

Science, Technology, Society: Prologue

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We can't know for certain, but when the first motor car was built back in the distant past, there may well have been a fundamental dispute between engineers and philosophers as to whether motor cars move *like* humans. Fascinated by their product, the engineers may have said, 'Cars move much faster, and what's more they don't get tired'. 'That's not true in every case, and certainly not on the north face of the Eiger', so the philosophers would reply in defence of man as the crown of locomotive creation, adding disdainfully, 'And a motor car has wheels but no legs'. The dispute tied up a great deal of intellectual capacity and took on increasingly subtle forms, but it was never resolved. At times it seemed that the one party was getting the upper hand, then the other. Finally the dispute was forgotten, as the intensification of motorization created other problems which were more important and more urgently in need of a solution.

Today we find ourselves in a similar situation. The question now in dispute is whether machines are able to think *like* people. We shan't be contributing anything to its solution either – not simply because we think the dispute unresolvable at the moment, but because we also consider it to be unimportant. What we do intend, however, is to contribute something to a closer definition of the point at issue by trying to show why it is off the mark of the actual problem. At the end we shall reformulate it from the sociological viewpoint.

Since Hume and Kant we know that there are forms and categories of human thought which express themselves in each individual's thinking and behaviour – we call them empirical subjects – but which are characterized by having super-individual validity. As Hume has shown, they cannot be derived from experience, i.e. empirically. Rather, they anticipate all experience. For this reason Kant calls them *a priori*, a manifestation of a transcendental subject of whatever kind, by which he is thinking first and foremost of mathematics, logic and pure physics.

Our hypothesis is that those forms and categories of thought that can be implemented on a machine are manifestations of the transcendental subject. A critique which insists that a machine is unable to think like a human because it has no intentionality, no physical feelings, etc. is off the mark of the actual problem right from the start. Such a critique has its problem formulated by AI engineers instead of questioning their formulation of the problem. In epistemological terms: It argues on the level of the consciousness of empirical subjects and not on that of the transcendental subject. A differentiation in the formulation of the problem, achieved in philosophy with Hume and Kant at the latest, is lost. Admittedly, for us today the idea of a transcendental subject is hardly an acceptable one any longer. Unlike in the days of Kant, the question as to the causes and the backgrounds of pure thought as a manifestation of such a transcendental subject of whatever kind must now be put expressly and in all clarity.

Humean interest centres on the cognition of the individual, empirical subject. On the one hand it can concern the pure, void activity of thinking, on the other hand it can relate to facts. The first case deals with intersubjectively cogent tenets that are 'general' in the strict sense of the word and which are not dependent on any worldly existence. Facts, as the second subject of human reason, are not established as certain in the same manner, says Hume. Equally different is the evidence of their truth, no matter how strong. The opposite of a fact always remains possible. For this reason there can never be absolute cognitive certainty for the individual subject. Hume contents himself pragmatically with the belief that the average dependability of daily phenomena is sufficient for practical actions. He remains undecided in the question of how to proceed epistemologically with 'general' tenets in the strict sense. There are tenets of *a priori* validity, of strict universality, because they leave all content out of account. It is impossible to derive them from observations and from experiences, no matter how numerous. Hume, who makes the cognition of the individual subject the starting point of his studies, has no answer to the question of how general tenets come about. This is the situation as found by Kant.

In his search for an escape from the empirical interpretation of consciousness, Kant moves human reason into the centre of his theory of cognition. And he takes a decision which is to prove portentous. He draws a line between the numerous empirical subjects seen by Hume and the epistemological figure of a transcendental, super-empirical subject whose consciousness is characterized by remaining formal and completely undefined as regards content. All empirical derivation is therefore ruled out. Hume had already asked: From where does experience want to derive its certainty if all the rules it strives after are always empirical and hence random? The conclusion Kant draws from this is: Subjective individual cognition must depend on an authority which does not have its origins in the individual. The validity of the scientific perception of empirical subjects is founded, he says, in a transcendental summit exceeding their empirical existence and definition of content, i.e. in the epistemological figure of the transcendental subject. All thinking (empirical) subjects are identical in what characterizes the consciousness of the transcendental subject. As Kant says, transcendental consciousness is one and the same in all consciousness.

Misunderstanding has often surrounded Kant's argument that the validity of rational principles is completely independent of the way in which they arise in empirical consciousness. For Kant, apriority is not a psychological but an epistemological characteristic, a universality and necessity of the validity of rational principles that extends beyond all experience and which cannot be substantiated by any experience. Kant examines the logical preconditions of pure reason. He does not inquire into their origin. If objective perceptions exist, then there must also be intellectual power that is independent of the individual, a purely intellectual power of judgement which cannot be attributed to man's basic physical equipment. Empirical subjects as physical entities differ from one another; as intellectual entities independent of the individual they are identical. From the existence of objective perception Kant deduces analytically – not genetically – that there must be pure reason independent of physical feelings.

Let us sum up. There is a form of thought which lays claim to universality and cogency regardless of social positions and regardless of the interests of individual subjects of perception. It forms the basis on which

general human reason, general rules of human thought, categories of rational philosophy and, finally, formalized, fully unambiguous and consistent language systems (unlike the natural languages) crystallize – fundamental forms of consciousness which from the outset display nothing historical or social and which can therefore be implemented on machines. For us today, however, the epistemological figure of a transcendental subject hovering over all empirical subjects is unsatisfactory. We would be only too glad to dispel it, but would not like to relapse onto a pre-critical, pre-Kantian level of cognition. Nor can we look for the Kantian transcendental subject in *the* nature of man, man *per se*. Otherwise, people of all known ethnic groups would have to possess this form of thought, which is not the case. Nor, as Hume has shown, can it be derived from an individual corporeality, a soul, a brain. And the consciousness of the transcendental subject certainly isn't the manifestation of a metaphysical deity of whatever kind. Since Kant, all these routes to an explanation have been barred. So what does the Kantian transcendental subject consist of? How does it enter the world? How is it assimilated by empirical subjects?

Hume spoke of three principles which govern man's imagination: similarity, the relationship of time and space, and causality. They are universal, says Hume, characteristics of human nature pure and simple, and incapable therefore of further explanation. He was never satisfied, however, with this renunciation of a further explanation. Kant called time and space forms of perception of pure reason, forms of perception which reason has *a priori*. Like the principle of causality, they are applied to facts, things and processes. Using concepts (the categories of quantity, quality, relation and modality), judgements and rules it is possible for the mind to grasp the objects of sensory perception intellectually.

Piaget now uses the most highly developed formal structures of pure reason, i.e. logic and mathematics, as a conceptual instrument to portray the structure and development of human patterns of thought and behaviour. Although he concedes that the development of formal thought may be biologically founded, it is far more important for him that this development takes place in the growing person's dealings with his surroundings.

For Piaget, the characteristic of logical thought lies in its being operative, i.e. that it comes from action by subjectivizing this action. Writing against the advocates of nativism in the psychology of thought, he argues that the mistake has sometimes promoted the belief that the *a priori* exists already in finished structures present at the beginning of development. Although it is true that the invariant function of thought is at play in even the most primitive stages of development, its intrusion in the consciousness is only gradual, namely through the shaping of structures that are increasingly better adapted to this way of functioning. The *a priori*, Piaget says, does not adopt the form of necessary structures until the end of the development and not at its beginning. Piaget differentiates between four phases.

The sensorimotor relationships between the subject and its environment, which set in toward the end of the first six months of life, form the origin of preverbal intelligence extending beyond pure reflex actions. This *sensorimotor* period (up to the age of two years) is followed by the *preoperational* period (two to seven years). It ranges from the learning of language and the formation of symbolic and pre-conceptual thought to perceptual thought. In the period of *concrete operations* (seven to twelve years) the child learns to operate with concrete objects or their ideas. His thinking remains limited, however, to his own concrete experiences. He is still not able to handle abstractions. Finally, in the period of *formal operations* (from the age of eleven years) the growing person learns to operate with operations and to formulate general laws behind a wealth of confusing single cases. He can follow the form of an argument and disregard its content.

Much of Piaget's empirical studies is concerned with the interactions between the individual and his physical surroundings. During the early development stages of childhood, interactions with the social environment are of relatively little significance. In this period a child still behaves for the most part egocentrically. He ignores everything which his achieved structure of consciousness makes him incapable of assimilating. In other words, he is socially incomplete. The significance of social intercourse for the development of thought does not become evident until on the level of concrete operations, and above all on the formal operations level.

Here for the first time it becomes absolutely clear that the psychogenesis of logical thought is a social phenomenon at bottom. During adolescence the growing individual leaves his egocentric standpoint behind. He learns to acknowledge social norms and rules and becomes capable of cooperation. The concept of exchange, the cooperation between equal-ranking subjects within the framework and in observance of binding social norms, becomes a key concept of analysis for Piaget. He writes: If you ask what an exchange of ideas between individuals can mean, you discover that it consists essentially of producing systematic associations, i.e. exactly defined relations. A specific relationship seen from viewpoint A corresponds after the exchange of ideas to a different relationship from viewpoint B, and a specific operation performed from A corresponds to a different operation performed from B, be it now equivalent or reciprocal. And he sums up: The intellectual exchange between individuals is like a giant game of chess that is continued without interruption so that every action performed at a specific point leads to a whole series of equivalent or supplementary actions on the part of the partners. The laws of relation are nothing less, he says, than the rules which ensure the mutual agreement of the partners and the coherence of their game. To be more precise: every relation subjectivized in an individual's thoughts is a system of operations, and cooperation is formed by the system of co-executed operations or, as Piaget puts it, co-operations.

The individual's exchange with his social environment – we could also say his interaction with it – stands at the centre of studies conducted by George Herbert Mead. He reconstructs the development of thought from the perspective of the socially acting subject. The primacy of social and especially language-based exchange is emphasized to a greater degree than by Piaget. For Mead the universality, i.e. sheer impersonal nature of pure thought and reason has to do with the fact that in the course of his psychogenesis the growing individual learns to assimilate the attitude of others to himself and that he is finally able to condense all these attitudes into a single one, into that of the 'generalized other'. The 'generalized other' is the universalization, the objectivization of role acting. Insofar as it includes invariant characteristics of the most general cooperative actions, it is well possible to implement these actions on machines as an

organizational structure. Mathematization, formalization and operationalization could thus be interpreted as steps in the search for structural invariance, for social universality and objectivity. We don't want to over-stress the figure of the 'generalized other' here, but it can well be looked on as a socio-psychological counterpart to the historical concept of god or to the Kantian transcendental subject.

Logical thought is apparently only possible where corresponding rules and norms are acknowledged as socially binding. Such a conclusion is suggested by the writings of both Piaget and Mead. It is only in a society of this type that a child can 'come of age' for rational discourse. It would be very difficult, so Piaget writes, to understand how concepts could retain their constant meaning and their definition without cooperation. The reversibility of thought is constrained in that it is held within social exchange. Logical thought's specific form of equilibrium, such as it exists in the previously mentioned laws of relation for formal structures, is achieved only when society does not exert any distorting force on the individual.

Mead, who focuses special attention in his analysis on the interaction between subject and *social* environment, becomes clearer still. For him, intellect is nothing other than the assimilation of social processes into the individual. The social process, he believes, exists temporally and logically before the individual on his way to consciousness. Intellect grows out of the social process and develops in it, within the empirical matrix of social interplay. The universal part of our cognition cannot lie, therefore, in the biology of man. What we *all* see, writes Mead, is what is expressed in universal concepts. But each individual has his own sensitivity. A colour looks different to one person than to another. This, says Mead, has to do with differences owed to specific characteristics of the organism, as opposed to what corresponds to the universal. A symbol, for example, such as the raising of a policeman's arm at a crossroads to direct traffic, involves something which lies outside the thing itself. It cannot be explained by the physiognomy of the arm. Mead uses the example of the traffic policeman to illustrate how absurd it would be to explain intellect solely from the view of the single human organism. For although intellect may be located there in physical terms, it is essentially a social phenomenon.

Mead has no doubt that rational laws are abstractions of social relationships. Abstract thought, its technique and its method, is of social character in the final analysis. For Mead, the logical universe is a system of joint social meanings. The evolutionary emergence of the intellect, he says, takes place when the overall process of social experience and behaviour is assimilated into the experience of each individual affected by it, and when the individual's adaptation to the process is modified and refined by consciousness of this very process. But apparently the condition quoted by Mead for the emergence of intellect does not apply for every society. We read in Piaget, for example, that in contrast to today's societies such formal structures as characterize pure thought are missing from the logic of so-called primitive societies. Formal structures, says Piaget, seem to have an ontogenetic history that is bound up with the evolution of culture and of collective ideas.

Let us take stock of what we now know: Empirical subjects adopt the universals and forms of pure thought in dealing with their physical and social environment. This does not dispel the Kantian transcendental subject, however, because the forms and categories of thought adopted go before them in time, are always there. The question still unanswered is how pure thought's convincing character of validity for empirical subjects comes about in the first place. How does it get into the world? And why, to take up Piaget, does it apply for some societies and not for others?

The epistemological figure of the Kantian transcendental subject represents an epistemological *cul-de-sac* from which there is no escape. Unless, says Norbert Elias, you dismiss the philosophical fiction of the *homo clausus* who enters the world as an adult, opens his eyes and achieves perception all on his own. The evolution of man, says Elias, is a two-fold process. For the individual man it is a process of growing up, for all men together it is the process of mankind's development. For Elias, the process of psychological development to adulthood in western societies represents nothing other than the individual process of civilization, to which everyone growing up in the civilized societies is subjected automatically from his early years as the result of the centuries-old social process of civilization. It is not

possible, therefore, to understand the psychogenesis of the adult habitus in civilized society if viewed separately from the sociogenesis of our civilization. In accordance with a kind of basic sociogenetic law, the individual during his brief life passes through something of the processes through which his society has passed in its vast history. This idea of the major stages of sociogenesis repeating themselves in the psychogenesis can also be found in Piaget. One could object that this is at best an heuristically productive working hypothesis, but certainly not a statement of scientific fact. Be that as it may. It allows us, whatever the case, to make the following reflection: What form must the sociogenetic phase in mankind's dealings with his environment take so that it conforms with the period of formal operations in the individual's psychogenesis as the final and highest development stage in terms of life history? Probably the most comprehensive study of this aspect so far has been carried out by Alfred Sohn-Rethel.

According to Sohn-Rethel, the sociogenesis of transcendental consciousness has its origin in the way in which people relate to one another socially, the way they synthesize their individual activity into social activity, creating social figurations which in turn have a remoulding effect on the individuals. Different types of social synthesis are conceivable and historically verifiable, but only one type has produced forms of pure thought which so far have found their highest expression in transcendental consciousness: synthesis through the exchange of commodities. The act of exchange, says Sohn-Rethel, requires abstraction of all the physical characteristics of the commodities involved. In the act of exchange, nothing happens to change the physical nature of the things. Exchange is an act aimed at the pure movement of possessions, i.e. at changes of purely social significance. Yet it is itself an utterly real operation. This is why Sohn-Rethel also talks of a *real abstraction*. The act of exchange, i.e. the transfer of ownership of the commodity, has the same content of reality as the physical changes it excludes. For the exchange to be real, it must exclude usage. The physical nature of the commodity must be abstracted in the act of exchange. Everything qualitative and sensory is disregarded, everything perceived is subjected to quantifying principles. For people, this operation becomes abstract nature, social reality.

The abstraction of commodities has its origin in man's actions, not in his thoughts. Whereas the concepts of natural perception are intellectual abstractions, the concept of economic value, as Sohn-Rethel stresses repeatedly, is a real abstraction. True, it exists only in human thought, but does not issue from it. It is directly social in nature. It has its origin in human relations of commerce. These abstractions are not created by persons but by their actions.

The exchange of commodities is abstract because it not only differs from the use of the commodities but is also removed from it in time. The acts of exchange and usage are self-excluding. Sohn-Rethel has this to say: As long as commodities are the object of exchange negotiations, i.e. on the market, they are not allowed to be put to use. During this period they are subject to the fiction of complete physical constancy. The reason is that the act of exchange changes only the social status of the commodities. To be able to implement this social change properly and in accordance with its inherent rules, the commodities must be kept removed from all physical changes. At least it must appear to be so. Sohn-Rethel can say, therefore, that the exchange is also abstract in the time taken for it.

Sohn-Rethel's hypothesis that abstractions have their origin in human actions and not in thought is astonishing. Even more astonishing is that he does not mean man's dealings with nature, with his physical environment, but with others of his kind, with his social environment. The abstractions undertaken in the act of exchange do not find any parallel in the sensorily perceptible form of the objects of exchange. What happens is that physically totally different commodities are rendered equivalent in an exchange equation. The commodities are not identical in themselves, the exchange renders them equivalent. The act of exchange does not create the 'identicalness' of two commodities, but their equivalence. Briefly speaking, Sohn-Rethel surmises the sociogenetic foundation of the mathematical concept of equivalence to lie in this real abstraction, in the equivalence produced by the act of exchange. Following this argument, the emergence of purely mathematical thought in its unique logic would be expected in that historical development stage of human coexistence in which the exchange of commodities becomes the dominant principle of social synthesis, at that point of time made striking by the introduction

and spread of minted money. And indeed, it is possible to show that the money-based exchange of equivalents developed at that time and in that region which was also first to turn out Kantian subjects of reason. The meticulous study produced by Rudolf Wolfgang Müller explains that in the 6th century B.C. Greek culture invented money as well as logic, equivalents and categories. Ever since, identity and contradiction, number and quantity, space and time have been considered general categories of rational philosophy. Greek culture finds its primary figure of abstraction in the abstraction of exchange. Real abstraction prompts the mind to intellectual abstraction. Logic becomes the money of the mind. Presumably the profound congeniality between early Greek and late bourgeois culture has its roots here.

Exclusion of the act of usage during the act of exchange and the fiction of the complete physical constancy of commodities on the market have socio-genetic significance not only for the relation of equivalence, but equally so for further principles inherent in the abstractive power of the exchange of commodities, particularly for time and space, for cause and effect, for essence and appearance. We won't pursue this point here in detail, but will return instead to what seems to us today to be a paradox, namely that the conceptual forms of exact scientific thought have not developed where they now find their principal application, not in production but in exchange, not where people have entered a relationship with their physical environment but with their social environment. These forms and categories of thought do not have a meaning and cannot be understood anywhere except among civilized people, among people who know what the exchange of commodities and money is. They can be grouped under the concept of mechanical thought. They are concepts and principles of pure reason. They exist only in human thought, but they do not issue from it. They derive from a preform which Kant calls transcendental. But whereas Kant moves this preform into the consciousness, the intellect or mind, Sohn-Rethel's efforts are aimed at showing it to be historical in nature and belonging to a specific form of social existence – the production of commodities. It is in this preform that the activity of pure thought, which man is today trying to implement on machines, finds the explanation of its form and its origin.

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We remember it well. It was back in the early 1950s when the first traffic policemen in our town were replaced by traffic lights. And again a dispute flared up, this time between philosophers and traffic planners, as to whether a set of traffic lights could direct the traffic *like* a policeman. 'Never!' said the one side, 'It doesn't have the policeman's intuition or his experience. As a man he can put himself in the mind of the car driver and direct the streams of traffic by good judgement.' 'Which is precisely why we need traffic lights,' said the others. 'They are more incorruptible in their decisions, more impartial, and in a certain sense even more human.' This time, too, the argument failed to decide the dispute. It settled itself. Every crossroads got its traffic lights, where they appeared meaningful.

The reason why a policeman's arm can be replaced by a set of traffic lights is not to be found in the policeman's arm, nor in the traffic lights, even if we were to dissect both micro-surgically down to the smallest molecule. Since Mead and Elias at the latest we know that the reason is to be found solely in the social figuration 'crossroads'. The facts of the case appear to be as follows: As the interlinking of urban traffic routes has intensified, human patterns of thought and behaviour have been subjected to such a high level of standardization that finally the control mechanisms essential for the figuration can be represented as an algorithm and can be implemented on a machine. The social figuration has turned, as can also be seen purely externally, into a sociotechnical figuration.

The time has come to stop thinking that questions of the type

- Will the computer be able to think *like* a man?
- Will the automobile be able to move *like* a man?
- Will lights be able to direct traffic *like* a man?

are a relevant problem, and believing that their answers will make even the slightest contribution to solving the problems of our technological civilization. Such questions cannot be taken seriously, not because the answer is obvious, but because it is obviously unimportant what the answer turns out to be. So what is the problem? To be able to define it

from the sociological perspective and as a sociological contribution to cognitive science, we must recapitulate the argument so far.

There are forms and categories of thought characterized in that their validity is not bound up with any special corporeality and not dependent on any special experience. Hume and Kant agree in this respect. Kant calls them manifestations of the transcendental subject. Each empirical subject assimilates these forms and categories of thought in a psychogenetic process. Piaget and Mead describe the process of this assimilation. It is clear, therefore, that the phenomena in question are not of divine or biological origin, but issue from society. Nevertheless, this does not dispel the epistemological figure of the Kantian transcendental subject. The first time this step is taken is in the studies of Sohn-Rethel and Elias. Sohn-Rethel's argument in particular indicates that the forms of pure thought, such as can be implemented ultimately on machines, do not issue from people's dealings with their physical environment, but from a specific mode of their social coexistence: the social synthesis of their relationships through the production of commodities. Within this social formation characterized by the production of commodities it is possible to discern various development stages and figurations, in the course of which there is increasing success at implementing routines of thought and behaviour on machines. This roughly describes the situation in which we find ourselves today. In this situation the problem outlined at the beginning is no longer one of philosophical contemplation but one of practical action:

- (1) Which areas of transcendental consciousness, to speak in philosophical terms, can we implement on machines? Inasmuch as the question is one of technological feasibility, its answer will depend *inter alia* on the state of development of technology and at the same time on the ability of the technical sciences to enter into interdisciplinary cooperation. The future will decide how successful they are, and no philosophy is likely to be in a position at the moment to make any serious forecasts. Strictly speaking, the question splits into two further questions:
 - (a) Can the complexity and dynamism of social figurations be reduced far enough to enable a corresponding algorithm to be formulated

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and implemented on a machine, an algorithm that transforms the social figuration into a sociotechnical one or the latently socio-technical figuration into a manifestly sociotechnical one?

- (b) Is it possible to formulate a formal theory that is more discerning than those to date, is it possible to construct algorithms in such a way that they do better justice to the complexity and dynamism of social figurations but can still be implemented on a machine?
- (2) Which areas of transcendental consciousness, to speak again in philosophical terms, are to be implemented on machines? This is less an ethical question than a socio-political one, a question that does not concern only ethics and other commissions, but everyone.

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Graz and Klagenfurt, May 2010