FROM THE "USPEKHI FIZICHESKIKH NAUK" ARCHIVE

On the life of Descartes and his method of rightly conducting the reason and seeking truth in the sciences

C G Jacobi

Abstract. Events of world importance have necessitated a change to a new basis of life and economy of a multimillion population on an immense territory. Such work in each particular area calls for a deep, cautious and circumstantial analysis, because the human mind is given to taking the probable for the true, and, resorting to fanciful reasoning, arrives at wrong results rather than correct conclusions. Because of this we deemed it worthwhile to remember the life of a philosopher who called for special caution in reasoning, and who even resolved to put forward his own method for rightly conducting the reason. The life of this philosopher and the basics of his teaching were described with amazing power and brevity by one of the greatest mathematicians of the last century, C G Jakobi, in a public lecture delivered in Berlin on January 3, 1846. This lecture was published in volume 7 of Jacobi's 'Gesammelte Werke'. Such publications rarely fall into the hands of readers other than specialists in mathematics. This is the reason why we believe that the publication of the translation of this lecture in Physics - Uspekhi is appropriate and timely.

Preface to the Russian translation of 1918 by *A N Krylov*

There is a midnight time in history — around 1000 A D — when the human race had lost even the memory of art and science itself. The last glow of twilight of the bright heathen world had faded, and nothing yet intimated the dawn of a new day. Whatever remained in the world of the enlightenment belonged to the Saracens, and the future Pope eager for knowledge had to study at their universities in disguise, and was therefore held in the lands of the West as a wonder . When Christendom finally had had enough of worshipping the dead bones of martyrs, it turned again to the Holy Sepulcher only to find that the tomb was empty and that Christ had risen from the dead. So the Christian world came to life again and returned to the activities and occupations of life, with renewed enterprise got engaged in trade and art, the cities thrived, free citizenship took root, Cimabue ¹ revived the lost

Uspekhi Fizicheskikh Nauk **169** (12) 1332–1238 (1999) Translated by A S Dobroslavskii; edited by S D Danilov art of painting, and Dante that of poetry. Then such great and valiant spirits as Abélard² and Saint Thomas Aquinas³ introduced the Aristotelian logic into the Catholic doctrine, and this was the beginning of *scholastic philosophy*. When, however, the Church took the sciences under its auspices, it demanded the same degree of reverence to the teachings of science as to its own doctrines. So the scholastics did not free human spirit, but kept it in manacles for long centuries, proscribing the very idea of liberal scientific inquiry. But eventually the day broke here too, and humankind began to make use of its right to gain knowledge of the nature of things with *man's own independent reasoning*.

In history, the advent of these days is known under the name of Renaissance, or the Revival of Learning. And towering above all at the threshold of this epoch we see *René Descartes*, who made the momentous decision to start anew the studies of all aspects, and to subject to scrutiny *everything* that had so far been based on authority. So please allow me to devote my talk to this outstanding man and to the history of his decision of historic importance.

Born in 1596 to a family of old nobility and educated at the Jesuit School at La Flèche, in his eighteenth year he grew disillusioned with the sciences, which he had so far been studying with great diligence, willing to gain accurate and faithful knowledge of all things of life, and decided to give up his studies. For a short while with other young gentlemen in Paris he indulged in occupations befitting his age and rank, mainly gambling; even less satisfied with such, he abandoned his friends, and for the next two years devoted himself to mathematical meditations in deep solitude in a secluded house of Faubourg St. Germain. Finally discovered, and realising that there is no way of keeping clear from the maelstrom of Parisian society, he decides to study the world on a greater scene. The bandolier of a soldier serves for him as a pass in this war-fevered time. First he goes to Breda in Holland, to study the art of war under Prince Maurice⁴. Since the latter, however, concluded a two-year armistice with

¹ Cimabue (original name: Benciveni di Pepo, modern Italian: Benvenuto di Giuseppe, born before 1251, died in 1302), painter and mosaicist, the last great Italian artist in the Byzantine style, which had dominated early medieval painting in Italy. (*Translator's note*.)

C G Jacobi (Lecture delivered by C G J Jacobi in Berlin on January 3, 1846 at the Berlin Academy of Singing. First published 1846 by W Adolf und Comp., Berlin. Specially translated for this publication from the German original by Alexander Dobroslavskiĭ. Quotations from the 'Method' of Descartes are given in the immaculate translation of John Veitch) First published in "Uspekhi fizicheskikh nauk" 1 (2) 165 (1918)

² Abélard (French: Pierre Ablard, or Abailard, Latin: Petrus Abaelardus, or Abeilardus, born in 1079, Le Pallet, near Nantes, Brittany, died on April 21, 1142, Priory of Saint-Marcel, near Chalon-sur-Sane, Burgundy, France), French theologian and philosopher best known for his solution of the problem of universals and for his original use of dialectics. (*Translator's note.*)

³ St. Thomas Aquinas (Italian: San Tommaso d'Aquino, born in 1224 or 1225, at Roccasecca, near Aquino, died on March 7, 1274 at the Cistercian abbey of Fossanova), a Christian philosopher who developed his own conclusions from Aristotelian premises, notably in the metaphysics of personality, creation, and Providence. His masterwork is Summa Theologica (1266–1273). (*Translator's note.*)

⁴ Maurice (in full Maurice, Prince of Orange, Count of Nassau, Dutch: Maurits, Prins van Oranje, Graaf van Nassau, born on November 13, 1567, Dillenburg, Nassau, died on April 23, 1625, The Hague), hereditary stadholder (1585–1625) of the United Provinces of the Netherlands, or Dutch Republic. (*Translator's note.*)

Spinola, he goes to Frankfurt to attend the magnificent spectacle of the coronation of Kaiser Ferdinand II, and then he volunteers to the troops rallied by the Bavarian herzog against Bohemia. He starts the campaign in the winter quarters in a small village in the duchy of Neuburg on the Danube. Here, in deepest solitude, the 22-year-old youth comes to the conclusion that, in order to find the truth, he has to abandon all the knowledge inherited from authorities, tear down his entire intellectual and moral world, and create a new and better one using the power of mind bestowed on the sons of the earth. This is not an enterprise of insolent ambition: he feels very strongly about this self-sacrifice, so he fervently appeals to Blessed Virgin Mary to help him in his hard undertaking and takes a solemn oath to make a pilgrimage to Loretto. It goes without saying that, while making it his duty to question everything that belongs to the realm of reason, he assumed that the truths and beliefs of religion are outside the compass of the mind, and have to be accepted without justification.

In the spring of 1620 the duke of Bavaria advanced his troops to Swabia; here, in Ulm, Descartes takes the opportunity to pay a visit to the famous old teacher of mathematics Johannes Faulhaber, who was certainly much surprised to find such knowledge of mathematics in the young soldier who effortlessly solved his difficult problems. In September Descartes goes with the French envoy to Vienna. Here he learns that his general, the duke of Bavaria, is moving his troops to Bohemia. He rejoins the army, takes part in the famous battle of Prague, and enters the city with the victors. So his first military engagement was against the father of the princess who later was to become his first and most diligent student in philosophy and mathematics. Having spent the winter in southern Bohemia immersed in his studies in pursuance of his great plans, in the spring of 1621 he followed the Austrian general de Bucquoy to Hungary in the campaign against the famous Transylvanian prince Bethlen Gåbor⁵, and took part in the victorious siege of Pressburg and Tyrnau. The catastrophe at Neuhäusel, where de Bucquoy fell, deterred him from the war. The next day after the siege was withdrawn, together with many other French and Walloon volunteers he returned to Vienna, and since in France the war with the Huguenots had broken out again, and the plague fallen upon Paris, he decided to visit the peaceful northern Europe. He returns to Moravia, from there to Silesia, travels across all Poland, which at that time was quite extensive, the Baltic coast, Pomerania, Brandenburg, Holstein, East Friesland. During the sea voyage from Emden to West Friesland he, being accompanied by just one servant, is nearly murdered by the seamen. From there he goes back to Holland, spends some time there, and in March 1622 eventually returns to his father in Rennes. On this journey he probably also visited Königsberg and Berlin. He spends one year with his family, deliberating on the way of life befitting his profession and his scientific plans. Again he goes to Paris, where the people had just started breathing clean air after three years of pestilence, and where he was taken for a Rosicrucian, although in all his travels he never had a chance of discovering the trace of this invisible society, much discussed in print at the time. He is regarded as one of the 36 messengers presumably dispatched all over Europe by their mysterious chief, with whom they

could only communicate by thought and will, in an inconceivable way. Selling most of the property inherited from his mother's side in Poitou in order to buy himself an appropriate office, he decides to visit Italy before settling down. Via Basel, Zürich, Graubünden, Tirol he goes to Venice, attends the espousal of the doge with the sea, fulfills his vow taken in Neuburg to visit Loretto, and from there goes to Piedmont so as to fulfill the promise given to his father and get himself the office of an intendant in the French army, which under the seasoned Constable Lesdiguières was waging a campaign in alliance with the Piedmontese against Genoa and the Spanish. When this attempt fails, he pilgrimages to Rome, which attracts the Catholic believers by the celebration of the 25th anniversary and where he has an opportunity to study the habits of many different nations assembled here, so he gives up his intention to visit Sicily and Spain. He returns to Florence, missing his chance to meet his great contemporary Galileo, who shares with him the glory of the reviver of sciences. He witnesses the conquest of Gavi by the French, and the illustrious exploits of the Duke of Savoy. Via Turin and Lyons he returns back home, where he is offered the office of Lieutenant général of Châtellerault. However, he is no longer willing to give up the habit of devoting his life entirely to his studies. He spends three years in Paris, leading a life as secluded and simple as was only possible without affectation. In any case, we must always imagine our philosopher in green taffeta garments according to the fashion of those days, in a feathered hat, with the scarf and sword which were an indispensable part of the gentleman's attire. He devotes his time now to the most abstract mathematical problems, now to physical experiments, acquiring great skill in the polishing of glass; now he goes into the depths of mechanics, where he formulates the principle of virtual velocities which is a fundamental concept in this discipline even today. Seeing, however, how few are those with whom he can speak of these matters, he switches to something that he holds as the topmost - the study of man. He finds, however, that most people know even less about man than about geometry, and goes even deeper into himself. His fame, alas, makes the so much desired solitude impossible - crowds of literati and savants, seeking acquaintance or conversation, turn his home into an academy. In vain he tries to hide in the remotest quarters of Paris: his servant, recognised by somebody, betrays him. Resentfully he leaves Paris in August 1628 to take part as volunteer in the siege of La Rochelle, commanded by the king himself; he takes the opportunity to survey the famous dam of Richelieu. After the victorious entry of the king into La Rochelle he returns to Paris.

On account of his great assiduity, not interrupted even by the hardships of the camp life, he collected a lot of material, which he had not yet, however, made public. Catholic clergy of the time ought to be given due credit for fostering and loving the sciences in the highest degree. In this respect they stood as a praiseworthy opposite to the Protestant zealots, whose outcry smothered sciences in Germany. So it is very likely that the world must be grateful to two cardinals, the Cardinal de Bérulle and the papal nuncio Cardinal de Bagné, for the taste of the fruit that Descartes was slowly letting ripen. At a soirée at the papal nuncio's, a certain Monsieur de Chandoux ⁶ set forth the principles of a new philosophy, and

⁵ Gåbor Bethlen (1613-29), the most famous of all the princes of Transylvania, at home Bethlen's rule was thoroughly despotic. (*Translator's note.*)

⁶ Later this Monsieur de Chandoux, at the time of civil unrest in France, like many others started making counterfeit money, and was hanged on the Place de Grive.

won great applause with his witty and eloquent presentation. Insistently pressed to voice his opinion, Descartes praises the speaker for having the courage to shake off the shackles of scholasticism, but draws attention to the force with which the probable takes the place of the true. If one be content with the probable, as the distinguished audience is, then it is easy to prove with presumptive arguments that the false is true, or, conversely, that the true is false. To prove his point, he asked the audience to formulate an indubitably true statement, and then with twelve arguments, one as plausible as another, proved that this statement was false. Then he asked for a certainly false statement, and used another twelve arguments to convince the audience that it was true. Asked whether there was a safeguard against specious arguments, he points to his own method derived from the province of mathematics. In many private discussions he indoctrinates the Cardinal de Bérulle into this method and its diverse applications, which are also aimed at improving the material well-being of mankind; he already believed that mechanical improvements can increase the productivity of human labour - the idea that has come true today and changed the world.

The good cardinal used his spiritual influence to warn Descartes that he would answer before God as a robber if he withheld the fruits of his studies from mankind, whereas otherwise God's grace would be upon him. So he decides to do his best to complete and publish his work, and to sink from view so as to devote himself wholly to this great task. He moves to Holland, whose cool climate he likes. There he remains for twenty years, constantly on the move; like the people of Israel in the desert, he makes his temporary home now in a village, now in a country estate, now in the outskirts of a big city. Staying in the shadow, he nevertheless keeps in touch with the brightest minds of his time through the learned Father Mersenne⁷ in Paris, his oldest friend and a graduate of La Flèche like himself, who alone was informed of his whereabouts. His cell at the Minims de l'Annociade near the Place Royale became the centre of the most learned exchange: here Mersenne gave the answers from the oracle consulted through him, and collected new queries and doubts.

Arriving in Holland, Descartes devotes himself with renewed ardor to dioptrical, chemical and physical experiments, alternating with anatomical and medical studies, astronomical observations, and metaphysical speculations. The phenomenon of mock suns⁸ inspired him to study the entire realm of atmospheric phenomena, especially the rainbow; on a short trip to England he observed the declination of a magnetic needle near London. He planned to put everything into a single book entitled 'The World', in which he wanted to explain and prove the necessity of all Creation. To guard himself against theological criticism, he chose the following form: he completely disassociated from the *real* world, and surmised what would the world have been if God had made the natural laws act upon the chaotically tangled matter. First he gives the description of such matter, to which he ascribes the most simple properties; then he formulates the laws of Nature and proves their necessity on principle that should God have created many worlds, they all would have been governed by the same laws. He shows how this barren chaos is transformed into the heavens with the Sun and fixed stars, planets and comets, demonstrates the necessity and the nature of the light of the sun and fixed stars, how the light travels immense distances in space in a moment, and how it must be reflected by the planets. He describes the substance, the mutual position, the motion and other properties of celestial bodies, so that one was brought to the conclusion that nothing in this world is different from what it should be. Then he comes down to earth, explains how its parts must tend to the centre, how the position of Earth relative to the Moon and the Sun produces the tidal rise and fall, the great ocean current from east to west in the tropics, the trade winds; how in accordance with the laws of Nature formed are mountains, seas, fountains, rivers, how the metals concentrate in ore veins; how all complex bodies are produced, how the plants grow. Then he goes to the animals, to man, but admits that his knowledge of chemistry and anatomy is not sufficient for getting a complete insight into the necessity of this organism. However, a thinking spirit cannot arise from all these forms of matter, a new act of God's creation is required for that. He wants to conclude his work with the description of the essence of the spirit.

We are astounded by the daring of this enterprise. The spirit, breaking out of the dungeons of scholasticism and regaining its strength, feasts on the divine inspiration of liberal studies, exultantly desires to cover the immeasurable path of learning with winged strides, and, seeing the shimmering ultimate goal of all learning on the far horizon, fancies to reach it in a wreck of a boat.

On the 17th February 1600, *Giordano Bruno*⁹ was burned alive on Campo dei Fiori in Rome, in front of the Theatre of Pompey, while his judges trembled more than he did. *Lucilio Vanini* was strangled on the 19th February 1619 in Toulouse after his tongue was torn out, and then his body was reduced to ashes. *Campanella* ¹⁰ was dragged through 50 underground dungeons, seven times he was put to cruel tortures of which one continued for 40 hours.

But nothing apparently had impressed Descartes more than the news he received in 1633, right at the time when he was giving a final touch-up to his 'World' before sending it to Father Mersenne, that the illustrious, famous, and patronised by the Grand Duke of Tuscany Galileo had been arrested by the Inquisition and had to kneel down and renounce the revolution of Earth around the steadfast sun as a heresy. The heart of Descartes split in two, and never was healed again. The truth of Copernicus' theory was as certain for him as the

⁷ Mersenne, Marin (born on September 8, 1588 in Oize in Maine, France, died on September 1 1648 in Paris, France) is best known for his role as a clearing house for correspondence between eminent philosophers and scientists and for his work in number theory. (*Translator's note.*)

⁸ Parhelion, also called mock Sun or Sun dog, atmospheric optical phenomenon appearing in the sky as luminous spots 22 degrees on each side of the Sun and at the same elevation as the Sun. Usually, the edges closest to the Sun will appear reddish. Other colours are occasionally visible, but more often the outer portions of each spot appear whitish. (*Translator's note.*)

⁹ Bruno, Giordano (original name: Filippo Bruno, byname Il Nolano, born in 1548, Nola, near Naples, died on February 17, 1600, Rome), Italian philosopher, astronomer, mathematician, and occultist whose theories anticipated modern science. On Feb. 8, 1600, when the death sentence was formally read to him, he addressed his judges, saying: 'Perhaps your fear in passing judgment on me is greater than mine in receiving it'. Not long after, he was brought to the Campo dei Fiori, his tongue in a gag, and burned alive. (*Translator's note.*)

¹⁰ Campanella, Tommaso (original name: Giovanni Domenico Campanella, born on September 5, 1568, Stilo, Kingdom of Naples [Italy], died on May 21, 1639, Paris, France), Italian philosopher and writer who sought to reconcile Renaissance humanism with Roman Catholic theology. He is best remembered for his socialistic work 'La citta del sole' (1602; 'The City of the Sun'), written while he was a prisoner of the Spanish Inquisition (1599–1626). (*Translator's note.*)

fact of his own existence, but he was also convinced of the infallibility of the pope. Embittered, he decided not to publish his work. Since then, the research of the next two centuries have proved beyond any doubt the things that previously had appeared to the creative mind in vague notions; free studies have brought about such results that could not have been dreamed of. In our happier times, when the life of genius is no longer threatened by fiery censorship, we have the pleasure to welcome the 'World' of the noble mind and the great scholar that we have the honour to call our compatriot¹¹ — the 'World' that makes up so generously for the lost one.

Finally, friends convinced Descartes to revise his decision not to publish anything during his lifetime, and so his first big work was published in Leiden in 1637, for which he received from France, ruled at that time by the great Cardinal, the founder of the Paris Academy of Sciences, a distinguished privilege to publish not only this book, but all books that he had written previously or would write in the future, whether in France or abroad. This is a delightful contrast to the persecution of Descartes by the Protestant theologians of the newly founded University of Utrecht, who wrathfully denounced his theories as being atheistic and dangerous for the state, and against whom he only found protection in the enlightened wisdom of Prince Maurice of Orange. In a similar way, a few years earlier the Protestant theologians of Tübingen University had banned our great Kepler, refused him the permission to print his astronomical writings, so that the Jesuits of Innsbruck had to publish them at their own expense. Kepler, who may be regarded as a martyr for the Protestant faith professed by him without fear at the emperor's court, was refused the holy communion for being true to the Augsburg confession, for declining to swear to the Formula of Concord and curse the Calvinists. Reading the Bible was forbidden to him as something not appropriate for a layman, and they nearly burned his mother at the stake as a witch — he only managed to save her through a skillful defence before the court, and on account of his position as royal mathematician.

The book of Descartes contains four different works: "Discourse on the method of rightly conducting the reason and seeking truth in the sciences", 'Dioptrics', 'Meteors', and 'Geometry'. In the last three tracts he wanted to give examples of application of his method to purely mathematical, purely physical, and mixed subjects. His 'Geometry' transformed mathematical sciences, freed geometry from the domination of details and figures, and made it a discipline of general calculus. In his 'Dioptrics' we find the beginning of the concept of light to which physicists have currently returned, and which alone is capable of explaining the marvelous phenomena of single and double refraction, and the perception of colours. I am referring to the wave theory of light, which holds that it is not matter leaving the luminous body that is perceived by the eye, but rather the oscillations of the light ether. In this distinguished audience, however, I would like to speak in some detail only about the 'Method' of Descartes, as the first of his four above-mentioned works is

¹¹ Reference to Alexander von Humboldt and his book 'Cosmos' (Greek for 'universe', 'world'), just published at the time of Jacobi's lecture (*note in the Russian translation of 1918*). Humboldt, Alexander von (in full Friedrich Wilhelm Heinrich Alexander, Freiherr (baron) von Humboldt, born on September 14, 1769, Berlin, died on May 6, 1859, Berlin), German naturalist and explorer who was a major figure in the classical period of physical geography and biogeography. (*Translator's note.*) usually referred to, where he gives an outline of his theory. At the same time, this work by its simple and noble manner of expression is an unsurpassable monument of French literature.

Of all things among men, — thus he begins his 'Method', — good sense is the most equally distributed; for every one thinks himself so abundantly provided with it, that those even who are the most difficult to satisfy in everything else, do not usually desire a larger measure of this quality than they already possess. And in this it is not likely that all are mistaken — the conviction is rather to be held as testifying that the power of judging aright and of distinguishing truth from error, which is properly what is called good sense or reason, is by nature equal in all men; and that the diversity of our opinions, consequently, does not arise from some being endowed with a larger share of reason than others, but solely from this, that we conduct our thoughts along different ways, and do not fix our attention on the same objects.

Descartes believes that from the start it had been his singular good fortune to have very early in life fallen in with certain tracks which have conducted him to considerations and maxims, of which he had formed a method of gradually augmenting his knowledge, and of raising it by little and little to the highest point which the mediocrity of his talents and the brief duration of his life would permit him to reach. To learn from the general opinion whether he is not mistaken, he wants to describe the paths he had followed, and to delineate his life as in a picture. His tract does not contain any universal rules that should be followed by everyone, but ought to be regarded merely as a history, or, if you will, as a tale, from which anyone can take whatever he finds suitable for him.

From my childhood, — he continues, — I have been familiar with letters; and as I was given to believe that by their help a clear and certain knowledge of all that is useful in life might be acquired, I was ardently desirous of instruction. But as soon as I had finished the entire course of study, I found myself involved in so many doubts and errors, that I was convinced I had advanced no farther in all my attempts at learning, than the discovery at every turn of my own ignorance. And yet I was studying in one of the most celebrated schools in Europe, in which I thought there must be learned men, if such were anywhere to be found. I had been taught all that others learned there, I had, in addition, read all the books that had fallen into my hands, treating of such branches as are esteemed the most curious and rare. I knew the judgment which others had formed of me; and I did not find that I was considered inferior to my fellows, although there were among them some who were already marked out to fill the places of our instructors. And, in fine, our age appeared to me as flourishing, and as fertile in powerful minds as any preceding one. I was thus led to take the liberty of judging of all other men by myself, and of concluding that there was no science in existence that was of such a nature as I had previously been given to believe.

I still continued, however, to hold in esteem the studies of the schools. I was aware that the languages taught in them are necessary to the understanding of the writings of the ancients; that the grace of fable stirs the mind; that the memorable deeds of history elevate it; and, if read with discretion, aid in forming the judgment; that the perusal of all excellent books is, as it were, to interview with the noblest men of past ages, who have written them, and even a studied interview, in which are discovered to us only their choicest thoughts; that eloquence has incomparable force and beauty; that poesy has its ravishing graces and delights; that in the mathematics there are many refined discoveries eminently suited to gratify the inquisitive, as well as further all the arts lessen the labour of man; that numerous highly useful precepts and exhortations to virtue are contained in treatises on morals; that theology points out the path to heaven; that philosophy affords the means of discoursing with an appearance of truth on all matters, and commands the admiration of the more simple; that jurisprudence, medicine, and the other sciences, secure for their cultivators honours and riches; and, in fine, that it is useful to bestow some attention upon all, even upon those abounding the most in superstition and error, that we may be in a position to determine their real value, and guard against being deceived.

But I believed that I had already given sufficient time to languages, and likewise to the reading of the writings of the ancients. For to hold converse with those of other ages and to travel, are almost the same thing: when too much time is occupied in travelling, we become strangers to our native country; and the over curious in the customs of the past are generally ignorant of those of the present.

I esteemed eloquence highly, and was in raptures with poesy; but I thought that both were gifts of nature rather than fruits of study. I was especially delighted with the mathematics, on account of the certitude and evidence of their reasonings; but I had not as yet a precise knowledge of their true use; and thinking that they but contributed to the advancement of the mechanical arts, I was astonished that foundations, so strong and solid, should have had no loftier superstructure reared on them. On the other hand, I compared the disquisitions of the ancient moralists to very towering and magnificent palaces with no better foundation than sand and mud: they laud the virtues very highly, and exhibit them as estimable far above anything on earth; but they give us no adequate criterion of virtue, and frequently that which they designate with so fine a name is but apathy, or pride, or despair, or parricide. I revered our theology, and aspired as much as any one to reach heaven: but being given assuredly to understand that the way is not less open to the most ignorant than to the most learned, and that the revealed truths which lead to heaven are above our comprehension. I did not presume to subject them to the impotency of my reason. Regarding philosophy I will say nothing, except that when I saw that it had been cultivated for many ages by the most distinguished men, and that yet there is not a single matter within its sphere which is not still in dispute, and nothing, therefore, which is above doubt, I did not presume to anticipate that my success would be greater in it than that of others; and further, when I considered the number of conflicting opinions touching a single matter that may be upheld by learned men, while there can be but one true, I reckoned as well-nigh false all that was only probable. As to the other sciences, inasmuch as these borrow their principles from philosophy, I judged that no solid superstructures could be reared on foundations so infirm; and neither the honour nor the gain held out by them was sufficient to determine me to their cultivation: for I was not, thank Heaven, in a condition which compelled me to make merchandise of science for the bettering of my fortune; and though I might not profess to scorn glory as a cynic, I yet made very slight account of that honour which I hoped to acquire only through fictitious titles.

For these reasons, as soon as my age permitted me to pass from under the control of my instructors, I entirely abandoned the study of letters, and resolved no longer to seek any other science than the knowledge of myself, or of the great book of the world. I spent the remainder of my youth in travelling, in visiting courts and armies, in holding intercourse with men of different dispositions and ranks, in collecting varied experience, in proving myself in the different situations into which fortune threw me, and, above all, in making such reflection on the matter of my experience as to secure my improvement. I learned to entertain too decided a belief in regard to nothing of the truth of which I had been persuaded merely by example and custom; and thus I gradually extricated myself from many errors powerful enough to darken our natural intelligence, and incapacitate us in great measure from listening to reason.

But after I had been occupied several years in thus studying the book of the world, I at length resolved to make myself an object of study, and to employ all the powers of my mind in choosing the paths I ought to follow, an undertaking which was accompanied with greater success than it would have been had I never quitted my country or my books. I was then in Germany, attracted thither by the wars in that country, which have not yet been brought to a termination; and as I was returning to the army from the coronation of the emperor, the setting in of winter arrested me in a locality where fortunately no cares or passions disturbed my own thoughts. Of these one of the very first that occurred to me was, that there is seldom so much perfection in works composed of many separate parts, upon which different hands had been employed, as in those completed by a single master.

In the same way I thought that the sciences contained in books, composed as they are of the opinions of many different individuals massed together, are farther removed from truth than the simple inferences which a man of good sense using his natural and unprejudiced judgment draws respecting the matters of his experience. And because we have all to pass through a state of infancy to manhood, and have been of necessity, for a length of time, governed by our desires and preceptors (whose dictates were frequently conflicting, while neither perhaps always counseled us for the best), I farther concluded that it is almost impossible that our judgments can be so correct or solid as they would have been, had our reason been mature from the moment of our birth, and had we always been guided by it alone. As for the opinions which up to that time I had embraced, I thought that I could not do better than resolve at once to sweep them wholly away, that I might afterwards be in a position to admit either others more correct, or even perhaps the same when they had undergone the scrutiny of reason. I recognised various difficulties in this undertaking, these were not, however, without remedy, nor once to be compared with such as attend the slightest reformation in public affairs. Large bodies, if once overthrown, are with great difficulty set up again, or even kept erect when once seriously shaken, and the fall of such is always disastrous. Then if there are any imperfections in the constitutions of states, custom has without doubt materially smoothed their inconveniences, and the defects are almost always more tolerable than the change necessary for their removal. Hence it is that I cannot in any degree approve of those restless and busy meddlers who, called neither by birth nor fortune to take part in the management of public affairs, are yet always projecting reforms; and if I thought that this tract contained aught which might justify the suspicion that I was a victim of such folly, I would by no means permit its publication.

Physics - Uspekhi 42 (12)

I have never contemplated anything higher than the reformation of my own opinions, and basing them on a foundation wholly my own.

And although my own satisfaction with my work has led me to present here a draft of it, I do not by any means therefore recommend to every one else to make a similar attempt. Those whom God has endowed with a larger measure of genius will entertain, perhaps, designs still more exalted; but for the many I am much afraid lest even the present undertaking be more than they can safely venture to imitate. After all, the majority of men is composed of two classes, for neither of which would this be at all a befitting resolution: in the first place, of those who with more than a due confidence in their own powers, are precipitate in their judgments and want the patience requisite for orderly and circumspect thinking; whence it happens, that if men of this class once take the liberty to doubt of their accustomed opinions, and quit the beaten highway, they will never be able to thread the byway that would lead them by a shorter course, and will lose themselves and continue to wander for life; in the second place, of those who, possessed of sufficient sense or modesty to determine that there are others who excel them in the power of discriminating between truth and error, and by whom they may be instructed, ought rather to content themselves with the opinions of such than trust for more correct to their own reason. For my own part, I should doubtless have belonged to the latter class, had I received instruction from but one master; I could, however, select from the crowd no one whose opinions seemed worthy of preference, and thus I found myself constrained, as it were, to use my own reason in the conduct of my life.

But like one walking alone and in the dark, I resolved to proceed so slowly and with such circumspection, that if I did not advance far, I would at least guard against falling. I did not even choose to dismiss summarily any of the opinions that had crept into my belief without having been introduced by reason, but first of all took sufficient time carefully to satisfy myself of the general nature of the task I was setting myself, and ascertain the true method by which to arrive at the knowledge of whatever lay within the compass of my powers. And as a multitude of laws often only hampers justice, so that a state is best governed when, with few laws, these are rigidly administered; in like manner, instead of the great number of precepts of which logic is composed, I believed that the four following would prove perfectly sufficient for me, provided I took the firm and unwavering resolution never in a single instance to fail in observing them.

The *first* was never to accept anything for true which I did not clearly know to be such; that is to say, carefully to avoid precipitancy and prejudice, and to comprise nothing more in my judgment than what was presented to my mind so clearly and distinctly as to exclude all ground of doubt.

The *second*, to divide each of the difficulties under examination into as many parts as possible, and as might be necessary for its adequate solution.

The *third*, to conduct my thoughts in such order that, by commencing with objects the simplest and easiest to know, I might ascend by little and little, and, as it were, step by step, to the knowledge of the more complex; assigning in thought a certain order even to those objects which in their own nature do not stand in a relation of antecedence and sequence.

And the *fourth*, in every case to make enumerations so complete, and reviews so general, that I might be assured that nothing was omitted.

This is the foundation of Cartesian logic — the simple rules which he used for studying anew each and every branch of science. But before commencing to rebuild the house in which we live, it is likewise necessary that we be furnished with some other house in which we may live commodiously during the operations. So that he might not remain irresolute in his actions, while his reason compelled him to suspend his judgment, and that he might not be prevented from living thenceforward in the greatest possible felicity, he formed a provisory code of morals, composed of three or four maxims:

The *first* was to obey the laws and customs of my country, adhering firmly to the faith in which, by the grace of God, I had been educated from my childhood and regulating my conduct in every other matter according to the most moderate opinions, and the farthest removed from extremes. In order to ascertain the real opinions, I ought rather to take cognisance of what they practiced than of what they said, not only because, in the corruption of our manners, there are few disposed to speak exactly as they believe, but also because very many are not aware of what it is that they really believe.

The *second* maxim was to be as firm and resolute in my actions as I was able, and not to adhere less steadfastly to the most doubtful opinions, when once adopted, than if they had been highly certain.

The *third* maxim was to endeavour always to conquer myself rather than fortune, and change my desires rather than the order of the world, and in general, accustom myself to the persuasion that, except our own thoughts, there is nothing absolutely in our power; we shall no more regret the absence of such goods as seem due to our birth, when deprived of them without any fault of ours, than our not possessing the kingdoms of China or Mexico. We shall no more desire health in disease, or freedom in imprisonment, than we now do bodies incorruptible as diamonds, or the wings of birds to fly with. But I confess there is need of prolonged discipline and frequently repeated meditation to accustom the mind to view all objects in this light; and I believe that in this chiefly consisted the secret of the power of such philosophers as in former times were enabled to rise superior to the influence of fortune, and they had some ground on this account for esteeming themselves more rich and more powerful, more free and more happy, than other men who, whatever be the favours heaped on them by nature and fortune, if destitute of this philosophy, can never command the realisation of all their desires.

In fine, to conclude this code of morals, I thought of reviewing the different occupations of men in this life, with the view of making choice of the best. And, without wishing to offer any remarks on the employments of others, I may state that it was my conviction that I could not do better than continue in that in which I was engaged, viz., in devoting my whole life to the culture of my reason, and in making the greatest progress I was able in the knowledge of truth, on the principles of the method which I had prescribed to myself. Inasmuch as we neither seek nor shun any object except in so far as our understanding represents it as good or bad, all that is necessary to right action is right judgment, and to the best action the most correct judgment, that is, to the acquisition of all the virtues with all else that is truly valuable and within our reach; and the assurance of such an acquisition cannot fail to render us contented.

Having thus provided himself with these maxims, and having placed them in reserve along with the truths of faith, which had ever occupied the first place in his belief, he came to the conclusion that he might with freedom set about ridding himself of what remained of his opinions. To erect the new building itself, however, he decides to exercise himself in the solution of mathematical difficulties, by having detached them from such principles of these sciences as were of inadequate certainty. This ought to teach his mind to deal with truths and not to be content with probabilities; by applying mathematics to physics, through experiments and observations get a better knowledge of Nature, through constant exercise become more and more versed in his method and rid of the obsolete opinions and misbeliefs. Reaching maturity, and urged by the good Cardinal to expound his system and publish his findings, he finally comes to the foundation of his philosophy. However, he pulled down all the existing concepts, he has no firm ground under his feet, and where in this ocean of uncertainty can he find the ultimate truth to serve as the starting point, as the cornerstone of his edifice? Is it surprising then that for him whose entire existence has become deep thought, it is the thought that is firm truth, firmer than his own existence, or, rather, the proof of his existence is his ability to think? So he writes down and formulates as the foundation of his philosophy the following statement:

I think, therefore I am; je pense, donc je suis; cogito ergo sum.

These words became the first principle of the new philosophy, this is the slogan with which the new science is marching on. Man knows what his essence is, the mist of scholasticism is dispersed, the sun of thought has risen over the renewed word, and it is in its light that we are walking even today. This is not a wild and desperate onslaught against religion and the state — it is the calm confidence of self-aware genius that is willing to solve the problem of humankind in agreement and cooperation. Wise moderation and exalted action — this is the distinctive trait of Descartes; even Rome mentioned his writings in the Index with a very mild comment 'pending correction' (donec corrigantur, 22 November 1663).

It is not my intent to continue presenting the teaching of Descartes as it is expounded further in his 'Method' and the subsequent 'Principles'. I will only say a few words about two princesses, with whom Descartes was closely connected and who accompanied him to the end of his days.

In the village called the Hague, which could be compared to the most beautiful European cities, at that time one could see three remarkable parties of courtiers. Two thousand noblemen in rawhide colletins with orange scarves, in huge jackboots and with broadswords, surrounded the Prince of Orange. In black velvet with ruff lace collars, with foursquare beards, the deputies of States-General and the magistrates represented the civil aristocracy. The Dowager Queen of Bohemia with her five daughters drew together the third circle, where the ladies assembled daily, and the fashionable society was paying homage to the grace and erudition of the princesses. Two miles away, in the small seaside village of Endegeest near Leiden, since Easter of 1641 lived Descartes, who over the years had become more sociable. The eldest of the princesses, Elisabeth, was a prodigy of learnedness. Well acquainted with letters and having mastered many languages (six the sisters had learned under the guidance of their mother), she turned to the more serious subjects of mathematics and physics. But everything that she had learned before seemed to her small and insignificant after the writings of Descartes fell into her hands. Accounts of his friend burggraf Dohna whetted her desire to get to know him

personally. She invited him to her house and became his ardent student. He could share with her his most sublime metaphysical speculations, his most abstract geometrical constructions, and in his 'Principles', dedicated to her, he declares that of all his students she alone had a complete understanding of his writings¹².

On account of her love of Cartesian philosophy, she declined the hand of Wladislav IV, the King of Poland. When her younger brother Philipp out of jealousy slew a certain Monsieur d'Epinay at the hay market in the Hague in broad daylight, her mother, suspecting her complicity, banned her from the Hague, and private instruction gave place to a longtime correspondence with Descartes, of which we, unfortunately, do not possess the letters of the princess. Until the Peace of Westphalia she lived in Crossen and Berlin with her Brandenburg relatives, and then in Heidelberg with her brother Carl Ludwig, who regained sovereignty over Pfalz as a result of the Westphalia settlement. When his wife, whom she had befriended, broke with her husband and under pretext of going hunting ran away on subterfuge horses to her brother, a landgraf in Cassel, Princess Elisabeth also returned to Cassel. Later in her life, in spite of being a Calvinist, she received a Lutheran abbey Herforden in the county of Ravensberg, which, with a rent of 20,000 thalers, for the first time warranted an independent and carefree existence for her. She transformed this abbey into a philosophical academy, which till her death was the most celebrated Cartesian academy. She granted admission to anyone without distinction of confession, be they Catholics, Calvinists, Lutherans, Socinians or Deists, as long as they practiced philosophy. She died in 1680 in her 61st year.

Another prodigy of her time was the young Swedish queen Christine. At that time she was a 19-year-old girl, who day after day studied Tacitus, learned Greek, and seriously immersed herself in sciences. At the same time she was adroit in all physical exercises. None of her courtiers could shoot a running hare with equal skill; she was a deft rider, and once spent ten hours on horseback during a hunting expedition. She feared neither heat nor frost, never put on bonnets or shawls; a plain feathered hat was her only protection from rough weather. Her toilette took her a quarter hour, all her headgear consisted of a comb and kerchief. Her table was simple and unseasoned, and she slept five hours. With all this, she carried one of the most potent crowns with dignity; what she lacked in experience was compensated by her sharp wit, which allowed her to go into the most baffling situations and come up with decisions. Her genius dominated over the state council, and mature statesmen were sometimes surprised with their own compliance. Foreign ambassadors negotiated not with the ministers as before, but directly with the queen. When she got acquainted with the works of Descartes, she immediately desired to take private lessons from him in his philosophy. When Descartes, in spite of her insistent invitations, vacillated, she sent her Admiral Flemming in the spring of 1649 with a ship at his complete disposal; then he resisted no longer, and in October 1649 arrived in Stockholm.

In spite of the winter season, the queen daily took his lessons at five in the morning in her study. She intended to grant him a hereditary estate from her possessions in Bremen or in Pomerania, wishing to bind him even more strongly to

¹² Among other things, she used the analytical geometry invented by her teacher for solving the problem of drawing a circle tangent to three given circles.

herself. But being unaccustomed to the harsh climate, he fell ill and died within a few days at the beginning of February.

Seventeen years after his death, when Christine had long laid down her crown, his ashes were brought to Paris and buried in the Church of St. Geneviève, the today's Pantheon. It is often much more comfortable to possess such ashes than such men alive.