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## PEARSON'S GRAMMAR OF SCIENCE.

## ANNOTATIONS ON THE FIRST THREE CHAPTERS.

BY C. S. PEIRCE.

IF any follower of Dr. Pearson thinks that in the observations I am about to make I am not sufficiently respectful to his master, I can assure him that without a high opinion of his powers I should not have taken the trouble to make these annotations, and without a higher opinion still, I should not have used the bluntness which becomes the impersonal discussions of mathematicians.

An introductory chapter of ethical content sounds the dominant note of the book. The author opens with the declaration that our conduct ought to be regulated by the Darwinian theory. Since that theory is an attempt to show how natural causes tend to impart to stocks of animals and plants characters which, in the long run, promote reproduction and thus insure the continuance of those stocks, it would seem that making Darwinism the guide of conduct ought to mean that the continuance of the race is to be taken as the *summum bonum*, and '*Multiplicamini*' as the epitome of the moral law. Professor Pearson, however, understands the matter a little differently, expressing himself thus: "The sole reason [for encouraging] any form of human activity . . . lies in this: [its] existence tends to promote the welfare of human society, to increase social happiness, or to strengthen social stability. In the spirit of the age we are bound to question the value of science; to ask in what way it increases the happiness of mankind or promotes social efficiency."

The second of these two statements omits the phrase, 'the welfare of human society,' which conveys no definite meaning; and we may, therefore, regard it as a mere diluent, adding nothing to the essence of what is laid down. Strict adhesion to Darwinian principles would preclude the admission of the 'happiness of mankind' as an ultimate aim. For on those principles everything is directed to the continuance of the stock, and the individual is utterly of no account, except in so far as he is an agent of reproduction. Now there is no other happiness of mankind than the happiness of individual men. We must, therefore, regard this clause as logically deleterious to the purity of the doctrine. As to 'social stability,' we all know very well what ideas this phrase is intended to convey to English apprehensions; and it must be admitted that Darwinism, generalized in due measure, may apply to English

society the same principles that Darwin applied to breeds. A family in which the standards of that society are not traditional will go under and die out, and thus 'social stability' tends to be maintained.

But against the doctrine that social stability is the sole justification of scientific research, whether this doctrine be adulterated or not with the utilitarian clause, I have to object, first, that it is historically false, in that it does not accord with the predominant sentiment of scientific men; second, that it is bad ethics; and, third, that its propagation would retard the progress of science.

Professor Pearson does not, indeed, pretend that that which effectually animates the labors of scientific men is any desire 'to strengthen social stability.' Such a proposition would be too grotesque. Yet if it was his business, in treating of the grammar of science, to set forth the legitimate motive to research—as he has deemed it to be—it was certainly also his business, especially in view of the splendid successes of science, to show what has, in fact, moved such men. They have, at all events, not been inspired by a wish either to 'support social stability' or, in the main, to increase the sum of men's pleasures. The man of science has received a deep impression of the majesty of truth, as that to which, sooner or later, every knee must bow. He has further found that his own mind is sufficiently akin to that truth, to enable him, on condition of submissive observation, to interpret it in some measure. As he gradually becomes better and better acquainted with the character of cosmical truth, and learns that human reason is its issue and can be brought step by step into accord with it, he conceives a passion for its fuller revelation. He is keenly aware of his own ignorance, and knows that personally he can make but small steps in discovery. Yet, small as they are, he deems them precious; and he hopes that by conscientiously pursuing the methods of science he may erect a foundation upon which his successors may climb higher. This, for him, is what makes life worth living and what makes the human race worth perpetuation. The very being of law, general truth, reason—call it what you will—consists in its expressing itself in a cosmos and in intellects which reflect it, and in doing this progressively; and that which makes progressive creation worth doing—so the researcher comes to feel—is precisely the reason, the law, the general truth for the sake of which it takes place.

Such, I believe, as a matter of fact, is the motive which effectually works in the man of science. That granted, we have next to inquire which motive is the more rational, the one just described or that which Professor Pearson recommends. The ethical text-books offer us classifications of human motives. But for our present purpose it will suffice to pass in rapid review some of the more prominent ethical classes of motives.

A man may act with reference only to the momentary occasion, either from unrestrained desire, or from preference for one desideratum over another, or from provision against future desires, or from persuasion, or from imitative instinct, or from dread of blame, or in awed obedience to an instant command; or he may act according to some general rule restricted to his own wishes, such as the pursuit of pleasure, or self-preservation, or good-will toward an acquaintance, or attachment to home and surroundings, or conformity to the customs of his tribe, or reverence for a law; or, becoming a moralist, he may aim at bringing about an ideal state of things definitely conceived, such as one in which everybody attends exclusively to his own business and interest (individualism), or in which the maximum total pleasure of all beings capable of pleasure is attained (utilitarianism), or in which altruistic sentiments universally prevail (altruism), or in which his community is placed out of all danger (patriotism), or in which the ways of nature are as little modified as possible (naturalism); or he may aim at hastening some result not otherwise known in advance than as that, whatever it may turn out to be, to which some process seeming to him good must inevitably lead, such as whatever the dictates of the human heart may approve (sentimentalism), or whatever would result from every man's duly weighing, before action, the advantages of his every purpose (to which I will attach the nonce-name *entelism*, distinguishing it and others below by italics), or whatever the historical evolution of public sentiment may decree (*historicism*), or whatever the operation of cosmical causes may be destined to bring about (evolutionism); or he may be devoted to truth, and may be determined to do nothing not pronounced reasonable, either by his own cogitations (rationalism), or by public discussion (dialecticisim), or by crucial experiment; or he may feel that the only thing really worth striving for is the generalizing or assimilating elements in truth, and that either as the sole object in which the mind can ultimately recognize its veritable aim (educationalism), or that which alone is destined to gain universal sway (pancratism); or, finally, he may be filled with the idea that the only reason that can reasonably be admitted as ultimate is that living reason for the sake of which the psychical and physical universe is in process of creation (*religionism*).

This list of ethical classes of motives may, it is hoped, serve as a tolerable sample upon which to base reflections upon the acceptability as ultimate of different kinds of human motives; and it makes no pretension to any higher value. The enumeration has been so ordered as to bring into view the various degrees of generality of motives. It would conduce to our purpose, however, to compare them in other respects. Thus, we might arrange them in reference to the degree to which an impulse of dependence enters into them, from express obedi-



ence, generalized obedience, conformity to an external exemplar, action for the sake of an object regarded as external, the adoption of a motive centering on something which is partially opposed to what is present, the balancing of one consideration against another, until we reach such motives as unrestrained desire, the pursuit of pleasure, individualism, sentimentalism, rationalism, educationalism, religionism, in which the element of otherness is reduced to a minimum. Again, we might arrange the classes of motives according to the degree in which immediate qualities of feeling appear in them, from unrestrained desire, through desire present but restrained, action for self, action for pleasure generalized beyond self, motives involving a retro-consciousness of self in outward things, the personification of the community, to such motives as direct obedience, reverence, naturalism, evolutionism, experimentalism, pantheism, religionism, in which the element of self-feeling is reduced to a minimum. But the important thing is to make ourselves thoroughly acquainted, as far as possible from the inside, with a variety of human motives ranging over the whole field of ethics.

I will not go further into ethics than simply to remark that all motives that are directed toward pleasure or self-satisfaction, of however high a type, will be pronounced by every experienced person to be inevitably destined to miss the satisfaction at which they aim. This is true even of the highest of such motives, that which Josiah Royce develops in his 'World and Individual.' On the other hand, every motive involving dependence on some other leads us to ask for some ulterior reason. The only desirable object which is quite satisfactory in itself without any ulterior reason for desiring it, is the reasonable itself. I do not mean to put this forward as a demonstration; because, like all demonstrations about such matters, it would be a mere quibble, a sheaf of fallacies. I maintain simply that it is an experiential truth.

The only ethically sound motive is the most general one; and the motive that actually inspires the man of science, if not quite that, is very near to it—nearer, I venture to believe, than that of any other equally common type of humanity. On the other hand, Professor Pearson's aim, 'the stability of society,' which is nothing but a narrow British patriotism, prompts the *cui bono* at once. I am willing to grant that England has been for two or three centuries a most precious factor of human development. But there were and are reasons for this. To demand that man should aim at the stability of British society, or of society at large, or the perpetuation of the race, as an *ultimate* end, is too much. The human species will be extirpated sometime; and when the time comes the universe will, no doubt, be well rid of it. Professor Pearson's ethics are not at all improved by being adulterated with utilitarianism, which is a lower motive still. Utilitarianism is one of

the few theoretical motives which has unquestionably had an extremely beneficial influence. But the greatest happiness of the greatest number, as expounded by Bentham, resolves itself into merely superinducing the quality of pleasure upon men's immediate feelings. Now, if the pursuit of pleasure is not a satisfactory ultimate motive for me, why should I enslave myself to procuring it for others? Leslie Stephen's book was far from uttering the last word upon ethics; but it is difficult to comprehend how anybody who has read it reflectively can continue to hold the mixed doctrine that no action is to be encouraged for any other reason than that it either tends to the stability of society or to general happiness.

Ethics, as such, is extraneous to a Grammar of Science; but it is a serious fault in such a book to inculcate reasons for scientific research the acceptance of which must tend to lower the character of such research. Science is, upon the whole, at present in a very healthy condition. It would not remain so if the motives of scientific men were lowered. The worst feature of the present state of things is that the great majority of the members of many scientific societies, and a large part of others, are men whose chief interest in science is as a means of gaining money, and who have a contempt, or half-contempt, for pure science. Now, to declare that the sole reason for scientific research is the good of society is to encourage those pseudo-scientists to claim, and the general public to admit, that they, who deal with the applications of knowledge, are the true men of science, and that the theoreticians are little better than idlers.

In Chapter II., entitled 'The Facts of Science,' we find that the 'stability of society' is not only to regulate our conduct, but, also, that our opinions have to be squared to it. In section 10 we are told that we must not believe a certain purely theoretical proposition because it is 'anti-social' to do so, and because to do so 'is opposed to the interests of society.' As to the 'canons of legitimate inference' themselves, that are laid down by Professor Pearson, I have no great objection to them. They certainly involve important truths. They are excessively vague and capable of being twisted to support illogical opinions, as they are twisted by their author, and they leave much ground uncovered. But I will not pursue these objections. I do say, however, that truth is truth, whether it is opposed to the interests of society to admit it or not—and that the notion that we must deny what it is not conducive to the stability of British society to affirm is the mainspring of the mendacity and hypocrisy which Englishmen so commonly regard as virtues. I must confess that I belong to that class of scallawags who purpose, with God's help, to look the truth in the face, whether doing so be conducive to the interests of society or not. Moreover, if I should ever attack that excessively difficult problem, 'What is for the true interest of society?' I

should feel that I stood in need of a great deal of help from the science of legitimate inference; and, therefore, to avoid running round a circle, I will endeavor to base my theory of legitimate inference upon something less questionable—as well as more germane to the subject—than the true interest of society.

The remainder of this chapter on the 'Facts of Science' is taken up with a theory of cognition, in which the author falls into the too common error of confounding psychology with logic. He will have it that knowledge is built up out of sense-impressions—a correct enough statement of a conclusion of psychology. Understood, however, as Professor Pearson understands and applies it, as a statement of the nature of our logical data, of 'the facts of science,' it is altogether incorrect. He tells us that each of us is like the operator at a central telephone office, shut out from the external world, of which he is informed only by sense-impressions. Not at all! Few things are more completely hidden from my observation than those hypothetical elements of thought which the psychologist finds reason to pronounce 'immediate,' in his sense. But the starting point of all our reasoning is not in those sense-impressions, but in our percepts. When we first wake up to the fact that we are thinking beings and can exercise some control over our reasonings, we have to set out upon our intellectual travels from the home where we already find ourselves. Now, this home is the parish of percepts. It is not inside our skulls, either, but out in the open. It is the external world that we directly observe. What passes within we only know as it is mirrored in external objects. In a certain sense, there is such a thing as introspection; but it consists in an interpretation of phenomena presenting themselves as external percepts. We first see blue and red things. It is quite a discovery when we find the eye has anything to do with them, and a discovery still more recondite when we learn that there is an *ego* behind the eye, to which these qualities properly belong. Our logically initial data are percepts. Those percepts are undoubtedly purely psychical, altogether of the nature of thought. They involve three kinds of psychical elements, their qualities of feelings, their reaction against my will, and their generalizing or associating element. But all that we find out afterward. I see an inkstand on the table: that is a percept. Moving my head, I get a different percept of the inkstand. It coalesces with the other. What I call the inkstand is a generalized percept, a quasi-inference from percepts, perhaps I might say a composite-photograph of percepts. In this psychical product is involved an element of resistance to me, which I am obscurely conscious of from the first. Subsequently, when I accept the hypothesis of an inward subject for my thoughts, I yield to that consciousness of resistance and admit the inkstand to the standing of an external object. Still later, I may call this in question. But

as soon as I do that, I find that the inkstand appears there in spite of me. If I turn away my eyes, other witnesses will tell me that it still remains. If we all leave the room and dismiss the matter from our thoughts, still a photographic camera would show the inkstand still there, with the same roundness, polish and transparency, and with the same opaque liquid within. Thus, or otherwise, I confirm myself in the opinion that its characters are what they are, and persist at every opportunity in revealing themselves, regardless of what you, or I, or any man, or generation of men, may think that they are. That conclusion to which I find myself driven, struggle against it as I may, I briefly express by saying that the inkstand is a *real* thing. Of course, in being real and external, it does not in the least cease to be a purely psychical product, a generalized percept, like everything of which I can take any sort of cognizance.

It might not be a very serious error to say that the facts of science are sense-impressions, did it not lead to dire confusion upon other points. We see this in Chapter III., in whose long meanderings through irrelevant subjects, in the endeavor to make out that there is no rational element in nature, and that the rational element of natural laws is imported into them by the minds of their discoverers, it would be impossible for the author to lose sight entirely of the bearing of the question which he himself has distinctly formulated, if he were not laboring with the confusing effects of his notion that the data of science are the sense-impressions. It does not occur to him that he is laboring to prove that the mind has a marvelous power of creating an element absolutely supernatural—a power that would go far toward establishing a dualism quite antagonistic to the spirit of his philosophy. He evidently imagines that those who believe in the reality of law, or the rational element in nature, fail to apprehend that the data of science are of a psychical nature. He even devotes a section to proving that natural law does not belong to things-in-themselves, as if it were possible to find any philosopher who ever thought it did. Certainly, Kant, who first decked out philosophy with these chaste ornaments of things-in-themselves, was not of that opinion; nor could anybody well hold it after what he wrote. In point of fact, it is not Professor Pearson's opponents but he himself who has not thoroughly assimilated the truth that everything we can in any way take cognizance of is purely mental. This is betrayed in many little ways, as, for instance, when he makes his answer to the question, whether the law of gravitation ruled the motion of the planets before Newton was born, to turn upon the circumstance that the law of gravitation is a formula expressive of the motion of the planets 'in terms of a purely mental conception,' as if there could be a conception of anything not purely mental. Repeatedly, when he has proved the content of an idea to be mental, he seems to

think he has proved its object to be of human origin. He goes to no end of trouble to prove in various ways, what his opponent would have granted with the utmost cheerfulness at the outset, that laws of nature are rational; and, having got so far, he seems to think nothing more is requisite than to seize a logical maxim as a leaping pole and lightly skip to the conclusion that the laws of nature are of human provenance. If he had thoroughly accepted the truth that all realities, as well as all figments, are alike of purely mental composition, he would have seen that the question was, not whether natural law is of an intellectual nature or not, but whether it is of the number of those intellectual objects that are destined ultimately to be exploded from the spectacle of our universe, or whether, as far as we can judge, it has the stuff to stand its ground in spite of all attacks. In other words, is there anything that is really and truly a law of nature, or are all pretended laws of nature figments, in which latter case, all natural science is a delusion, and the writing of a grammar of science a very idle pastime?

Professor Pearson's theory of natural law is characterized by a singular vagueness and by a defect so glaring as to remind one of the second book of the *Novum Organum* or of some strong chess-player whose attention has been so riveted upon a part of the board that a fatal danger has, as it were, been held upon the blind-spot of his mental retina. The manner in which the current of thought passes from the woods into the open plain and back again into the woods, over and over again, betrays the amount of labor that has been expended upon the chapter. The author calls attention to the sifting action both of our perceptive and of our reflective faculties. I think that I myself extracted from that vein of thought pretty much all that is valuable in reference to the regularity of nature in the *POPULAR SCIENCE MONTHLY* for June, 1878, (p. 208). I there remarked that the degree to which nature seems to present a general regularity depends upon the fact that the regularities in it are of interest and importance to us, while the irregularities are without practical use or significance; and in the same article I endeavored to show that it is impossible to conceive of nature's being markedly less regular, taking it, 'by and large,' than it actually is. But I am confident, from having repeatedly returned to that line of thought that it is impossible legitimately to deduce from any such considerations the unreality of natural law. 'As a pure suggestion and nothing more,' toward the end of the chapter, after his whole plea has been put in, Dr. Pearson brings forward the idea that a transcendental operation of the perceptive faculty may reject a mass of sensation altogether and arrange the rest in place and time, and that to this the laws in nature may be attributable—a notion to which Kant undoubtedly leaned at one time. The mere emission of such a theory, after his argument has been fully set forth, almost amounts to a confession of failure to

prove his proposition. Granting, by way of waiver, that such a theory is intelligible and is more than a nonsensical juxtaposition of terms, so far from helping Professor Pearson's contention at all, the acceptance of it would at once decide the case against him, as every student of the *Critic of the Pure Reason* will at once perceive. For the theory sets the rationality in nature upon a rock perfectly impregnable by you, me or any company of men.

Although that theory is only problematically put forth by Professor Pearson, yet at the very outset of his argumentation he insists upon the relativity of regularity to our faculties, as if that were in some way pertinent to the question. "Our law of tides," he says, "could have no meaning for a blind worm on the shore, for whom the moon had no existence." Quite so; but would that truism in any manner help to prove that the moon was a figment and no reality? On the contrary, it could only help to show that there may be more things in heaven and earth than your philosophy has dreamed of. Now the *moon*, on the one hand, and the *law of the tides*, on the other, stand in entirely analogous positions relatively to the remark, which can no more help to prove the unreality of the one than of the other. So, too, the final decisive stroke of the whole argumentation consists in urging substantially the same idea in the terrible shape of a syllogism, which the reader may examine in section 11. I will make no comment upon it.

Professor Pearson's argumentation rests upon three legs. The first is the fact that both our perceptive and our reflective faculties reject part of what is presented to them, and 'sort out' the rest. Upon that, I remark that our minds are not, and cannot be, positively mendacious. To suppose them so is to misunderstand what we all mean by truth and reality. Our eyes tell us that some things in nature are red and others blue; and so they really are. For the real world is the world of insistent generalized percepts. It is true that the best physical idea which we can at present fit to the real world, has nothing but longer and shorter waves to correspond to red and blue. But this is evidently owing to the acknowledged circumstance that the physical theory is to the last degree incomplete, if not to its being, no doubt, in some measure, erroneous. For surely the completed theory will have to account for the extraordinary contrast between red and blue. In a word, it is the business of a physical theory to account for the percepts; and it would be absurd to accuse the percepts—that is to say, the facts—of mendacity because they do not square with the theory.

The second leg of the argumentation is that the mind projects its worked-over impressions into an object, and then projects into that object the comparisons, etc., that are the results of its own work. I admit, of course, that errors and delusions are everyday phenomena, and hallucinations not rare. We have just three means at our command for

detecting any unreality, that is, lack of insistency, in a notion. First, many ideas yield at once to a direct effort of the will. We call them *fancies*. Secondly, we can call in other witnesses, including ourselves under new conditions. Sometimes dialectic disputation will dispel an error. At any rate, it may be voted down so overwhelmingly as to convince even the person whom it affects. Thirdly, the last resort is prediction and experimentation. Note that these two are equally essential parts of this method, which Professor Pearson keeps—I had almost said sedulously—out of sight in his discussion of the rationality of nature. He only alludes to it when he comes to his transcendental ‘pure suggestion.’ Nothing is more notorious than that this method of prediction and experimentation has proved the master-key to science; and yet, in Chapter IV., Professor Pearson tries to persuade us that prediction is no part of science, which must only describe sense-impressions. [A sense-impression cannot be described.] He does not say that he would permit generalization of the facts. He ought not to do so, since generalization inevitably involves prediction.

The third leg of the argumentation is that human beings are so much alike that what one man perceives and infers another man will be likely to perceive and infer. This is a recognized weakness of the second of the above methods. It is by no means sufficient to destroy that method, but along with other defects it does render resort to the third method imperative. When I see Dr. Pearson passing over without notice the first and third of the only three possible ways of distinguishing whether the rationality of nature is real or not, and giving a lame excuse for reversing the verdict of the second, so that his decision seems to spring from antecedent predilection, I cannot recommend his procedure as affording such an exemplar of the logic of science as one might expect to find in a grammar of science.

An ignorant sailor on a desert island lights in some way upon the idea of the parallelogram of forces, and sets to work making experiments to see whether the actions of bodies conform to that formula. He finds that they do so, as nearly as he can observe, in many trials invariably. He wonders why inanimate things should thus conform to a widely general intellectual formula. Just then, a disciple of Professor Pearson lands on the island and the sailor asks him what he thinks about it. “It is very simple,” says the disciple, “you see you made the formula and then you projected it into the phenomena.” *Sailor*: What are the phenomena? *Pearsonist*: The motions of the stones you experimented with. *Sailor*: But I could not tell until afterward whether the stones had acted according to the rule or not. *Pearsonist*: That makes no difference. You made the rule by looking at some stones, and all stones are alike. *Sailor*: But those I used were very unlike, and I want to know what made them all move exactly according to one rule. *Pear-*

*sonist*: Well, maybe your mind is not in time, and so you made all the things behave the same way at all times. Mind, I don't say it is so; but it may be. *Sailor*: Is that all you know about it? Why not say the stones are made to move as they do by something *like* my mind?

When the disciple gets home, he consults Dr. Pearson. "Why," says Dr. Pearson, "you must not deny that the facts are really concatenated; only there is no rationality about that." "Dear me," says the disciple, "then there really is a concatenation that makes all the component accelerations of all the bodies scattered through space conform to the formula that Newton, or Lami, or Varignon invented?" "Well, the formula is the device of one of those men, and it conforms to the facts." "To the facts its inventor knew, and also to those he only predicted?" "As for prediction, it is unscientific business." "Still the prediction and the facts predicted agree." "Yes." "Then," says the disciple, "it appears to me that there really is in nature something extremely like action in conformity with a highly general intellectual principle." "Perhaps so," I suppose Dr. Pearson would say, "but nothing in the least like rationality." "Oh," says the disciple, "I thought rationality was conformity to a widely general principle."