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THE ECONOMICAL CHARACTER OF PHYSICAL RESEARCH.

BY PROF. ERNST MACH.¹

[CONCLUDED.]

The recognition of the economical character of science will now help us, perhaps, to understand better certain physical notions.

Those elements of an event which we call "cause and effect" are certain salient features of it, which are important for its mental reproduction. Their importance wanes and the attention is transferred to fresh characters the moment the event or experience in question becomes familiar. If the connexion of such features strikes us as a necessary one, it is simply because the interpolation of certain intermediate links with which we are very familiar, and which possess, therefore, higher authority for us, is often attended with success in our explanations. That *ready* experience fixed in the mosaic of the mind with which we meet new events, Kant calls an innate concept of the understanding (*Verstandesbegriff*).

The grandest principles of physics, resolved into their elements, differ in no wise from the descriptive principles of the natural historian. The question, "Why?" which is always appropriate where the explanation of a contradiction is concerned, like all proper habitudes of thought, can overreach itself and be asked where nothing remains to be understood.

Suppose we attributed to nature the property of producing like effects in like circumstances; just these like circumstances we should not know how to find. Nature exists once only. Our schematic mental imitation alone produces like events. Only in the mind, therefore, does the mutual dependence of certain features exist.

All our efforts to mirror the world in thought would be futile if we found nothing permanent in the varied changes of things. It is this that impels us to form the notion of substance, the source of which is not different from that of the modern ideas relative to the conservation of energy. The history of physics furnishes numerous examples of this impulse in almost all fields,

and pretty examples of it may be traced back to the nursery. "Where does the light go to when it is put out?" asks the child. The sudden shrivelling up of a hydrogen balloon is inexplicable to a child; it looks everywhere for the large body which was just there but is now gone.

Where does heat come from? Where does heat go to? Such childish questions in the mouths of mature men shape the character of a century.

In mentally separating a body from the changeable environment in which it moves, what we really do is simply to extricate one group of sensations with which our thoughts are busied and which is of relatively greater stability than others, from the stream of all sensations. Absolutely unalterable this group is not. Now this, now that member of it appears and disappears, or is altered. In its full identity it never recurs. Yet the sum of its constant elements as compared with the sum of its changeable ones, especially if we consider the continuous character of the transition, is always so great that for the purpose in hand the former usually appear sufficient to determine the body's identity. But because we can separate from the group every single member without the body's ceasing to be for us the same, we are easily led to believe that after abstracting all the members something additional still remains. It thus comes to pass that we form the notion of a substance distinct from its attributes, of a thing-in-itself, whilst our sensations are regarded merely as symbols or indications of the properties of this thing-in-itself. But it would be much better to say that bodies or things are compendious mental symbols for groups of sensations—symbols that do not exist outside of thought. Thus, the merchant regards the labels of his boxes merely as indexes of their contents, and not the contrary. He invests their contents, not their labels, with real value. The same economy which induces us to analyse a group and to establish special signs for its component parts, parts which also go to make up other groups, may likewise induce us to mark out by some single symbol a whole group.

On the old Egyptian monuments we see objects represented which do not reproduce a single visual impression, but are composed of various impressions.

¹An address delivered before the anniversary meeting of the Imperial Academy of Sciences, at Vienna, May 25, 1882. Translated by *μσρκ*.

The heads and the legs of the figures appear in profile, the head-dress and the breast are seen from the front, and so on. We have here, so to speak, a mean view of the objects, in forming which the sculptor has retained what he deemed essential, and neglected what he thought indifferent. We have living exemplifications of the processes put into stone on the walls of these old temples, in the drawings of our children, and we also observe a faithful analogue of them in the formation of ideas in our own minds. Only in virtue of some such facility of view as that indicated, are we allowed to speak of a body. When we speak of a cube with trimmed corners—a figure, which is not a cube—we do so from a natural instinct of economy, which prefers to add to an old familiar conception a correction instead of forming an entirely new one. This is the process of all judgment.

The crude notion of "body" can no more stand the test of analysis than can the art of the Egyptians or that of our little children. The physicist who sees a body flexed, stretched, melted, and vaporised, cuts up this body into smaller permanent parts; the chemist splits it up into elements. Yet even an element is not unalterable. Take sodium. When warmed, the white, silvery mass becomes a liquid, which, when the heat is increased and the air shut out, is transformed into a violet vapor, and on the heat being still more increased glows with a yellow light. If the name sodium is still retained, it is because of the continuous character of the transitions and from a necessary instinct of economy. By condensing the vapor, the white metal may be made to reappear. Indeed, even after the metal is thrown into water and has passed into sodium hydroxide, the vanished properties may by skilful treatment still be made to appear; just as a moving body which has passed behind a column and is lost to view for a moment may make its appearance after a time. It is unquestionably very convenient always to have ready the name and thought for a group of properties wherever that group by any possibility can appear. But more than a compendious economical symbol for these phenomena, that name and thought is not. It would be a mere empty word for one in whom it did not awaken a large group of well-ordered sense-impressions. And the same is true of the molecules and atoms into which the chemical element is still further analysed.

True, it is customary to regard the conservation of weight, or, more precisely, the conservation of mass, as a direct proof of the constancy of matter. But this proof is dissolved, when we go to the bottom of it, into such a multitude of instrumental and intellectual operations, that in a sense it will be found to constitute simply an equation which our ideas in imitating facts have to satisfy. That obscure, mysterious lump

which we involuntarily add in thought, we seek for in vain outside the mind.

It is always, thus, the crude notion of substance that is slipping unnoticed into science, proving itself constantly insufficient, and ever under the necessity of being reduced to smaller and smaller world-particles. Here, as elsewhere, the lower stage is not rendered indispensable by the higher which is built upon it, no more than the simplest mode of locomotion, walking, is rendered superfluous by the most elaborate means of transportation. Body, as a compound of light and touch sensations, knit together by sensations of space, must be as familiar to the physicist who seeks it, as to the animal who hunts its prey. But the student of the theory of knowledge, like the geologist and the astronomer, must be permitted to reason back from the forms which are created before his eyes to others which he finds ready made for him.

All physical ideas and principles are succinct directions, frequently involving subordinate directions, for the employment of economically classified experiences, ready for use. Their conciseness, as also the fact that their contents are rarely exhibited in full, often invests them with the semblance of independent existence. Poetical myths regarding such ideas,—for example, that of Time, the producer and devourer of all things,—do not concern us here. We need only remind the reader that even Newton speaks of an *absolute* time independent of all phenomena and of an absolute space—views which even Kant did not shake off, and which are often seriously entertained to-day. For the natural inquirer, determinations of time are merely abbreviated statements of the dependence of one event upon another, and nothing more. When we say the acceleration of a freely falling body is 9.810 metres per second, we mean the velocity of the body with respect to the centre of the earth is 9.810 metres greater when the earth has performed an additional 86400th part of its rotation—a fact which itself can be determined only by the earth's relation to other heavenly bodies. Again, in velocity is contained simply a relation of the position of a body to the position of the earth.¹ Instead of referring events to the earth we may refer them to a clock, or even to our internal sensation of time. Now, because all are connected, and each may be made the measure of the rest, the illusion easily arises that time has significance independently of all.²

The aim of research is the discovery of the equa-

¹ It is clear from this that all so-called elementary (differential) laws involve a relation to the Whole.

² If it be objected, that in the case of perturbations of the velocity of rotation of the earth, we could be sensible of such perturbations, and being obliged to have some measure of time, we should resort to the period of vibration of the waves of sodium light,—all that this would show is that for practical reasons we should select that event which best served us as the *simplest* common measure of the others.

tions which subsist between the elements of phenomena. The equation of an ellipse expresses the universal conceivable relation between its co-ordinates, of which only the real values have geometrical significance. Similarly, the equations between the elements of phenomena express a universal, mathematically conceivable relation. Here, however, for many values only certain directions of change are physically admissible. As in the ellipse only certain values satisfying the equation are realised, so in the physical world only certain changes of value occur. Bodies are always accelerated towards the earth. Differences of temperature, left to themselves, always grow less; and so on. Similarly, with respect to space, mathematical and physiological researches have shown that the space of experience is simply an actual case of many conceivable cases, about whose peculiar properties experience alone can instruct us. The elucidation which this idea diffuses cannot be questioned, despite the absurd uses to which it has been put.

Let us endeavor now to summarise the results of our survey. In the economical schematism of science lie both its strength and its weakness. Facts are always represented at a sacrifice of completeness and never with greater precision than fits the needs of the moment. The incongruence between thought and experience, therefore, will continue to subsist as long as the two pursue their course by the side of each other; but it will be continually diminished.

In reality, the point involved is always the completion of some partial experience; the derivation of one portion of a phenomenon from some other. In this act our ideas must be based directly upon sensations. We call this measuring.¹ The condition of science, both in its origin and in its application, is a *great relative stability* of our environment. What it teaches us is interdependence. Absolute forecasts, therefore, have no significance in science. With great changes in celestial space we should lose our coordinate systems of space and time.

When a geometer wishes to understand the form of a curve, he first resolves it into small rectilinear elements. In doing this, however, he is fully aware that these elements are only provisional and arbitrary devices for comprehending in parts what he cannot comprehend as a whole. When the law of the curve is found he no longer thinks of its elements. Similarly, it would not become physical science to see in its self-created, changeable, economical tools, molecules and atoms, realities behind phenomena, forgetful of the lately acquired sapience of her older sister, philosophy, in substituting a mechanical mythology for the old animistic or metaphysical scheme, and thus creating

no end of suppositious problems. The atom must remain a tool for representing phenomena, like the functions of mathematics. Gradually, however, as the intellect, by contact with its subject-matter, grows in discipline, physical science will give up its mosaic play with stones and will seek out the boundaries and forms of the bed in which the living stream of phenomena flows. The goal which it has set itself is the *simplest and most economical* abstract expression of facts.

* * *

The question now remains, whether the same method of research which till now we have tacitly restricted to physics, is also applicable in the psychical domain. This question will appear superfluous to the physical inquirer. Our physical and psychical views spring in exactly the same manner from instinctive knowledge. We read the thoughts of men in their acts and facial expressions without knowing how. Just as we predict the behavior of a magnetic needle placed near a current by imagining Ampère's swimmer in the current, similarly we predict in thought the acts and behavior of men by assuming sensations, feelings, and wills similar to our own connected with their bodies. What we here instinctively perform would appear to us as one of the subtlest achievements of science, far outstripping in significance and ingenuity Ampère's rule of the swimmer, were it not that every child unconsciously accomplished it. The question simply is, therefore, to grasp scientifically, that is, by conceptional thought, what we are already familiar with from other sources. And here much is to be accomplished. A long sequence of facts is to be displayed between the physics of expression and movement and feeling and thought.

We hear the question, "But how is it possible to explain feeling by the motions of the atoms of the brain?" Certainly this will never be done, no more than light or heat will ever be deduced from the law of refraction. We need not deplore, therefore, the lack of ingenious solutions of this question. The problem is not a problem. A child looking over the walls of a city or of a fort into the moat below sees with astonishment living people in it, and not knowing of the portal which connects the wall with the moat, cannot understand how they could have got down from the high ramparts. So it is with the notions of physics. We cannot climb up into the province of psychology by the ladder of our abstractions, but we can climb down into it.

Let us look at the matter without bias. The world consists of colors, sounds, temperatures, pressures, spaces, times, and so forth, which now we shall not call sensations, nor phenomena, because in either term an arbitrary, one-sided theory is embodied, but simply *elements*. The fixing of the flux of these elements,

¹ Measurement, in fact, is the definition of one phenomenon by another (standard) phenomenon.

whether mediately or immediately, is the real aim of physical research. As long as, neglecting our own body, we employ ourselves with the interdependence of those groups of elements which, including men and animals, make up *foreign* bodies, we are physicists. For example, we investigate the change of the red color of a body as produced by a change of illumination. But the moment we consider the special influence on the red of the elements constituting our body, outlined by the well-known perspective with head invisible, we are at work in the domain of physiological psychology. We close our eyes, and the red together with the whole visible world disappears. There exists, thus, in the perspective field of every sense a portion which exercises on all the rest a different and more powerful influence than the rest upon one another. With this, however, all is said. In the light of this remark, we call *all* elements, in so far as we regard them as dependent on this special part (our body), *sensations*. That the world is our sensation, in this sense, cannot be questioned. But to make a system of conduct out of this provisional conception, and to abide its slaves, is as unnecessary for us as would be a similar course for a mathematician who, in varying a series of variables of a function which were previously assumed to be constant, or in interchanging the independent variables, finds his method to be the source of some very surprising ideas for him.¹

If we look at the matter in this unbiassed light it will appear indubitable that the method of physiological psychology is none other than that of physics; what is more, that this science is a part of physics. Its subject-matter is not different from that of physics. It will unquestionably determine the relations the sensations bear to the physics of our body. We have already learned from a member of this academy (Hering) that in all probability a sixfold manifoldness of the chemical processes of the visual substance corresponds to the sixfold manifoldness of color-sensation, and a threefold manifoldness of the physiological processes to the threefold manifoldness of space-sensations. The paths of reflex actions and of the will are followed up and disclosed; it is ascertained what region of the brain subserves the function of speech, what region the function of locomotion, etc. That which still clings to our body, namely, our thoughts, will, when those investigations are finished, present no difficulties new in principle. When experience has

once clearly exhibited these facts and science has marshalled them in economic and perspicuous order, there is no doubt that we shall *understand* them. For other "understanding" than a mental mastery of facts never existed. Science does not create facts from facts, but simply *orders* known facts.

Let us look, now, a little more closely into the modes of research of physiological psychology. We have a very clear idea of how a body moves in the space encompassing it. With our optical field of sight we are very familiar. But we are unable to state, as a rule, how we have come by an idea, from what corner of our intellectual field of sight it has entered, or by what region the impulse to a motion is sent forth. Moreover, we shall never get acquainted with this mental field of view from self-observation alone. Self-observation, in conjunction with physiological research, which seeks out physical connexions, can put this field of vision in a clear light before us, and will thus first really reveal to us our inner man.

Primarily, natural science, or physics, in its widest sense, makes us acquainted with only the firmest connexions of groups of elements. Provisory, we may not bestow too much attention on the single constituents of those groups, if we are desirous of retaining a comprehensible whole. Instead of equations between the primitive variables, physics gives us, as much the easiest course, equations between *functions* of those variables. Physiological psychology teaches us how to separate the visible, the tangible, and the audible from bodies—a labor which is subsequently richly required, as the division of the subjects of physics well shows. Physiology further analyses the visible into light and space sensations; the first into colors, the last also into their component parts; it resolves noises into sounds, these into tones, and so on. Unquestionably this analysis can be carried much further than it has been. It will be possible in the end to exhibit the common elements at the basis of very abstract but definite logical acts of like form,—elements which the acute jurist and mathematician, as it were, *feels* out, with absolute certainty, where the uninitiated hears only empty words. Physiology, in a word, will reveal to us the true real elements of the world. Physiological psychology bears to physics in its widest sense a relation similar to that which chemistry bears to physics in its narrowest sense. But far greater than the mutual support of physics and chemistry will be that which natural science and psychology will render each other. And the results which shall spring from this union will, in all likelihood, far outstrip those of the modern mechanical physics.

What those ideas are with which we shall comprehend the world when the closed circuit of physical and psychological facts shall lie complete before us, (that

¹ I have represented the point of view here taken for more than thirty years and developed it in various writings (*Erhaltung der Arbeit*, 1872; *The Forms of Liquids*, 1872 [*The Open Court*, No. 333]; *Bewegungsempfindungen*, 1875). The idea, though known to philosophers, is unfamiliar to the majority of physicists. It is a matter of deep regret to me, therefore, that the title and author of a small tract which accorded with my views in numerous details and which I remember having caught a glance of in a very busy period (1879-1880), have so completely disappeared from my memory that all efforts to obtain a clue to them have hitherto been fruitless.

circuit of which we see now only two disjointed parts,) cannot be foreseen at the outset of the work. The men will be found who will recognise the right and will have the courage, instead of wandering in the intricate paths of logical and historical accident, to enter on the straight ways to the heights from which the mighty stream of facts can be surveyed. Whether the notion which we now call matter will continue to have a scientific significance beyond the crude purposes of common life, we do not know. But we certainly shall wonder how colors and tones which were such innermost parts of us could suddenly get lost in our physical world of atoms; how we could be suddenly surprised that something which outside us simply clicked and beat, in our heads should make light and music; and how we could ask whether matter can feel, that is to say, whether a mental symbol for a group of sensations can feel?

We cannot mark out in hard and fast lines the science of the future, but we can foresee that the rigid walls which now divide man from the world will gradually disappear; that human beings will not only confront each other, but also the entire organic and so-called lifeless world, with less selfishness and with livelier sympathy. Just such a presentiment as this perhaps possessed the great Chinese philosopher Licius some two thousand years ago when, pointing to a heap of mouldering human bones, he said to his scholars in the rigid, lapidary style of his tongue: "These and I alone have the knowledge that we neither live nor are dead."

THE STRIKE OF THE HORSES.

ARTICLES as clear, keen, and elucidative as Prof. Ernst Mach's exposition of "The Economical Character of Physical Research" in the last and the present number of *The Open Court* are rare. I have no doubt that our readers greatly enjoy the classical simplicity of his style, for we justly count our honored contributor by Kirchhoff, Helmholtz, Thomson, Maxwell, and Tyndall among the foremost scientists of the world. The comparison made by Professor Mach between science and business is very suggestive and it seems to me that the analogies are perhaps greater than they may appear at first sight. Professor Mach says:

"Just as a single human being, restricted wholly to the fruits of his own labor, could never amass a fortune, but on the contrary the accumulation of the labor of many men in the hands of one is the foundation of wealth and power, so, also, no knowledge worthy of the name can be gathered up in a single human mind limited to the span of a human life and gifted only with finite powers, except by the most exquisite economy of thought and by the careful amassment of the economically ordered experience of thousands of co-workers. What strikes us here as the fruits of sorcery are simply the rewards of excellent housekeeping, as are the like results in civil life. But the business of science has this advantage over every other enterprise, that from its amassment of wealth no one

suffers the least loss. This, too, is its blessing, its freeing and saving power."

I am not sufficiently familiar with Professor Mach's views on social and economical questions to say whether his words are intended to mean only what they imply, viz., that the "rewards of housekeeping in business are an amassment of wealth by which somebody suffers a loss." If this is Professor Mach's view I respectfully venture to differ from him. The economy established by our business methods is as much a gain all round as the economy of thought produced by science, and the blessing that rests on science finds its main realisation in its practical application to actual life.

Take as an instance any great business-establishment with which you happen to be acquainted. The economy which a wholesale business introduces is a benefit to all concerned in that business, to the laborers of all kinds, to the employers of labor, and to those who buy the goods. The prosperity of a great and economically conducted business may be a misfortune to competitors who can no longer compete with it, but we cannot in such a case speak of a loss. Economy in business, by organising the industry of many men so as to render them more productive, is a genuine gain, as much so as the economy of thought in science, and there is nowhere a loss.

We make this statement, fully conscious of the fact that it contradicts a favorite superstition of the times according to which we have much poverty because we have much wealth. The proposition is made: Reduce the wealth of our great money-kings and you will abolish the misery of our paupers. The tramp and the millionaire, the hut and the palace, the slave and the power-wielding lord are coupled together as if one were the cause of the other, as if riches could be produced only by making some one destitute, and power could rise into existence only by enslaving somebody. This view is wrong and the sooner we understand how deeply wrong it is, the quicker the eyes will be opened of both the lordly suppressors of their fellow-men and the slavery-scenting haters of power and wealth. A correct view of the solidarity of all members of society will ensure a wholesome evolution of a freer and nobler mankind; it will bring peace on earth among those who now imagine that their interests are at variance and hope to improve their conditions by destroying the very means by which mankind has, with great trouble, worked its way up from barbarism to a higher civilisation.

When saying that no economical organisation of labor entails any loss upon any member of society, we neither say that there are not business enterprises which underpay their laborers, nor would we begrudge the laborer the right of contending for higher wages.

On the contrary, we regard it as every one's duty to aspire for the improvement of the material conditions of his life by all the legal and rationally approved means at his disposal. Experience teaches that the civilisation of a country where laborers receive the highest pay is most advanced, and high wages, so long as they do not endanger the existence of a business, are more an advantage than a disadvantage. And the rule is, a high average of wages in a country indicates the presence of much wealth in the hands of capitalists. Every successful strike increases the amassment of wealth in few hands.

What is the consequence of a strike or any other movement that succeeds in securing for a certain class of laborers higher wages? It involves a reduction of the number of both the laborers and employers in that line of industry, and would, if carried to the extreme, exterminate the whole business.

The economical law will perhaps be clearer if stated in its generality and elucidated by an example taken from the fable-land of animals acting like men.

The horses struck and contended that they received no payment for all their work generously given to mankind for the mere sustenance of their lives. The justice of their claim was obvious, and their right to strike, since animals had acquired speech and the privilege of meeting in free assembly, could no longer be doubted. The claim of the horses consisted in demanding a dollar a day for every horse. They succeeded and all their demands were granted.

What was the consequence of this successful strike? All the horses whose labor brought less returns than the value of their food plus one dollar per day were discharged, and many livery-stables went out of existence. Inventors of machinery were greatly benefited, for steam-engines began more and more to replace the power of living horses. It was a sad sight to see the horses that had been dismissed, for they were doomed to a slow perdition; the higher condition of horsemanship actually served to starve out a large class of horses who were unable to reach the standard the horses had fixed upon as the price of horsemanship.

Those horses, however, who survived the change had reason to be satisfied; both the luxury and the labor horses were a choice breed and, although their lot was no easier than before, they had acquired a share, or at least the opportunity of acquiring a share, in the wealth of the earth.

Now do you think that the employers of horses who had managed to continue in business were dissatisfied with the new conditions? By no means. Their business was to a great extent of such a kind that the public could not do without horse-help. Hence it had been increased by the failure of many weak competitors, and the returns, too, had become

proportionally greater, for they charged higher prices. Instead of one dollar per horse more in return to pay their employer, they had about two and sometimes even two and a half or three dollars. The reason was that such horse employers as made only one dollar, or scarcely one dollar per horse capita, could not stand the bad times which now and then swept over the country. They could just manage to pull through in good times and went to the wall on the appearance of the slightest social or financial disturbance.

High wages are as much a check upon an industry as a high duty, and there is an ascertainable highest and lowest margin. The lowest margin is such wages as will barely keep the laborer and his family alive; the highest margin is that which, if it were raised one cent, would shut down the factory on the first symptom of a financial crisis.

High duties sometimes tax commodities out of existence. Take for instance small beer. Americans who never visited Europe do not know what "small beer" means, because such a thing does not exist here, but if they go to Europe they will find that *cinfaches Bier*, a kind of temperance beer, for it contains no alcoholic ingredients, is a very refreshing beverage, and is much used in the household to make an ice-cold beer-soup in summer, which would be very delicious during the hot season of our climate. Why is "small beer" not brewed in America? Simply because we have all over the United States a tax on all kinds of beers, and this tax taxes the cheap beers out of existence. No one would pay five cents for a pint of small beer, and otherwise the brewing does not pay; no brewer could afford to pay the tax on small beer, and our big brewers, who pay the beer-tax, do not care, for they find more profit in brewing lager beer.

When we maintain that the economy of a well-conducted business is under all circumstances a gain and involves no direct loss to any one (for otherwise the employee would not agree to work for his employer), we understand by business, genuine enterprises of service to mankind, and exclude all such establishments which, like gambling-houses, are based upon immoral principles. That there are many business transactions in which the gain of one is the exact equivalent of the loss of some one else cannot be denied; but the existence of frauds in business does not disprove the truth that all economical organisations of labor in industrial enterprises, all trade and commerce if it is the right kind, is of mutual benefit, and pure gain without any loss. Fraudulent business methods only cause a loss to one party, and the same is true of the economy of thought, which has been found to be the lasting boon of scientific work. The results of science, too, can be misused for criminal purposes; and how often one scientist succeeds in getting for

himself the glory of a discovery which belongs to one of his fellow-workers! Stealing is neither impossible nor unknown in the intellectual realm of science, the arts, and the *belles-lettres*. There are acquisitions of scientific renown which entail a loss on some one else to whom the reward of a general recognition rightfully belongs. And very often personal jealousies keep one influential man, who has the public ear, from acknowledging the truth of a discovery, which is thus many years belated, and so an invaluable amount of important knowledge destroyed before it can be properly tested and utilised.

There is a superstition prevalent in absolute monarchies that the power of king or emperor is built upon the serfdom of his subjects, and therefore sovereign rulers are in the habit of jealously guarding the burdensome privileges of their autocracy. The fact is, that if the kings of England had been and had remained autocrats, England would have remained an unimportant little island, like Corsica, or Madagascar, or Borneo; and if the Czar of Russia were the sovereign of a free nation, which could freely develop all its latent possibilities, the chief of a nation like the English nation, he would, with the enormous territory of his empire, be ten times more powerful as the leader of the destinies of a ten times more civilised people. The English kings certainly did not lose in power when they surrendered those of their privileges which were a check upon the free development of their subjects.

True power is not built upon the necks of slaves, but is the result of the free coalition of free men.

One of the first conditions of progress is the recognition of the laws of social economy. There can be no question about the right of all people to secure for themselves the best possible conditions; but violence and the destruction of wealth are not the right means to secure these rights for manual labor. The methods preached by many labor-agitators would frequently bring about, if carried into effect, quite different results from those expected or promised. And capitalists, too, are mistaken when they imagine they can prosper only so long as they keep their employees in a state of wretched poverty.

Let every one fight for his rights by all legal means, especially strikes, with careful abstention from violence or threats of violence; but let us at the same time understand that under normal conditions the prosperity of one, far from being a loss to others, contributes to the welfare of all.

P. C.

CORRESPONDENCE.

A LETTER FROM JAPAN.

To the Editor of *The Open Court* :

You kindly inquire as to the cause of my hurrying home so suddenly. My coming home has nothing to do with the war now

going on between Japan and China. I am not in danger of being drafted in any near future, although I should be only too glad to serve the army if such a crisis comes.

You also ask me to state impartially something about the present war. I am willing to do so, but as your letter came to me after such a long delay I think it is almost too late for me to say anything of interest. Let me simply tell you that the war is growing in its dimensions almost every minute. We shall not be satisfied at all until we come to Peking either to beat or to be beaten. You know all about the victories of Japan both on land and on water. We do not mean, however, to fight for the sake of fighting. Neither do we mean to glory in our victory or in our conquest. Our motive is nobler. We intend to help Corea in its struggle for independence and civilisation, and to wake up China from its long dream of ignorance and darkness. We struggle not merely for our own sake, but for the real good of China and of Eastern Asia as a whole. This is our ambition in this present war.

The attitude of Japan towards its neighbor China in the present war is in many respects similar to that of the United States to Japan some fifty years ago, when Commodore Perry visited Japan. We mean to play the part of the United States of that time, while China wittingly or unwittingly is playing the part of Japan of that time.

You know the cause of this present war. There is no injustice or wrong on our part. "Justice" is our motto, and "civilisation" is our object. We do not like war, but we could not evade it. However, from another point of view we may say that this war is probably the best chance for us Japanese to show the strength of civilisation to the rest of the world, although it is a very expensive way of doing so.

I wish you could see some, at least, of the patriotic demonstrations which are found all over the country. The whole Japanese nation is as if on fire. Almost every soldier—nay, every common person—is willing to go to war for his country, and for its righteous cause; indeed, he is willing to die. Such is our national feeling about the present war.

NOBUTA KISHIMOTO.

ALWAYS ONE.

(Translated from the German of Goethe.)

LIFE I never can divide,
 Inner and outer together you see.
 Whole to all I must abide,
 Otherwise I cannot be.
 Always I have only writ
 What I feel and mean to say.
 Thus, my friends, although I split,
 Yet remain I one always.

BOOK NOTICES.

Ueber die Ursachen der Blitzschläge in Bäume. By Dimitrie Joneco. (Stuttgart: E. Koch. 1892. Pp. 62.) According to this investigation, all kinds of trees are liable to be struck by lightning at high electrical tensions; oleous trees are safe against lightning in proportion to the amount of oil which they contain; but both oleous and amylaceous trees when poor in oil are sought out by the lightning; the aqueous contents of trees play no essential part; dead limbs increase the liability of being struck; bark and foliage do not alter the electrical conductive capacity of trees; and finally, the character of the soil stands in no direct connexion with the frequency of accidents.—*Notiz über eine einfache Methode, um dielectriche Flüssigkeiten auf ihr Leitungsvermögen zu untersuchen.* By K. R. Koch. (Leipzig: J. A. Barth. 1893. Pp. 3.) The result of this research is, that the cause of the conductivity of

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dielectric liquids is impurities of the substance ; for example, benzol when very pure is apparently a complete and perfect insulator of electricity.—*Ueber künstliche Gletscher*. By K. R. Koch. (Leipzig: J. A. Barth. 1894. Pp. 8.) This communication contains directions and diagrams for making models of glaciers ; by means of viscous liquids the chief phenomena of glacier motion can be reproduced with interesting and instructive results.—*Ethnologische Mitteilungen aus Ungarn*. This is a magazine of folklore for Hungary and the related countries, and has been in existence three years, being edited and published by Dr. Anton Herrmann. Much of its space is devoted to gypsy-lore. (Budapest, I., Szent-György-utca. 2.)—In this connexion it may be mentioned for the benefit of lovers and students of folklore that an *International Dictionary of Contemporaneous Folklorists* is to be published by subscription in Paris (G. Colombier, 4 Rue Cassette) under the direction of Prof. M. Henry Carnoy. It will contain biographies of all the notable folklorists of the world with their portraits, addresses, and a list of their works. According to the prospectus any person who has thirty-five francs can obtain a notice, accompanied with his photograph, in this dictionary. Undoubtedly, it will be a bulky volume, and as a *directory* of folklorists will have its value.—*Cosmopolis Revista Universal*, a magazine first issued in May, 1894, and purporting to be the universal review of the Spanish Main, published at Caracas, Venezuela, ("Imprenta Bolivar," Oeste 4, No. 4). In the opening article of the first number, the editors discuss the mission of the magazine from a patriotic and humanistic point of view. In the second article Pedro César Dominici treats of modern neurosis and of the decadents. There is a review of M. Julien Leclercq's "Six Masters," two poems, and the first installment of Daudet's "Tartarin of Tarascon." The authors of the articles are from the Northern South American States, from Cuba, and from the Central American States.

The American University and the American Man. The Second Commencement Address at the Leland Stanford Junior University. By George Elliot Howard. (Palo Alto, California. 1893.) Professor Howard reviews the rise of the new humanism and considers its effects upon the culture of to day. The ideal springing from this movement is "a spiritual utilitarianism whose creed is social perfection." Professor Howard justly rates the utility of knowledge very high, and sees in the practical emphasis which Americans lay upon it one of the best of the national tendencies. This tendency is incorporated in the practical character of our universities, which in a short time will place them much higher as institutions of education than the lop-sided systems of Europe. The new American university will secure a harmonious development of the mind and the character. Its function is to fit men to meet the grave social problems of the present ; "to direct self-conscious society in the dual task of self-regeneration and self-development." In the present tendency of American educationists to imitate slavishly the institutions of Europe, Professor Howard's plea is very timely.—*Can Organic Life Exist in the Planetary System Outside of the Earth?* By C. A. Stetefeldt. (Astronomical Society of the Pacific.) Mr. Stetefeldt tries to show from a consideration of the physiography and meteorology of the bodies of the planetary system that organic life cannot exist outside the earth. The conclusion from the data which he cites would be that organic life like that on the earth does not *now* exist on the planets. Mr. Stetefeldt admires "the inductive acumen of the theologians who considered the earth the most important of the planets, and the centre of creation. Although their opinions were not based upon scientific facts, they arrived at the truth, nevertheless."

Instructors and professional educationists will derive profit from an examination of the *Programme des cours* of the Brussels

Institut des Hautes Etudes of the *Ecole Libre D'Enseignement Supérieur*. This institution aims to give an education distinct from the traditional professional courses, and more adapted to the needs of the times. The faculty includes many eminent names.

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