

THE TRAGEDY OF KNOWLEDGE
AT THE TIME
OF THE RENAISSANCE

I. CONTEMPORARY RETROSPECTION

In our times, when the pace of economic, scientific and technological, social and cultural change calls to mind the relativist velocities of contemporary physics, Einstein's criterion begins to be applicable to the historical process itself; movement can be recorded (and consequently the notion of velocity acquire meaning) provided an adequate reference system is available. Where science is concerned, such systems have always existed: historians have brought out the increase in adequate knowledge in the past by comparing it with present knowledge, which then offered a system of absolute reference. But now, the theory of relativity, quantum mechanics, molecular biology and the radical transformation of standards of value in all cultural areas have made like absolutization of contemporary ideas impossible. Today ideas furnish no more than a point of departure for *non-classical retrospection* which, as Jaurès said, seeks the fire, not the ashes,

Translated by Nina Godneff and Barbara Thompson

in the history of science. But the fire of science, its dynamics, its movement, is inseparable from its value, its effect, its psychological 'accompaniment.' Contemporary science, with unprecedented dynamism, is distinguishable from classical science by its far more emotional coloring. It lays bare not only the logical collisions of knowledge but also the emotional collisions. Einstein called the history of science the 'drama of ideas.' A drama which sometimes turns into a tragedy. The tragic sense Lorentz was aware of in the crumbling of old conceptions is easily perceptible in the remark he made when he confessed he would have preferred to be dead before the structure of classical physics collapsed. For Erenfest the tormenting experience of a personal inability to understand the positive bases of non-classical physics was also tragic and, according to Einstein, was what drove him to suicide. Einstein's own dissatisfaction for thirty years while he strove in the field theory alone to find a stable universal conception possessing more complete 'internal perfection' than the then existing solution, was again tragic. The real characteristic of the collisions of non-classical science, however, is their ambivalence: the tragic notes blend with the optimistic perception of irreversible general progress in knowledge. The collisions of knowledge and this optimistic perception together sound a very complex chord, major on the whole, but with minor harmonics.

The entire problem springs from the fact that the collisions of contemporary science are collisions of *irreversible knowledge*. The theory of relativity and quantum mechanics have provided a new thoroughly general physical basis for the irreversibility of time, so general even that it has passed from physics—a body of observations relating to the world—to the theory of science, where the irreversibility of the object of knowledge—the cosmic process—leads to the irreversibility of the knowledge of that object. The very conclusion of non-classical science. In classical science, the endeavor to discover a foundation for the irreversibility of time, in other words for the impossibility for a situation to recur, or for the prohibition against identifying *before* and *after*, in the main involved referring to the principle of entropy. Heat passes from a warm body into a cold body, but cannot do the opposite unless there is even further equalization of temper-

ature throughout the world. Differences in temperature become attenuated with time, the measure of the uniformization of temperature—entropy—grows, the universe is threatened with inevitable caloric death, and the process is irreversible.

Independently of its accuracy or inaccuracy, this pessimistic variant of the physical justification of the irreversibility of time was of no consequence either for the notion of historical time or for the notion of inner, immediate, psychological time. In the 18th century the pessimistic variant presenting time as an evolution from the golden age to the terrors of civilization (Rousseau) and all that had led up to that variant, like the optimistic variants of the irreversible social progress found in Voltaire and his forerunners, did not look for physical justification and in any case would have failed to find it. In 17th and 18th century science the sweeping cosmogonic, geological and biological ideas which might have served as a basis for a universal notion of the irreversibility of time were lacking. In the 19th century the notions of cosmic evolution, of the evolution of the Earth and the organic world, including the notion of the entropy of the universe, then in the course of developing, had no effect on the psychological sense of time. Only the more general conception on which non-classical contemporary science rested could exert influence.¹

This alters historical retrospection. Seen in the light of contemporary representations of irreversibility, the collisions of knowledge which marked the Renaissance appear as a characteristic feature of the essential cultural content of that period. It is impossible to define Renaissance culture without stating the specific shape taken by the irreversibility of the historical process which distinguished the period from what went before, the Middle Ages, and what followed, Modern Times.

The irreversibility of a culture—the hand of time pointing onward—offers an invariant general historical definition for that culture. But on what aspect of the cultural process, on what cultural component is the irreversibility based? The answer is on the knowledge of the world inherent in culture, a knowledge

¹ Cf. B. Kuznetsov, "The Value of Scientific Error and the Irreversibility of Science," *Diogenes* No. 97, pp. 105-123.

which includes the notion of the objective irreversibility of time, of the irreversibility of the cosmic process, and links cultural irreversibility with the irreversibility of the temporal co-ordinate of the space-time continuum. *The Divine Comedy*, *The Mona Lisa*, *The Dialogue of the Two Systems of the World*, bear witness to the subservience of the ideals of good and beauty to the ideal of truth—characterizing all the masterpieces of 14th-17th century culture—and show to what extent moral and aesthetic values are governed by the enlargement, the differentiation, the complexity and the unity of the representation of the world.

II. STRONG IRREVERSIBILITY AND COLLISIONS OF KNOWLEDGE

Compared with the cultural evolution of previous and subsequent periods, that of the 14th-16th centuries is outstanding for the far more obvious relation among the ideals of truth, good and beauty—science being narrowly linked with morals and art. This feature of 14th-16th century culture springs from its *specific* irreversibility. Reichenbach made a distinction between *weak irreversibility* of time—absence of repetition, irreducible difference between *before* and *after*—and *strong irreversibility* of time, characterizing every moment, every *now*, and able to be revealed without calling on either the past or the future, without contrasting *before* and *after*.² In Renaissance culture, irreversibility appears in the guise of a local definition, plainly demonstrated by every masterpiece in science and art.

What exactly accounts for the principle of irreversibility in the process of knowledge? Logical deductions are generally reversible: if proposition A leads to proposition B, the opposite must be possible and B can lead back to A. However, these deductions cease to be commutative if conclusion B drawn from A is accompanied by a passage to another logical order. It is precisely with this type of metalogical passage that we have to deal when the apparently a-logical but actually metalogical transitions occur, enabling the mind to grasp wholly and intuitively a chain still virtually full of deductions.

² H. Reichenbach, *The Direction of Time*, with a commentary by Mario Reichenbach, Berkeley and Los Angeles, 1971.

Tragedy of Knowledge in the Renaissance

These changes of logical order provide the specific poetry of knowledge. Metalogical transitions are moments of intuitive illumination when, to quote Mozart, 'one hears an entire symphony that is still unwritten,' when one logic is incapable of relying on its own canons to deduce another logic, other canons, and gives way to intuitive illumination, metalogical by nature, and to aesthetic criteria of knowledge. The Renaissance was a period when strong irreversibility of knowledge made these metalogical transitions an unbroken 'accompaniment' to intellectual apprehension of the world. Hence the dictatorship of aesthetic criteria in Renaissance culture. Truth was not yet in possession of autonomous criteria—the natural logical deduction of ideas from altogether general relatively invariant principles (what Einstein called 'internal perfection') and the agreement of ideas with experience (what Einstein called 'external justification'). Knowledge did not enrich itself with these criteria until the 17th century. Their absence during the Renaissance brought about a very harsh collision. All the energies of Renaissance thinkers were centered on these standards. It was an aspiration that marked not only the Cinquecento philosophers of nature but also the Trecento poets and the Quattrocento painters. If Renaissance poets and painters were thinkers, it was precisely because beauty had become the yardstick of truth; and there lies the epistemological cause of the universality of these geniuses. But, unwittingly, these thinkers were in quest of as yet unattained autonomous criteria of truth and therefore new and stable logical norms, new social bases, new canons of being and knowledge. In the philosophical and scientific, social, moral and aesthetic thought of the Renaissance, what Hegel called *becoming* required what he named *being here*. Hence the variety of mental attitudes which contradicted one another. These found expression in a famous poem by Lorenzo de Medici,

Canzone di Bacco

Quant'è bella giovinezza,	How beautiful is ever-fleeting youth
che si fugge tuttavia!	Let him who wills be merry:
Chi vuol esser lieto, sia:	None can be sure of the morrow.
di doman non c'è certezza.	

The triumph of the moment was the emotional equivalent of our idea that the time of the Florentine humanists was a golden age. But a *here and now* when man no longer hopes for tomorrow and forgets yesterday becomes converted into the moment in the strict sense of the word, fleetingly brief and ephemeral. This is what accounts for the sadness betrayed in Bacchic joy and in the chimes of the bell heard in *The Divine Comedy*, 'like a farewell to the departing day.'

This sadness had deep gnosiological roots. The humanists did not place their hopes in the morrow, or when they did, life quickly took good care to destroy their expectations. The future became less and less tangible. Economic ideals (the national market), political ideals (the unification of Italy), scientific ideals (strict truth demonstrated by internal perfection and external justification) did not entirely disappear, but seemed an increasingly distant prospect, like the lot of future generations.

A sad tragic coloring also characterized what might be called Renaissance science. The history of science can sometimes overlook the coloring and psychological effect of knowledge, but where the Renaissance is concerned this is impossible. In speaking of a sad and tragic coloring and its epistemological criteria, it is not uninteresting to quote the aporia of knowledge, the aporia of infinite time, of the infinite complexity of the universe. There, as with the other problems of cultural evolution, it is important to grasp the special role of the irreversible component: developing knowledge. All cultural components establish a link between the local and the integral, the finite and the infinite. But knowledge of the infinite world consists in bridging the gap between infinite and finite, an endeavor which is essentially unlimited and never-ending. With art and morals the ancient canons may be preserved or appealed to on occasion, but with knowledge things are different. Knowledge consists precisely in transforming canons—it is the living achievement of time which never stops. Its psychological effect reaches its peak in the satisfaction afforded by the level of the knowledge attained and also in the discovery of the aporia, in the awareness of the endless road still to be travelled, in the sense of dissatisfaction—what has been called *the interrogative component of knowledge*.

The expression 'sometimes tragic' mentioned earlier implies

Tragedy of Knowledge in the Renaissance.

an important question: under what historical circumstances does the dissatisfaction aroused by what has been learned turn into a tragedy for the researcher? In other words when does the idea of the infinite and perpetually moving character of knowledge, the awareness of the inevitable fragility of what has been attained, the recognition of the temporary and condemned nature of positive scientific values impress itself on the mind and encroach upon epistemological optimism based on the irreversibility and infinity of knowledge? These questions remove the problem to a properly historical plane and allow a characteristic feature of the Renaissance to be glimpsed in the emotional style of the period.

In Leonardo Olschki's very well known book on the scientific literature of the Renaissance there is a particularly important passage on these problems. According to Olschki, the infinity of knowledge is bound to create a feeling of despondency. 'For those who generally go to the roots of things, Galileo threw light on an insoluble riddle of the universe and discovered a science stretching to infinity in time and space, a science of an unlimited character that was to lead to the sense and awareness of human solitude and powerlessness.'³ In point of fact, the prevailing psychological effect of infinite knowledge is an optimistic one. It was for Galileo and also for other 17th century thinkers, with the exception perhaps of Pascal. But particularly for Galileo. The general tone of the *Dialogue* is joyful and triumphant in its assessment of reason conquering the bounds of knowledge and thereafter on the road to unending evolution. The sad and tragic motives mentioned occur in Galileo's correspondence, but seem rather to be due to the idea that the mainstream of knowledge was moving away from Italy and the style of thought familiar to it.

However, although the reconstruction of the psychological effect of the infinity of knowledge proposed by Olschki may be inexact where Galileo is concerned, it can be applied to Galileo's forerunners, the thinkers and artists of the 15th and 16th centuries. Galileo could avail himself of a criterion of truth suited

³ L. Olschki, *Geschichte der Neusprachlichen Wissenschaftlichen Literatur*, v. III, Leipzig, Florence, Rome, Geneva, 1922.

to the infinite world: the mathematical method, which allowed absolutely certain results to be obtained for a limited local experiment—though the knowledge of the infinite world remains perpetually deficient. We never actually know what has been nor what will be outside the limited local situation of the *here and now*. Nevertheless this is where we come up against an *invariant of knowledge*: the representations we can now no longer reject. Local truth, known with certainty, ('the knowledge which springs from objective certainty is the equivalent of divine knowledge')⁴ means that the particular moment apprehended in its being is preserved in knowledge. This notion is typical of the 17th century, the post-Renaissance. It forecasts the differential representation of the infinitely small *here and now* when the permanent law is expressed in terms of a differential equation, when we meet an invariant of the enlargement of space, the growth of time, the increase in space/time. And it is precisely the absence of this local standard, the 'pre-classicism' of Renaissance thought, that makes this idea the minor accompaniment to a major melody.

III. LEONARDO DA VINCI

Quattrocento culture as a whole failed to initiate the chain of positive deductions about nature—the sole cause of its life and development—the last link of which was Spinoza's doctrine of *Natura naturans* and *natura naturata* and the first the philosophy of nature that emerged in the 16th century. In the Italian humanism of the 15th century and above all in Florentine humanism, criteria of truth had not yet been emancipated from criteria of beauty, they were not yet associated with the new dynamic invariants of knowledge, and a closer look soon shows that the elements of Quattrocento science were more of interrogations than established notions, more a striving and a quest for invariant perceptions than those perceptions as such. This situation persisted until the 16th century. The philosophical systems Telesio and Bruno provided as an explanation of nature were anything but generalizations based on experimental science, yet they blazed the trail for science by proclaiming its sovereignty. The actual progress of 15th century science was due not to these statements

⁴ Edizione nazionale, VII, p. 128-129.

but to the fact that the knowledge of the world had shifted its center of gravity and was directed towards sensual aesthetic knowledge. Leonardo's sensualism derived from the practice of his art, and in return was materialized in that practice, achieved in painting; it was not a matter of principle. What is striking in Leonardo's work is not the profusion of parallel genres it offers but that the genres overlap, that his productions contain an overall gnosiological aesthetic program. If this program was not achieved, in the way later associated with the word 'achievement' and if it failed to establish permanent canons of knowledge is another question. The pictorial masterpieces remain (not always, unfortunately: the experimental character of Leonardo's painting condemned many of his pictures to be shortlived) but no new invariants of knowledge were created.

Once we become acquainted with the philosophical, mechanical and mathematical, chemical, geological and anatomical fragments in Leonardo's work, we realize that all these efforts have one aim: the visual representation of the world. As a thinker, Leonardo strove to create a system of conceptions, but above all remained an *artist*. The ideas capable of moving freely in the realm of pure thought while preserving their links with form, with their sensual roots, were ideas which did not make their appearance until the 17th century and in their supreme expression, the analytical mechanics of Lagrange, where even the tracings disappear, came still later. The unfinished character of scientific ideas and their sensual and aesthetic form brought about a conflict between artistic intentions and the quest for scientific explanations of nature, both the one and the other remaining incomplete. When Leonardo left Florence for Milan he did not break with the Florentine tradition, which is why his departure failed to solve the conflict. The court of Ludovico Sforza distinguished itself from the surroundings of Lorenzo de Medici by the more pronounced interest taken in practical problems, though the interest had been lively in Florence as well and it in no way excluded literary and humanistic preoccupations in Milan. The celebrated 'Leonardi Academia'—the Latin inscription on the emblematic geometrical ornaments Leonardo composed—did not denote a real academy as there might have been in Milan; no such academy ever existed. At the most there were conversations,

comparatively few and far between, among painters, architects, military engineers and university professors at the palace of Ludovico in Pavia and sometimes in Leonardo's studio in Milan. The legend of an academy and the term itself merely bear witness to the desire to imitate Florentine models and the spread of Florentine humanism. The turn taken by the preoccupations of Leonardo's true Milanese entourage was proof that its initial Florentine interest had undergone some alteration—externalization being an evolution not only in space, but also in time. In Florence, the ideas of Neoplatonism—in inverted form—looked for new foundations, though did not always find them. In Milan, art looked for new canons and technique for new scientific bases. Both quests were constant and therefore often fruitless. For Leonardo, the period in Milan was the time of certain consummate masterpieces, and yet the equestrian statue of Francesco Sforza was never cast and his treatises on painting, movement, shock, gravity, and human gestures were never completed. One wonders whether this non-performance of many projects and sometimes of commissions, which at first sight may seem accidental or due to outside circumstances and the unfinished character of many pieces, might not be attributed to a few basic features of the actual works and even more of the day.

That this was not just a personal trait is plain, but it is equally certain that external obstacles had little to do with the unfinished character of the work. Leonardo was a very great painter and his wish was to express the dynamism of form not only through design and color but also in direct scientific and philosophical constructions and experimental and applied mechanisms. Olschki believed that the reason why Leonardo failed to carry out this program as far as his experimental and theoretical conceptions were concerned was due to his empiricism: when Leonardo reached the bounds of sensorial perception, or the point where he ought to have transferred the relation among the mechanical phenomena observed to the world of theory and mathematical abstraction so as to discern the law that governed it, he always went back over the same ground, enriched by experience and disconnected data, but not by scientific knowledge.⁵

⁵ L. Olschki, *Op. cit.*

Tragedy of Knowledge in the Renaissance

For Olschki, Leonardo was incapable of abstract thought. But in fact, the real reason for Leonardo's difficulties was far more profound and more historical. His aptitude for theoretical reflection is not in doubt here—he had that aptitude—the problem was linked with the universals needed to transfer 'the relation among the mechanical phenomena observed to the world of theory and mathematical abstraction...' The old universals were no longer adequate, they no longer matched artistic vision, experiment, applied mechanics. The new universals—the concepts of mechanics—had not yet become universals, as laws of the universe as a whole. They needed the ideas not formed until the 18th century. In the 15th century, the new concepts were lacking. This explains why a painter and engineer of genius was unable to bring about the transfer from empirical experiment and applied phenomena to a unique vision of nature. Neither medieval canons, nor Neoplatonist animation of the world could erect the bridge that would bear men from the sensual universe to the abstract mathematical universe. Leonardo sometimes ventured there by accident, as one might say, and each time almost had to grope his way back. There lay his tragedy. For the 15th century, this tragedy mainly indicated a presentiment of future science, not in positive coincidences or "anticipation" but in that there was an extreme yearning for a dynamic representation of the world. Leonardo's painting was dynamic and his philosophy of nature a tragic striving after dynamism. And there lay the unity of his work—artistic, technical, experimental and philosophical.

This unity bestowed historical value on what has been called the tragedy of the Renaissance and introduced Renaissance culture into the history of science. Between the science of the Middle Ages and the science of modern times we find an interval when not only the content but the very notion of science and the standards allowing the inclusion of this or that representation were transformed. Anthropomorphic definitions are characteristic of the 15th century and belong to the history of science because they convey the continuous *interrogative* line, the eternal interrogation, the eternal tragedy of the *becoming* and the *being here* of science.

An eternal interrogation underlies all Leonardo's excursions into the field of the natural sciences and all his applied con-

structions. Leonardo tried to portray a causal mechanical image of the world and his notes show that he was in search of new concepts, particularly in the notes he devoted to painting. The *Treatise on Painting* begins with conceptions deriving from the philosophy of nature and physics. And if 'his personal research in optics and mechanics carried him far beyond the artistic and technical problems he had raised, without being sufficient for science,' as Olschki said,⁶ that is another matter. His research may have been insufficient for science in its classical form, as a summum of established observations, but it belonged to science as a process in which unsolved problems keep epistemological value by the influence they exerted on the irreversible evolution of standards of knowledge. Olschki believed that the reason for the deficiency of Leonardo's scientific generalizations lay in his empiricism. But Leonardo's empiricism and sensualism included a search for universality, a search for general conceptions embracing the whole universe. In the historical perspective they signify: a search for the substance of the world, a substance capable of being apprehended sensually, empirically: a search for that substance extended; a conviction that outside the extended cause of sensations there was no other substance. That was a perfectly general trend at the Renaissance and the Florentine Quattrocento was the time of the plainest statements on the subject. I should like to quote a few lines from Savonarola, the direst enemy of Florentine humanism, who nevertheless shared the sensualist idea as understood in the 15th century: 'In the order of knowledge, that part of science which relates to the sensually perceptible substance precedes that related to the substance which cannot be apprehended by sensation.'⁷ The conclusions Savonarola drew from this sensualist conception were different from those of Leonardo. For Savonarola the difference lay in *transferring* the knowledge of the 'first part'—empirical assessment of the world—to the 'second part'—the suprasensible substance. Whereas Leonardo never separated *Logos* from *Sensus* and never introduced the suprasensible substance into his representation of the world. At the time of the Renaissance, the

⁶ L. Olschki, *Op. cit.*, p. 195.

⁷ Savonarola, *Compendium totius philosophiae*, Venice, 1542, book, I 17 and 28 recto, and 5 recto.

Neoplatonists—notably Ficino and Pico della Mirandola—endeavored to approach traditional suprasensible categories, but by seeking the sensual content, they proceeded from ideas to forms and sensualized the idea. Those among whom Leonardo had moved followed this trend with more conviction still, as they meant to generalize artistic and technical experience and integrate it in their philosophical conceptions of nature.

The many serenades to vision found in Leonardo's manuscripts convey this gnosiological meaning—knowledge looks towards the visible, the point of departure of knowledge is the perception of things in their spatial being.

For Leonardo, painting itself was knowledge. His saying: 'Painting is philosophy, it speaks of movement—the essential problem of philosophy,' provides a statement, though not yet scientific in form, on the representation of space, time and movement. It not only defines painting, by making it a function of knowledge, but also philosophy—the essential object of which is movement. But this was not the last demonstration—movement is the initial state of bodies. That demonstration only came with Galileo. Nevertheless it was already an assumption: painting illustrates movement. We can therefore draw the gnosiological conclusion deriving from all Leonardo's painting and grasp the characteristic of that painting. Leonardo's canvases and frescoes render the *here and now* in its new sense, as an epitome of the *beyond here and now*. That is why Leonardo's painting always possesses something which eludes empirical knowledge and can only be known through the transformation of the image into ideas, an enigma. The enigmatic smile of the Mona Lisa is typical of all Leonardo's painting. That smile, that enigma, and lastly that tragedy of knowledge, in no way diminishes either the aesthetic value of the picture or the historical and cultural value of the conflictual, ambivalent and tragic period of the Renaissance. On the contrary, they link Renaissance culture with the total irreversibility of the infinite knowledge of the world.

The positive notion of the tragedy of the Renaissance—a notion inseparable from epistemological optimism—recurs even when the work of the artist and thinker shows a firmly pessimistic trend. This is the case with Michelangelo in particular. The sad pensive face of Lorenzo de' Medici, the equally sad

expression of the symbolical figures in the Medici chapel can be explained to a certain extent by the idea of the irreversibility of time which haunted their creator. For Michelangelo the irreversibility of time had a somewhat different meaning than for Leonardo. To take the Hegelian notions of *emergence* (nothingness passes into being) and destruction * (being passes into nothingness) one might say that for Leonardo the accent in the perception of becoming was laid on *emergence* and for Michelangelo on the notion of *going beyond*. But for Michelangelo above all, everything about him bore the seal of irreversible evanescence, drawing near.

Clearly the abstract Neoplatonist background to Hegel's philosophical constructions in no way interfered in these sensations. No more than the immediate impressions of Florentine life in the 16th century. Here we find ourselves faced with a complex amalgamation of perceptions and tendencies, sometimes unconscious, sometimes conscious, which mingled with reflection on the surrounding world and self. But this attitude was more than a mere page in the inner life of Michelangelo or an episode of the social psychology of the Cinquecento. It was also a page in the history of knowledge at the Renaissance, a time when standards of scientific truth were still inseparable from psychology, emotions and the moral and aesthetic conception of the world.

Like Leonardo, Michelangelo progressed towards the knowledge of the world from the sensual apprehension of its local elements. The idea, the form, the essence which Michelangelo wrested from stone and the sensualism of Leonardo, who took local observations as a point of departure for attaining universal conceptions, were two neighboring itineraries leading from the generalization of immediate form to a new universal idea. But the idea which might have been based on form, the idea achieving the fusion of logical analysis (internal perfection) and observation (external justification) still lay far ahead. So local observation was not infinitized, did not acquire infinite extension, the *here and now* did not pass into the infinite *beyond here and now*. Leonardo had not perceived this, he contented himself with the upsurging of ever new local images. Michelangelo, on the contrary, felt the

* *aufheben*: to destroy and preserve

Tragedy of Knowledge in the Renaissance

absence of the *beyond here and now* and saw local impressions as leading to non-being. The idea of death, so recurrent in his verse, was a generalization of the awareness of universal transience, the inevitable wasting away of all that served as an immediate cause of knowledge.

IV. MACHIAVELLI

If we attempt to discern the historical link of the tragedy of the Renaissance as presented here, as the tragedy of knowledge characterized by certain collisions of morals, it is worth trying to see how this relation emerges in Machiavelli's conceptions of history and morality. Of all the Renaissance thinkers Machiavelli was undoubtedly the most controversial. Some (the majority, in the 16th-18th centuries) regarded him as the personification of evil and, with the simplification typical of the period, even as the devil incarnate. This is how Polo and Benedetto Barca described him in their writings in the 16th century and Voltaire thought no differently two centuries later. Some 17th century authors even went so far as to ascribe the St. Bartholomew massacre to the influence of *The Prince* and it would have taken little for them to lay all the other cruelties of the time at his door. Bacon alone said that Machiavelli described what people did and not what they ought to do.⁸ In the next century, Spinoza alone had a kind word for him, which is not surprising as Spinoza contrasted the causal understanding of the world and moral assessment, precisely what was essential in Machiavelli. In the 18th century, the attitude towards Machiavelli changed little—the age of enlightenment was that of the causal explanation of everything except social life, social institutions and social behavior. The situation altered in the 18th century because historians strove to examine objective facts and see in the real group and class interests they created the causal foundation of politics, social life and morals. And it was from that angle that Machiavelli began to be approached.

Macaulay, always alive to the psychology of historical figures and the social psychology of historical periods, noticed the ambi-

⁸ N. Orsini, *Bacone e Machiavelli*, Genoa, 1936, p. 76.

valence of the ideological and moral fabric of *The Prince*. 'One sentence is such as a veteran diplomatist would scarcely write in cipher for the direction of his most confidential spy; the next seems to be extracted from a theme composed by an ardent schoolboy on the death of Leonidas.'

The first was the advice to the tyrant and sometimes included a recipe for assassination ('suppression' writes Machiavelli, offering the Prince a lesson not only in cruelty but also in hypocrisy, with no attempt to mitigate the outspokenness of the recommendations). The second expressed the Republican patriotism of Florentine politics.

Macaulay discarded the absolute moral judgements masquerading as historical and emphasized the changing character of moral standards. In Machiavelli's Italy, the opinion formed of Othello and Iago would have been different from that in our day. The simplicity of the credulous Moor would have raised a laugh and the cunning of Iago would have commanded respect. It was in this light that Macaulay spoke of the ambivalence of the Renaissance politician.

'Indifferent to truth in the transactions of life, honestly devoted to truth in the researches of speculation... Habits of petty intrigue and dissimulation might have rendered him incapable of great general views, but that the expanding effect of his philosophical studies counteracted the narrowing tendency.'¹⁰

The study goes on with a remarkable analysis of the portraits painted in the Renaissance, an analysis agreeing with Pushkin's observation: 'We are wrong to say that this face speaks a double language.' However it is wise to complement the artistic analysis of the 'duplicity' of Renaissance politicians with certain features that emerge when things are viewed from the angle of the relation between being and duty, as brought out by contemporary retrospection.

In the Middle Ages, men were still far from the divorce between moral standards ('truth in the transactions of life') and standards of truth in representations of the world. Both were

⁹ Macaulay, *Complete Works*, Russian translation, St. Petersburg, 1860, v. I. p. 66.

¹⁰ *Complete Works*, Vol. VII, Longmans, Green & Co., London, 1898.

¹⁰ *Ibid.*, p. 85.

Tragedy of Knowledge in the Renaissance

absolute. They had a common source—revelation—and a common nature—the mystic or scholastic conception of divine will. Morals and the pragmatic or rather eschatological value of truth were one and the same thing. But the time came when the achievement of moral ideals, deprived of providential guarantees, became a human affair, an affair for man discovering the structure of the world and influencing the world. For man taking causal perceptions as a point of departure, to which moral canons were then attached. The notion of *natural* acquired a new meaning in addition to that of norms agreeing with the canonized tradition. Natural was what derived from the laws of nature. There we have a full analogy with the evolution of *natural movement*, defined from statics in Aristotle and by the cinematics of a body left to itself in the mechanics of modern times. The connection between causal perceptions and natural deliberate acts is based on *interests*. The absolutization of interests, taken as standards of behavior, leads to the removal of moral standards, to 'everything is permitted.' And practical 'Machiavellianism' is nothing else. But Machiavelli is anything but guilty of that kind of Machiavellianism and the quotation marks are added here to show the distinction which should be made between the moralizing reproaches of the 16th-18th centuries and the analysis of the real historical meaning of the tyranny which replaced Republican order in Italian cities first in practice then officially.

The real de-moralization of politics and its theoretical recognition in *The Prince* were a consequence of the shift in the center of gravity of political problems and the substitution of the causal notion of universal order for traditions and references to revelation and canonical norms. When Macaulay characterized the men of the Renaissance in the aforementioned passage by a combination of falsehood, hypocrisy and 'devoted to truth in the researches of speculation,' he did more than explain the ambivalence of Machiavelli's book, he placed the problem of the origin of that ambivalence on the historical plane. Why in fact should the thirst for scientific truth and the pursuit of great general ambitions be mingled with hypocrisy and cruelty? It is impossible to answer this question without analysing 'scientific truth' and 'great general views,' which involves looking back from the positions of contemporary science and the definition of the relation

between science and the economic development of Italian towns from the 14th-16th centuries.

The fact that tyranny, cruelty, violence and treachery, personified by Caesar Borgia, should have become Machiavelli's moral and political ideals was a tragedy not only for the Florentine thinker, it was the tragedy of Florence, of the Florentine Renaissance, of the Italian Renaissance as a whole. This tragedy however, which was aggravated in the following period under the influence of new factors—the decline of the Renaissance and the rise of an Atlantic cultural and economic area—ultimately reflected rather than obliterated (although it slowed up) the general process of the desacralization of ideas and the development of the 'indicative mood'—the objective perception of being—which Henri Poincaré contrasted with the 'imperative mood,' or duty.¹¹ For the history of ideas and for the analysis of the relation between the philosophy of nature and socio-political thought the important thing was the passage from purely dogmatic deduction of the definition of the State, the ideal government, the ideal court, the ideal foundations of state structure and politics, to logical deduction of those definitions from observation and awareness of the events that affected Italy in the 15th century and the earlier period. Neither Machiavelli nor Guicciardini deduced their conception of the State—the State and its policy—from a combination of theological norms and scholastic universals. In that sense, the socio-historical, legal, philosophical and moral ideas of the Renaissance, like the ideas characterizing the philosophy of nature, fall wholly into the pattern of rationalist and sensualist analysis, both logical and empirical at once. The two lines of thought consider that man apprehends with his reason and his senses on the earth he inhabits and bypass the universals of medieval thought, accessible only through revelation and the exegesis of canonical texts and possessing no earthly source.

What then is the connection between an assessment of Machiavelli's ideas—one of the fundamental problems of the history of political and moral conceptions—and the representation of Renaissance science as an intense transformation of the image of the world, the notion of strong irreversibility of knowledge,

¹¹ H. Poincaré, *Dernières pensées*, Paris, 1919, p. 225.

Tragedy of Knowledge in the Renaissance

in the 14th-16th centuries? What relation is there between Machiavelli's tragedy and the tragedy of *knowledge* at the time of the Renaissance? Such a link seems very important. So important even that it would be impossible to reach any accurate definition of Machiavelli's political and moral ideas without taking it into account.

As we said, in its relation with political thought and morals Renaissance science is characterized by its expectative or better its interrogative component, altogether more perceptible than in the other 'organic' periods with prevailing affirmative, positive and relatively stable motives, as if separated from the unbroken course of time. To define Renaissance science in its specific form—expectative, interrogative, but already preparing an answer—by a few stable notions, we must compare it with *before*, medieval thought, and *after*, post-Renaissance science, classical science. And we can characterize Machiavelli's doctrine by comparing it with the broad lines of medieval representations of the State and morality and corresponding representations in modern times.

In our system of reference by analogy, Renaissance science appears as a transition from a static pattern of the universe to a dynamic harmony brought to light in the differential representation of the movement leading from one local situation to another. With regard to moral representations, we find ourselves faced with a transition from static moral canons to dynamic moral norms, then to the notion of natural morality, the content and development of which depend on man's nature and historical evolution. In the 17th-18th centuries the notions of natural morality, like the ideas relating to the natural rules of social life as a whole, rested to a great extent on the laws of nature expressed at the time and deduced from nature itself, discarding the a priori extra-terrestrial absolutes. But it remains to be seen whether the Renaissance was actually aware of this type of relation between ideas.

And if it was, can its reflection be said to lie in Machiavelli's conception of morals and politics and in the fundamental collision of that conception?

Machiavelli regarded human nature as immutable. That was his fundamental thesis. His entire conception of history derives

from there. He set up the history of Rome as a kind of recurrent archetype. Recurring in 15th century Italy. This is why his essay on the first decade of Livy serves as an introduction to the *History of Florence* and *The Prince*.¹² All in all, in Machiavelli's conception of history there is a transition from history as such—when periods are clearly defined, when changes in economy, political forms, cultural life, morals, etc. can be perceived—to historiology, or the search for the invariants in these changes and general laws of social life and awareness. But Machiavelli's very historiology is a step outside its historical frame; the invariant nature of man is invariant in absolute terms. Machiavelli knew of no deeper change, no more fundamental historical invariants, no alteration of what he considered as the immutable nature of man.

In politics and morals the task of the Renaissance most closely related to Machiavelli's ideas consisted in freeing moral norms from the dictatorship of extra-temporal eternity and extra-spatial infinity, in secularizing them, in shifting their foundations to place them in the local circumstances of a given State and the historical moment. The canonical criteria of medieval morality referring to the infinitely great, to God, to revelation, to the abstract man of St. Augustine and St. Thomas Aquinas are no longer found in Machiavelli. Yet Machiavelli fails to offer another morality, based on local action with an outcome in the infinite number of like situations, as Kant did with his notion of the categorical imperative. Nor does he offer a dynamic and no longer static morality, a morality assessing acts in accordance with their influence—positive or negative—on the irreversible infinite progress of human society.

The Renaissance had already escaped the authority of the absolute canon. What was important was the local situation; morals had become relative. But the new canons did not appear until the 17th and 18th centuries. Machiavelli was unaware of the dynamic invariants of historical evolution, the ideal of the State—a State which achieves the free uninterrupted transformation of society without breaks; he was unaware of dynamic moral canons, devoid of the inhuman cruelty of Dante's *Inferno*.

¹² E. Garin, *La Renaissance. Histoire d'une révolution culturelle*. Brussels, 1970.

Tragedy of Knowledge in the Renaissance

And the Renaissance philosophy of nature was unaware of the ideas expressing the continuous transformation of *being here* including *becoming*. None of that became known until the 17th and 18th centuries, when science discovered the differential invariants of movement and the notions of an initial and a final state, establishing the true boundaries of *before* and *after* and laying the foundations for representing the weak irreversibility of time. In the modern period, while Rousseau placed the aesthetic ideal in the past and Voltaire placed it in the future, the collision between being and duty, between knowledge and morality, became a collision of periods and was no longer an inner collision like that experienced by the thinkers of the 14th-16th centuries.

V. THE RENAISSANCE TRADITION AND THE FUTURE OF CONTEMPORARY SCIENCE

Analysis of the inner collisions of Renaissance science brings out certain likenesses which allow us to establish a connection between the 14th-16th centuries and our times. These analogies show up both periods in a new light. From the point of view of contemporary retrospection Renaissance culture takes on certain new tonalities. Such rectification of the 'factors constituting the offense' however also involved rectifying the 'composition of the court' and even the rules of the penal code (penal terminology obviously being hardly suitable for a description of historico-scientific and historico-cultural analysis). The return effect of this analysis, its influence on the definition of contemporary science, can be explained by the fact that the development of contemporary science has ceased being 'a function of a situation.' Its future can no longer be determined by reference to a definition of the present stage and century-old principles are brought back into question, exposed to historical analysis, to consideration of the circumstances and limits of their applicability, consideration of a change in those circumstances and limits and even to forecasts about that change. This characteristic alone links our period with the Renaissance, although it can only be understood by taking into account the influence of Renaissance retrospection on the

character of humanism and its evolution, looking in its turn towards ancient culture.

Where exactly can the analogy between the 14th-16th centuries and the 20th century be said to lie? Certainly not in the *repetition* of positive ideas, nor in the resemblance among the representations of the world put forward at different periods, when we meet the 'forerunners' and the 'followers.' There is a resemblance, of course, but the word repetition is definitely not the right term to convey it, unless countless reservations are made. Cultural progress is irreversible—and the foundation of that irreversibility is scientific progress, the historical development of knowledge. True *repetition*, the true link between the 'forerunners' and the 'followers,' have nothing to do with positive perceptions, they are notions characterizing a spiral movement, the circles of knowledge, the analogies, the gradients, the derivatives, the rhythms of the movement of thought at successive levels of knowledge, the structural analogies of knowledge, and the relations of the logic of knowledge with empirical foundations at different times. The analogies between the periods when the passage to a higher level of knowledge occurs, when the dynamics of knowledge become more obvious, when the progress and the content of knowledge are inseparable are particularly important. The *beginning* of scientific knowledge, when scientific knowledge was contrasted with myth, the *beginning* of the new dynamic representation of the world contrasting with the static image of the universe, and likewise, the *beginning* of modern science, when modern science noticed the connection between the dynamics of the elements of being and the transformation of the world as a whole, were all periods of this type. In other words, they were revolutionary periods, periods of strong irreversibility of knowledge.

The imperfect just employed calls for some explanation. The restructuring of the fundamental representations of the universe and the micro-universe, which began during the first quarter of our century, is still going on and remains a *beginning* in so far as the new invariants of knowledge have not yet acquired what makes invariants permanent. It is precisely there where the first analogy between the 14th-16th centuries and the 20th century, the analogy of departure, resides.

Tragedy of Knowledge in the Renaissance

The plasticity, the mobility of 20th century science, its strong irreversibility, require prospective study if we are to understand the structure and define the trend of its development. At present, just as in the Renaissance, it is impossible to reach stable general definitions without thorough analysis, without hypotheses—which will only become univocal results in the future. The modern 'codex' methods of the theory of elementary particles, allowing the innumerable meanings of energy and change to be avoided, lack 'internal perfection,' they fail to derive naturally and without complementary proposals from a non-contradictory and sufficiently general conception, which is why they are also said to be put forward 'on account' on the conception to come. But this is not a feature peculiar to these methods, it applies to contemporary science as a whole, where the swift change in lines of thought (somewhat limited by the periodicity of newspapers) prevents us from arriving at a full estimate of the trend taken by science as 'a function of a situation' on the basis of local perceptions. This analogy, still purely negative, links the Renaissance with 20th century science. And it follows that positive analogies should associate the characteristic features of scientific thought in the 14th-16th centuries with the dynamics of modern science—with its forecasts about its own future and all that can be ascertained, even hypothetically, within the framework of the 20th century and perhaps beyond its bounds into the century to come.

Forecasts of this kind help to single out certain peculiarities of the essentially non-classical style of the scientific thought of our time, which obviously ought to be named. Today it is impossible to speak in prose, like Monsieur Jourdain, without adopting appropriate language. The peculiarities of the contemporary style of science most reminiscent of Renaissance traditions spring from the role of the image and the idea in the genesis of scientific theories, from the notions of sensualism and rationalism in the 20th century, from the combination of strong and weak irreversibility in the scientific process, from the new relation between the Whole and the local elements of being, from the modern relation between *natura naturata* and *natura naturans*, from the emotional accompaniment of science. Let us take a brief look at these peculiarities.

In its prospects of associating the theory of elementary particles

and cosmology, contemporary science achieves the idea of the identification of the total universe, the Whole as an entity, the unity of Nature, Spinoza's *natura naturans* (the modern form of which is the 'total universe,' a conception of relativist cosmology), and differentiated, modal nature, Spinoza's *natura naturata*—in its contemporary infra-nuclear analysis. Together the philosophy of nature in the 16th century, and the 14th-15th century culture which provided the foundations for it progressed towards this synthesis in their historically limited and sometimes naïve generalizations. The path which led from Telesio to Spinoza, by way of Bruno, included this irreversible—and therefore lasting—trend.

The sensualization of mathematics expressed this and at the same time provided the foundation. Leonardo had already considered mathematics as the description of the empirically apprehended spatio-temporal substratum of the universe, not as an idea of the suprasensible world. The notion of physical geometry and the idea of a physical meaning of axioms, offspring of the 20th century, were extensions of the visual, sensual image of reality which 16th century philosophy had borrowed from the artistic genius of the 14th-16th centuries and handed down to classical science and its non-classical generalizations. But an essential difference was introduced between Renaissance thought and classical science. In the 15th-16th centuries and even before (in Dante's philosophy of nature), attention had been mainly turned towards the world as a whole. Then classical science shifted the emphasis to the infinitely small elements in the universe. This was already characteristic for Galileo who refused to give univocal reply to the question of the extensive infinity of the world. This was the trend of classical science as a whole. Today, things have changed. In the second half of the 20th century, the style of scientific reflection evolved towards the inclusion of the integral characteristics of the universe, associated with the experimental and theoretical progress achieved in the study of the ultra-microscopic world. There is every reason to believe that this reversion, (with all the provisos already made in respect of the term) to the Renaissance tradition should enter into the contemporary outlook on the future.

But what are we to say of the tragic collision characteristic

Tragedy of Knowledge in the Renaissance

of the Renaissance between invariant and transformation, a transformation which had become continuous and neverending—to the search for a new invariant and the failure to find it? Overlooking this question could create the illusion of an idyllic epilogue, like the traditional epilogues of many 19th century novels ('... let us see what will happen to our heroes now after the riotous adventures the reader followed while...' etc.).

There is nothing idyllic about contemporary science: it is perhaps even further removed from the idyll than the science of earlier periods. But its cardinal collision is fundamentally different from the collision of the Renaissance. The latter was a period of continuous change, strong irreversibility, transformation of the image of the world, passage to other universals, other basic principles and other conceptions. To stable conceptions, as yet unformulated but instinctively sensed as stable nevertheless. This explains why their absence was felt as a tragic lack, a privation. In contemporary modern science, the almost unbroken transformation of fundamental representations becomes a state inherent in science, something more or less similar to what happened in the 17th century when movement ceased being motion towards something to become an immanent state of a body. Lorentz's tragedy was that of arrival at the threshold of non-classical science. The collision belonging to advanced non-classical science, no longer hoping to turn into classical science (and perhaps dreading that change!) can sometimes lead to great disenchantment, to growing difficulties and yet there is no truly tragic note as in the Renaissance, produced by the impossibility of anchoring on the desired shore, by the fact that merciless time assumed no positive function, swept all away and brought nothing. Now, the accent has shifted from destruction to *emergence*, or rather these two components of becoming have fused. This explains why contemporary science has lost all ambivalence towards itself, it no longer claims to perceive 'the golden age' (very close to the ideal of development achieved) nor does it heap angry invective upon itself. The anti-intellectualist curses levelled at scientific research and scientific pretensions, have nothing in common with the inner collisions of contemporary science. These are accompanied by an awareness of the depth of unsolved problems and the certainty that their depth like the

acuity of situations such as the catastrophe of the infinite meanings of energy are the token of movement, movement excluding the possibility of an end, of a limitation to the progress of knowledge.

This is not saying that there is no tragic component in contemporary collisions. It means that the very notion of tragic in science is being altered. Ancient tragedy portrayed the collision of an allpowerful destiny and Man in rebellion against it, a tragedy which ended in man's downfall. Such were the tragedies of Aeschylus, Sophocles and Euripides and such was the definition of tragedy in Aristotle. Its scientific and philosophical equivalent was the peripateticist dissolution of the particular and local in the universals embracing all creation, and the medieval opposition between eternity and the 'time of the created'. Classical science in the 17th-19th centuries had its collisions with the question of the 'sun spots.' Max Planck regarded the fate of ether ('the son of classical science, born of pain') as tragic, but there was no longer a break between the local image and the integral idea, experience was ultimately to demonstrate the submission of the concrete fact to the eternal laws of being—to its axioms.

The case of the Renaissance was quite different. The 15th-16th centuries witnessed the passage from the old static foundations of the representation of the world to the new dynamic foundations. These could not be regarded as stable and their basic variability entered science—to retreat into the shade in the following century, and reappear later on. The aim of the quest for new invariants of knowledge was indeed to find them, but invariants that would be permanent, and the tragedy of Renaissance science was that it found none. In Shakespearean tragedies the local situation alters the entire course of the action, the hero's entire fate, but that very alteration is subject to new axiomatic morals—which Hamlet strove desperately to find in order to reconstruct the time 'out of joint,' the inaccessibility of which was equally fatal to the followers of Paolo and Francesca—Romeo and Juliet. Surely this shows a relation—distant, indirect, discreet but undeniable—with the knowledge of the world as presented in the Renaissance philosophy of nature—a philosophy teaching the decisive importance of experience when the new and stable axioms of being are lacking. This is the new meaning of the tragedy of knowledge and the understanding of the world.

Tragedy of Knowledge in the Renaissance

Laws can no longer annihilate the man who rebels against them—Antigone is not trampled beneath the heel of fate; but man is in need of new moral laws—and it was this quest that led Hamlet to his doom.

Where then can the pathos and the moral and emotional equivalent of contemporary science be said to lie? In the continuous transformation of universal laws into an unbroken series of experiments. In practice, the entire transformation of the world becomes *experimentum crucis* for what knowledge we may have of it. Renaissance tragedies have not disappeared, they have lost their limitations: the transformation that leads to new stable and hence permanent norms. They obey the essential tradition of the Renaissance: anti-traditionalism.