Mystic Modern Science?
Sociological Reflections on the Strange Survival of the Occult within the Rational Mechanistic World View

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Mystik in der modernen Wissenschaft?
Soziologische Reflexionen über das merkwürdige Fortleben des Okkultischen innerhalb des rational-mechanistischen Weltbildes


A b s t r a c t: The sociology of science has so far mainly been dealing with the question of the emergence of the “new” in the so-called scientific revolutions. Here we are concerned with the opposite question of the persistence of the “old” through processes of scientific change. An important example is the transition of basic concepts of the Hermetic world view into those of the modern rational mechanistic one since the sixteenth century. An examination of this development suggests that, in addition to “new” ideas, “old” ones are re-interpreted and thus substantially retained.

For the maggot the cheese is the great mysterium.

Paracelsus

A. Metastuctural Implication of the Structure of Scientific Development

In the field of the sociology of science the variety of factors contributing to the emergence and development of modern science is a widely discussed topic. One of the issues of this debate was and is the question about the preceding intellectual origins of modern science’s world view. These origins have always been studied in terms of astronomy and physics which resulted in a one-sided, too narrow view on the essentials of natural science. At least in equal parts modern science was also based on preceding conceptions of biology and medicine. These conceptions are closely connected with the Hermetic doctrines, a mystical occult tradition during the European Renaissance. While astronomy and physics were mainly related to the Aristotelian tradition, the Hermetic philosophy was explicitly anti-Aristotelian. It was based on similar philosophical orientations in the late phase of the Egyptian antiquity.

This essay wants to be a first step to close this gap in the current sociology of science. Besides this there is another objective. Under the influence of THOMAS S. KUHN’s The Structure of Scientific Revolutions and his later writings the main interest of historians and philosophers of science has chiefly been focused on the emergence of the “new” in the so-called scientific revolutions. Yet little attention has so far paid to the complementary sociological question of the continuance of the past, the transition of older presuppositions from one paradigmatic tradition to its followers. Accordingly there is a gap between our knowledge of KUHN’s phases of “normal science” and those of “scientific revolutions”. To clarify what we are trying to deal with it has to be said that the title of KUHN’s The Structure of Scientific Revolutions is misleading. For what he describes is above all the structure of the long-term development of science, characterized by alternating episodes of normal science and scientific revolutions. Here we want to look at the structure of a singular scientific revolution itself, i.e. the structural connection of the emergence of a new paradigm in the presence of a declining but still dominating old one.

1 quoted from PACTER (1961: 178)
Let us further illustrate this gap between what is known about "normal science" and "scientific revolutions" by trying to picture the fundamental structural assumptions of both notions.

Scientific work during phases of normal activities, characterized by one dominating paradigm, consists merely of two different tasks: the elaboration of the basic paradigmatic ideas (a) to more specific and detailed statements and (b) to cover more and more exceptional cases. The resulting structure of normal science may thus be illustrated like this:

**FIGURE 1**

![](image1)

A figure well enough known as illustration of the structure of very diverse theoretical systems in quite different disciplines. The fact that we are indeed able to impose this simple triangulate structure on KUHN's notion of normal science makes clear how familiar this idea is for us and how much we seem to know about it.

Let us attempt to search for a similar illustration of scientific revolutions. First of all it seems that a temporal dimension has to be introduced because the process of generating and articulating a new, revolutionary paradigm, its competition with its forerunners and its acceptance as the new, and only valid one, is stretched over a certain period of time. (The normal phases of science are also obviously processes through time, but the temporal dimension is of less interest as in the case of scientific revolutions.) Would therefore a triangle rotated at a right angle be adequate?

**FIGURE 3**

![Triangle](image2)

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2 The following sources are selected; their purpose is merely to indicate, across very different fields and standpoints, the large diversity in the use of a stereotyped triangle (contin. p. 253):
This is of course an illustration of a theory of the evolution of science, namely that of the conception of continuous growth of knowledge, with new realizations derived from common knowledge already existing: for KUHN typical of a normal science. However, scientific revolutions are characterized as breaks or ruptures in the overall development of science, interrupting its smooth evolution through introducing essentially new ideas which don’t fit into the paradigmatic triangle shown above.

The event of a scientific revolution could therefore be perhaps better illustrated as:

FIGURE 4

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and the overall process of scientific development following as:

FIGURE 5

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<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note 2, contin.

ALMAR NAESS (1921): Zur Theorie der Tiraden im dreidimensionalen Raum, Kristiana, passim.

In fact, this attempt, too, is unsatisfactory as we still cannot be sure about some of its essential features such as, for example, the position of the initial width of the new paradigm in relation to that of the ending old one. And what happens during the gaps?

These difficulties in drawing a picture representing the process of scientific revolutions make clear how little is known about its structure and especially about the structure of the connection of two succeeding paradigms. Of course it may be doubted that there is any structured connection between two paradigms to be found at all. This seems to be the underlying suggestion of KUHN.

Note 2, contin.

However, the investigation of the survival of Hermetic presuppositions in modern science shows that this is not the whole truth. Another, similarly illuminating, example which further clarifies this issue is the unfortunately still little known monograph "Entstehung und Entwicklung einer wissenschaftlichen Tatsache" (Emergence and Development of a Scientific Fact) by LUDWIK FLECK. In a penetrating way FLECK, a Polish physician, reveals the impact of medieval medical conceptions on the emergence of the modern aetiology of syphilis and the finding of a chemical reaction for its diagnosis, the WASSERMANN reaction, in the first years of the 20th century: A number of presuppositions of medieval medicine percolated into the new scientific conception.

A retropective reflection on the intellectual bases of a paradigmatic doctrine seems

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3 The diffusion of this triangular structure of analysis is even wider than the examples in footnote 2 suggest. To appreciate this larger application we have only to recognize that any form of a cross-classification schema is only a special case of the triangulate presentation.

To illustrate this:
The two-by-two table

<table>
<thead>
<tr>
<th>method</th>
<th>substance</th>
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<tbody>
<tr>
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<tr>
<td>static</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>dynamic</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>d</td>
</tr>
</tbody>
</table>

may be written as:

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FIGURE 6

FIGURE 7

contin. p. 255
promising, both in FLECK’s analysis of medieval science as well as in the following pages which are concerned with the presuppositions of modern science: They help to reveal some general features of the structure of revolutionary breaks in science.

B. The Egyptian Hermetics

The term “Hermetics” was originally assigned to the followers of “Hermes Trismegistos”, the Egyptian God of magic and alchemy of the late antiquity. Their conception of the Genesis, as found in the texts ascribed to them, are insofar comparable to the Mosaic Genesis as it is based on a similar sequence: Creation - Fall - Regeneration. However, according to the Hermetic conception, in the beginning and at the end of this process man is on the same level as the divinity (YATES 1968): After the creation of light and elements of nature the seven Governors, respectively the seven planets on which the rest of the world is dependent, were brought into being. “Then followed the creation of man who when he saw the creation which the demiurge had fashioned ... wished also to produce a work, and permission to do this was given him by the Father. Having thus entered into the demiurge sphere in which he had full power, the Governors fell in love with man, and each gave to him a part of their rule...’” (YATES 1968: 257).

Through a Fall man lost his dignity, which was won by the equalization with the governor of the world. Thereupon the aim of man was the recapture of this dignity: He shall again rule nature, together with the governors. However, then he won’t be man any more - but rather “magus” (magician) again, within the universe, able to reign nature by magical-religious cults.

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4 The fact that this monograph is still unknown, although it anticipates many of KUHN’s ideas (and is mentioned by KUHN himself in the preface to The Structure of Scientific Revolutions, p. vii/viii), is certainly not due to its unobtainability. Published originally by Benno Schwabe & Co., Basel 1935, a new edition with W. BALDAMUS, F. ROTSCUH and W.Ch. ZIMMERLI as editors is now being prepared. At the same time an English translation edited by T.J. TRENN and ROBERT K. MERTON has been announced (MERTON 1977). At least the following libraries have copies of FLECK’s book in their stocks:

UK: British Museum (08466.g.86).
USA: Princeton University, University of California, University of Illinois, University of Kansas, John Crerar Library of Chicago, University of Chicago.
Poland: Polish Academy of Sciences, Institute for Philosophy.
Austria: Nationalbibliothek Wien, Universitätsbibliothek Wien.
Switzerland: Landesbibliothek Bern, Universitätsbibliothek Basel.

(We are indebted to ULRIKE LAUGWITZ, Köln, and WILLIAM M. EVAN, Philadelphia, for having located these copies.)

A number of important pieces of FLECK’s book are quoted in English translation in W. BALDAMUS (1977).

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Note 3, contd.

Here, evidently, the “method” versus “substance” principle is given a bigger value than that of “static” versus “dynamic”. Placed in the reverse order the result of this evaluation would be:

**FIGURE 8**

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  static
    /    \
  /      \\  dynamic
    /      \
  /        \\method
    /          \\substance
  /            \\method
/              \\substance
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Hence the use of the cross-classification model is a means to escape the compulsion to evaluate competing principles. Incidentally, this explains the relative dullness of cross-classifications compared with the triangulate method: It shuns the perils of value-commitment.
This development towards magus is only possible if man gains once more the knowledge about the now still mysterious powers of nature which he lost in the Fall. The Hermetic thinkers regarded all spheres of nature as characterized by mysterious forces - by the sympathies and antipathies between things. These forces are ruled by the stars (which correspond to the seven governors) and determine along a hierarchy from the angels to the minerals the features of all entities. Whoever knows these mysteries of nature may use them to his benefit: He is able to realize by certain acts desired results. He uses nature's forces and thus reigns over them.

Therefore the cognitive interests desired by the Hermetic scholars are focused on "knowledge for immediate personal gain, whether by attaining knowledge of the future (astrology), or creating fabulous wealth (alchemy), or conferring mastery of nature and ensuring salvation in the after-life (magic and the occult sciences)" (RATTANSI 1972: 5).

This is completely contrary to the Aristotelian ideal of "desinterested knowledge". The Hermetic writings emerge in demarcation from the Aristotelian philosophy. This also becomes evident in a second respect: ARISTOTLE's aim was to find "first principles" of all entities. This was impossible for the Hermetics: To understand nature's powers knowledge about "mirabilia" (wonders), particular things and extraordinary properties has to be collected.

The priest-hood is of special importance in the framework of this conception: The priests are those who are, because of their already established wisdom, able to comprehend the knowledge of the stars and to make use of it. They will be the first magi who rule over nature by magical religious cults.

C. Hermetic Thought in European Renaissance

1. Motives for the Resumption of Hermetic Ideas

In the Mediterranean and transalpine countries Hermetic ideas were resumed again in the late 15th and 16th century. As in the late antiquity they served to undermine the dominant Aristotelian scholasticism.

According to RATTANSI one of the essential reasons for this development was the crucial increase of the secular sphere which had to be legitimized. Above all this is true for the Italian cities where for the first time the clerical monopoly of the intellectual field was broken. It is there a strong practical orientation hostile to the Aristotelian "contemplative rationalism" arose. Subjects as grammar, rhetoric, history, poetry and moral philosophy became dominant features of education; dialectic logic and natural philosophy were no longer of interest.

Different lay-movements spread in the North of Europe counselling emotional instead of learned religiosity. In the 16th century a number of economic, social and religious processes shook the former intellectual forces and caused an intellectual reorientation: The war of religion in France destroyed the illusion of the perfection of Christian belief, the reformation shattered the belief in the unity of Christendom. The discovery of new countries necessitated giving up the idea of Europe as a model of Christian society. At the same time the humanists rediscovered new spheres of classical thought, whereby the few former known ancients were challenged. In addition these have been questioned completely, as already mentioned above.

RATTANSI recognizes two different responses to these tensions: Firstly there were efforts to reconstruct Aristotelian scholasticism to enable it to meet the challenges. LUTHER and MELANCHTON are mentioned by RATTANSI as representatives of this trend in addition to certain Italian universities. The second type of reaction was the attempt to return to Hermetic thoughts in order "to release anxiety and confer at least the illusion of control when traditional modes of dealing with the world seemed to be breaking down" (RATTANSI 1972: 8). This mainly by attempting to reestablish the "importance and dignity of man in the universe".

2. The Hermetics of the Renaissance

The first prominent representatives of the new Hermetics were the two Florentines MARSILIO
FICINO and his pupil PICO DELLA MIRANDOLA (1464 - 1493).

PICO sees man's dignity residing in man as magus (RATTANSKI 1972: 9f): This magus has the ability to "act in cosmos". He can achieve this on account of his knowledge about the powers of the stars and the secret natural forces of sympathy and antipathy emerging from them. He is thus able to use nature's forces to dominate them. His deeds contribute to the benefit of himself and of his friends.

To be able to become magus the mysterious forces and powers of nature have to be explored by man. It was assumed that they have been hidden in the old myths and in cabbala5. This is the reason why the Hermetic scholars of Renaissance were very deeply interested in secret and mystical doctrines.

The influence of Christendom may be clearly recognized in PICO's concepts: Through the occupation with the strange mysteries of nature "(it) rouses him (man) to the admiration of God's work, which is the most certain condition of a willing faith, hope and love ..." (RATTANSKI 1972: 10).

In that perspective Hermetic scholars of the Renaissance developed quite similar conceptions to those evident in the late phase of the Egyptian antiquity: Through the revelation of nature's secret forces man hopes to transform himself into a divine entity to be able to control nature to his benefit. These doctrines have a strong influence on arts and culture of Renaissance in the North-West of Europe. It is not only architects, artists and sculptures who endeavour to find through the beauty and harmony of their arts divine archetypes. At the same time, the equivalent of what we would today call "technology" persuaded a similar aim in trying to make "discoveries in secret matters" by means of new mechanical inventions. Their objective was in fact the construction of a "machine of the world", comparable to divinity.

AGrippa (1486-1535), in taking over and developing FICIONE's and PICO's ideas, distinguishes three different types of magic which would be used by magus in the three different worlds (YATES 1968:258f):

- In the elemental world - the realm of natural magic - the forces are influenced through the manipulation of the occult sympathies.

- In the "middle" celestial world of the stars mathematical magic rules. It makes use of natural philosophy, mathematics and the "middle" sciences as arithmetics, music, geometry, optics, astronomy and mechanics and creates thereby "marvelous things".

- In the supercelestial world religious magic rules through religious rituals.

The Hermetic thinkers sought progress in all of these spheres of knowledge. They supported therefore also strongly the development of the middle sciences mentioned above, which subsequently reached their heydays later in the 17th century. This also is entirely parallel to the developments in Egypt of the late phase of antiquity, where through the help of new technological knowledge the construction of statues able to move and speak was attempted. The aim has thus always been - in Egypt as in the Renaissance - the construction of divine images to explore thereby the mysterious, hidden knowledge about nature's forces.

No fundamental differences were made between what today we call the exact sciences and mythical doctrines. All disciplines served to the same end, to reveal the mysteries of nature.

The Hermetic thoughts have been importantly further developed by PARACELSUS (1494-1541): He regarded the visible world as no more than a veil around the "invisible world of active power" (RATTANSKI 1972:10). He imagined that all power of the world emerge from one "fount of power", from where force is continuous-

5 Cabbala is "a secret traditional lore, theological, metaphysical, and magical, of Jewish rabbis, who read hidden meanings into the Bible" (Chambers Twentieth Century Dictionary, Chambers Ltd., 1977).
ly infused into all things. Because all entities are fed by the same spiritual force, PARACELSUS concludes furthermore that all entities were also built up in a similar way. They contain as constituents all things in heaven and earth.

In order to gain knowledge about the macrocosm of the universe it is thus sufficient to analyze e.g. the microcosm man. From the constitution of the universe one can infer the constitution of man because both are made up of all things in heaven and earth.

The only important thing is to recognize the equivalents of the constituents embodied in the microcosm and in the macrocosm. This is possible through the examination of the "attracting sympathies". The forces of sympathy rule between the representatives of the same substance in microcosm and in macrocosm.

PARACELSUS regards the universe as being a "chaos" (KAYSER 1921:350), interminably diversified. He, as the classical Hermetic thinkers - objected therefore strongly to any attempt to develope through logic and reason basic principles of nature. Accordingly nature can only be comprehended through the observation of the processes in it: Knowledge emerges from "the union with the object" through experience. This notion of the "union with nature" depends also on the idea of a uniform fount of force for all things, and their homogeneous constitution of all existing substances. A thing of nature is explored "through an act of sympathetic attraction between an object and its inner representation in man's own constitution" (RATTANSI 1972:10).

Nature shows itself thus on the one hand in an interminability of diversity. Therefore man cannot perceive it through the development of abstract principles. But on the other hand man does not manifest a specific human nature: In man as a microcosm the entire diversity of the universe is represented. He gains knowledge of the nature therefore only through its exact observation. Because he gains thereby simultaneously knowledge about the universe, if he recognizes the forces of sympathy between the corresponding parts in microcosm and in macrocosm, the observation of nature on a relatively low level is sufficient for him. This conception of the nature is a basic constituent of the writings of all Hermetic scholars of the Renaissance.

The thought of PARACELSUS, as so far described, constitutes a further development of the former Hermetic conceptions concerning the procedures of increasing the knowledge about the "secret forces" of nature. Moreover, PARACELSUS gives the Hermetic conception of the aim of man's efforts a new shape, by combining them clearly with social-Christian ends: For PARACELSUS, God pursues two aims in creation. On the one hand everything shall be revealed, nothing shall remain hidden. On the other hand all uncompleted shall be completed. Mankind serves both ends: the first, predominantly through his making new discoveries and intentions, and the second through alchemy. At the end of this task mankind enters the paradise "in which nothing would remain hidden and art and sciences would attain their greatest perfection" (RATTANSI 1972:12). PARACELSUS was convinced that the paradise was imminent where all misery and suffering of mankind would be overcome.

PARACELSUS's development of the Hermetic thoughts becomes intelligible within this objective: While PICO still believed that the magi use their possibilities of acting to the benefit of themselves and that of their friends, for PARACELSUS the most important purpose of advancing knowledge is to overcome the suffering of the whole of mankind. Throughout his life, PARACELSUS as a physician devoted himself to this aim.

PARACELSUS's conceptions influenced the intellectual development of Europe to an important extent: The interest of the Hermetic scholars turned from the arts more towards alchemy and medicine (cf. YATES 1968).

3. The reception of Paracelsus's ideas in England

During the Elizabethan era up to the middle of the 17th century PARACELSUS' ideas exerted a strong influence in England. RATTANSI (1963) quotes the common crises and uncertainties in the religious and political areas at this time as its most important social reasons.
The Hermetic idea, which was to seek a "supernatural illumination", permitted the questioning of the established order in State and Church and the legitimation of its elimination. All traditional authorities were undermined by this belief of men to be able to gain the illumination of the Holy Ghost.

The apothecaries, for example (RATTANSI 1963), used Hermetic arguments in such a way so as to free themselves from their control by the "College of Physicians", a kind of guild organisation of physicians: The large increase of London's population in the first half of the 17th century caused a large raise in the demand for medical care. The "College of Physicians", because of its traditional structure, was not able to license more physicians, and therefore could not meet these needs. Yet at the same time, the members did not want to give up their dominant position over the quickly increasing number of apothecaries. Hermetic arguments helped the apothecaries to justify their therapies, furthermore they attacked the competence of the "orthodox physicians".

In a similar way Hermetic thoughts served to promote and justify the reform of universities. The reformers aimed at the replacement of scholasticism, which they thought was the only taught doctrine.

These examples show that Hermetic thoughts were of a strong influence during the lifetime of FRANCIS BACON (1561 - 1626) and even beyond.

D. The Impact of the Hermetic Ideas on the Development of Modern Science

Historians of science such as RATTANSI, YATES, ROSSI, DEBUS and WESTFALL attempted to provide a new interpretation of the intellectual origins of the modern sciences. They pointed out that a number of men who were usually regarded as having elaborated the basis for modern science in turning away from former religious-philosophical conceptions, had absorbed Hermetic principles and ideals in their philosophies. This legacy of Hermetic ideas was especially explored in the work of FRANCIS BACON (1561-1626) who developed his conceptions in opposition to both the Aristotelian doctrine and the Hermetic mystical tradition.

1. The Hermetic Influence on Francis Bacon

According to BACON, the study of nature serves both for the glory of God and the benefit of mankind. Through the Fall man lost his dominion over nature and its creatures. For BACON, the recovery of this power is identical with the glorification of God to the benefit of mankind, and will only be possible through gaining knowledge of nature. Aristotelian scholasticism would not have served this purpose at all: For BACON it is entirely out of the question to attempt to comprehend nature through deduction from a few, basic principles. BACON regarded this "arrogance of ARISTOTLE's logical method" as a "second Fall". To gain knowledge is according to him only possible through the "humble, industrious, painstaking and exact observation" and investigation of nature.

RATTANSI argues that BACON adopted this conception from PARACELSUS without much modification. Indeed, the close parallels of BACON's conceptions to those of the Hermetics are striking: A mankind which has lost its knowledge about nature through the Fall seeks to reestablish its control over nature through the attempt to regain this knowledge. They both agree, too, in their rejection of Aristotelian scholasticism as being incapable of contributing to this end (cf. RATTANSI 1972).

However, ROSSI points out that for BACON the aim of human effort was no longer the divine dominion over nature - man as magus on one level with divinity. Man shall rather dispose of nature by being able to use and manipulate its laws through the knowledge of them (ROSSI 1969: 18 f. and YATES 1968: 266). BACON assigns man though not the role of a magus but the one of a "servant and interpreter" of nature. But with this modification BACON by no means breaks with the Hermetic framework. Already AGGRIPPA has developed a concept similar to this: The magi do not serve to suppress nature but should be its servants. They help to reveal the miracles produced by the force of nature.
Hence Bacon no longer aims at man’s development into a magician who operates in collaboration with the divinity, but only at man’s knowledge and utilisation of nature’s forces. Bacon regarded this as the expression of highest religious conviction - mankind plays even in paradise, in comparison with God, a minor role. Bacon demands therefore a strict distinction between religious and secular knowledge. For “from this unholy mixture of things human and divine there arises not only a fantastic philosophy but also a heretical religion” (Rattansi 1972: 13). With this Bacon turns clearly against the Hermetic tradition.

In Rattansi’s view the social reasons for this strict distinction between secular and religious areas are to be interpreted as reaction against the threat to the authority in Church and State caused by the Hermetic tradition (1963 and 1972:14). “Bacon reflected a widespread conviction that the restoration of stability and order was necessary no less in intellectual matters than in social, political, and religious spheres where a century of swift change had brought about a series of crises. Authority had to be re-established in the arts and sciences by defining once again the relation between the recognised sources of valid knowledge” (Rattansi 1972:15).

But the rejection of the Hermetic opposition of all traditional authority reached its full effect only after Bacon’s death, when in the middle of the 17th century a religious civil war was raging in England. It became manifest in the flood of polemics against Paracelsus from 1650 onwards (Rattansi 1963).

Bacon also denies Paracelsus’s assumption that the entire diversity of the world is present in all beings through representative constituents (Rattansi 1972: 16). However, he does not relinquish this conception altogether, because he, too, assumes that there is contained in all substances side by side with the physical components a uniform spirit or spiritual body. It is this spirit which gives life to the substances, and in the last analysis it derives from God (Rossi 1969:13).

Although Bacon thereby takes up Paracelsus’s idea of a “uniform fount of all power”, the distinction between the physical constituents of all entities and the life infused into them from God through the spirit corresponds to his strict distinction between religious and secular knowledge. (Contrarily Paracelsus made his distinction between the invisible world of forces and the visible world covering the former on a qualitatively different level.)

It is therefore entirely impossible for him to “enter” through magic occults into nature, in order to gain on this way knowledge of nature. Man can succeed in this only through exact observations conducted carefully and systematically - on a secular-physical level, as it were.

Bacon elaborated these conceptions in his proposition for the “advancement of learning”: “Traditional learning must be replaced by the cult of nature so as to reestablish the contact between man and reality; collections of facts are a means of study, an instrument for scientific research and not objects of pleasure and curiosity” (Rossi 1969:9). This is also an expression of his rejection of the possibility of increasing knowledge through “illumination”. Scientific effort can’t be anything but a continuous, extensive collection of observations. This has moreover to be conducted in a “humble” way, which is to say that new discoveries can’t be the result of individual efforts but only of the cooperative communication of all scientists (Yates 1968:266). To enable this cooperation, Bacon fought vehemently for the establishment of scientific institutions, though without success during his life-time. With these conceptions Bacon separates himself distinctly from the Hermetic tradition. He associated with it “secret-mongering” on the basis of pagan myths (Rattansi 1972:17).

Bacon rejected all logical-deductive methods of gaining general knowledge. In this he agreed with the Hermetic authors. For him the inductive method, trying to find general statements emanating from individual phenomena, was the only valid and possible one. Therefore he objected for example to mathematics as a basis of modern science. On the other hand he criticized sharply all mystical methods of the Hermetics whom he reproached for being heretical.

Yates supposes that his rejection of mathematics is caused in the first place perhaps by the
importance of the magic of figures for the Hermetic mystics rather than by the rejection of Aristotelian scholasticism (YATES 1968:267f). Neither did he accept the Copernican heliocentrism and GILBERT’s work on magnets. This is, according to YATES, perhaps because of the close connection of these elaborations with magical philosophies. Moreover the magnet was looked upon as the most obvious example for the magical forces of sympathy. The above mentioned historians of science have therewith drawn a picture of BACON which describes him firstly as an opponent of the Hermetic tradition: Bacon postulated completely new ideals for the methods to be applied to gain increased knowledge, but secondly as absorbing distinctly Hermetic conceptions, especially related to his concepts of Fall and the aim of human efforts.

This Hermetic influence on BACON is often neglected, so YATES and also ROSSI suggest. RATTansi points out that BACON was for reasons of time alone forced to rely on Hermetic authors for the elaboration of his fundamental theory of physics and nature which he began during the last years of his life only (1972:28).

Therefore it is not really surprising that BACON, despite his sharp turning against alchemy and accusing it of pagan heresy, devoted himself to a problem which was very similar to that of the alchemists: the genesis and development of new entities on the basis of already existing substances (ROSSI 1969:15). For BACON was interested in the different “forms” of natural phenomena like for example fluidity and solidity, heat and cold (RATTansi 1972:23). He hoped to be able to combine the different “forms“ with every kind of matter, in order to obtain by this way new substances. (PARACELESUS spoke of the “completion of all uncompleted“ as the aim of alchemy.)

In his “New Atlantis“, written shortly before his death in 1624, BACON finally develops a design of a society, which shows a number of parallels with the utopian designs of the Hermetics CAMPANELLA (“City of the Sun”) and JOHAN VALENTIN ANDRAE (“Christianopolis“, published in 1619). ANDRAE imagined his ideal city Christianopolis as ruled by priests. These priests, through their understanding and knowledge of the astral magic and the sciences, influence the stars in a pleasing way and guarantee thereby happiness and well-being of the population. BACON’s New Atlantis is governed by “sages who keep the citizens in tune with the cosmos; and in this late utopia the wisdom tradition is turning ever more and more in the direction of scientific research and collaboration for the betterment of man’s estate” (YATES 1968). Here, too, BACON dispenses with the use of magic or occults for the achievement of this aim. Science alone takes their place.

This example more than any other illustrates very clearly how Hermetic conceptions found their way into the philosophical foundations of modern science: The scientists who serve mankind fulfill the same function as the Hermetic magi: This they accomplish through the extension of knowledge which keeps man thereby in harmony with the cosmos and which enables him to govern the world and nature, i.e. to regain Adam’s knowledge. Through their knowledge of nature’s secret powers and forces they raise man onto a divine level, from where they govern the world again as before the Fall (cf. YATES 1968:258).

2. The Emergence of the Mathematical-Mechanistic World View

WESTFALL (1972) argues that the seemingly plausible belief is that the mechanistic world view developed in the 17th century is completely contradictory to the Hermetic tradition: “Where the latter posited active principles, the mechanical philosophy asserted the inert inactivity of a matter dominated in its motion by forces and laws external to it. Instead of interpreting physical phenomena in organic terms, it explained organic processes by mechanisms and banished life itself from the universe. Although it did not also banish thought from existence, it did separate it utterly from matter, so that physical action had nothing in common with psychic process. - In the Hermetic tradition, the spiritual and the physical thoroughly penetrated each other and did not stand in sharp distinction” (1972: 184 f.). However, this impression is misleading: The mechanistic models are based without doubt on an entirely inactive physical world, which nevertheless is dominated and ruled by controlling forces from outside. These outside forces influence the particles of matter, they
determine the manner of their movement. In other words, the mechanistic world view conceives the physical world as consisting of particles of matter which are put into and kept in movement through external influences.

As a result, the mechanistic conceptions are already combined with Hermetic ideas: PARACELSUS, too, distinguished between the "visible world" and the "invisible world of forces", spreading from one single "fount of force". BACON then picked up this idea, but broke with the imagined unity of these two worlds which was inherent in PARACELSUS's thoughts: BACON distinguished between the physical world and life. This living world was infused to the former in the form of ghosts from outside, in the last instance from God. Mechanism continues to retain exactly this distinction. The constitution of the physical world is no longer defined through BACON's inductive method of searching for new "forms" of matter. It is now analysed solely through mechanistic models. Both doctrines describe the physical world as "dead". It receives, in the case of BACON, its life, in the case of mechanistic models, its movement from outside forces.

Both BACON and PARACELSUS derived their concepts on a uniform source of this life (PARACELSUS: "the one fount of all power", BACON: God). Interestingly the conception of diverse forces is temporarily reintroduced in some early mechanistic models. Against that PARACELSUS assumed the interminable diversity only of the observable nature, not of the invisible source of power; BACON spoke of the diversity of the physical-secular world.

RATTANSI describes ROBERT BOYLE and the group around SAMUEL HARTLIB cooperating with him as the first European philosophers who developed a mechanistic concept and combined it with Hermetic principles (1972: 18f). After the increasing attacks and rejections of PARACELSUS in England from 1640 onwards, in reaction against the spreading of religious sects and the English civil war, this group referred first of all to BACON and developed views about Fall and the ends and purposes of human effort which were very similar to his. BOYLE introduced the Continental mechanistic philosophy and developed along with it his own mechanistic model. He hoped to be able to explain BACON's "forms" of matter better in the framework of this model's conception of the structure and movements of small particles. For this reason RATTANSI concludes that "the Hermetic conception of a universal science of chemistry was now to be realized in mechanical terms" (RATTANSI 1972:23).

The mechanistic scholars were to begin with in the dark about the constitution of the power influencing the physical world. The philosophers whom RATTANSI called Cambridge Platonists including, among others, HENRY MORE, were the first who pointed out the absolute necessity of a regulating spiritual force; this was in the second half of the 17th century. Differing from BOYLE they thought that no natural phenomenon could be completely analysed through mechanistic chains of causality. Mechanistic laws operating entirely on their own would necessarily create chaos in the world. Here the continuous intervention of a regulating spiritual force would be indispensable. God would fulfill this task of regulation (RATTANSI 1972:37).

That the mechanistic world view would be incomplete without active and immaterial principles was pointed out by a number of other philosophers of this period. This reflection becomes an important starting point for the work of ISAAC NEWTON (1643 - 1727).

WESTFALL (1972) describes the development of very different concepts and models by NEWTON, which deal with the quality of the "active principles of motion". According to this development the theory of gravitation is to be found only at the end of a number of approaches which reflect more distinctly than the theory of gravitation itself the Hermetic influence on NEWTON's conceptions.

In his early work "Hypothesis of Light" (1675) NEWTON assumes first, as far as the quality of the "dead" matter is concerned, that the basic substance of all bodies is an aether. This aether is conceived as a gas like the air, but rather more elastic in its different manifestations.
In condensed form it is the substance of solid bodies. The Creator has at first shaped the first solid bodies by condensing aether. After that nature has copied these models, and that in a balanced and stable circulation: Aether escapes from mouldering bodies by evaporating, nature condenses an equal part for the creation of new bodies.

Movement is infused into the aether (the matter) by corpuscles of light, because they would contain a "principle of motion". They spread within the aether the "aethereal spirit", which explains a number of "active phenomena": NEWTON traces phenomena as for example gravity, magnetism, static electro phenomena, the cohesion of bodies, elasticity, heat, sense perception, muscular motion and the growth of plants back to them.

WESTFALL stresses that these conception of NEWTON may be called a combination on an alchemic, mystical doctrine with a mechanistic system of nature.

During his life time NEWTON speculated with yet a number of other attempts to explain the causes of motion. Temporarily he tended to regard the corpuscles of light as the last source of all active motion, because they would soak into all bodies.

But he rejected this approach increasingly in favour of his concept of force which became the basis of his understanding of nature. In elaborating it he first of all picked up the concept of the forces of sympathy and antipathy. He also tried to explain with their help phenomena such as the attraction and repulsion between bodies. He based his conceptions on a diversity of different forces. Mixtures of these forces would be responsible for specific affinities between different kinds of bodies. NEWTON regarded the degree of motion of the different bodies as proportional to the force received by them. Temporarily he took over the conception of BACON, BOYLE and the Cambridge Platonists, too, according to which all force would in the last instance emerge from God, who moves the bodies with its help.

Later then he named chemical processes as being responsible for the forces operating between the bodies: Heat, originating in chemical reactions, would be the impulse of the particles of matter.

When NEWTON began for the first time to work on circular motion, he tried to transfer this concept of attraction between bodies through chemical processes to the cosmos. This approach was not yet based on a uniform gravity, but still on diverse forces which are specific to different bodies.

It took many years before NEWTON, stimulated through the work of KEPLER, among others, developed from these early ideas the concept of a uniform force of attraction. This leads him then also to the principle of the uniformity of all matter, in opposition to the last Hermetic bastion of the interminable diversity of the substances.

Certainly no further Hermetic ideas may be recognized in his theory of gravitation. But the comprehension of NEWTON's concept will be much easier if one bears in mind the influence of the Hermetic tradition on the initial concepts of NEWTON: The development of the theory of gravitation would not have been possible at all without the powerful Hermetic tradition of "sympathetic attraction" of things.

E. Conclusions: Some Suggestions of the Metastructure of Scientific Change

What this paper, we hope, has shown is that although there are striking and contradictory differences between the Hermetic tradition and modern science's philosophy, the emergence of the latter's basic presuppositions cannot be understood without the retrospection reflection on their roots in the former doctrine.

The contradictory concepts of modern science and Renaissance mysticism described in the paper are above all

- the interminable diversity versus the uniformity of matter and force and
- the mystical unity of nature versus the rational analysis of nature as a means of generating knowledge.
These oppositional concepts allow us to speak of revolutionary breaks through which the Hermetic "paradigm" was replaced, eventually, by that of modern science.

However, within this framework of changing presuppositions others have endured. The most obvious example is certainly NEWTON's idea of explaining motion through the gravitational force. That this was indeed derived from the Hermetic conception of sympathetic attraction between certain bodies becomes even more convincing if one remembers that the theory of universal gravitation was only the last of a number of attempts by NEWTON to explain the origin of motion. All the other preceding approaches have also been derived from Hermetic ideas: So can for example his attempt to relate motions to chemical reactions be seen as inspired by the alchemist tradition. The same is true for his model of aetherial substance and aetherial spirits.

Also very evident are the similarities between the corresponding conceptions of the purpose of man's scientific effort. Step by step the hope of becoming a divine ruler over nature was transformed into the conviction of reentering the paradise; the hope of gaining personal benefit through the use of collected knowledge into the ideal of overcoming the misery of mankind; the concept of "magus" into that of the "scientist", the distinction between the visible and the invisible world of forces into that of mechanism and motion coming to the world from outside. It is important to note that all essential ideals of modern science do have their counterparts in the Hermetic doctrine. These were retained and modified, under the influence of the modern division between the rational observation of nature and the expected salvation, i.e. between the secular and the religious spheres.

Thus we think it is justified to conclude: Dominating concepts of a declining paradigm endure because they are received and reused by the representatives of the emerging new school of thought. They are reinterpreted within the framework of some essentially new presuppositions. The past and the new merge together. Thus the direction and content of a new school of thought is to a great extent already predetermined by former conceptions because of their sheer existence. Strains of presuppositions are retained, and may even run through a chain of several subsequently following phases of normal science.6

6 Although it should be plain that the complexity of these transformations is of such a degree that a diagrammatic representation, of any kind whatsoever, would be somewhat premature and oversimple, here is one nevertheless:

FIGURE 9
Bibliography

AGrippa, H. C.: see WHITEHEAD (1897, 1971).


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