

Interface.

The tree has been for long, probably for too long, the model for the structure of progressive disciplines, especially for science. Such progress is conceived to be a discourse which branches out tree-like into ever more narrow specialisations which do not, however, lose contact with the trunk from which they all stem. Such a structure means that the passage from one branch to another is made through the point from which both branch out, that the closeness of two branches can be measured by the number of such point which separates the two, and that the tree-top shows at every stage of growth the stage in which the discipline finds itself. Thus the tree model serves both the purpose of orientation within the discipline, and the purpose of its genetic explanation. It is a synchronical and a diachronical model.

As happens often, there is a complex feed-back between the model and the discipline it models. Originally the tree imposed itself as a model for various not necessarily quite conscious reasons. Among them are (1) the fact that some disciplines, like classical physics in its early stages, does in fact demand the branching out into specialisations. (2) For the romantic mentality the tree with its organical dynamics is a preferential model, and it works well in disciplines which romanticism favors, like biology and etymology, in the form of "genealogical tree". And romanticism continues to be of great importance for all our models. (3) The structure of branching-out is reminiscent of dialectical structure, and the tree taken as a whole, (as an organism which which spreads out into branches and roots), is, with some reserves, a good model for the dialectical process. And for many dialectics structure every real process. (4) The tree as a model sits probably deep in our unconscious, (as the "tree of life"), and such models surface inevitably again and again.

If one applies the tree as a model to cumulative disciplines, (as it happened to science ever since romanticism), the disciplines tend to adapt to the model. A sort of closed circuit is established, by which the process modelled becomes ever better adapted to the model, and therefore the model becomes ever "truer". For science this circuit is established through the present university structure. It is a tree structure which branches out into colleges, chairs and ever more restricted specialisations, and the disciplines thought at universities are forced to follow that structure, thus absorbing it ever better. Scientific structure becomes in fact tree-like.

But there comes a point at which such a circuit becomes of necessity a vicious circle. At that point the model threatens to freeze the process it models. Even if it is a dynamic model like the tree. That processes may be frozen dynamically, that progress is a form of inertia, is a fact which may be observed in many contexts, not only the one under consideration. In science, but also in the arts, in philosophy and similar cumulative disciplines the tree model is now reaching that point of crisis. In fact, one aspect of the crisis of science is the crisis of its tree model. It manifests it-

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self in various ways, for instance as a crisis of methodology in various of the branches of science, and as a crisis of the university structure.

If a point of crisis in the feed-back between model and process model is reached, there are three possible issues: Either the model proves itself to be stronger than the tendencies of the process to escape from it. An example of this alternative is offered by medieval scholastics. The Aristotelian model was so strong that it succeeded to force back some of the tendencies of philosophy to escape from it, and to amputate all others. Thus scholastic philosophy continues to follow the same model as before, and the tendencies eliminated, (modern philosophy and modern science), had to find new structures for themselves. Or the centrifugal tendencies of the process are stronger than the model and destroy it. An example of this alternative is offered by medieval politics. The model of the state, (Platonic Utopia), was abandoned in the face of revolutionary changes in the feudal states, and new models of the state were elaborated. Or else the model succeeds in adapting itself to the tendencies of the process which are opposed to it. An example of this alternative is offered by the economic crisis of '29. The model of a free-market economy adapted itself to the tendencies of capitalist economy to break through it, and the crisis was thus postponed.

The crisis here considered, the one between the tree model and the process of science, must have one of the three issues mentioned. Either the tree model will prevail, and in that case science will freeze into academism. Or the anti-tree tendencies in science will prevail, and in that case science will find a new structure which we can not even suspect yet. Or else the tree structure will adapt itself to present anti-tree tendencies in science.

One of those tendencies is the ever more urgent necessity for an interdisciplinary research. What is called "interface" in some places. This tendency toward interface must be distinguished from a similar one, which in some way also opposes the tree structure, but does so less radically. Namely the tendency toward a crossing of branches. Originally the structure of the tree allows only for continuous spreading of branches. Some branches of science tend to cross, like chemistry and physics. But the tree structure can be adapted to this in at least two ways: it may chop off one branch, (chemistry), by reducing it to the other, (physics), or it may grow a new branch, (physical chemistry). With the tendency toward interface it is not so easy.

In order to see the problem interface poses for the tree structure it is necessary to look at the criteria from which the tree structure orders science. They are the criteria of a more or less hidden ontology: they order science according to what that ontology assumes to be the reality science deals with. The tree branches off at various levels. The first level corresponds to "physical" reality, the second to the "biological" one, the third to the "psychological" one, the fourth to the "sociological" one, the fifth to the

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"deontological" one, and so forth. On the first level there are branches like astronomy which branches again into branches like astrophysics. And the tree is structured in an analogous way on all other levels, (with branches that bridge the various levels, like molecular biology, social psychology and so forth). The tree permits branches which span various levels which do not neighbour, like legal medicine which bridges between the biological and the deontological level. It is a very versatile structure. But it does not allow to order all the disciplines of science.

The criteria of the tree structure of science being ontological ones, (criteria that concern the "object" of research), they cannot operate in the case of formal disciplines, (which do not, by themselves, have any such "object"). Like logics and mathematics. They have no good place in the tree of science. Either one has to consider them to be branches which grow in a way different from all other branches, (which is not at all tree-like). Or else one has to consider them to be "methods of science", not branches. Now such a perturbing element in the structure of science was bearable as long as there were only two disciplines to perturb it. By the way this fact may explain in part the futile attempt to reduce mathematics to logics or logics to mathematics: to reduce the perturbing factors to one. But now the perturbation is becoming ever more unbearable as new formal disciplines are being formulated. For instance informatics, cybernetics, theory of games, theory of decision, and so forth. All those disciplines are related to each other and to logics and mathematics, but not at all like branches are related to a trunk: rather like crossing circles. But there is more to the problem. All those disciplines cross the branches of the tree of science without respect for the level of reality they grow on, and some of them even cross over to other trees, like the tree of the arts, of philosophy, of theology, and so forth. It is in such a context of chaotisation of the tree structure of science that the problem of interface must be stated.

It consists in the fact that there are problems which are best approached by applying both the traditional branches of science and the formal disciplines to them. Such problems in fact do not lie between the branches of science, but do not fit into the tree structure. Let the problem posed by the human brain serve as an example. Of course: several traditional branches of science, like neurology, are competent for it. But so are several formal disciplines like cybernetics and theory of games, (and so forth). Under the first approach the brain is seen as an organ of the body, under the second as a complex system. Under the first approach it is related to phenomena like the liver, under the second to phenomena like a communication system or a computer. But the important point is that the brain can best be approached if both avenues coincide on it: it is an "interface problem". If it is forced into the present structure of science, some of its aspects escape research.

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The problem interface poses can be stated as follows: at the present stage of scientific discourse some disciplines have come about which do not fit into the criteria of the tree structure of science. Therefore it is now possible and necessary to admit that the tree structure does not cover all the problems with which science deals. Some problems, (and their number is growing), can be dealt with best outside that structure. Therefore the tree structure is in a crisis. After what has been said earlier in this paper, that crisis may have one of three issues: (a) Either the tree model will prevail over the tendencies toward interface, and in that case interface will be eliminated from science as being "unscientific". It will then find its own context outside science. (b) Or interface will prevail over the tree model and this will change the structure of science. (c) Or the tree model will be adapted somehow to permit the absorption of interface into the present structure of science. All these alternatives will have important consequences, and merit to be rapidly considered.

(a) The universities are the places where the tree model is most effectively impressed on the structure of science. Interface activities go on in the universities, but they do not fit well. No adequate place is reserved for them either financially or ideologically. The academic establishment tends to distrust them. Should this academic resistance prevail, interface activities will leave the universities and establish themselves elsewhere, for instance in industry or other private and public institutions. Now this will have two consequences: universities will preserve their present structure, (and with them official academic science), and many previously scientific activities will go on outside official science. These activities will necessarily tend to overlap into other disciplines like the arts and philosophy, and in the end will find their own and new structure. This is a situation not dissimilar from the one that prevailed in the late Middle Ages: academisation of scholasticism, elimination of specific activities from it, and the coming about of modern science and philosophy. In that case interface activities would be analogous to the experimental activities of certain late medieval alchemists and artists. They would herald a new epoch.

(b) On the other hand it is possible that the interface activities now going on in the universities will establish themselves firmly in those places. Especially in the United States, where they already have a firm foothold, (for instance "Art-Science Interface" at Columbia University Teachers College, futurological studies at Farleigh Dickinson University, or Media Study at NYC at Buffalo). Should this happen, the university structure will fall apart sooner or later. Not only because such activities require a collaboration of teachers and student from many branches of science which are unrelated in the tree structure. But more important, because they

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require the collaboration of non-academic persons like artists, politicians, industrialists and media operators. If the university structure falls apart under such pressure, (and no doubt also under the pressure of some other tendencies like student revolts and new teaching media), the structure of the scientific disciplines taught there will change. It is too early to try and guess what sort of new structure will evolve, but no doubt it will be more open than the present tree structure. What is now considered to be art will very probably come under the heading of science. In that case interface activities will have played an important role in the reshaping of science, in the search for a new model for science. Given the place of science on our scene, the consequences of this cannot be ~~und~~ overestimated.

(c) But one can also observe a tendency on the part of universities to co-opt interface activities, officialize them and thus render them less academically offensive. Outlandish academic titles like "poet in residence" point at that direction. This is a method to preserve present university structure and still allow some sort of interface research at its dubious fringes. Should this prevail, scientific structure would remain more or less as it is, but an aura of quasi-scientific activities would go on around it which would be more or less tolerated. In this case the present crisis of the tree structure of science would be postponed, but probably not for a very long time. It would re-emerge later even more violently.

The argument of the present paper may be resumed as follows: We have a more or less vague concept of "science", namely a number of cumulative disciplines related to each other as are the branches of a tree. This concept is vague, because it has never been easy to order all the disciplines which claim to be scientific into such a structure. One of the reasons why it is so problematic to try and define "science". But at present our tree concept of science no longer works well. Interface is an important example of why not. Therefore one of three things will happen. Either we shall insist on our present concept of science. In that case science will become academically frozen, and the vital interest of society will shift toward those tendencies which escape that academism. Or we shall elaborate a new concept of science, and this will have important consequences for the future. Or else we shall modify our concept of science, but preserve its essence. In that case we shall have avoided to face a very important problem of the present and it will re-emerge in the future. In any case we must not take the present crisis of university structure to be a problem of teaching: it is an aspect of the crisis of scientific structure.

There are numerous points of view with regard to that crisis. Here the point of view of theory of communication has been assumed. It shows the crisis to be one of feed-back between tree model and scientific discourse.

A point which should not be forgotten, if science is in question.