

THE SCIENTIFIC ATTITUDE OF MIND¹

I have undertaken the duty of addressing you for a few moments in order to welcome you to this society and also to make some suggestions which seem appropriate to the beginning of your connection with it. What we expect this society to do for you is, that it shall confirm your devotion to true science and help to train you in scientific methods of thought and study.

Let us begin by trying to establish a definite idea of what science is. The current uses of the term are both very strict and very loose or vague. Some people use the term as a collective term for the natural sciences; others define science as orderly knowledge. Professor Karl Pearson, in his *Grammar of Science*,² does not offer any definition of science, but he tells the aim of science and its function.

“The classification of facts and the formation of absolute judgments upon the basis of this classification — judgments independent of the idiosyncrasies of the individual mind — is peculiarly the *scope and method of modern science*. The scientific man has above all things, to strive at self-elimination in his judgments, to provide an argument which is as true for each individual mind as for his own. *The classification of facts, the recognition of their sequence and relative significance is the function of science*, and the habit of forming a judgment upon those facts unbiased by personal feeling is characteristic of what we shall term the scientific frame of mind.” These

¹ Address to initiates of the Sigma Xi Society, on Mar. 4, 1905.

² P. 6.

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statements we may gladly accept so far as they go, but they are not definitions of science.

I should want to make the definition of science turn upon the *method* employed, and I would propose as a definition: knowledge of reality acquired by methods which are established in the confidence of men whose occupation it is to investigate truth. In Pearson's book, he refers constantly to the opinions and methods of scientific scholars as the highest test of truth. I know of no better one; I know of none which we employ as constantly as we do that one; and so I put it in the definition. I propose to define science as knowledge of reality because "truth" is used in such a variety of senses. I do not know whether it is possible for us ever to arrive at a knowledge of "the truth" in regard to any important matters. I doubt if it is possible. It is not important. It is the pursuit of truth which gives us life, and it is to that pursuit that our loyalty is due.

What seems to me most important is that we should aim to get knowledge of realities, not of phantasms or words. By a phantasm I mean a mental conception which is destitute of foundation in fact, and of relations to the world of the senses. In the Middle Ages all men pursued phantasms; their highest interest was in another world which was a phantasm, and they were anxious about their fate in that world. They tried to provide for it by sacraments and rites which were fantastic in their form, and in their assumed relation to the desired end. They built up a great church corporation and endowed it with a large measure of control of human affairs so that it could provide for welfare in the other world. It had special functions which were fantastic with reference to the end which they were to accomplish because they contained no rational connection between means and

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ends. All the societal power which the church did not have was given to the Emperor, because in a certain text of Scripture mention was made of "two swords." The historical period was spent in a war between the Pope and the Emperor to see which should rule the other. The Crusades were an attempt to realize a great phantasm. Chivalry and the devotion to women were phantasms. The societal system was unreal; it assumed that men were originally in a state of slavery and that all rights which they had were due to gift from some sovereign. It resulted that only two men in the world, the Pope and the Emperor, had original and independent rights. The relation of classes, parties, and corporations in the society was therefore both loose and complicated. It is amazing to notice the effect of all this attention to unrealities on all the products of the Middle Ages. People had no idea of reality. Their poetry dealt with arbitrary inventions and demanded of the reader that he should accept tiresome conventions and stereotyped forms. They formed ideas of Cathay such as we meet with in the Arabian Nights, and they were ready to believe that there might be, in Cathay, any animal form which anybody's imagination could conceive, and any kind of a human figure, for instance, one with a countenance on the elbows or the knees. Theologians quarreled about whether Jesus and his disciples abjured property and lived by beggary, and whether the blood which flowed from the side of Jesus remained on earth or was taken up to heaven with him. The most noticeable fact is that all the disputants were ready to go to the stake, or to put the other party to the stake, according as either should prove to have the power. It was the rule of the game as they understood it and played it. It was another striking manifestation of the temper of the times that within

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a few days after the capture of Antioch, the poets in the several divisions of the successful army began to write the history of the conflict, not according to facts, but each glorifying the great men of his own group by ascribing to them great deeds such as the current poetry ascribed to legendary heroes. What could more strikingly show the absence of any notion of historic reality?

Now, if you compare our world of ideas with that of the Middle Ages, the greatest difference is that we want *reality* beyond everything else. We do not demand the truth because we do not know where or how to get it. We do not want rationalism, because that is only a philosophy, and it has limitations like any other philosophy. We do not demand what is natural or realistic in the philosophical sense, because that would imply a selection of things, in operation all the time, before the things were offered to us. In zoology and anthropology we want to know all forms which really exist, but we have no patience with invented and imaginary forms. In history we do not allow documents to be prepared which will serve a purpose; to us, such documents would have the character of lies. That they would be edifying or patriotic does not excuse them. Probably modern men have no harder task than the application of the historic sense to cases in those periods of history when it was not thought wrong to manufacture such documents as one's cause required.

The modern study of nature has helped to produce this way of looking at things, and the way of looking at things has made science possible. I want to have the notion of science built on this thirst for reality, and respond to it at every point. There may be knowledge of reality whose utility we do not know, but it would be overbold for any one to say that any knowledge of reality is useless.

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Since our ancestors devoted so much attention to phantasms and left us piles of big books about them, one great department of science must be criticism, by which we discern between the true and the false. There is one historical case of this requirement which always rises before my mind whenever I think of the need of criticism — that is witch-persecution. Although the church had a heavy load of blame for this frightful abuse, yet the jurists were more to blame. As to the church also, the Protestants, especially the Puritans of Scotland, were as bad as the Homan Catholics. Witch-persecution is rooted in demonism, which is the oldest, widest, and most fundamental form of religion. Whenever religion breaks down there is always produced a revival of demonism. The developments of it may be traced from early Chaldaea. It was believed that demons and women fell in love and begot offspring. Nightmare, especially in the forms experienced on mountains, led to notions of midnight rides, and Walpurgis-Nacht assemblies; then the notion of obscene rites was added. It was believed that witches could provoke great storms and convulsions of nature; all remarkable instances of calamity or good luck, especially if it affected one or a few, were ascribed to them. Especially hail-storms and tornadoes, which sometimes destroy crops over a very limited area, but spare all the rest, were thought to be their work. It was believed that they could transfer good crops from their neighbors' fields to their own. Here we see how phantasms grow. The bulls of popes summed up and affirmed the whole product as fact. Then, too, all the apparatus of pretended investigation and trial which the Inquisition had developed was transferred to the witch-trials. As women chiefly were charged with witchcraft, the result was that all this accumulation of superstition,

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folly, and cruelty was turned against them. If we try to form an idea of the amount of suffering which resulted, our hearts stand still with horror.

Now there are some strong reasons for the faith in witchcraft. Everybody believed that witches existed, that they could enter into contracts with demons, and could get supernatural aid to carry out their purposes in this world. All the accused witches believed this. It was held to be wicked to make use of witches or demons, but it was believed that there were possible ways of accomplishing human purposes by employing them. Consequently when men or women wanted wealth, or office, or honor, or great success, or wanted to inspire love, or to gratify hate, envy, and vengeance, or wanted children, or wanted to prevent other people from having children, this way was always supposed to be open. No doubt very many of them tried it, at least in homely and silly ways — when put to the torture they confessed it. Then, too, somnambulism, dreams, and nightmare took forms which ran on the lines of popular superstition, and many a woman charged with witchcraft did not know but she had been guilty of it to some extent and without conscious knowledge. Again, the Scripture argument for demonism and witchcraft was very strong. It was this pitfall which caught the Protestants; how could they deny that there are any witches when the Bible says: "Thou shalt not suffer a witch to live." Witches were persons who had gone over to the side of Satan and his hosts in their war on God; they were enemies of the human race. The deductions from the primary fantastic notion of demons were all derived on direct and indisputable lines, and those deductions ruled the thought of Christian Europe for five hundred years.

What was wanted to put a stop to the folly and wicked-

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ness was criticism. The case shows us that we men, including the greatest and best of us, may fall at any time under the dominion of such a mania, unless we are trained in methods of critical thinking. A series of great sceptics from Montaigne to Voltaire met the witch doctrines with scorn and derision. They were not afraid to deny the existence of demons. It appears also that the so-called common-sense of the crowd revolted at the absurdities of witchcraft. Every person who was executed as a witch named, under torture, others, who were then arrested, tortured, and executed; each of these named others, and so the witch-judges found that they were driven on, by judicial execution of the most cruel form, to depopulate a whole territory. It was a critical revolt when they saw this construction of their own conduct and turned against it. When we read the story we are amazed that good and honest men could have gone on for centuries inflicting torture of the extremest kind on old women without the bit of critical reflection which should have led them to ask themselves what they were doing.

Let us not make the mistake of supposing that all follies and manias of this kind are permanently overcome and need not be feared any longer. The roots of popular error are ineradicable; they lie at the bottom of human nature; they can produce new growth and new fruits at any time. In this twentieth century the probable line on which the deductions will be drawn is in politics and civil institutions. The modern world has rejected religious dogmatism, but it has taken up a great mass of political dogmatism, and this dogmatism is intertwined with the interests of groups of men. If you accept the political dogmas of the eighteenth century and begin to build deductions on them you will reach a construction as absurd and false as that of witchcraft. The only security

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is the constant practise of critical thinking. We ought never to accept fantastic notions of any kind; we ought to test all notions; we ought to pursue all propositions until we find out their connection with reality. That is the fashion of thinking which we call scientific in the deepest and broadest sense of the word. It is, of course, applicable over the whole field of human interests, and the habit of mind which insists on finding realities is the best product of an education which may be properly called scientific. I have no doubt that, in your lifetime, you will see questions arise out of popular notions and faiths, which will call for critical thinking such as has never been required before, especially as to social relations, political institutions, and economic interests.

Here I may notice, in passing, the difference between science and religion in regard to the habits of thought which each encourages. No religion ever offers itself except as a complete and final answer to the problems of life. No religion ever offers itself as a tentative solution. A religion cannot say: I am the best solution yet found, but I may be superseded tomorrow by new discoveries. But that is exactly what every science must say. Religions do not pretend to grow; they are born complete and fully correct and our duty in regard to them is to learn them in their integrity. Hence Galton says that "the religious instructor, in every creed, is one who makes it his profession to saturate his pupils with prejudice." ¹

Every science contains the purpose and destiny of growth as one of its distinguishing characteristics; it must always be open to re-examination and must submit to new tests if such are proposed. Consequently the modes and habits of thought developed by the study of

¹ Hereditary Genius, p. 210.

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science are very different from those developed by the study of religion. This is the real cause, I think, of the antagonism between science and religion which is vaguely felt in modern times, although the interest is lacking which would bring the antagonism into an open conflict. I cannot believe that this attitude will remain constant. I am prepared to believe that some of you may live to see new interest infused into our traditional religion which will produce an open conflict. ¹ At present scientific methods are largely introduced into history, archaeology, the comparison of religions, and Biblical interpretation, where their effect is far more destructive than the mass of people yet know. When the antagonism develops into open conflict, parties will take sides. It is evident that the position of the parties on all the great faiths and interests of men will differ very widely and that each position will have to be consistent with the fundamental way of looking at the facts of life on which it is founded. It does not seem possible that a scientist and a sacramentarian could agree about anything.

There is another form of phantasm which is still in fashion and does great harm, that is, faith in ideals. Men who rank as strong thinkers put forward ideals as useful things in thought and effort. Every ideal is a phantasm; it is formed by giving up one's hold on reality and taking a flight into the realm of fiction. When an ideal has been formed in the imagination the attempt is made to spring and reach it as a mode of realizing it. The whole process seems to me open to question; it is unreal and unscientific; it is the same process as that by which Utopias are formed in regard to social states, and contains the same fallacies; it is not a legitimate mental

¹ Thomas Aquinas said that "science is sin except as pursued because it leads to a knowledge of God." Summa II, 2, Qu. 167, 1.

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exercise. There is never any correct process by which we can realize an ideal. The fashion of forming ideals corrupts the mind and injures character. What we need to practise, on the contrary, is to know, with the greatest exactitude, what is, and then plan to deal with the case as it is by the most approved means.

Let me add a word about the ethical views which go with the scientific-critical way of looking at things. I have mentioned already our modern view of manufactured documents, which we call forged. In regard to history it seems to me right to say that history has value just on account of the truth which it contains and not otherwise. Consequently the historian who leaves things out, or puts them in, for edifying, patriotic, or other effect, sins against the critical-scientific method and temper which I have described. In fact, patriotism is another root of non-reality, and the patriotic bias is hostile to critical thinking.

It must be admitted that criticism is pessimistic. I say that it must be admitted, because, in our time, optimism is regarded as having higher merit and as a duty; that which is pessimistic is consequently regarded as bad and wrong. That is certainly an error. Pessimism includes caution, doubt, prudence, and care; optimism means gush, shouting, boasting, and rashness. The extreme of pessimism is that life is not worth living; the extreme of optimism is that everything is for the best in the best of worlds. Neither of these is true, but one is just as false as the other. The critical temper will certainly lead to pessimism; it will develop the great element of loss, disaster, and bad luck which inheres in all human enterprises. Hence it is popularly considered to consist in fault-finding. You will need to guard against an excess of it, because if you yield to it, it will lame your energies

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and deprive you of courage and hope. Nevertheless I cannot doubt that the popular feeling in our time and country needs toning down from a noisy and heedless optimism. Professor Giddings,¹ a few years ago, made a very interesting analysis and classification of books published in this country, from which he thought that he proved, statistically, that the temper of our people now is between ideo-emotional and dogmatic-emotional. By ideo-emotional he means inquiring or curious, and convivial; by dogmatic-emotional he means domineering and austere. We must notice, as limiting this test, that the book-market can bear testimony only to the taste of the "reading public," which is but a very small part of the population, and does not include the masses. Professor Giddings found that 50 per cent of the books published aimed to please and appealed to emotion or sentiment; 40 per cent aimed to convert, and appealed to belief, ethical emotion, or self-interest; 8 per cent aimed to instruct, were critical, and appealed to reason. The other 2 per cent contained all the works of high technical or scientific value, lost really in an unclassifiable residuum. This means that our literature is almost entirely addressed to the appetite for romance and adventure, probable or improbable, to sentimentalism, to theoretical interest in crime, marital infelicity, and personal misfortune, and to the pleasure of light emotional excitement, while a large part of it turns on ethical emotion and ignorant zeal in social matters. This accords with the impression one gets from the newspapers as to what the people like. The predominance of the emotional element in popular literature means that people are trained by it away from reality. They lose the power to recognize truth. Their power to make independent

¹ *Psychological Review*, VIII, 337.

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ethical judgments is undermined, and all value is taken out of their collective opinion on social and political topics. They are made day-dreamers, or philistines, or ready victims of suggestion, to be operated upon by religious fakers, or politicians, or social innovators. What they need is criticism, with all the pessimism which it may bring in its train. Ethics belong to the folkways of the time and place; they can be kept sound and vigorous only by the constant reaction between the traditional rule and the individual judgment. What we must have, on this domain also, is a demand for reality and a trained power to perceive the relation between all human interests and the facts of reality at the time existing.

These are the ideas which it seemed to me most desirable to suggest to you at this moment when you are joining this society. I hope that you will here, by your work, your influence on each other, and all the exercises of the society, develop your zeal for scientific truth, and all the virtues of mind and character which common pursuit of reality may be expected to produce. We cannot welcome you to grand halls and old endowments. You cannot carry on your work under fine paintings, with beautiful furniture, or a rich society library. I will say frankly that I wish you could do so; I wish that we had all the accumulations of time and money which such conveniences would present. I do not doubt, however, that your youth and zeal will suffice for you and we expect that you will make up for all deficiencies by your earnest work. It should be the spirit with which you enter the society to make your connection with it tell on your education. You have been selected as men of earnest purpose and industry. You can do much for each other. Common interest in the same line of work will draw you together.

I wish you all prosperity and success.