SCIENCE

VOL. LXXIII — FRIDAY, JANUARY 16, 1931 — No. 1881

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS
New York City: Grand Central Terminal
Lancaster, Pa. — Garrison, N. Y.
Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

ENGINEERING CULTURE[1]

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AT the outset of this paper it seems necessary that we should define what we mean by culture. The conventional thing to do is to quote an authoritative dictionary, but here we are met with difficulty. The word "culture" has seven or eight different definitions, varying all the way from "the details of a map which do not represent natural features of the area delineated," to the definition "refinement in manners and tastes." By some of our artist friends culture is regarded as measured by the production of works of art, while our friends the philosophers would doubtless insist that culture includes the formation of a philosophy of life. For the purposes of this paper we may perhaps regard culture as "the training, disciplining or refining of the moral and intellectual nature."

I wish to point out that taken in the sense of refinement of manners and morals, or in the artist's sense of production of works of art, a cultured man may be very narrow-minded. In Conan Doyle's novel "Sir Nigel," the young squire visits an old authority on the culture of knighthood, and the old knight is anxious above all else that this young friend always use exactly the correct word, lest he be the cause of laughter to his hearers and of grief to his friends. Especially must he recognize the fact that each species of animal has a distinctive name to designate a group. One must *never* speak of a *herd* of lions, but rather of a *pride* of lions. To speak of a *flock* of pheasants is a grievous sin against culture—it is a *nye* of pheasants. Similarly, to-day, there are many guardians of culture who are more shocked at a misspelled word (even in our quite unsystematic English spelling) than at a hazily expressed thought. Many there are who boast of themselves as liberals who are as deeply distressed as the strictest Pharisee at any infraction of any detail of the current social or literary

[1] Address of the vice-president and chairman of Section M—Engineering, American Association for the Advancement of Science, Cleveland, December 30, 1930.

code. If we limit the field of culture to literature, art and music we certainly are shutting out from any philosophy of life a consideration of many viewpoints which, be they good or evil, are certainly powerful to-day. In this paper I wish to maintain, first, that if we regard culture as the "training, disciplining, and refining of the moral and intellectual nature," we are not justified in excluding from any system of general culture a consideration of the viewpoint, either of the scientific *method,* or of the viewpoint of *applied* sicence. Why should we call uncultured the man who knows thoroughly and broadly the history and philosophy of the heat engine, but is ignorant of the music of Brahms, while we hail as cultured the musician who is a master of technique and knows the field of harmony, but is contemptuous of the applied science which has made possible the modern pipe organ.

The speaker wishes to make it very plain that he does not himself despise nor does he wish any engineer to despise the viewpoint of the philosopher, the artist, the writer, the musician, the student of literature, or the theologian. He does maintain, however, that no one of these, no, nor all of them put together, have the basis for a complete disciplining of the moral nature if they leave out of consideration the work and the methods of thought of the applied scientist. The author admires Plato, he reads his works (in translation) with interest, he is glad that Plato lived and that his work survived, but he does not believe that Plato is a complete guide for living and working.

It may be objected that the speaker has proposed so broad a field for culture that no man can thoroughly master it all. This is true. No man can master the whole field of art, of literature, of pure science or of applied science. He may, however, hope to master some part of one field and to be an interested and respectful observer of other fields. The jack of all trades and master of *none* is not an admirable figure. The speaker believes that the jack of all trades and the master of *one is* an admirable figure, and is more deserving of the title of cultured man than is the super-master of one trade who despises all others. The speaker believes that the narrow specialist, be his specialty music or hog breeding, poetry or heat engines, is frequently, especially at times of crisis, a most useful citizen, but that he does not embody a high degree of culture.

Accepting the idea that culture includes as a major object the development of a philosophy of life, the speaker believes that the engineer has some positive contribution to make to such a philosophy. Perhaps the positive contributions are not so great as the indirect, and this point will be discussed later.

One positive contribution toward a development of culture which the engineer is well fitted to make, or at least to emphasize, is the demand that the field of interest underlying such a philosophy be broadened to include not only the viewpoint of pure science but the application of that viewpoint to the affairs of daily life, and a consideration of the resultant effect upon our thinking. The speaker, so far from wishing to belittle the importance of the classical viewpoint of culture wishes to express his admiration—a rather uncritical admiration—of it, and his belief that all modern thinkers, including all engineers, might well become more familiar with the classical viewpoint. However, one characteristic attitude of that culture—the frank placing of the affairs of earning a livelihood in an *inferior* class—the writer believes to be a fault of that culture and not a virtue. An effect of that fault is plainly illustrated by the inability of the great minds of the classical world to develop the science of mechanics beyond a most elementary stage. It was not until an entirely new frame of mind came in, under Galileo—a frame of mind which in the search for knowledge, and in the development of the philosophy of life, "called nothing common or unclean"—that the science of mechanics, the first ripening fruit of the scientific age, was able to develop.

The essentially aristocratic attitude of superiority to those who have to work for a living is not necessarily snobbish, but it easily sours into snobbishness, and a contribution to a philosophy of life to the effect that no phase of life is unworthy the attention of a scholar may well be emphasized over and over again by the engineer.

A second positive contribution to culture may well be the engineer's idea of tolerance. In general we think of tolerance as a kindly, somewhat careless virtue, whereby we recognize that there is much bad in the best of us and much good in the worst of us, and so why worry much about it. To the engineer, tolerance carries an entirely different meaning. He states, for example, that in making steel for rails there is allowed a tolerance of 1/20 of 1 per cent. of phosphorus. That does not mean that he refuses to worry about phosphorus in steel. He worries about it very much, and as a result of his intelligent worrying he has decided that the cost and the time of removing that last 1/20 of 1 per cent. of phosphorus from steel is very great, whereas the evidence of material damage done by such a small amount of phosphorus is very slight. Therefore, he places the line below which it is not wise to reduce phosphorus at this figure.

This idea of this sort of tolerance of those manners and morals which seem to us undesirable is suggested

as a contribution to culture. We should by no means be good-naturedly careless about the undesirable things, but we may well try to develop a careful discrimination in choosing those evil things which we will try to eliminate and the good things which we will try to encourage, and we realize that as absolute perfection is never reached in the chemical and mechanical world, so there are limits of perfection beyond which effort in the social and ethical world is ineffective, and that these limits are not fixed, but vary from age to age.

A third positive contribution which the speaker believes the engineer may make to culture is the pointing out of the fact that not infrequently development of abstract ideals may come as the result of daily work on the job. Perhaps such development may come from the day's work as often as from abstract thinking. In the engineer's professional life the immediate thing before him is always a job, but frequently as he wrestles with a job general ideas of the relation of his job to various other jobs and of the development of various values and general truths come to him. The engineer reacts with hearty approval to that statement of the Carpenter of Nazareth, "If ye do the will ye shall know of the doctrine," and the speaker believes that the engineer may well contribute to culture by the insistence of the fact that the road between the shops of the doers of jobs and the studies of thinkers of thoughts is not a one-way street.

The speaker has mentioned what he believes to be some positive contributions of engineering to culture. These contributions make up only a small part of the body of culture, and the speaker wishes to emphasize the fact that many phases of culture are outside the professional field of the engineer, and that he should cultivate an attitude of interest toward them, even though it is not feasible for him to make direct contributions to these phases. Very few engineers can make noteworthy contributions to music, yet the engineer may well regard music as important in the scheme of things.

The speaker believes that the greatest contributions of the engineer to culture are indirect contributions. Some early records of the Christian church, at Ephesus, have been unearthed, probably for the period about 300 A. D. In those records we find that the preacher of the church was set apart to his sacred office by the solemn laying on of hands. We find that the director of the music of the church was likewise ordained to his position with the solemn laying on of hands. We find also that the janitor—the sacristan—was ordained to his office with the solemn laying on of hands. They had some good ideas in those times. Apparently they recognized that the work of the man who saw that the church building was orderly, clean, and as well ventilated as possible was worthy of sacerdotal recognition. The engineer should be regarded as a sacristan for the temple of civilized society and the office of sacristan should be restored to its ancient Ephesian dignity. For the fine arts, the fine tastes, the fine manners *may* develop amid conditions of hunger, cold, poor housing and difficult transportation, but these conditions are usually handicaps and not helps.

I would urge to engineers, first, that they accept openly and unashamed their function as smoothers of the path for the development and refinement of manners and morals. I would urge that they insist upon the dignity of this work not noisily but firmly. The great artist who paints a picture before which men and women dream is more notable than the chemist who developed for him the pigments which he used and the textile expert who has made possible the canvas on which he paints, but the artist comes short of the full stature of culture if he holds chemists and textile experts in contempt. I am asking not for formal praise to the engineer as the smoother of the path, but I am asking him to keep his own inner conviction of the worthwhileness of his task, and to honor worthy writers, painters, musicians and artists, not as a higher class of beings, but as workers who also have done well.

But we may face the fact that with the smoothing of the path to finer manners, finer tastes, finer art there has developed a great tendency for people to loiter along the smooth path making their own existence a pleasant, aimless journey. Frequently the engineer is blamed for the fact that men have used in this lazy fashion the highway he has helped to prepare, or that some of them have actually walked backward on it toward the things that are ugly and cruel. The engineer physicist who has developed the modern talking, moving picture is blamed because there has developed so large a group of people incapable of entertaining themselves and who have become slaves to professional entertainment at so much per head. The automotive engineer is blamed for the daily crowds of people who go on joy rides and frequently spoil all pleasure for others in riding. The chemical engineer is blamed for the hellishness of poison gas warfare. Some blame must be taken by the engineer for this state of affairs. In common with the great multitude of people, he has failed to raise his voice very loudly against the abuse of the smooth roadways he has made possible. He, with others, has carelessly assumed that, given an easier pathway to the fine things of life, people will of

course seek them. But his blame is not greater than that of other groups of people. He must take his share of the blame, but he is not a sinner above other men in this respect.

The engineer, with other folk, must come to recognize that while clearing the ground is an important and dignified part of the process of building the temple of society, and that while in dignity and worthiness it is second to no other task, yet the clearing of the ground does not insure that a beautiful temple will be built, and that emphasis must be placed on the proper use of the facilities he has helped create. In considering the proper use of the facilities made available by applied science—surely a field of study of vital importance to culture—the speaker believes that the engineer may well emphasize the necessity of giving due consideration to the viewpoint of the workaday world—not on emphasis which overshadows the viewpoint of the leisurely scholar who is freed from anxiety for daily bread, but an emphasis which will cause attention to be given to *both* viewpoints—a really broad-minded emphasis. He may well emphasize the engineer's idea of tolerance. Moreover he must avoid the great error, rather common to the artist type, of the tendency to see everything outside one's own field through a reversed telescope, as small and unimportant. As the engineer demands that the dignity of his work for humanity be recognized, he must be willing to give adequate recognition to the view-points of preachers and economists, artists, and philosophers, authors and pure scientists.

SCIENTIFIC AND PHILOSOPHICAL METHODS IN EDUCATION[1]

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THERE is precedent for the discussion of this topic before this association. Several years ago, Dr. Pechstein, the retiring vice-president, discussed the question, "Is there a science of education?" He presented the results of a questionnaire addressed to well-known students of the science of education. He left the impression that while education may not be classed as a science similar to physics, chemistry, biology or psychology, it may use scientific methods and hence may be regarded as an applied science similar to engineering or medicine. Perhaps scientific students of education will not quarrel about a name if it be admitted that the problems of education can be attacked by scientific methods. At the meeting a year ago, Dr. Kelley discussed a question which is somewhat more nearly related to the one we have before us at this meeting. He took as his specific problem the relation between science and philosophy as methods of study of educational problems. The solution which he offered was that both science and philosophy have a place in the study of education. The place of science is to determine the general principles which govern educational procedures and the place of philosophy is to deal with and to find the solution of particular or concrete issues. When the student of education formulates a general law or principle, then, he is scientific, but, when he faces a complex situation demanding that he decide what form of practical action should be taken, he has recourse to philosophy. Science is general, philosophy is particular; science is theoretical, philosophy is practical. We shall find in the course of our discussion that concepts of the nature of philosophy and of its applications in education are varied. This is one which we shall have to include in our list for consideration.

The existence of a precedent is perhaps hardly sufficient justification for discussing the relation between the philosophical and the scientific methods on the present occasion. It is true that the recognition of education as having a legitimate place in a scientific association immediately suggests the problem. It is also true that questions of method are quite appropriate for discussion in meetings at which scientists of various interests and types of training join together. But the subject has recently been discussed in other groups as well as in this one, and it may be thought to be a hackneyed question if not indeed an academic one. I believe, however, that the problem at issue merits some further consideration. The question may be hackneyed, but there is still a marked difference of opinion upon it. The philosophy of education is made a prominent part of the curriculum of some departments or schools of education and it is omitted as a distinct subject of instruction in others. A contrast between the philosophical and the scientific mode of approach is represented not only in courses of instruction but also in the thinking and

[1] Address of the retiring vice-president of Section Q—Education, American Association for the Advancement of Science, Cleveland, December 30, 1930.