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## Modern Science

Leo Tolstoy

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I think that Carpenter's essay on Modern Science<sup>1</sup> may be especially useful to our society, where, more than in any other is spread the superstitious belief that, for the good of humanity it is not at all necessary to propagate true religious and moral knowledge, but only to study the experimental sciences, and that a knowledge of these sciences will satisfy all the spiritual demands of humanity.

It is obvious what a pernicious influence (similar to that of religious superstitions) such a crude superstition must have on the moral life of men, and therefore the dissemination of the thoughts of writers who critically examine the results and methods of the experimental sciences is especially desirable in our society.

Carpenter proves that neither Astronomy, nor Physics, nor Chemistry, nor Biology, nor Sociology gives us a true knowledge of actual facts, but that all the "laws" discovered by these sciences are only generalisations, which have but an approximate value as laws, and that only owing to ignorance or disregard of other factors. Further, that even these laws appear

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<sup>1</sup> Modern Science: A Criticism. "Civilisation, its Cause and Cure, and other Essays." By Edward Carpenter.

to be laws to us only because we discover them in a domain so distant from us in time and space that we cannot perceive their want of correspondence with actual fact.

Besides this, Carpenter also points out that the method of science, consisting in the explanation of phenomena near and important to us by phenomena more distant from and indifferent to us, is a false method which can never lead to the desired results.

"Each science," he says, "has been (as far as possible) reduced to its lowest terms. Ethics has been made a question of utility and inherited experience. Political Economy has been exhausted of all conceptions of justice between man and man, of charity, affection, and the instinct of solidarity; and has been founded on its lowest discoverable factor, namely, self-interest. Biology has been denuded of the force of personality in plants, animals and men; the 'self' here has been set aside, and the attempt made to reduce the science to a question of chemical and cellular affinities, protoplasm, and the laws of osmose. Chemical affinities, again, and all the wonderful phenomena of Physics are emptied down into a flight of atoms; and the flight of atoms (and of astronomic orbs as well) is reduced to the laws of dynamics. ..."

It is supposed that to reduce higher questions to terms of lower ones will explain the higher. But this explanation is never attained, and what happens is that descending lower and lower in its investigations, from the most essential questions to those less essential, science at last reaches a domain quite foreign to man, and only adjacent to him, to which domain it confines its attention, leaving without any solution all questions most important for man.

What occurs is something similar to what the result would be if a man desiring to understand the nature of an object before him should, instead of approaching it, examining it on all sides, and handling it remove farther and farther from it, finally removing to such a distance that all details of colour and un-

If even a small portion of its efforts, of that attention and toil which science devotes to the trifles it is occupied with, had been directed towards the development amongst men of correct religious, moral, social and even hygienic notions, there would not have occurred a hundredth part of those diphtherias, women's diseases, and deformities upon the curing of which science so prides itself, effecting these cures in hospitals, the luxurious appointments of which cannot be accessible to all.

It is the same as if men who had badly ploughed a field and badly sown it with bad seed should walk on this field and treat the broken ears of corn, meanwhile trampling on rest; and should then exhibit this art of treating the broken ears as a proof of their knowledge of agriculture.

Our science, in order to become a science and to be really useful instead of harmful to humanity must first of all renounce its experimental method which causes it to consider as its business merely the study of what exists, and return to the only wise and fruitful understanding of science according to which its subject is the investigation of how men must live. In this is the object and meaning of science, whereas the investigation of what exists can be the subject of science only to the extent to which this investigation contributes to the knowledge of how men should live.

It is precisely this acknowledgment of the incompetency of experimental science and of the necessity of adopting another method which is expressed in Carpenter's essay.

evenness of surface would disappear, and there remained only the outline which detached it from the horizon.

And from such a distance the man might begin to describe this object in detail, imagining that he has now a clear understanding of it, and that this idea, conceived at such a distance, would contribute to a complete understanding of the object. It is this self-delusion which is partly exposed by Carpenter's criticism, which, in the first place points out that the knowledge which science gives us in the sphere of natural science consists only of convenient modes of generalization which by no means express actual facts; and, secondly, that the method of science by which the phenomena of a higher order are reduced to the phenomena of a lower order, will never enable us to arrive at an explanation of the phenomena of the higher order.

But without settling beforehand the question whether the method of the experimental sciences can or cannot achieve a solution of the problems of life most important for humanity, the activity itself of the experimental sciences, considered in relation to the eternal and most legitimate demands of humanity, impresses one by its fallacy.

Men must live. And in order to live they must know how to live. All men always—well or ill— have learnt this, and in accordance with their knowledge, have lived and progressed. And this knowledge of how men should live was always, since the times of Moses, Solon, Confucius, considered a science—the very science of sciences; and it is only in our time that it has begun to be regarded that the science of how to live is not a science at all, but that true science is only experimental science, beginning with Mathematics and ending with Sociology.

And a strange misunderstanding ensues.

A simple and sensible working man—according to the old sense and common sense, as well supposes that if there are men studying all their life, and who think for him in return for being fed and provided for by him, then these men are probably engaged in studying what is needful for man, and he ex-

pects from science that it will solve for him those questions on which depend his welfare and that of all men. He expects that science will teach him how to live; how to act towards the members of his own family, his neighbours, and those of other countries; how to struggle with his passions; in what he should and should not believe, and much besides. And what does our science reply?

It triumphantly announces how many millions of miles the sun is from the earth, how many millions of undulations of ether per second are produced by light, and how many undulations of atmosphere by sound; it tells of the chemical composition of the Milky Way; it tells of a new element, Helium, of micro-organisms and their excrements, of the points in the hand where electricity concentrates, of X rays, and so on.

"But all this is not at all what I am in need of knowing," says the simple sensible man.

"I don't care what you are in need of knowing," replies Science, "what you ask for refers to Sociology. But before answering questions of Sociology we must settle questions of Zoology, Botany, Physiology - in short, Biology. And in order to settle these questions it is first necessary to solve questions of Physics, of chemistry; it is necessary also to agree as to the form of the infinitesimal atoms, and as to how it is that ether with neither weight nor resistance transmits force."

And men, chiefly those who sit on the backs of others, and who can therefore conveniently wait, are satisfied by such answers and continue sitting and yawning, awaiting what was promised. But the simple and sensible working man, he on whose back the men studying science are sitting, the great mass of people, humanity at large, cannot be satisfied with such replies, and naturally asks in wonder,

"But when will that be? We cannot wait. You yourselves say that you will find out all this after several generations. But we live, we are alive today and to-morrow we shall die, and

With a science taking as its subject not the investigation of how people should live, but of what exists, and therefore occupied chiefly in investigating inanimate objects, and meanwhile leaving the organisation of human society as it is: with such science no improvements, no victories over nature can improve the condition of men.

"And medical science? You forget its beneficial achievements. And inoculation with bacteria! And modern surgical operations!" generally exclaim the defenders of science, who as their last resort, bring forward the successes of medicine in proof of the fruitfulness of all science.

"We can by inoculation prevent disease and cure it, we can perform painless operations, we can cut open and treat the vital organs of the body, we can straighten deformity," generally say the advocates of science, thinking somehow, that a child cured of diphtheria (one of thousands of children who, in Russia, independently of diphtheria, average a death rate of 50 per cent., and in foundling asylums 80 per cent.) must convince people of the usefulness of science in general.

The order of our life is such that not only children but the majority of adults, through bad food, heavy injurious work, bad dwellings, bad clothes, and many hardships do not live half as long as they should; it is such that children's diseases, syphilis, consumption, and alcoholism are getting a firmer and firmer hold of men, that the greater part of the results of men's labour is taken from them in preparations for war, and that every ten or twenty years millions of men are exterminated by war. And all of this occurs because science instead of spreading amongst men correct religious, moral and social ideas which would cause all these calamities to disappear of themselves, is occupied on the one hand with the justification of the existing order, and on the other hand, with playthings. And in proof of the fruitfulness of science we are reminded that it cures one in a thousand of those invalids who, in reality, become ill, precisely because science does not fulfil its natural function.

pleasure. And so whereas all that is truly great is quiet, modest, imperceptible, the science of our time knows no limits to its self-glorification.

"All former methods were erroneous, and thus all that was formerly regarded as science is fraudulent, fallacious, frivolous. Our method is the only true one, ours the only true science. The progress of our science is such that thousands of years have not attained what we have achieved in the last century. In the future, by following in the same path, our science will solve all questions and give happiness to all humanity. Our science is the most important activity in the world, and we men of science the most important and necessary men on earth." So think and say the men of science of our time, and yet, seen in its full significance, no science in any age or nation has stood on so low a plane as the present one. One part of it, that which should study the means of making human life good and happy, is occupied in justifying the existing bad order of life, and the other is absorbed with the solution of questions of idle curiosity.

"How idle curiosity?" I hear exclaimed by voices indignant at such blasphemy. "How about steam, electricity, telephones, and all our technical improvements? Not to speak of their scientific importance, observe the practical results they have achieved. Man has conquered nature, subjected its forces to himself" ... and so on.

"But," replies the simple and sensible man, "all the practical results of man's victory over nature from long ago up to the present, are applied to manufactures injurious to the people; to means for exterminating men, to increasing luxury, dissolute-ness; and therefore, man's victory over nature has not increased the welfare of men, but, on the contrary, made their condition worse."

If the organisation of a society is bad, such as is ours, where a small number of men dominate the majority and oppress them, then every victory over nature will inevitably only serve to increase this power and this oppression. And so it happens.

therefore we must know how we are to live the life we are in now. Teach us, then."

"The stupid and ignorant man!" answers Science; "he does not understand that what science serves is not utility but science. Science investigates that which is subject to investigation, and cannot choose the objects of its study. Science studies everything. Such is the property of science." Men of science are indeed convinced that the characteristic of attending to trifles and neglecting things more substantial and important is not their own characteristic but that of science. But the simple, sensible man begins to suspect that this characteristic belongs, not to science, but to those who are inclined to occupy themselves with trifles, attaching to these trifles great importance.

"Science studies everything," say the men of science. But there is too much of everything. Everything means an infinite quantity of objects, and it is impossible to study all at once. As a lantern cannot light up everything but only the place it is directed towards, so also science cannot investigate everything, but inevitably investigates only that to which its attention is directed. And as the lantern throws the strongest light on the place nearest to it, weaker and weaker light on more remote objects, and does not light up at all those objects which its light cannot reach, so also human science of whatever kind has always investigated and is investigating in most detail that which appears to the investigators to be most important, studying in less detail what appears to them less important and not at all concerning itself with all the remaining infinite quantity of objects.

The standard which has defined and defines for men the very important, the less important, and the unimportant is men's general understanding of the sense and object of life, i.e., religion.

But our modern men of science, not acknowledging any religion-and therefore possessing no basis upon which they might select objects for study according to the degree of their

importance, separating the most important objects from the less important, and from that vast number of objects which will always remain uninvestigated because of the limitations of the human mind and their infinite quantity—have invented for themselves a theory of "science for science's sake," according to which science studies not what is necessary to men, but everything.

Indeed, experimental science does study everything, only not in the sense of the totality of objects, but in the sense of disorder and chaos in the distribution of the investigated subjects—i.e., science does not most investigate what is most needed by men, less what is less needed, and not at all what is not needed, but investigates, haphazard, anything it comes across.

Although there exists Comte's and other classifications of the sciences, these classifications do not direct the choice of subjects for investigation, this being directed by human weaknesses inherent to men of science as to all men. So that in reality experimental scientists do not, as they imagine and assert, study every-thing, but that which is more advantageous and easier for them to study.

It is more advantageous to study what may contribute to the welfare of those higher classes to which the men occupied with science themselves belong, and it is easier to study things devoid of life. And this is what the representatives of books, monuments, and inanimate experimental science do: they study objects, and this study it is that they regard as the most real science.

So that what in our time is regarded as the true and only "science" (in the sense that the "Bible" was once called the only book worthy of the name), is not the investigation of how to make the life of men better and happier, but consists in collecting and copying out of many books into one what was written concerning a certain subject by former men, or in pouring liquids from one phial into another, in skilfully dissecting micro-

scopic preparations, in cultivating bacteria, in cutting up frogs and dogs, in investigating the X rays, the chemical composition of the stars and so forth.

And all those sciences whose object is to make human life better and happier - religious, moral and social sciences - are not regarded as sciences by the reigning science. They are relegated to the theologians, philosophers, jurists, historians and political economists. These are occupied solely under the pretence of scientific investigation, in proving that the existing order of life (the advantages of which they profit by), is precisely the one which should exist, and should, therefore, not only not be reformed, but be maintained by all means.

Not to speak of theology, philosophy and juris-prudence, very noticeable in this respect is the most fashionable of this kind of science—Political Economy. The Political Economy most widely spread (that of Marx) acknowledging the existing order of life to be such as it should be, not only does not require of men, the reformation of this order, i.e., does not point how men should live in order that their condition might be improved, but, on the contrary, demands the continuation of the cruelty of the present state of things in order that the more than doubtful prophecies of what will happen if men continue to live as badly as they do at present should be realized.

And, as always happens, the lower human practice descends the further it recedes from what it should be, the more its self-assertion increases. This has happened with the science of our time. True science has never been appreciated by its contemporaries, but, on the contrary, has for the most part been persecuted. And it could not be otherwise. True science indicates to men their errors, and points to new, unusual ways of life, both of which services are obnoxious to the ruling part of society. Whereas the present science not only refrains from counteracting the tastes and demands of the ruling part of society, but completely coincides with them: it satisfies idle curiosity, astonishes people, and promises them increase of