to the idea of supernatural and irrational influences – that the necessity of maintaining the status of a level of complexity, which is higher than that of the environment, will produce events in a system of awareness if a situation occurs in which the structural difference between system and environment is not maintained from the outside. The latter is the case in the situation, which is described in figure 1, where the distinction between the living system and its environment is indeed maintained from the outside. Thus the attitude of a cognitive system is basically contemplative.

On the other hand, in the case of Buridan's Ass the environment presents itself to the living system in the shape of two hay bundles constituting physically a symmetrical exchange relation. In other words: the environment does not provide the volitive system with a directive situation from which the will can take its orders while maintaining at the same time its subjective distinction from the outside world. It must be understood that a symmetrical interchange relation is absolutely neutral in itself relative to the distinction between subject and object. In the cognitive attitude of the subject the exchange relation made possible and triggered a mental movement which resulted in the mapping of the world. But in the case of Buridan's Ass and the two equal hay bundles the existing exchange relation triggers a volitive process which results in a physical act within the realm of objectivity. The ass when facing the two bundles cannot remain in a situation of suspended choice where the outside world does not offer him a bona fide objectivity in form of a thing but feeds him instead an alternative between two things. And since we know that the relation between subjectivity and its environment contains also an element of order it is the animal in this case which has to supply this order by making a choice. If the animal turns from the alternative itself to one of the alternates it establishes an ordered relation between itself and the chosen object relegating the other alternate into the realm of the mere potential which might have been chosen but was not. As long as Buridan's Ass is facing a choice it has not established itself as an autonomous subject versus an objective world because the world as a mere alternative of possibilities has no objectivity either. Only by making a choice and choosing one of the hay bundles the ass identifies what is objective for it and what is relegated to the limbo of a mere potentiality.

At this point an objection has to be taken care of. The classic thinker will insist that both hay bundles are equally real at all times, no matter what the ass decides to do. It would be false to deny the validity of this argument, but it misses the point we are trying to make. The statement that both hay bundles are equally real at all times belongs within the context of our fig.\_1. It is a judgment originated in the system of contemplative reason. And in this system undoubtedly correct. But we are now discussing fig.\_2 because we are analyzing a volitive and not a cognitive relation between a system of subjectivity and its environment. This volition manifests itself in the case of the ass by the fact that it eats from one bundle of hay at a given time and not from the other. The one which is disdained at the given moment remains for the will in the realm of a mere possibility of being eaten. And while it is in this state the will makes no direct contact with it as a representation of objective reality.

The lesson to be learned is that the ontological judgments which govern the cognitive relation of the subject to the world may motivate the volition but they do not control the mechanism of volitive action. The structural reason for this difference lies in the fact that the symmetrical exchange relation which, in the case of figure 1, is a mechanism of reasoning within the conceptual space of subjectivity where it is treated as an alternation of values, is, in the case of figure\_2, projected into the environment where in Buridan's example it turns up as an exchange relation between two objects. Since the alternative is now a property of the environment the mechanism of volitive subjectivity must express itself as an ordering process where we have only the choice between exchange and order. And we repeat: the exchange mechanism is the one which the cognitive subjectivity uses to set itself in motion.

We may now say that a system of subjectivity is a mechanism – albeit not a classic one – in which two interacting programs of cognition and volition regulate its relation to the environment concurrently. In one program the living system has to behave under the supposition that the environment represents the superior force of the *factum brutum* to which reason has to submit; now subjectivity finds itself placed at the bottom rung of a hierarchical ladder as long as the connection between subject and object is cognitive. In the other, the volitive program, the environmental objectivity is merely a nebulous field of potentialities which only the Will can transform to solid objective realities.

Being suspended in this unresolvable duality is the price the Universe has to pay when, as a cosmic synthesis of subject and object, it is aware of itself, with an awareness, however, which is restricted to certain ontologically preferred localities which show a highly complex structure. For classic Reason which looked at a subjectless Universe from a supernatural locus outside the world there was always the idea of the absolute truth that objects had identity *per se* and could be described as such without any regard to the describing subject. It was, of course, admitted that human reason which had strayed into this world by an ontological accident, so to speak, could for practical reasons never produce a totally accurate description of the object. This remained an unattainable ideal, but scientific efforts could at least converge towards it.

For the cybernetic viewpoint which looks at the cosmos as a compound structure of subject and object there is no such absolute truth *per se* and no absolute objectivity conceivable by a cognitive subject. We can only state that the Universe offers to our subjective awareness, split into a cognitive and a volitive sector, two complementary aspects of objectivity which are accessible to us only by hermeneutic methods because the world may either be interpreted as a system which dominates subjectivity after having created it as the last product of evolution and emanation. Or the world may be interpreted as an indifferent and inert substratum of mere potentialities out of which the subject as the font of volitive action produces that which Utopian thinkers of all times have called the realisation of the world as the Realm of Freedom. This second aspect is the one from which such disciplines as the social sciences and the humanities emerge.

Both interpretations are equally valid but equally incomplete – when one is used without the other – to interpret the totality of a Universe endowed with Life. So far these two aspects have been kept carefully separated and there has been much talk about a duality of methods of enquiry (Methodendualismus). However, by using hermeneutic methods it is possible to define a structural link between them on the basis of the thesis that cognition and volition are precisely complementary aspects of subjectivity. Part III of this paper will try to give a first description of the as yet missing link.

### **Part III**

We noticed that the relation of a system to its environment could be twofold and describable in terms of order and exchange. We are entitled to say that the environmental (material) world represents order and subjectivity a lack of order. This is the classic viewpoint where the subject has been traditionally considered the source of all error, unreliability, and even sin. If we translate such terms into a rigorously abstract language we can only say that subjectivity is a symmetrical exchange relation in the state of suspense where it is not yet decided which alternate will be chosen.

Complementary to this viewpoint is the other one which states that subjectivity (as pure form) is the potential source of all order and the environmental world a form- and orderless region of mere potentialities. Again in abstract structural terms: for the complementary viewpoint the environment shows the pattern of an exchange relation and systems of subjectivity display a degree of order and organization which is not to be found in the relations between mere objects.

This leads to the conclusion that the distinction between subject and object, when expressed by an impartial observer in purely logical terms, is nothing but a specific expression for the universal distinction between form and content of a form (materiality). In view of the complementarity between cognition and volition which we have observed it does not matter whether we say: the symmetrical exchange relation is the structural basis of all form and differences in materiality must reflect themselves in ordered relations; or whether we reverse our viewpoint and argue that an exchange relation is akin to material content, because an exchange relation involves the problem of contingency and that order relations always describe structural forms. The first viewpoint simply emphasizes cognition and the second volition. Because if we say that the exchange relation and its symmetry refers to mere form we mean that all formal logic is based on the symmetrical exchange of affirmative position and total (one-valued) negation. But if we reverse our attitude and state that an exchange relation with its implied contingency is akin to the material content we mean – if we stick to Buridan's example – the physical coexistence of the two hay bundles and the choice they offer. And generally speaking we mean that the contexture of subjectless physical objectivity is governed by the law of symmetry.

After having rid ourselves of the prejudice that the relation between form and content constitutes an irreversible order we have arrived at the crucial point where we may consider the theoretical possibility of a calculus which links cognition with volition – or to put it in more abstract terms – which is based on the principal exchangeability of form and the material content of form. This is, within the domain of logic, the very same question which has recently become so extremely important in the eyes of cyberneticists. We refer to the very urgent problem of the relation between the flow of energy and the acquisition of information. It has recently been noted that the use of "bound information" in the Brillouin sense of necessity involves energy. The use of energy, based on considerations of thermodynamic availability, of necessity involves information. Thus information and energy are inextricably interwoven.

If we transfer the terms information and energy to the theory of a system of subjectivity we may confidently replace them by the terms cognition and volition and assert that what is – logically or structurally speaking – valid for the interrelation of information and energy will logically and structurally also be valid for the linkage between cognition and volition. But both complementarities, energy / information on one side and cognition / volition on the other, must be related to each other on an ultimate level of abstraction which defines the relation between symmetrical exchange and non-symmetrical order.

It may be useful at this point to remind the reader that the relation between exchange and order is the formal equivalent of the ontological relation between form and (material) content. But not in the sense – as we must emphasize again – that exchange



stands for form and order for matter or vice versa but in the more involved sense that, if one relation is considered to be the basis for form, then the other is interpretable in terms of contents. However, which, of the two types of relations is interpretable in one or the other way, that always remains a function of a given state of a system of subjectivity relative to its environment. Thus our answer will always be different. It will depend on whether we assume that the state of the system of subjectivity is cognitive or whether we note that it is volitive.

In order to obtain a general formula for the connection between cognition and volition we will have to ask a final question. It is: How could the distinction between form and content be reflected in any sort of logical algorithm if the classic tradition of logic insists that in all logical relations that are used in abstract calculi the division between form and content is absolute? The answer is: we have to introduce an operator (not admissible in classic logic) which exchanges form and content. In order to do so we have to distinguish clearly between three basic concepts. We must not confuse

a relation  
a relationship (the relator)  
the relatum.

The relata are the entities which are connected by a relationship, the relator, and the total of a relationship and the relata forms a relation. The latter consequently includes both, a relator and the relata.

The relationship or the relator can, of course, assume many forms. It can be a negational operator. But the relationship can also be equivalential, conjunctive, disjunctive, transjunctive, or it can assume other logical forms. In arithmetic a plus sign or a symbol for subtraction e.g. are relators. Moreover we do not have to confine ourselves to formal languages – every living universal language contains a countless number of relationships.

These three distinctions between relation, relator, and relatum will enable us to answer the question how the distinction of form and content or, for that matter, between subjectivity and objectivity can be reflected in a specific sort of algorithm.

We assert: The distinction between form and content of form is algorithmically equivalent to the distinction between the relationship (or the relator) on one hand and the individual relatum on the other. Nobody who ever used the term 'subject' could have meant (although he will not have been aware of it) anything else but a relator and when he referred to 'objects' he talked wittingly or unwittingly about relata. However, when somebody used the term 'relation' (which means the relator *and* the relata) he referred unavoidably to a compound situation in which subject and object were inextricably fused. Incidentally, it should be added that the subjectivity involved in a complete relation is always the objective subject and not the subjective subject which generates, in the process of self-reference, an image of itself and in the process of hetero-reference an image of other egos, the Thous. It should now be clear why classic logic cannot handle the problem of subjectivity. A two-valued logic (as far as it is relational at all) deals only with relations, meaning: with a pre-established synthesis between relationship (relator) and relatum. And using such devices as the theory of types or meta-languages it can also use relations as relata. What these traditional

theories never deal with, however, is the theory of the relationship (relator) as related to the relatum. It is of utmost importance that this theory should not be confused with the description of the possible connection between a *relation* and a relatum. This can easily be taken care of by traditional logical devices.

We shall concentrate from now on the trans-classic relation between relator and a relatum. It will facilitate our understanding of this transclassic relation if we refer once more to the ontological problem which lies behind it. It is the peculiar nature of subjectivity in contraposition to objectivity. It is quite senseless – as Fichte has already pointed out in his criticism of Schelling – to speak of an object of an object. An object qua object has no objects, but a subject 'has' objects; which means: it constitutes itself only in its awareness of objectivity. And this objectivity will contain three subcategories of objects: 1) it will have an objective image of itself, 2) it will refer, by way of other images, to the physical things in its environment, and 3) its domain of objectivity will include – as pseudo-objects – other subjects, the Thous, and be aware of them as independent volitional centers, which are relatively objective to its own volitional activity.

This last observation makes us realize that our view of the world as our environment is rather one-sided, and that we may change places at any time with a given Thou which in its turn will act as a system of cognizance and demote us to the position of an observed system of volition within its own contexture of objectivity. In other words: the subjective Ego of cognizance forms with any other Ego it may confront an exchange relation. Or, to speak in the more abstract terms of an algorithm: what is a relationship (which means a relator) may now become a relatum and what was previously the relatum may now be elevated to the position of a relator. There is, however, a marked difference between the symmetrical exchange relation, as for instance implemented in the Table of Negation in two-valued logic, and the exchange of relator and relatum. In the classical exchange relation of symmetry only the two relata change their positions. Expressed formally:

becomes	$R(x, y)$
	$R(y, x)$

This does not materially change anything. However, if we let the relator assume the place of a relatum the exchange is not mutual. The relator may become a relatum, not in the relation for which it formerly established the relationship, but only relative to a relationship of higher order. And vice versa the relatum may become a relator, not within the relation in which it has figured as a relational member or relatum but only relative to relata of lower order. If:

	$R_{i+1}(x_i, y_i)$
is given and the relatum (x or y) becomes a relator, we obtain	$R_i(x_{i-1}, y_{i-1})$

where  $R_i = x_i$  or  $y_i$ . But if the relator becomes a relatum, we obtain

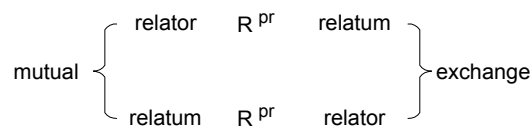
$$R_{i+2}(x_{i+1}, y_{i+1})$$

where  $R_{i+1} = x_{i+1}$  or  $y_{i+1}$ . The subscript  $i$  signifies higher or lower logical orders.

We shall call this connection between relator and relatum the 'proemial' relationship, for it 'pre-faces' the symmetrical exchange relation and the ordered relation and forms, as we shall see, their common basis.[3] Neither exchange nor ordered relation would be conceivable to us unless our subjectivity could establish a relationship between a relator in general and an individual relatum. Thus the proemial relationship provides a deeper foundation of logic as an abstract potential from which the classic relations of symmetrical exchange and proportioned order emerge.

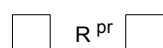
It does so, because the proemial relationship constitutes relation as such; it defines the difference between relation and unity – or, which is the same – between a distinction and what is distinguished, which is again the same as the difference between subject and object.

This author has, in former publications, introduced the distinction between value structures and the kenogrammatic structure of empty places which may or may not have changing value occupancies. The proemial relation belongs to the level of the kenogrammatic structure because it is a mere potential which will become an actual relation only as either symmetrical exchange relation or non-symmetrical ordered relation. It has one thing in common with the classic symmetrical exchange relation, namely, what is a relator may become a relatum and what was a relatum may become a relation. Or, to put it differently: what was a distinction may become something which is distinguished, and what has been distinguished may become a process of distinction. This applies to the mutual position of the subjective subject as the I and the objective subject as the Thou, insofar as what is now I may become a Thou, and what has been the Thou may become the I. And again in another version: what has been a volitive system may become the cognitive system and what has been the cognitive system may turn into a volitive system. Insofar the proemial relation displays the structural properties of exchange; but as we pointed out above, the exchange is not symmetrical. It does *not* have the form



The exchange which the proemial relation ( $R^{Pr}$ ) effects is one between higher and lower relational order. We can, as an example, consider an atom a relation between more elementary particles, the latter assuming then the part of the relata. But we can also say that the atom is a relatum in a more complex order which we call a molecule. Thus an atom is both, relative to the elementary particles it is a relator, but it can exchange this property with the one of a relatum if we consider it within the more comprehensive relationship of a molecule.

Thus the proemial relation represents a peculiar interlocking of exchange and order. If we write it down as a formal expression it should have the following form:



where the two empty squares represent kenograms which can either be filled in such a way that the value occupancy represents a symmetrical exchange relation or in a way that the relation assumes the character of an order.

It should be clear from what has been said that the proemial relationship crosses the distinction between form and matter, it relativizes their difference; what is matter (content) may become form, and what is form may be reduced to the status of mere "materiality". This reminds us of Aristotle's system of development which starts at its basis with the form and shapeless hyle which is as materiality a mere potential which becomes actual reality only by assuming a form. But this form again serves as a mere material potential for a higher form which in its turn assumes the role of the material substratum if it is topped by a new form still higher. And so it goes up the ladder in the exchange of matter and form till the apex of the pyramid is reached where the Aristotelian form of pure form appears. This is what later has been called the *actus purus* or the divinity.

However, the similarity to the Aristotelian concept of the relation of form and matter is superficial. In the metaphysics of Aristotle matter is clearly subordinate – and only subordinate – to form. Because, in order to emerge from mere potentiality into the actual, matter requires the assistance of form. But form, on the other hand, at the apex of the pyramid can support itself after the material component of reality has been fully absorbed into form. According to this scheme the opposite process – where all form melts into materiality – is not possible because form is the absolute superior to matter. In other words: the Aristotelian idea of development conforms only to one of our two figures\_1 and \_2 and therefore excludes what Warren McCulloch has called the "heterarchical" rule.

No wonder that for more than 2000 years a controversy raged whether cognition dominates the will or whether volition is the master of reason. The Aristotelian theory of development which should have answered this question remained ambiguous. It was never clear whether the so-called *actus purus* should be interpreted as reason or will. Only one thing was certain: if one accepted the Aristotelian theory of Development and its interpretation of the mutual relation of Form and Matter, then the relation of the two was definitely one of super- and sub-ordination. And if a philosopher chose to identify cognitive reason with form, then the theorem of the primordial primacy of Reason followed automatically. But if it was assumed that Form was the essence of volition, then the acclaim of primacy shifted from Reason to Will.

We know now enough to say that the Aristotelian viewpoint assuming a fixed hierarchical relation between Form and Matter, thus that Matter is always of lower ontological priority, is no longer acceptable. Especially not in cybernetics. What the proemial relation establishes is a heterarchical connection between Form and Matter and consequently between subject and object and therefore also between volition and cognition. Aristotle did claim that materiality – his hyle – is the sole potential which becomes actual and real only by assuming a form. But the proemial relation implies that we are equally entitled to say that Form is a mere potentiality which must be filled with content in order to become Reality.

Since this paper is devoted to the problem of the mutual relation between cognition and volition some remarks should be added as to how the proemial relationship unites these

two faculties and melts them together in a system of self-referential subjectivity. We stated that the proemial relationship presents itself as an interlocking mechanism of exchange and order. This gave us the opportunity to look at it in a double way. We can either say that proemiality is an exchange founded on order; but since the order is only constituted by the fact that the exchange either transports a relator (as relatum) to a context of higher logical complexities or demotes a relatum to a lower level, we can also define proemiality as an ordered relation on the base of an exchange. If we apply that to the relation which a system of subjectivity has with its environment we may say that cognition and volition are for a subject exchangeable attitudes to establish contact but also keep distance from the world into which it is born. But the exchange is not a direct one. If we switch in the summer from our snow skis to water skis and in the next winter back to snow skis, this is a direct exchange. But the switch in the proemial relationship always involves not two relata but four! Not only two subjective faculties, called cognition and volition, are exchanged, but the order of subject and object also suffers a reversal. What had to be interpreted as subjectivity in the cognitive attitude of the subject, namely the symmetry of position and negation, becomes, in the volitive faculty, a property of the objective world which offers a physical alternative for the will. And where, for the cognitive attitude, the whole Universe is content of the consciousness the volitional act is a content of this very same Universe. In other words: the symmetrical exchange relation between cognition and volition implies a reversal of the non-symmetrical order of subject and object. We have said above that the distinction between subjectivity and objectivity in an algorithm is reflected in the logical difference between relator and relatum. More than 2000 years of Aristotelian scientific tradition will make us inclined to say that the functional character of the relator always represents subjectivity and the argument character of the relatum refers to the object. We may still do so; but we should be aware that with such a semantic characterization we have wittingly or unwittingly implied that we interpret our algorithm as a calculus of cognition. The proemial relationship, on the other hand, permits us to reverse this interpretation and say that the relator stands for objectivity and the relatum should be treated as a subject. This is always the case if a cognitive system goes introspective or self-referential. If we prefer this second interpretation we have implicitly asserted that we consider our algorithm as a calculus of volitional processes. Incidentally, it is also possible to retreat from this hermeneutic attitude and to insist that only one is the case and the other is not. In other words: we do not deal with an ambivalent situation permitting different interpretations, but we are faced with a factual situation that is either correctly recognized or not. If we assume the epistemological attitude we have indirectly stated that our algorithm concerns only a subjectless Universe.

We are not going to analyze any further the difference between stating a fact and hermeneutically interpreting its significance. Instead, we shall devote the concluding part of this essay to a short demonstration of the heterarchical character of the proemial relation.

## **Part IV**

Since the proemial relation concerns the link between relator and relatum it will effect exchange as well as order and make itself felt in the combination of all functors of traditional logic. We shall choose for our demonstration only two functors which are the



most familiar and at the same time the easiest to handle. Furthermore, we shall confine ourselves to an elementary triadic situation, although we stated in Part III that a full display of the character of proemiality requires four basic data: exchange, order, cognition and volition. We shall simplify the situation by reducing the basic factors to three which we shall name exchange, cognition and volition. We can easily do so, for the mutual relations will display some order anyhow. And the order we have in mind is, of course, heterarchy.

Since it is the only aim of this paper to lay open some structural relation in an extremely formal manner we let our three basic data be represented by three values (and it does not matter which value is assigned to which datum because this would again be a hermeneutical affair). For expressing the values in symbols we shall use the first three integers. To simplify matters further we shall use only two variables  $p$  and  $q$ . This will give us an underbalanced pattern of three-valued logic which is, of course, structurally incomplete, because, in order to demonstrate its full complexity, we would have to balance the system by adding a third variable. Our two-valued system of classic logic is always balanced by having two values as well as two variables, because no system of logic can be developed with less than two variables.

As a symbol of negation we shall use a capital  $N$ . And since our three values form, of course, mutual exchange relations the  $N$  will carry corresponding subscripts. For the exchange relation of the values 1 and 2 we shall write  $N_1$  for the subsequent mutual exchange between 2 and 3 our negator will be written  $N_2$ ; there is no need to introduce a special negator for a two-valued system carrying the values 1 and 3 as the total table of negations for a three-valued system shows.

Since a system of negation for any  $m$ -valued logic encompasses all possible permutations between the values, the table of negation for a three-valued structure has the following shape as shown in figure 6 below.

	$N_1$	$N_2$	$N_{2.1}$	$N_{1.2}$	$N_{1.2.1}$	oder	$N_{2.1.2}$
1	2		2	3			3
2	1	3	3	1			
3		2	1	2			1

fig.\_6

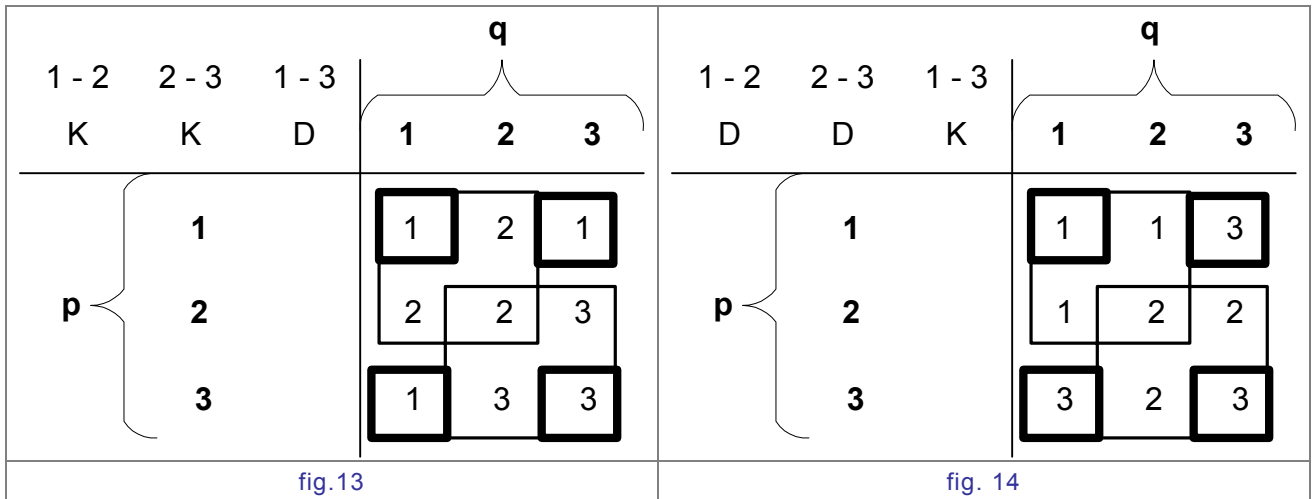
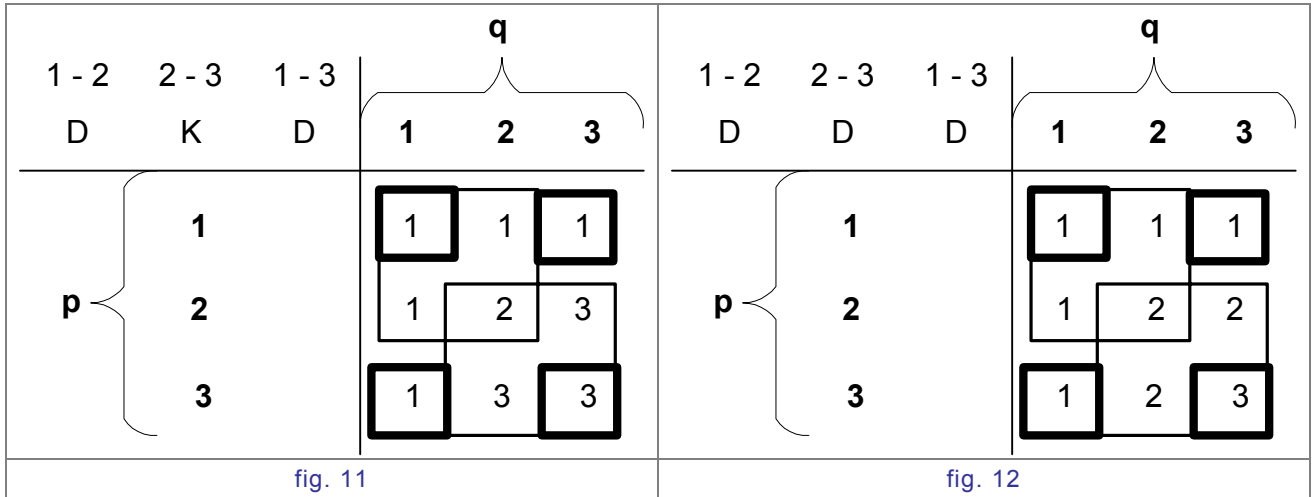
We have separated the classic table of negation involving the values 1 and 2 and operated by the negator  $N_1$  from the other parts of the table by a dotted rectangular line open to the left. And we have again separated the unnegated value sequence 1, 2, and 3 and its two negations by  $N_1$  and  $N_2$  from the second half of the table which contains what we shall call mediated negations, because the negation which establishes the specific configuration of any of the three vertical value sequences is always 'mediated' by the other negational operator. The negational operators of the second half of the table consequently show at least two and finally even three subscripts. They are not immediate negations of the original value sequence 1, 2, 3 but iterated negations. The last of the three mediated negations has been separated from the preceding ones by a dashed fine because it shows peculiar properties not shared by its predecessors.

We shall begin our discussion of the mutual relations between hierarchy and heterarchy as we have promised with the two logical functors which are most familiar to logicians and the easiest to handle. These are conjunction and disjunction. Two-valued logic has not enough structure to distinguish between a hierarchical and a heterarchical aspect of conjunctivity and disjunctivity, but the distinction shows up clearly in a three-valued system. As long as only the two classic values are at our disposal we can only say that the conjunctive functor always prefers one value and the disjunctive one the opposite, provided, of course the two variables  $p$  and  $q$  offer different values.

In a three-valued system, however, there are six hierarchical patterns of preference possible. We can say that – if we declare value 1 to be positive and 2 and 3 being subsequent negations – conjunction will always use, in a three-valued structure, the highest value 3 and 2 only if 3 is not available, provided 3 will be the second choice. Disjunction, on the other hand, will always give preference to the lowest value 1 and only then to 2 if the second preference will be 1. This leads to the following hierarchical tables for conjunction (K) and disjunction (D).

1 - 2 K	2 - 3 K	1 - 3 K	q { 1 2 3 }	1 - 2 K	2 - 3 D	1 - 3 K	q { 1 2 3 }	
p {	1	1	2	3	1	1	2	3
	2	2	2	3	2	2	2	2
	3	3	3	3	3	3	2	3
fig. 7				fig. 8				

1 - 2 D	2 - 3 K	1 - 3 K	q { 1 2 3 }	1 - 2 K	2 - 3 D	1 - 3 D	q { 1 2 3 }	
p {	1	1	1	3	1	1	2	1
	2	1	2	3	2	2	2	2
	3	3	3	3	3	1	2	3
fig. 9				fig. 10				



Figures 7, 8 and 9 belong to the conjunctive group. The following figures 10, 11 and 12 form the disjunctive group.

Our notation shows that we consider a three-valued system a place-value system of three two-valued 'logics' carrying either the values 1 and 2, 2 and 3 or 1 and 3. We have written the corresponding values to which conjunction (K) or disjunction (D) refer as superscripts on top of our functors. In each figure the interlocking of the three two-valued systems is shown by encasing the value choices of the two-valued subsystems in separate squares. For the systems of 1-2 and 2-3 only one square for each value interchange is necessary. These 2 squares, however, overlap in the central value choice of 2. For the mediating system 1-3 four small squares are necessary. Two of them are located in the larger squares because the mediating system shares with one of the other subsystems the value 1 and with the other the value 3. However, in two cases the value choice of the two-valued system 1-3 is independent. In this case we find two of the small squares outside of the larger squares, one in the top right corner and one in the bottom left corner. These six cases exhaust all hierarchical value choices for any combination of conjunction and disjunction. However, we notice that in the possible combinations of K's and D's two arrangements are still missing. They are KKD and DDK as shown in the. Figures 13 and 14.

In these two figures the two-valued subsystems operated by the single negators  $N_1$  and  $N_2$  are both either conjunctive or disjunctive, but the mediative alternative of the values 1 and 3 which is, according to our total table of negations, operated by a compound negator has always the opposite functor. Which means that, if the other two systems are conjunctive, then the mediating negator will be disjunctive and if they are disjunctive then mediation will assume a conjunctive function.

It is obvious that the value choice in these two functions will no longer be hierarchical because we have exhausted all hierarchical orders of preference. They will be heterarchical (or cyclic). In the case of KKD the order of preference is that 3 is preferred to 2 and 2 has preference over 1. the value 1, however, is in its turn preferred to 3 as figure\_15 shows.

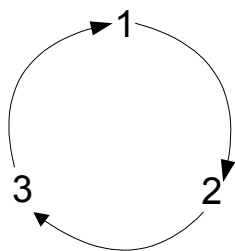


fig. 15

The arrows always point to the preferred number.

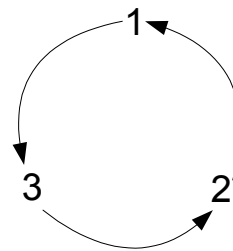


fig. 16

If we turn to the case of DDK (as shown in fig. 16) we notice that the cyclic order of preference is reversed. This time the value 1 has ascendancy over value 2. Value 2 in its turn is preferred to 3. But 3 takes precedence before 1.

It is interesting to know that in analogy to the deMorgan formulas which transform conjunction into disjunction and vice versa by first negating the variables and then negating either the conjunctive or disjunctive connection between  $p$  and  $q$  we can use exactly the same procedure of expressing KDK, DKK, KDD, DKD and DDD by applying our negation table of fig. 6. It turns out then that the two cyclic negations  $N_{2.1\dots}$  and  $N_{1.2\dots}$  do not yield the cyclic functions KKD and DDK. What we obtain instead is KDD and DKD, as the formulas below show:

$$\begin{aligned}
 p \text{ DKK } q &= N_1 ( N_1 p \text{ KKK } N_1 q ) \\
 p \text{ KDK } q &= N_2 ( N_2 p \text{ KKK } N_2 q ) \\
 p \text{ KDD } q &= N_{1.2} ( N_{2.1} p \text{ KKK } N_{2.1} q ) \\
 p \text{ DKD } q &= N_{2.1} ( N_{1.2} p \text{ KKK } N_{1.2} q ) \\
 p \text{ DDD } q &= N_{1.2.1} ( N_{1.2.1} p \text{ KKK } N_{1.2.1} q ) \quad \text{or} \\
 &= N_{2.1.2} ( N_{2.1.2} p \text{ KKK } N_{2.1.2} q )
 \end{aligned}$$

A highly significant feature which should be noted but which will not be interpreted within the scope of this essay is that if we follow the order of the negational operators as indicated in figure\_6 we do not obtain exactly the order of the conjunctive/disjunctive functors which they should have according to their logical strength.

The reason that negated conjunction does not produce the cyclic functors by simple application of the negational system of figure\_6 is obvious. Since the variables are negated by one cyclic negator and the conjunctive relation itself by the other one, the heterarchical order of values cancels itself out and the result is again a hierarchical order. In order to obtain the two cyclic functors, KKD and DDK we have to use a more involved negational process as the two following symbolic expressions show:

$$p \text{ KKD } q = N_{2.1} ( N_{1.2} p \text{ KKK } N_{1.2} q ) \text{ KKK } N_{1.2} ( N_{2.1} p \text{ KKK } N_{2.1} q )$$

and

$$p \text{ DDK } q = N_1 ( N_1 p \text{ KKK } N_1 q ) \text{ DDD } N_2 ( N_2 p \text{ KKK } N_2 q )$$

These formulas demonstrate an interesting relation between hierarchy and heterarchy of values which is easily recognized if we reduce the two preceding formulas to the next two simplified expressions in which all symbols of negation have been omitted.

$$p \text{ KKD } q = ( p \text{ DKD } q ) \text{ KKK } ( p \text{ KDD } q )$$

and

$$p \text{ DDK } q = ( p \text{ DKK } q ) \text{ DDD } ( p \text{ KDK } q )$$

A heterarchical order of values is – as it is now easily to be seen – a peculiar connection between conjunction and disjunction which requires a minimum of three two-valued systems. The order of values is cyclic for the functor when and only when the two values which are not immediate successors are connected by a different functor than the other two subsystems use. If the subsystems with the values 1 and 2 and 2 and 3 are conjunctively connected the connection must be disjunctive for the values 1 and 3 and vice versa in order to obtain a heterarchical relation. This we know already. But what the preceding two formulas show is that purely hierarchical orders of values can be used to produce the cyclic arrangement. It is only necessary to connect, either by total conjunction the two functors which are partly disjunctive (but not cyclical) or by total disjunction the two noncyclic but only partly conjunctive functors.

It was necessary to develop the three-valued tables for the relation of conjunction and disjunction in a three-valued system with hierarchical as well as heterarchical value choice because conjunction and disjunction may serve us as basis for the derivation of the implicative functors. We could, of course, use conjunction and disjunction in order to interpret relations between cognition and volition from a viewpoint which we have not yet touched in our present paper. However, we will refrain from doing so because we will confine ourselves for the rest of our analysis to the elementary patterns of figures\_1 and \_2 where we combined a simple alternative of choice with a hierarchical connection between subject and object. If the subject operated cognitively we interpreted this as a domination of the object (environment) over the subject. And if the subject assumed a dominating role subjectivity had to express itself in a volitional attitude. This corresponds, in formal logic, to the function of implication – where, as we know from classic logic, the positive value implies only itself and the negative value implies itself as well as the positive value.

There is a very simple technical way to derive the value sequence of implication from conjunction and from disjunction. We shall start with a classic two valued conjunction



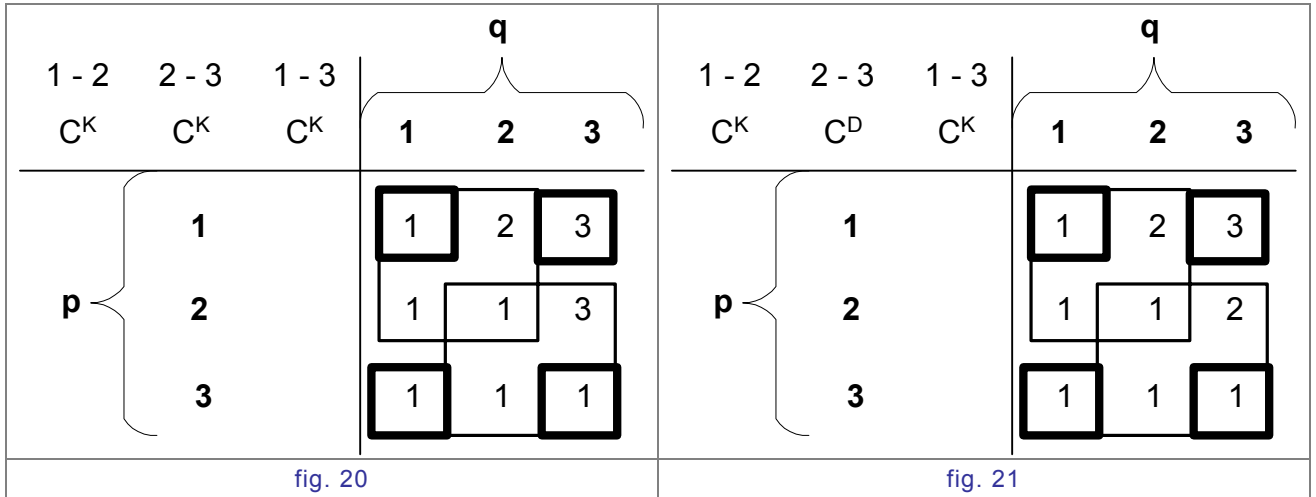
and disjunction as shown (as subsystems 1.2) in figures\_7, \_8, \_10, \_13 for conjunction and figures\_9, \_11, \_12, \_14 for disjunction.

1 - 2 K	q 1 2	1 - 2 D	q 1 2	1 - 2 C <sup>K</sup>	q 1 2	1 - 2 C <sup>D</sup>	q 1 2				
p {	1	1	1	1	1	1	1				
	2	2	1	2	1	1	1				
fig. 17				fig. 18				fig. 19			

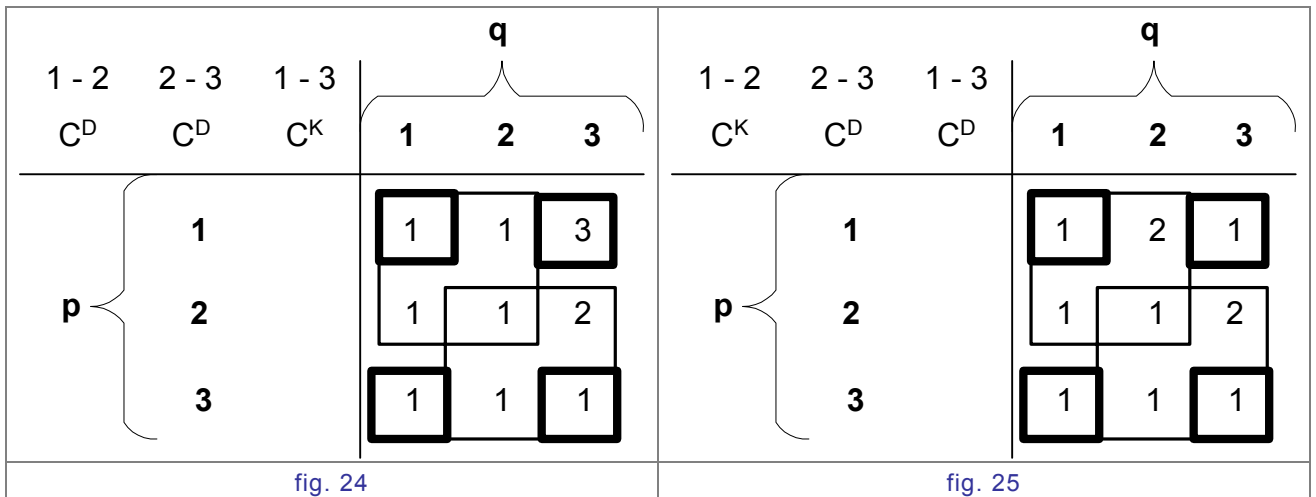
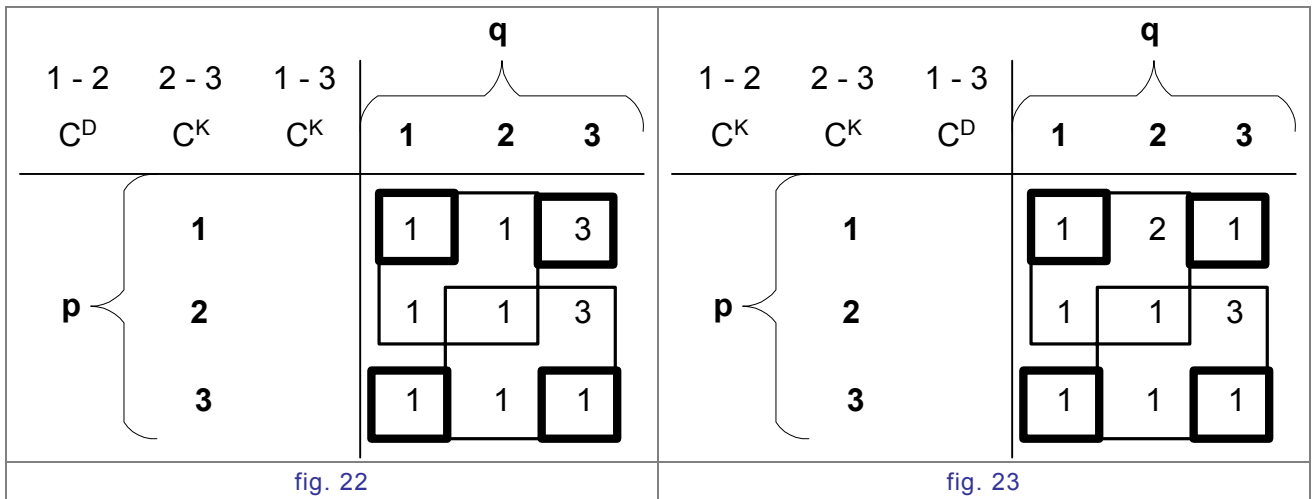
In order to produce implication we always write down value 1 if the variables p and q offer the same value. And we do exactly the same when the value of the first variable (normally p) is higher than that of the second variable. If the value of the first variable is lower, then we retain for the implicative function the value that was shown by the conjunctive or disjunctive functor. This yields, in our case, for implication (C) figures\_18 and \_19.

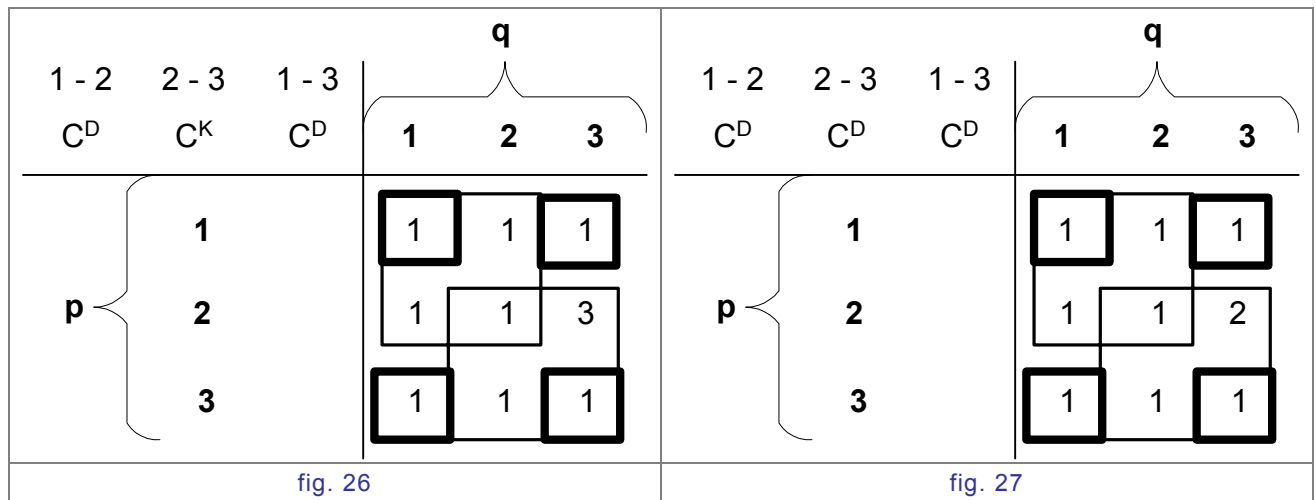
Thus we may distinguish between conjunctive and disjunctive implication. To introduce this distinction into implication seems to be superfluous or even non-sensible in the case of classic logic since figure\_19 shows nothing but positive values. This means that every datum of Reality implies not only itself but everything else. In other words: in the disjunctive implication of two-valued logic a totally subjectless Universe is implied which shows no gradient between objectivity and subjectivity, since the latter is non-existent.

On the other hand: if we proceed to a three-valued logic which corresponds to the minimal concept of a Universe which is a compound structure of objectivity and subjectivity we will not be able to derive even from total disjunction an implication which shows no gradient between position and negation. We shall only discover that there are many implications of different logical strength (where strength is understood in the sense in which Carnap used it in logic and von Foerster in biological computer theory). The strongest implication, will be the one derived from total conjunction (pKKKq) and the weakest will be the one dependent on the functor (pDDDq). The following figures\_20 to \_27 show the three-valued standard implications in the order of decreasing logical strength. We used the term 'standard implication' because a three-valued systems has even more implications which can be derived from functors which are totally or partially transjunctive. However, within the scope of this essay we must ignore the problem of transjunctivity.



Figures\_20, \_21, \_22, \_23 show the conjunctive group of implications (C). If an implication derives its value sequence from conjunction it carries the index K. If the value choice is taken from disjunction the index is D, The following figures 24 to 27 show the value distribution in disjunctive implication starting with the other cyclic value order of figure 24.





When we described the conjunctive and disjunctive functors, we separated them according to whether they showed hierarchical or heterarchical properties; but when we listed the corresponding implications in the figures\_20 to \_27 according to their logical strength we had to insert the two heterarchical implications between the first three which depended on those conjunctive-disjunctive functors which showed at least two subsystems being conjunctive (KKK, KDK and DKK) and those where at least two subsystems displayed disjunctive functors (KDD, DKD and DDD). When we inserted the heterarchical implications between these two groups we placed KKD ahead of DDK because KKD belongs, of course, to the group where conjunction prevails and DDK to the group where disjunction is dominant because, merely from the viewpoint of logical strength, we could as well have reversed their positions since both carry equal logical strength. This distinguishes them from the other six. In the hierarchical group every implication differs in logical strength from any other. The weakest, of course, is derived from total disjunction. But we notice that in contradistinction to two-valued logic the weakest is not one-valued but still carries, at least in one position, the lowest negative value – which means that even in the case of total disjunction a minimum gradient between objectivity and subjectivity is retained. It follows that a three-valued formal structure never refers to a totally subjectless Universe although it must be conceded that the amount of subjectivity which comes into play in a three-valued structure is minimal.

When we introduced figures\_1 and \_2 with the arrow in one case pointing from the environment into subjectivity and in the other case the arrow aiming from the subject towards the environment we explained that this meant that between subject and object there is always a relation of dominance or a gradient of strength which either decreases from the object towards the subject – as shown in figure\_1 – and signifies cognitive attitude on the side of the subject or which decreases from the subject towards the object. And this signifies a volitive attitude of the subject.

The fact that this gradient, when expressed in formal logical terms, boils down to implication and the other fact that we are dealing with implications of different logical strength indicates, ontologically speaking, that the dominance of the object over the cognitive subject and vice versa the dominance of the volitive subject over its environment will be capable of various degrees of strength. We pointed out above that

in empirical reality we will never encounter a purely cognitive or a purely volitive attitude of the subject. Even the most contemplative cognition, in order to exist at all, has to be supported by a modicum of volition. And no volition can come into action, unless it has been triggered by at least a wisp of an image conceived by cognition.

The more, of course, the influence of volition on cognition grows the weaker becomes the dominance of the environment over the subject. And the more "the native hue of resolution is sicklied o'er with the pale cast of thought" the weaker it becomes and the more the environment asserts itself, till the Will, totally hung up in image reflection, is incapable of decision. Thus the circle closes.

It is well known in logic that two inverse implicative gradients added together conjunctively form an equivalence. This is expressed in classic logic by

$$(p \text{ C}^k q) \text{ K } (q \text{ C}^k p) = (p \text{ E } q)$$

The above formula expresses the conventional viewpoint. The equivalence (E) is obtained by reversing the role of p and q as implicator and implicand. But we would achieve the same result if we refrained from reversing the positions of p and q and insisted rather unconventionally that a second type of implication is available to us where the negative value implies only itself and the positive itself as well as the negative. Both implications conjunctively added together would again yield equivalence. The second interpretation is not acceptable in the classic tradition of logic because it runs counter to its epistemological significance where subject and object cannot form a symmetrical exchange relation since classic logic cannot use its negations to describe a system of subjectivity. On account of its isomorphic character negations as well as assertions describe the very same subjectless Universe. But the above considerations throw a significant light on the mutual role of variable and value.

This role is different in many-valued systems and this is the point where the proemial relationship comes into play. Because the distinction between logical value and variable refers in a different form again to the relation between relator and relatum. Equivalence, of course, is a symmetrical exchange and implication an ordered relation – and let us repeat that the proemial relation is a connection between the two which can be interpreted (hermeneutically) as an exchange based on increasing or decreasing order or a fixed order founded on symmetrical exchange. It goes without saying that if we distinguish implicative orders of various logical strength we have automatically at our disposal also a corresponding number of distinctive equivalences with different value characteristics. A calculus of proemial relations which we have described in this paper only in the most abstract terms would, in its concrete development, no longer refer to the vague term 'symmetrical exchange' but would have to state on which of the many possible equivalences the exchange is based and if the proemial relation referred to higher or lower order, it would have to state which implicative strength the order has.

To conclude this analysis let us sum up the direct and the implied results in the following way: We are, for the time being, incapable of designing cybernetic machines which display approximately the traits of subjectivity which the brain – supported by the other parts of the body – produces. when brought in contact with its environment. Even a machine like the Iliac\_IV and other equally complicated or even more advanced designs which may be in the making imitate only the mechanisms of a subjectless

Universe. For the time being more is not possible; for we do not yet possess a theory of subjectivity translatable into a mathematical algorithm. Moreover, this theory of subjectivity can as yet not be developed because we are still under the influence of the age-old controversy regarding the primacy of Reason or Will, resp. of cognition or volition. We know that any system of subjectivity is set in motion by the two interacting programs of cognition and volition. But using exclusively Aristotelian logic in our thinking we cannot rid our-selves of the prejudice that either Reason must be the ultimate guide for the blindness of an otherwise helpless Will or that the power of Will must absolutely dominate the image-making of cognition. We are not yet sufficiently familiar with the insight that the connection between cognition and volition is in its inner core heterarchical and governed by the proemial relation.

One final remark. When in the past philosophy has asked itself whether the very core of the soul is cognition and volition only its subordinate attribute, or whether subjectivity is basically volition with some secondary cognitive capacities, our own analysis suggests that the whole controversy of the primacy of Reason or Will has its origin in an illegitimate metaphysical assumption. Our classic tradition believed that not only bona fide objects but subjects are also positively identifiable. (A significant expression of it is Kant's term "Ich an sich".) The trans-classical logic denies the validity of this assumption. It stipulates that subjects are only negatively identifiable. We shall explain what we mean by seeking an analogy in modern music. The English composer Edward Elgar once wrote a piece which he called "Enigma Variations". In this composition the variations of a theme are given *but the theme itself is not stated*. In our terminology: The theme is not positively identifiable only negatively. Likewise, our theme "subjectivity" is not stated if we speak of the I, the Thou, of cognition or volition. All these terms are only variations of a hidden theme which can never be directly identified.

The Greek classic term of truth is Aletheia which means "that which is not concealed". To seek out that which is not concealed is the self-confessed aim of our classic scientific tradition. Cybernetics, however, will only attain its true stature if it recognizes itself as the science which reaches out for that which is hidden.

## Notes and References

1. The validity of this division is implied in platonic idealism, and it is well compatible with naive ("vulgar") materialism as well. It is incompatible with dialectic materialism.
2. W. St. McCulloch: "Toward Some Circuitry of Ethical Robots or an Observational Science of the Genesis of Social Evolution in the Mind-Like Behavior of Artifacts", *Acta Biotheoretica*, Vol. XI, p. 147-156 (1956).
3. The proemial relationship (Greek: proimion = prelude) is not an original idea of this author. It is implicit in Hegel's dialectic logic. Moreover, it has been correctly described in a long forgotten book by the theologian Karl Heim, *Das Weltbild der Zukunft*, Berlin 1904. Heim calls it: das Grundverhältnis. However, he makes a peculiar use of it. Since he is incapable of conceiving trans-classic logic, he uses this relationship in an attempt to have philosophy totally replaced by theology.

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