

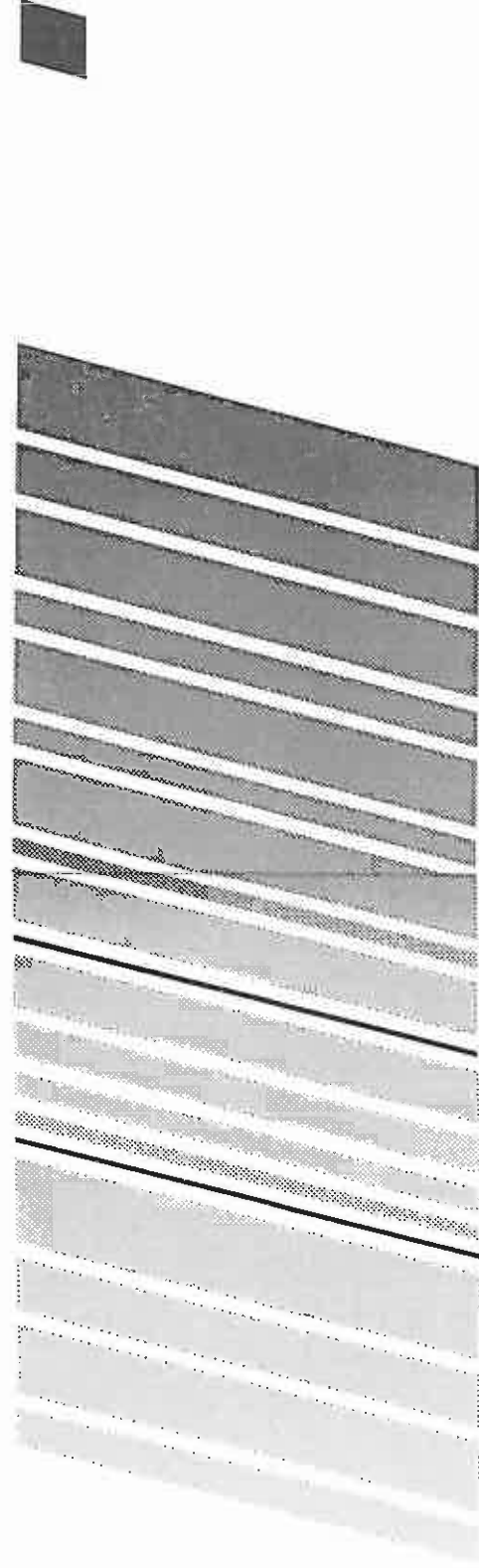
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Genesis and Development of a Scientific Fact

Ludwik Fleck



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Prologue

What is a fact?

A fact is supposed to be distinguished from transient theories as something definite, permanent, and independent of any subjective interpretation by the scientist. It is that which the various scientific disciplines aim at. The critique of the methods used to establish it constitutes the subject matter of epistemology.

Epistemology often commits a fundamental error: almost exclusively it regards well-established facts of everyday life, or those of classical physics, as the only ones that are reliable and worthy of investigation. Valuation based upon such an investigation is inherently naive, with the result that only superficial data are obtained.

Moreover, we have even lost any critical insight we may once have had into the organic basis of perception, taking for granted the basic fact that a normal person has two eyes. We have nearly ceased to consider this as even knowledge at all and are no longer conscious of our own participation in perception. Instead, we feel a complete passivity in the face of a power that is independent of us; a power we call "existence" or "reality." In this respect we behave like someone who daily performs ritual or habitual actions mechanically. These are no longer voluntary activities, but ones which we

Who today would study anatomy without embryology? In exactly the same way epistemology without historical and comparative investigations is no more than an empty play on words or an epistemology of the imagination.

It is nonsense to think that the history of cognition has as little to do with science as, for example, the history of the telephone with telephone conversations. At least three-quarters if not the entire content of science is conditioned by the history of ideas, psychology, and the sociology of ideas and is thus explicable in these terms.

In the context of our special investigation, I believe that the concept of syphilis is unattainable except through a study of its history. It has already been demonstrated here that *Spirochaeta pallida* alone cannot define the disease. Syphilis is not to be formulated as "the disease caused by *Spirochaeta pallida*." On the contrary, *Spirochaeta pallida* must be designated "the microbe organism related to syphilis." Any other definition of this microbe is hopeless, and further, because of the question of germ carriers, cannot serve to define the disease unambiguously.

It is also inadequate to define syphilis phenomenologically rather than conceptually, in the manner that animals and plants might be defined on the basis of their characteristics. For it is naive to think that, although its historical development has been tortuous and complicated, we can today arrive at the concept of the disease entity "syphilis" simply and safely merely by using current techniques of observation and experiment.

This assumption is not admissible even as a thought experiment [*Denkexperiment*]. Current research techniques, after all, are also the result of historical development. They are the way they are because of just this particular history. Even the modern concept of disease entity, for example, is an outcome of precisely such a development and by no means the only logical possibility. As history shows, it is feasible to introduce completely different classifications of diseases. Furthermore, it is possible to dispense with the concept of a disease entity altogether, and to speak only of various symptoms and states, of various patients and incidences. This latter point of view is by no means impracticable because, after all, the various forms and stages as well as the various patients and constitutions must always be treated differently. It is evident that the formation

Two Epistemological Conclusions from the Established History of a Concept

1. General Observations

The history of any scientific concept could be immaterial to those epistemologists who consider, for instance, the errors of Robert Mayer of no significance to the development of the law of conservation of energy.

Against this we would argue that there is probably no such thing as complete error or complete truth. Sooner or later a modification of the law of conservation of energy will prove necessary, and then we will perhaps be obliged to fall back upon an abandoned "error."

Furthermore, whether we like it or not, we can never sever our links with the past, complete with all its errors. It survives in accepted concepts, in the presentation of problems, in the syllabus of formal education, in everyday life, as well as in language and institutions. Concepts are not spontaneously created but are determined by their "ancestors." That which has occurred in the past is a greater cause of insecurity—rather, it only *becomes* a cause of insecurity—when our ties with it remain unconscious and unknown.

Biology taught me that a field undergoing development should be investigated always from the viewpoint of its past development.

of the concept "disease entity" involves synthesis as well as analysis, and that the current concept does not constitute the logically or essentially only possible solution.

In this context it is not possible to regard things simply as given. Experience gained over several years of working in the venereal disease section of a large city hospital convinced me that it would never occur even to a modern research worker, equipped with a complete intellectual and material armory, to isolate all these multifarious aspects and sequelae of the disease from the totality of the cases he deals with or to segregate them from complications and lump them together. Only through organized cooperative research, supported by popular knowledge and continuing over several generations, might a unified picture emerge, for the development of the disease phenomena requires decades.

Here, however, training, technical resources and the very nature of collaboration would repeatedly lead research workers back to the historical development of knowledge, since the bonds of history can never be cut.

For epistemology, it might be objected, it is not important to investigate how a connection was discovered, but only to legitimize it scientifically, prove it objectively, and construct it logically. But this could be countered as follows.

Legitimization is certainly very important in science generally and, within reasonable bounds and precision, to our case as well; otherwise syphilology would not be a branch of science. But I do not agree with the view that the sole or even most important task of epistemology consists in this kind of examination of the consistency of concepts and their interconnections within a system.

Whatever is known has always seemed systematic, proven, applicable, and evident to the knower. Every alien system of knowledge has likewise seemed contradictory, unproven, inapplicable, fanciful, or mystical. May not the time have come to assume a less egocentric, more general point of view and to speak of comparative epistemology? A rule of thought that allows one to make use of more details and more compulsory connections, as the history of science teaches us, deserves to be emphasized. I believe that the principles used in the present study render many a neglected relation both visible and suitable for investigation.

The concept of syphilis must be investigated like any other case in the history of ideas, as being a result of the development and confluence of several lines of collective thought.

It is not possible to legitimize the "existence" of syphilis in any other than a historical way. To avoid unnecessary and traditional mysticism it is thus appropriate to use the term "existence" restrictively as only a thinking aid and convenient shortcut.¹ But it would be a gross mistake merely to assert that the syphilis concept could not be attained without the consideration of particular historical connections. We still have to examine possible laws behind these connections and discover operative socio-cognitive forces.

2. Proto-ideas as Guidelines for the Development of any Finding

Many very solidly established scientific facts are undeniably linked, in their development, to prescientific, somewhat hazy, related proto-ideas or pre-ideas, even though such links cannot be substantiated.

We have described a hazy idea of syphilitic changes in the blood and shown that this idea existed centuries before scientific proof was available. Emerging from a chaotic mixture of ideas, it developed over many epochs, becoming more and more substantial and precise. Evidence for it was adduced from various points of view, and a dogma concerning syphilitic blood gradually consolidated. Several research workers, such as Gautier, succumbed to public opinion and claimed to have found proofs which actually were impossible to establish. The entire repertoire of research available at the time was used to an unprecedented degree until the goal was reached. The idea of syphilitic blood thus became scientifically embodied in the Wassermann reaction and subsequently in more simplified reactions. But the proto-idea has survived among the common people, who still refer to syphilis as having impure blood.

Seen from this point of view, the Wassermann reaction in its relation to syphilis constitutes the modern, scientific expression of an earlier pre-idea which contributed to the concept of syphilis. Other branches of science also have pre-ideas. The pre-idea of

atomic theory stems from Greek antiquity, specifically as taught by Democritus in his original "atomistics." Historians of science such as Paul Kirchberger¹ and Friedrich Lange agree that "modern atomic theory developed step by step from the atomistics of Democritus."² It is a constant source of amazement to see just how many features of modern atomic theory were performed in the theses of these ancient precursors, such as the combination and separation of atoms, mutual gravitational motions and their effects, as well as pressure and collision phenomena.

Theories of the elements and of chemical composition, the law of conservation of matter, the principle of a spherical earth as well as the heliocentric system each underwent a historical development from somewhat hazy proto-ideas. These existed long before any scientific proofs were available and were supported in different ways throughout the intervening period until they received a modern expression.

Very clear ideas about tiny invisible and living agents as causative of diseases were expressed long before the advent of the modern theory of infection and even before the invention of the microscope. A statement from Varro, "Minute animals that cannot be seen by the eye enter the body from the air through the mouth and also through the nose and cause severe diseases," might have come from a popular edition of Flügge's theory of droplet infection.*

I admit that sometimes a proto-idea could be found for a scientific discovery only through casuistry. We would look in vain for such a proto-idea in the case of isomerism or in the gram differentiation of bacteria. Nor must every ancient idea have a historical relation with a later discovery which it happens to resemble. The Aschheim-Zondek test for pregnancy, for example, is probably unrelated to the medieval idea of the possibility of diagnosing virginity or pregnancy from urine. In spite of prolonged investigation, some ideas remained devoid of scientific proof and were eventually discarded. After just such a search for the "absolute," today there is not even a scientific term to denote it clearly.

Can epistemology blandly ignore the fact that many scientific positions steadily developed from proto-ideas which at the time

*Fleck is referring to Flügge's *Die Mikroorganismen* (see Bibliography).—Eds.

were not based upon the type of proof considered valid today? This question should be reflected upon and investigated. But if we may borrow a hypothesis from the prehistory of paleontology, a proto-idea must not be construed as a "freak of nature." Proto-ideas must be regarded as developmental rudiments of modern theories and as originating from a socio-cognitive foundation.

It might be claimed that, whereas a large number of somewhat hazy ideas have emerged throughout history, it is science that has accepted the "right" ones and rejected the "wrong" ones. But this objection is untenable, since it cannot explain why there are so many possible "correct" representations of unknown objects. Implicit in such a view is the claim that the categories of truth and falsehood may be applied to these proto-ideas. But this suggestion is altogether erroneous. Was "befouled blood," "corrupted or melancholic blood," or "excessively hot and thick" the correct idea for syphilis? "Befouled" is not a precise scientific term. Because it is vague and ambiguous, we cannot decide whether it is suitable for syphilis or not. It is not a systematic term as required today, although it was clearly useful as a starting point in the development of a concept. Even the most suitable of the earlier descriptions—"change in the blood"—can no longer be checked for accuracy. The characteristic "change" is too vague, and a "change in the blood" could correspond in one sense or another to almost any condition or disease. Moreover, "syphilis" means something entirely different today from what it meant formerly. The value of such a pre-idea resides neither in its inner logic nor in its "objective" content as such, but solely in the heuristic significance which it has in the natural tendency of development. And there is no doubt that a fact develops step by step from this hazy proto-idea, which is neither right nor wrong.

Concerning other proto-ideas, such as the Greek pre-idea of the atom or that of the elements, we are also unable to decide whether they are right or wrong if they are taken out of their chronological context, because they correspond to a different thought collective and a different thought style. Although such ideas may not conform to modern scientific thought, their originators certainly considered them to be correct.

Any absolute criterion of judgment as to suitability is as invalid for fossilized theories as a chronologically independent criterion

would be for adaptability of some paleontological species. The brontosaurus was as suitably organized for its environment as the modern lizard is for its own. If considered outside its proper environmental context, however, it could not be called either "adapted" or "unadapted."

The development of thought proceeds so much more rapidly than the pace appropriate to paleontology that we continuously witness the occurrence of "mutations" in thought style. The transformation in physics and in its thought style brought about by relativity theory represents such a mutation, as does the adjustment in bacteriology resulting from the theories of variability and cyclogeny. Suddenly we no longer see clearly what is species and what is individual, or how broadly the concept of life cycle is to be taken. What just a few years ago was regarded as a natural event appears to us today as a complex of artefacts. Soon we shall no longer be able to say even whether Koch's theory is correct or not, because new concepts incongruent with Koch's will arise from the present confusion.

Another comparison taken from the area of word origin, as recently conjectured by some psychologists, may perhaps better explain the importance of pre-ideas. "Words were originally not phonetic nexuses arbitrarily assigned to certain objects, such as the word UFA* denoting a German film studio or 'L' denoting self-induction. They actually indicate a transference of experience and objects to a material that can easily be molded and is always available. Linguistic reproduction was therefore originally not a precise assignment according to logic but imagery in the dynamic sense of geometry. The meaning would be immediately implicit in ideophones created in this way."¹ The actuality of pre-ideas probably permits the assumption of a similar relationship. Mental reproduction would be originally not a clear-cut assignment according to logic, but rather a transference of experience to a material that could easily be molded and would always be available. The connection between reproduction and experience would not be like the conventional relation between a symbol and what it symbolizes, but would reside in a psychological correspondence

*Universum Film AG, which is a studio, like MGM.—Eds.

between the two. Evidence for this would be directly contained in the products of thought [*Denkgebilden*] created in this way.

Words, then, were not originally names for objects. And cognition, at least initially, does not depend upon mental reconstruction and preformation of phenomena or, as Mach taught,² upon the adaptation of thoughts to some arbitrary external facts as revealed to an average person.

Words and ideas are originally phonetic and mental equivalents of the experiences coinciding with them. This explains the magical meaning of words and the dogmatic, reverential meaning of statements.

Such proto-ideas are at first always too broad and insufficiently specialized. According to Hornbostel, ideas—just as word meanings—have a development that proceeds "not through abstraction from the particular to the general, but through differentiation or specialization from the general to the particular."

3. The Tenacity of Systems of Opinion and the Harmony of Illusions; Viewpoints as Autonomous, Style-Permeated Structures [Gebilde]

Once a structurally complete and closed system of opinions consisting of many details and relations has been formed, it offers enduring resistance to anything that contradicts it.

A striking example of this tendency is given by our history of the concept of "carnal scourge" in its prolonged endurance against every new notion. What we are faced with here is not so much simple passivity or mistrust of new ideas as an active approach which can be divided into several stages. (1) A contradiction to the system appears unthinkable. (2) What does not fit into the system remains unseen; (3) alternatively, if it is noticed, either it is kept secret, or (4) laborious efforts are made to explain an exception in terms that do not contradict the system. (5) Despite the legitimate claims of contradictory views, one tends to see, describe, or even illustrate those circumstances which corroborate current views and thereby give them substance.

In the history of scientific knowledge, no formal relation of

logic exists between conceptions and evidence. Evidence conforms to conceptions just as often as conceptions conform to evidence. After all, conceptions are not logical systems, no matter how much they aspire to that status. They are stylized units which either develop or atrophy just as they are or merge with their proofs into others. Analogously to social structures, every age has its own dominant conceptions as well as remnants of past ones and rudiments of those of the future. It is one of the most important tasks in comparative epistemology to find out how conceptions and hazy ideas pass from one thought style to another, how they emerge as spontaneously generated pre-ideas, and how they are preserved as enduring, rigid structures [*Getilde*] owing to a kind of harmony of illusions. It is only by such a comparison and investigation of the relevant interrelations that we can begin to understand our own era.

To clarify the point a few examples might be mentioned showing the various degrees of tenacity of viewpoints.

1. When a conception permeates a thought collective strongly enough, so that it penetrates as far as everyday life and idiom and has become a viewpoint in the literal sense of the word, any contradiction appears unthinkable and unimaginable. People argued against Columbus: "Could anyone be mad enough to believe that there are antipodes; people standing with their feet opposite our own, who walk with their legs sticking up and their heads hanging down? Is there really a region on earth where things are upside down, where trees grow downward, and where it rains, hails, and snows upward? The delusion that the earth is round is the cause of this foolish fable."

Today we know that the real cause of difficulty here was the absolute meaning of the concepts "up" and "down"—a problem that dissolves under a relativistic formulation. The same difficulty arises even today if such concepts as existence, reality, and truth are used in an absolute sense. To Kant, an unknowable substratum as "things in themselves" was indispensable for sensory appearances: "otherwise we should be landed in the absurd conclusion that there can be appearance without anything that appears." Wundt concurs by asking, "What can one do with properties and states which are not properties and states of something?"⁷

2. Every comprehensive theory passes first through a classical

stage, when only those facts are recognized which conform to it exactly, and then through a stage with complications, when the exceptions begin to come forward. The great theoretician Paul Ehrlich knew this only too well: "Unfortunately, this differs in no way from all other scientific problems, since it just becomes more and more complicated."⁸ In the end there are often more exceptions than normal instances.

Such a relation exists between classical chemistry and the chemistry of colloids. Colloidal reactions vastly predominate in nature over classical chemical reactions. Nevertheless, like the colloidal reactions, those events which occur with greater frequency have often had to wait longer for scientific discovery. Many aspects of tanning, dyeing, and the production of adhesives, rubber, and explosives do not correspond to the laws of classical chemistry. Furthermore, special laws must be assumed to explain how agricultural soil can retain nutrient salts, which according to classical chemical and physical laws should be washed away freely by the groundwater. All these many "exceptions" went unrecognized for a long time.

Another instructive example is the fate of observations made in 1908 by Bjerrum and Hantzsch. These seemed to contradict the classical theory of electrolytic dissociation and thus had to wait about ten years until they were repeated by other workers. Proper recognition of these observations obtained only after publication of the work of Laue and Bragg. The simple fact went unnoticed that the color of an ionic salt solution can, during dilution, be so modified that the degree of dissociation appears to remain unchanged. Nor was any attention paid to the fact that the addition of CaCl_2 to salt solutions displaces the normal reaction of the mixture in the acid direction.

Take an example from everyday life. At a time when sexuality was equivalent to uncleanness and naïveté to purity, naive children were thought to be asexual. How amusing it is that sexuality could not be recognized in them! Everyone has the experience of having himself been a child and now lives not entirely isolated from children. Yet it took psychoanalysts to discover children's sexuality.

We see the same thing happening in the classical theory of infectious diseases. Every infectious disease was supposed to be

caused by very small living "agents." Nobody could see that these "agents" were also present in healthy persons, because the phenomenon of the germ carrier was not discovered until much later. The variability of micro-organisms was a second shock. At the time when Koch's theory of specificity held complete sway, any variability was unthinkable.⁹ It was only some time later that relevant observations became more frequent. A third shock will be administered to the classical theory of infection by the theory of the filterable virus. It will be shown that invasion by a causative agent, which is the classic cause of infection, is actually an exceptional way to produce an infection.

This particular example well illustrates the important role that the tenacity of closed systems of opinion plays in the operation of cognition [*Erkenntnisphysiologie*]. Cognition proceeds in this and in no other way. Only a classical theory with associated ideas which are plausible (rooted in the given era), closed (limited), and suitable for publication (stylistically relevant) has the strength to advance. Loeffler's bacilli, for instance, would never have been isolated had they first been found in healthy persons. Without a function in an era preoccupied with "causes," this finding would never have attracted the necessary attention nor stimulated the necessary research effort.

Discovery is thus inextricably interwoven with what is known as error. To recognize a certain relation, many another relation must be misunderstood, denied, or overlooked.

The operation of cognition [*Erkenntnisphysiologie*] is analogous to the physiology of movement. To move a limb, an entire so-called myostatic system must be immobilized to provide a basis of fixation. Every movement consists of two active processes; namely, motion and inhibition. The corresponding features in the operation of cognition are purposive, directed determination and cooperative abstraction, which complement one another.

3. We have mentioned concealment of an "exception" among the stages of tenacity in opinion systems. One of many exceptions was the orbital motion of Mercury as related to Newton's laws. Experts in the field were aware of it, but it was concealed from the public because it contradicted prevailing views. It is mentioned only now because it became useful in the context of relativity theory.

4. The very persistence with which observations contradicting a

view are "explained" and smoothed over by conciliators is most instructive. Such effort demonstrates that the aim is logical conformity within a system at any cost, and shows how logic can be interpreted in practice. Every theory aspires to being a logical system but often merely begs the question.

The following passage from Paracelsus is so much to the point here that to quote it here will spare the reader many examples.¹⁰

Man, who alone walks in the visible light of nature, is unable to believe that a man could be possessed by the devil and harbor him in such a way that one must think: This man is *not* a man, but a devil. This possibility arouses revulsion and resentment in any living person. Must it not be a miracle of God that a man living in this world could appear to have a devil? "Man is supposed to be made in the image of God and not of the devil, who is as different from man as stone from wood. Aside from the fact that man is made in the image of God, he has also been redeemed from the devil by the Son of God. How incredible therefore that nevertheless he can be thrown into such frightful captivity without protection!

Two articles of faith confront each other here, namely, that man could be possessed by the devil, and that yet he was freed from the devil. Neither of these articles may be doubted, but something must be done to save the relevant logic. A miracle of God is invoked to bring them into accord. This saves the logic of the matter and no one need any longer harbor "revulsion and resentment."

No matter how illogical this may appear to us, the whole thing is true to style. Let us try to imagine ourselves in the world of Paracelsus, where every object and event is a symbol, and every symbol and metaphor also has objective value. It is a world full of hidden meanings, spirits, and mysterious powers, full of defiance and awe as well as love and hate. How else could one live in such an impulsive, unsafe, and hazardous reality than to believe in miracles? The miraculous becomes the fundamental principle and most immediate experience within Paracelsian reality and permeates every aspect of his science. It anticipates every consideration, and springs forth from every consideration.

A closed, stylized system of this kind is not immediately receptive to new ideas. These would be reinterpreted to make them conform.

5. The liveliest stage of tenacity in systems of opinion is creative fiction, constituting, as it were, the magical realization of ideas and the interpretation that individual expectations in science are actually fulfilled.

Almost any theory can be quoted as an example here, because all contain some element of wishful thinking by their scientific proponents. But concrete and detailed examples are more useful for illustrating the extent of such wishful thinking than for merely establishing its existence.

In an age when marveling at nature was sufficient to be regarded as knowledge, and before man had learned to utilize his admiration in a practical way to stimulate proper investigation, the purposefulness of things in nature, both living and inanimate, was wondered at and enormously overvalued. Marvelous instincts aroused particular fascination. In an essay "The Nests of Animals" published in 1866, Wood tells the following story.¹² "Maraldi was struck by the great regularity exhibited by bees' honeycombs. He measured the angles of the rhombohedral dividing walls and found them to be $109^{\circ} 28'$ and $70^{\circ} 32'$. Convinced that these particular angles must somehow be related to the economy of the cells, Réaumur asked the mathematician König to calculate what shape a hexagonal vessel bordered by three rhombi would have if it enclosed the maximum volume with minimum surface. Réaumur received the answer that the rhombic angles would have to be $109^{\circ} 26'$ and $70^{\circ} 34'$, constituting a difference of only two minutes of arc. Not satisfied with this lack of agreement, Maclaurin repeated Maraldi's measurements and confirmed them. But when he repeated the calculation he spotted an error in the table of logarithms used by König. It was not the bee but the mathematician that had made the mistake. The bees even helped to discover the error." Mach also comments on this case: "Those who know how to measure crystals, and have seen a honeycomb with its rather rough and non-reflecting surfaces, will doubt that an accuracy of two minutes can be achieved in its measurement. The story must therefore be considered only a doughty legend of mathematics . . . It must also be said that the mathematical problem had not been fully presented, so there is no way to judge to what extent the bees have actually solved it."

Those who find this story, written as it is in a quite scientific

style,¹³ insufficiently convincing to demonstrate the occurrence of self-fulfilling scientific expectation* [*Wunschtraumerfüllung*], may prefer to look at even "more objective fiction" in the form of pictorial representations.

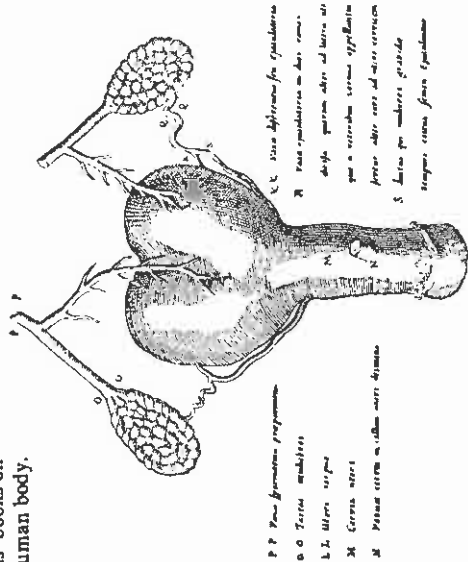
In an Amsterdam transcription by N. Fontanus¹⁴ of Vesalius's *Epitome*, the uterus is illustrated on page 33, with the following legend on page 32. "Question: How does the seed enter the woman during ejaculation if the womb is so tightly closed that not even a needle can enter through it, according to Hippocrates, book 5, aphorisms 51 and 54? Answer: Through a branch leading from the ejaculatory duct entering the cervix of the uterus, as this illustration shows."

The idea of a fundamental analogy existing between male and female genitals, as held in antiquity, is exhibited most effectively here, and illustrated as if it really occurred in nature. Anatomists will notice immediately that the proportions of the organs, as well as the corresponding positioning, have been restyled to conform to this theory.¹⁵ Truth and fiction or, perhaps better, relationships that have been retained within science and others that have disappeared from this structure appear here visibly side by side. The duct labeled S, "through which the woman becomes impregnated by the seed ejaculated at the time of intercourse," is typical, and it is indispensable to this theory of analogy. Although unknown in modern anatomy, it is pictured in early anatomical descriptions in a style appropriate to that theory—right amidst other excellent data of observation.

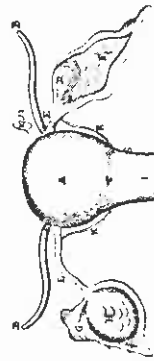
When I selected this illustration for the present work, I was tempted to add a "correct" and "faithful" one for comparison. Leafing through modern anatomical atlases and gynecological textbooks, I found many good illustrations but not a single natural one. All had been touched up in appearance, and were schematically, almost symbolically, true to theory but not to nature. I found one particular photograph in a textbook on dissecting techniques. This, too, was tailored to theory with orientation lines and indicating arrows added to make it graphically suitable for use in teaching.

*This free, anachronistic translation of *Wunschtraumerfüllung* echoes the title of a paper by Robert K. Merton, "The Self-Fulfilling Prophecy," *Antioch Review*, summer 1948 (reprinted as chap. 13 of Merton's *Social Theory and Social Structure*, New York, 1968).—Eds.

From Andreas Vesalius' books on the structure of the human body. After Fontanus 1642.



From Thomas Bartholin's *Anatomy*, 1673.



From Coelestin Nauwerck, *Technique of Dissection*, 1912.

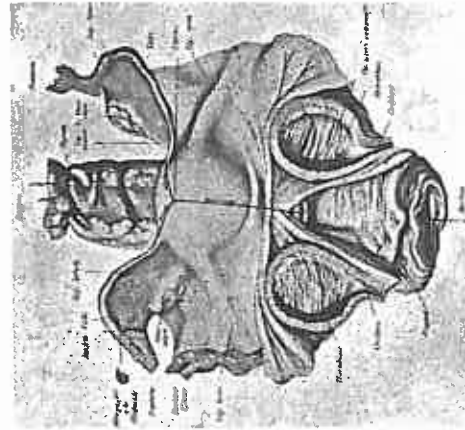


Figure 1

ing. I thus once again convinced myself that it is not possible to carry out such a comparison. It is only theories, not illustrations, that can be compared. It is true that modern doctrine is supported by much more sophisticated techniques of investigation, much broader experience, and more thorough theory. The naive analogy between the organs of both sexes has disappeared, and far more details are available. But the path from dissection to formulated theory is extremely complicated, indirect, and culturally conditioned. The more clearly we visualize it, the more we will be confronted with connections in the history of ideas and psychology leading us to their originators. In science, just as in art and in life, only that which is true to culture is true to nature.

Any attempt to legitimize a particular approach as the correct one is at best of limited value, since it is inextricably bound to a thought collective. Neither the style characteristic of opinion nor the technical skills required for any scientific investigation can be formulated in terms of logic. This sort of legitimization is therefore possible only where it is actually no longer required, namely among persons whose intellectual constitution is thought-stylized in common and, more particularly, who share approximately the same educational background.

Berengar, for instance, discusses somewhere the old argument about the origin of the veins.¹⁶ According to Aristotle the veins originate in the heart, according to Galen in the liver. "I say that the veins originate neither in the heart nor in the liver except in a figurative and metaphorical sense, yet metaphorically they originate more in the liver than in the heart, and thus in this respect I agree more with the physicians than with Aristotle." Here it is obvious that any logical discussion is bound to fail. We do not recognize such "metaphorical and figurative" origins for the veins, but only a morphological, phylogenetic, and embryological "origin" of the blood vessels. To us the human body does not represent such a collection of metaphors and symbols, although we are unable to provide a logical reason why we have changed the style of approach.

Simple lack of "direct contact with nature" during experimental dissection cannot explain the frequency of the phrase "which becomes visible during autopsy", often accompanying what to us seem

the most absurd assertions. Such contact was generally very tenuous. It was much less the autopsy itself than the ancient views that were consulted, yet this only served to reinforce the ancient thought style. Stereotyped opinions handed down a thousand times meant more to and were considered safer by those authors than any autopsy as such, which was only a "gruesome duty."¹⁷

This period was associated with a specifically symbolic "anatomia imaginabilis" and was followed by another period when a purely morphological approach to anatomy was attempted. The latter, however, could not be pursued without phylogenetic, ontogenetic, and comparative symbols.¹⁸ Then came physiological anatomists, using physiological symbols and evolving chemical organs, the endocrine system, the reticulo-endothelial system: structures to which no sharply outlined morphological organs correspond. During each period with its own characteristic style the concepts used were absolutely clear, since clarity is based upon reducibility to other stylized concepts. Despite this clarity, direct communication between the adherents of different thought styles is impossible.¹⁹ How is the ancient anatomical term "bosom" [Schoss],* for instance, to be translated into a modern one? Where is this mystical organ to be positioned?

An example of a nineteenth-century scientific illustration might be added, very similar to the one from the seventeenth century. When Haeckel, the romantic, high-spirited champion of truth, wanted to demonstrate his ideas about descent, he did not shrink from occasionally using the same blocks for the illustration of different objects such as animal and human embryos which should look alike according to his theory. His *History of Natural Creation* abounds with biased illustrations appropriate for his theory. Compare, for instance, the intelligent faces of the old chimpanzee and the old gorilla on figure 13 with the exaggeratedly gruesome ones of the Australian aborigine and the Papuan on figure 14. I should like to mention in conclusion a particularly gross example of the tendency to save a point of view. "The seemingly best support for the heredity of acquired characteristics comes from the experiments of

*The German word *Schoss* means "lap" physically but "bosom" metaphorically or mystically, as to be "safe in the bosom of Abraham."—Eds.

Kammerer. Using the effect of dampness, yellow background, and other, general factors he had altered specimens of spotted salamanders, *Salamandra maculosa*, to appear as striped ones. He excised the ovaries of these artificially striped salamanders, transplanted in their place ovaries of spotted specimens. When he mated these animals with normally spotted salamanders, the latter produced offspring with spots arranged in rows. It appeared here that the artificially altered somatic cells had influenced the egg cells of the mate.²⁰ These results caused lively discussion until suddenly "Kammerer's experiments were proved to have been fraudulent (1926), a discovery which led to his suicide."²⁰

To the objection that such examples, particularly the last one, are not representative of the normal function of cognition, I would admit that many of these self-fulfilling expectations could be viewed in this way. But as a physician I know that we cannot distinguish sharply between normality and abnormality. The abnormal is often only an enhancement of the normal. It is also known that both normality and abnormality often have identical social effects. Although the philosophy of Nietzsche has, for instance, a psychopathological motif, it generates social effects no different from those produced by a normally conditioned outlook on life. At any rate, once a statement is published it constitutes part of the social forces which form concepts and create habits of thought. Together with all other statements it determines "what cannot be thought in any other way." Even if a particular statement is contested, we grow up with its uncertainty which, circulating in society, reinforces its social effect.²¹ It becomes a self-evident reality which, in turn, conditions our further acts of cognition. There emerges a closed, harmonious system within which the logical origin of individual elements can no longer be traced.

Every pronouncement leaves behind either the solution or the problem, if only the problem of the problem's own rationality. The formulation of a problem already contains half its solution. Any future examination must return along existing thought tracks. The future will never be completely isolated from the past, whether normal or abnormal, except when a break with it occurs as the result of the rules characteristic of the thought structure in question.

The tenancy of systems of opinion shows us that, to some extent, they must be regarded as units, as independent, style-permeated structures. They are not mere aggregates of partial propositions but as harmonious holistic units exhibit those particular stylistic properties which determine and condition every single function of cognition.

The self-contained nature of the system as well as the interaction between what is already known, what remains to be learned, and those who are to apprehend it, go to ensure harmony within the system. But at the same time they also preserve the harmony of illusions, which is quite secure within the confines of a given thought style.

4. Introduction to Thought Collectives

In comparative epistemology, cognition must not be construed as only a dual relationship between the knowing subject and the object to be known. The existing fund of knowledge must be a third partner in this relation as a basic factor of all new knowledge. It would otherwise remain beyond our understanding how a closed and style-permeated system of opinions could arise, and why we find, in the past, rudiments of current knowledge which at the time could not be legitimized by any "objective" reasons and which remained only pre-ideas.

Such historical and stylized relations within knowledge show that an interaction exists between that which is known and the act of cognition. What is already known influences the particular method of cognition; and cognition, in turn, enlarges, renews, and gives fresh meaning to what is already known.

Cognition is therefore not an individual process of any theoretical "particular consciousness." Rather it is the result of a social activity, since the existing stock of knowledge exceeds the range available to any one individual.

The statement, "Someone recognizes something," whether it be a relation, a fact, or an object, is therefore incomplete. It is no more meaningful as it stands than the statements, "This book is larger," or "Town A is situated to the left of town B." Something is still missing, namely the addition, "than that book," to the second statement, and either, "to someone standing on the road between

towns A and B while facing north," or "to someone walking on the road from town C to town B," to the third statement. The relative terms "larger" and "left" acquire a definite meaning only in conjunction with their appropriate components.

Analogously, the statement, "Someone recognizes something," demands some such supplement as, "on the basis of a certain fund of knowledge," or, better, "as a member of a certain cultural environment," and, best, "in a particular thought style, in a particular thought collective."

If we define "thought collective" as a *community of persons mutually exchanging ideas or maintaining intellectual interaction, we will find by implication that it also provides the special "carrier" for the historical development of any field of thought, as well as for the given stock of knowledge and level of culture. This we have designated thought style.* The thought collective thus supplies the missing component.

The statement, "Schaudinn discerned *Spirochaeta pallida* as the causative agent of syphilis," is equivocal as it stands, because "syphilis as such" does not exist. There was only the then-current concept available on the basis of which Schaudinn's contribution occurred, an event that only developed this concept further. Torn from this context, "syphilis" has no specific meaning, and "discerned" by itself is no more explicit than "larger" and "left" in the examples above.

Siegel also recognized, in his own way, protozoa-like structures as the causative agent of syphilis. If his findings had had the appropriate influence and received a proper measure of publicity throughout the thought collective, the concept of syphilis would be different today. Some syphilis cases according to present-day nomenclature would then perhaps be regarded as related to variola and other diseases caused by inclusion bodies. Some other cases would be considered indicative of a constitutional disease in the strict sense of the term. Following the train of thought characterized by the "carnal scourge" idea, still another, completely different set of concepts concerning infectious disease and disease entities would have arisen. Ultimately we would still have reached a harmonious system of knowledge even along this line, but it would differ radically from the current one.

Although such a possibility could be envisioned logically and

"objectively," it can never be construed as a historical possibility. By Siegel's time, the syphilis concept had already become too rigid for such a sweeping change. A century earlier, when the concept was still sufficiently adaptable, the intellectual and experimental requirements did not yet exist for Siegel's finding. We need have no scruples about declaring that the finding of Schaudinn was correct and that of Siegel incorrect. Schaudinn's was uniquely linked with a thought collective (usually there is only one such possible link), whereas Siegel's lacked such a connection. The former served as the junction for lines of development of several ideas within this collective, but the latter did not. The meaning and the truth value of Schaudinn's finding is therefore a function of the community of those who, maintaining intellectual interaction on the basis of a shared intellectual past, made his achievement possible and accepted it.

Correctly formulated, the statement describing Schaudinn's discovery would read as follows: "Conforming to then-current views about syphilis and causative agents, Schaudinn suggested that *Spirochaeta pallida* should be recognized as the causative agent of syphilis. The significance of *Spirochaeta pallida* was duly accepted, and this idea was used for the further development of syphilology." Does not every reputable textbook in bacteriology describe the circumstances in this manner?

Cognition therefore means, primarily, to ascertain those results which must follow, given certain preconditions. The preconditions correspond to active linkages and constitute that portion of cognition belonging to the collective. The constrained results correspond to passive linkages and constitute that which is experienced as objective reality. The act of ascertaining is the contribution of the individual.

The three factors involved in cognition—the individual, the collective, and objective reality (that which is to be known)—do not signify metaphysical entities; they too can be investigated, for they have further relations with respect to one another.

These further relations consist in the facts that, on the one hand, the collective is composed of individuals and that, on the other, objective reality can be resolved into historical sequences of ideas belonging to the collective. It is therefore possible from the view-

point of comparative epistemology to eliminate one or perhaps even two factors.

Although the thought collective consists of individuals, it is not simply the aggregate sum of them. The individual within the collective is never, or hardly ever, conscious of the prevailing thought style, which almost always exerts an absolutely compulsive force upon his thinking and with which it is not possible to be at variance.

The presence of thought style makes it necessary and, indeed, indispensable to construct the concept "thought collective." Whoever might nevertheless prefer to eliminate the thought collective must introduce value judgments or dogmatic faith into the theory of knowledge. In so doing he would only succeed in creating a particular dogmatic type of epistemology out of the general comparative type.

The important role of the collective effort in any scientific work is clearly shown by the history of syphilology as described in chapter 1. Every theme in the sequence of ideas originates from notions belonging to the collective. Disease as a punishment for fornication is the collective notion of a society that is religious. Disease caused by the influence of the stars is a view characteristic of the astrological fraternity. Speculations of medical practitioners about therapy with metals spawned the mercury idea. The blood idea was derived by medical theoreticians from the vox populi, "Blood is a humor with distinctive virtues."* The idea of the causative agent can be traced through the modern etiological stage as far back as the collective notion of a disease demon.

Not only the principal ideas but also all the formative stages of the syphilis concept, however, are the result of collective, not individual effort. Although we spoke of Schaudinn as the discoverer, he really no more than personified the excellent team of health officials whose work, described in the previous chapter, cannot easily be dissected for individual attribution. As we shall presently show, even the origin of the Wassermann reaction is due to a kind of experience of the collective, which actually militated

*Cf. Goethe's *Faust*, line 1740: "Blut ist ein ganz besonderer Saft."—Eds.

against Wassermann's views. Wassermann, like Schaudinn, is rather a standard-bearer in discovery than its sole agent.

When we look at the formal aspect of scientific activities, we cannot fail to recognize their social structure. We see organized effort of the collective involving a division of labor, cooperation, preparatory work, technical assistance, mutual exchange of ideas, and controversy. Many publications bear the names of collaborating authors. Scientific papers almost invariably indicate both the establishment and its director by name. There are groups and a hierarchy within the scientific community: followers and antagonists, societies and congresses, periodicals, and arrangements for exchange. A well-organized collective harbors a quantity of knowledge far exceeding the capacity of any one individual.

The same pertains also to the humanities, although here the organization is less developed. Any kind of learning is connected with some tradition and society, and words and customs already suffice to form a collective bond.

Cognition is the most socially-conditioned activity of man, and knowledge is the paramount social creation [*Gebilde*]. The very structure of language presents a compelling philosophy characteristic of that community, and even a single word can represent a complex theory. To whom do these philosophies and theories belong?

Thoughts pass from one individual to another, each time a little transformed, for each individual can attach to them somewhat different associations. Strictly speaking, the receiver never understands the thought exactly in the way that the transmitter intended it to be understood. After a series of such encounters, practically nothing is left of the original content. Whose thought is it that continues to circulate? It is one that obviously belongs not to any single individual but to the collective. Whether an individual con- strues it as truth or error, understands it correctly or not, a set of findings meanders throughout the community, becoming polished, transformed, reinforced, or attenuated, while influencing other findings, concept formation, opinions, and habits of thought. After making several rounds within the community, a finding often returns considerably changed to its originator, who reconsiders it himself in quite a different light. He either does not recognize it as

his own or believes, and this happens quite often, to have originally seen it in its present form.* The history of the Wassermann reaction will afford us the opportunity to describe such meanderings in the particular case of a completely "empirical" finding.

This social character inherent in the very nature of scientific activity is not without its substantive consequences. Words which formerly were simple terms become slogans; sentences which once were simple statements become calls to battle. This completely alters their socio-cognitive value. They no longer influence the mind through their logical meaning—indeed, they often act against it—but rather they acquire a magical power and exert a mental influence simply by being used. As an example, one might consider the effect of terms such as "materialism" or "atheism," which in some countries at once discredit their proponents but in others function as essential passwords for acceptability. This magical power of slogans, with "vitalism" in biology, "specificity" in immunology, and "bacterial transformation" in bacteriology, clearly extends to the very depth of specialist research. Whenever such a term is found in a scientific text, it is not examined logically, but immediately makes either enemies or friends.

New themes such as propaganda, imitation, authority, rivalry, solidarity, enmity, and friendship begin to appear—themes which could not have been produced by the isolated thought of any individual. Every such motif acquires epistemological importance, because the entire fund of knowledge as well as the intellectual interaction within the collective take part in every single act of cognition, which is indeed fundamentally impossible without them. Every epistemological theory is trivial that does not take this sociological dependence of all cognition into account in a fundamental and detailed manner. But those who consider social dependence a necessary evil and an unfortunate human inadequacy which ought to be overcome fail to realize that without social conditioning no cognition is even possible. Indeed, the very word "cognition" acquires meaning only in connection with a thought collective.

A kind of superstitious fear prevents us from attributing that

*Cf. the discussion of "the retroactive effect" in R. K. Merton, *Social Theory and Social Structure* (1968), pp. 16, 17, 37.—Eds.

which is the most intimate part of human personality, namely the thought process, also to a collective.²² A thought collective exists wherever two or more people are actually exchanging thoughts. He is a poor observer who does not notice that a stimulating conversation between two persons soon creates a condition in which each utters thoughts he would not have been able to produce either by himself or in different company. A special mood arises, which would not otherwise affect either partner of the conversation but almost always returns whenever these persons meet again. Prolonged duration of this state produces, from common understanding and mutual misunderstanding, a thought structure [*Denkgebilde*]* that belongs to neither of them alone but nevertheless is not at all without meaning. Who is its carrier and who its originator? It is neither more nor less than the small collective of two persons. If a third person joins in, a new collective arises. The previous mood will dissolve and with it the special creative force of the former small collective.

We could agree with anybody who calls the thought collective fictitious and the personification of a common result produced by interaction. But what is any personality if not the personification of many different momentary personalities and their common psychological Gestalt? A thought collective, by analogy, is composed of different individuals and also has its special rules of behavior and its special psychological form. As an entity it is even more stable and consistent than the so-called individual, who always consists of contradictory drives.

The individual life of the human spirit contains incongruent elements, such as tenets of faith and superstition which, stemming from various individual complexes, muddy the purity of any theory or system. Both Kepler and Newton, who contributed so much to the modern concept of nature, were ritualistic and religious in their basic attitudes. Rousseau's ideas of education had much greater

*Fleck's terminology appears ambiguous, for *Denkgebilde* can designate the structures of thought taken as thought products, mental creations, works of the (communal) mind, etc., but it can also be a synonym for *Denkstruktur* taken as mental structures, thought structures, thought patterns, thought forms, etc. In contexts such as this, both may even be intended in the sense of thought structures created according to thought structures.—Eds.

relevance to the thought collective than to his own individual life.

Every individual belongs to several thought collectives at once. As a research worker he is part of that community with which he works. He may give rise to ideas and developments, often unconsciously, which soon become independent and frequently turn against their originator. As a member of a political party, a social class, a nation, or even a race, he belongs to other collectives. If he should chance to enter some other society, he soon becomes one of its members and obeys its rules. The individual can be examined from the viewpoint of a collective just as well as, conversely, the collective can be considered from that of the individual. Whether in the case of the individual personality or in that of the collective entity, that which specifies the one or the other is accessible only to adequate methods.

The history of science also records cases of independent—one might say personal—exploits. But their independence is only characterized by an absence of collaborators and helpers, or possibly of pioneers; that is, it manifests itself in the personal and independent concentration of historical and contemporary collective influence. In a manner corresponding closely to personal exploits in other areas of society, such scientific exploits can prevail only if they have a seminal effect by being performed at a time when the social conditions are right. The achievement of Vesalius as the originator of modern anatomy was just such an audacious and artistic feat. Had Vesalius lived in the twelfth or thirteenth century he would have made no impact. It is just as difficult to imagine him in that era, as it is, for instance, to imagine Napoleon before the French Revolution. Outside the appropriate social conditions, any development into historical greatness would have been denied to both. The futility of work that is isolated from the spirit of the age is shown strikingly in the case of that great herald of excellent ideas Leonardo da Vinci, who nevertheless left no positive scientific achievement behind.

This by no means implies that the individual must be ruled out as an epistemological factor. His sensory physiology and psychology are certainly very important. But a firm foundation for epistemology cannot be established without investigation of the thought community [*Denkgemeinschaft*]. Let me introduce a somewhat

trivial analogy. If the individual may be compared to a soccer player and the thought collective to the soccer team trained for cooperation, then cognition would be the progress of the game. Can an adequate report of this progress be made by examining the individual kicks one by one? The whole game would lose its meaning completely.

The importance of sociological methods in the investigation of intellectual activities was already recognized by Auguste Comte. Recently it was stressed by Durkheim's school in France and by the philosopher Wilhelm Jerusalem among others in Vienna.

Durkheim speaks expressly of the force exerted on the individual by social structures both as objective specific facts and as controlled behavior. He also mentions the superindividual and objective character of ideas belonging to the collective. He describes that which is produced by the activities of the collective intellect, "as we encounter them in language, in religious and magic beliefs, in the existence of invisible powers, and in the innumerable spirits and demons which dominate the entire course of nature and the life of the tribe, and as we meet them in customs and habits."²³

Lévy-Bruhl, a student of Durkheim, writes: "Ideas belonging to the collective follow laws of their own which, especially in primitive races, we cannot discover by studying the white, adult, and civilized individual. On the contrary, it is the study of those ideas belonging to the collective and their connections in primitive societies that throws some light on the origin of our own categories and logical principles."²⁴ "This approach will certainly lead to a new and positive epistemology based upon the comparative method."²⁵ Lévy-Bruhl contests the belief in "the identity of the human mind," "which at all times and in all places is supposed to have remained unchanged as far as logic is concerned."²⁶ He doubts whether "scientific use can at all be made of the idea of a human mind assumed to be untouched by any experience,"²⁷ because this concept "is just as chimerical as that of man before society."²⁸

Gumpłowicz expressed himself very poignantly on the importance of the collective. "The greatest error of individualistic psychology is the assumption that a *person* thinks. This leads to a continual search for the source of thought within the individual himself and for the reasons why he thinks in a particular way and not in any other. Theologians and philosophers contemplate this

problem, even offer advice on how one ought to think. But this is a chain of errors. What actually thinks within a person is not the individual himself but his social community. The source of his thinking is not within himself but is to be found in his social environment and in the very social atmosphere he 'breathes.' His mind is structured, and necessarily so, under the influence of this ever-present social environment, and *he cannot think in any other way.*"²⁹

Jerusalem dealt with this problem in a number of essays, the last of them bearing the apposite title "Social Conditioning of Thinking and of Thought Patterns." "Kant's firm belief in a timeless, completely immutable logical structure of our reason, a belief that has since become the common heritage of all who adopt an a priori point of view and is maintained with great tenacity also by the latest representatives of this direction of thinking, has not only failed to be confirmed by the results of modern ethnology but proved to be definitely erroneous."³⁰ "The primitive individual feels himself only a member of his tribe and clings to its traditional way of interpreting sensory perceptions with absolutely incredible tenacity."³¹ "I have no doubt, and it is confirmed through the diverse institutions found in primitive societies, that tribesmen reinforce each other's belief in the ubiquity of spirits and demons, which is already sufficient to give these figments of the imagination some degree of reality and stability. This process of mutual corroboration is by no means confined exclusively to primitive societies. It is rather prevalent today, fully effective in our everyday lives. I wish to designate this process and any structure of belief formed and fortified by it *social consolidation.*"³² "Even particular and objective observations . . . require confirmation by the observation of others. Only then will they become common property and thus suitable for practical utilization. Social consolidation functions actively even in science. This is seen particularly clearly in the resistance which as a rule is encountered by new directions of thought."³³

All these thinkers trained in sociology and classics, however, no matter how productive their ideas, commit a characteristic error. They exhibit an excessive respect, bordering on pious reverence, for scientific facts.

"When mystical elements lose some of their dominance," writes

Lévy-Bruhl, "objective properties ipso facto attract and retain more attention. The share of perception proper grows in inverse proportion to the withering away of mystical ideas belonging to the collective."³⁴

Lévy-Bruhl believes that scientific thought yields concepts which "solely express objective features and conditions of beings and phenomena."³⁵ But he would find it difficult to define the meaning of "objective features" and "perception proper." Moreover, the attraction of attention by objective properties alleged to occur "ipso facto" is psychologically impossible. The perception of scientifically accepted properties (assuming Lévy-Bruhl considers these "objective") must first be learned. It does not occur ipso facto and, indeed, the ability to perceive scientifically is only slowly acquired and learned. Its prime manifestation is discovery. This occurs in a complex, socially conditioned way, which resembles the origin of other ideas of the collective.

"Once the mentality of primitive societies is opened to experience," Lévy-Bruhl continues, "it also becomes more sensitive to contradiction."³⁶ "As soon as any society's intellectual structure and institutions develop, . . . a feeling for, or knowledge of, what physically is possible or impossible emerges and gradually becomes established. The situation is therefore much the same with physical absurdity as it is with logic. The same causes render the prelogical mentality insensitive to both types of absurdity."³⁷

We must object in principle that nobody has either a feeling for, or knowledge of, what physically is possible or impossible. What we feel to be an impossibility is actually mere incongruence with our habitual thought style. Until recently the transmutation of elements as well as many other phenomena of modern physics, let alone the wave theory of matter, were regarded as absolutely "impossible." "Experience as such," to which one has or does not have access is chimerical, and thus every being gains experience according to his own fashion. Present experiences are linked with past ones, thereby changing the conditions of future ones. So every being gains "experience" in the sense that he adjusts his way of reacting during his lifetime. Scientific experience in particular derives from special conditions established by the history of ideas and by society. Traditional patterns of training are involved in this experience, which is, however, not accessible to everyone.

Jerusalem, too, believes in the possibility of "thinking purely theoretically" and "stating given facts purely objectively." "Man acquires this ability only slowly and by degrees, to the extent that by conscious effort he overcomes the state of complete social bondage and thus develops into an *independent* and *self-reliant* personality."³⁸ "Only the strengthened individual acquires the ability to state facts purely objectively and thus learns to think theoretically, that is, free from emotion."³⁹ Jerusalem calls it the "connection between fact and individual." But how is this to be brought into agreement with his statement previously quoted, about the importance of social consolidation even in science?

"A judgment is now objectively true only when it can be considered as exclusively as possible a *function of the process of judgment*. This new, purely objective criterion of truth, which hitherto in a rather superficial and useless formulation was usually designated "agreement" between judgment and facts, must thus be regarded as a product of the tendency to individualistic development."⁴⁰

To this we must object that any thinking, to be emotionless, must be independent of momentary and personal mood, and flow from the average mood of the collective. The concept of absolutely emotionless thinking is meaningless. There is no emotionless state as such nor pure rationality as such. How could these states be established? There is only agreement or difference between feelings, and the uniform agreement in the emotions of a society is, in its context, called freedom from emotions. This permits a type of thinking that is formal and schematic, and that can be couched in words and sentences and hence communicated without major deformation. The power of establishing independent existences is conceded to it emotively. Such thinking is called rational. The causality relation, for instance, was long regarded as purely rational, yet it was actually a relic of strongly emotive demonological ideas belonging to the collective.⁴¹

If we attempt a critical separation of the so-called subjective from the so-called objective in concrete terms, we will find again and again the active and passive links within knowledge that were mentioned earlier. Not a single statement can be formulated from passive links alone. Active links, usually inappropriately called "subjective," are always involved. A passive linkage can be con-

sidered active from a different point of view, and vice versa, as will be discussed in due course. What is the reason for this special position of current scientific statements as required by the philosophers just quoted?

They believe that our present-day scientific opinions are in complete contrast with all other ways of thinking. As if we had become wise and our eyes had been opened, they believe that we have simply discarded the naive self-consciousness of thought processes which are primitive or archaic. We are supposedly in possession of "correct thinking" and "correct observation," and therefore what we declare to be true is *ipso facto true*. What those others such as the primitives, the old people, the mentally ill, or the children declare to be true seems to be true only to them. This arch-naive view, which prevents the building up of a scientific epistemology, reminds us very much of the theory of a French philologist of the eighteenth century who claimed that *pain, sitos, bread, Brot, pain* were arbitrary, different descriptions of the same thing. The difference between French and other languages, according to this theory, consisted in the fact that what is called bread in French really was bread.

Natural scientists in their philosophizing commit the opposite and also very typical error. They are aware that there are no "solely objective features and conditions" but only relations governed by a more or less arbitrary reference system. Their error consists in an excessive respect for logic and in regarding logical conclusions with a kind of pious reverence.

To these epistemologists trained in the natural sciences, for instance, the so-called Vienna Circle including Schlick, Carnap, and others, human thinking—construed as an ideal, or thinking as it should be—is something fixed and absolute. An empirical fact, on the other hand, is relative. Conversely, the philosophers previously mentioned with a background in the humanities construe facts as something fixed and human thought as relative. It is characteristic that both parties relegate that which is fixed to the region with which they are unfamiliar.

Would it not be possible to manage entirely without something fixed? Both thinking and facts are changeable, if only because changes in thinking manifest themselves in changed facts. Con-

versely, fundamentally new facts can be discovered only through new thinking. These points will be taken up later.

The fruitfulness of the thought collective theory is revealed especially in the facility with which it enables us to compare primitive, archaic, naive, and psychotic types of thinking and to investigate them uniformly. It can also be applied to the thinking of a whole nation, a class or any group no matter how it is constituted. I consider the postulate "to maximize experience" the supreme law of scientific thinking. Thus, once the possibility of such comparative epistemology arises, it becomes a duty to carry it out. The old point of view, which is confined to normative pronouncements about "bad" and "good" thinking, is accordingly obsolete.

The views outlined here should not be construed as skepticism. We are certainly capable of knowing a great deal. If we cannot know "everything," according to the traditional position, it is simply because we cannot do much with the term "everything," for every new finding raises at least one new problem: namely an investigation of what has just been found. The number of problems to be solved thus becomes infinite and the term "everything" meaningless.

An "ultimate" or set of fundamental first principles from which such findings could be logically constructed is just as nonexistent as this "everything." Knowledge, after all, does not repose upon some substratum. Only through continual movement and interaction can that drive be maintained which yields ideas and truths.