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TECHNOLOGY AND MATERIAL PROGRESS[1]

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THERE is nothing in fixity. It is a figment of the imagination. The fact is old, the discovery is modern. Progress and not product dominates mankind. This has always been a changing universe. Perhaps the cave-man noted no change, but nevertheless its continuity had already been long established. Nowhere in the widest stretches of astronomical time is there any sign of one changeless period. The starry firmament itself has only been known to us through its changes. We interpret rays from the stars as proof that the most stable things on earth, our very elements, are being reduced and produced. The atoms are wireless stations which broadcast information of changes quite beyond our earlier comprehension.

Continuous change marks not only celestial systems and our inorganic worlds, but every living thing, from polyp to politician. All have developed by change and are still changing.

The single living cell which first slipped the hawser that anchored it to some submarine rock hopefully wiggled its residual stump, or cilium, and, thus experimentally moving about, found it could better meet its food half way. Thus changes for good in life may be due to an unsatisfied, but not necessarily dissatisfied previous state. Being unsatisfied or inquisitive is not safety first, and in the Devonian age many an experimenting fish must have died at low tide before satisfactory lungs were developed.

Certainly the persistence of change, the absence of fixity which is so evident to-day, must have been seen by early philosophers, though I suspect that the possibilities in change, nay, the certainty that changing, or progress, is the all-important thing, had not been

[1] Presented at the general meeting of the American Philosophical Society, Philadelphia, April 23, in the symposium on "Tendencies in the Natural Sciences in the Changing World."

discovered at the time of Socrates. I find him saying in Plato's "Republic" something which is not further expanded. In considering the possible source or training of leaders for the republic, Socrates asks briefly, "What sort of knowledge is there which would draw the soul from *becoming* to *being?*" I am supported by Jowett's notes on the "Republic," which contain this significant reference: "The regular *growth* of a state enlightened by *experience, progressing* in knowledge, improving in the arts of which the citizens were *educated* by the fulfilment of political duties, appears never to have come within the range of their hopes and aspirations."

Our knowledge of nature's laws is always incomplete and ragged. Man-made laws are imperfect and inconclusive. The edges of all human fabrics are rough and frayed. Our inventions and devices are like little islands rising from an infinite ocean, or like living trees in fertile fields growing at all exposed surfaces. All sciences are adding new science at the tips of countless branches to-day, and must always do so. This fact in turn becomes a necessary and inseparable part of our technology and material progress.

Once the men of every race were less appreciative of their possibilities of change and more deferential to powers in lower animals. Every country, every tribe and almost every family at one time adopted, and even worshipped, some lower animal. So we have the American Eagle, the Russian Bear, the British Lion, the Mohawk Turtle, the Egyptian Scarab, the Chinese Dragon, etc. Francis Bacon attributed to Herodotus the view that the Egyptians deified many animals because they were so much better discoverers and inventors than men. It is as though inquisitive change was recognized in lower animals long before man saw any direct possibilities in discovery for himself.

In some respects, the beginning of advancement of science might be attributed to the twelfth and thirteenth centuries. At that time (or even earlier), foreign students in European cities, living abroad to acquire new knowledge in medicine, religion, civil customs, etc., were forced to protect themselves by forming organizations which became the universities. This process of international spread of knowledge has never been reduced, and some of our modern physical, chemical and mechanical processes and products are directly traced to researches in pure science, carried out entirely under university auspices. In other words, it was through the efforts of ancient organizations, themselves changing or progressing, that the scientific foundations were laid for our material as well as our spiritual progress. The process has become continuous and at no time has there been absence of a spiritual aim.

Having the possibilities of infinite change in mind, Bacon in 1600 wrote powerfully against the inactivity of men who were limited by fear and superstition, taboos and cumbersome words.

A change did, indeed, begin about this time. Men were encouraged to seek freedom from false gods, from mysterious words, from ancient traditions; unprejudiced attack by experiment and observation was suggested, and means for improved communication, for economical recording and preserving of truth were devised. Cheap printing was in vogue.

From then on even those institutions of highest religious aim turned gradually toward considering the lily, and to diligently questioning and enjoying study of the rest of the universe. Galileo and the first scientific society date about 1600. The British Royal Society (1662), the French Academy of Sciences (1666), the Berlin Academy (1700), and the American Philosophical Society (1769) followed this great change. Gradually the universities all over the world began devoting effort to progress in new knowledge. Not satisfied to be mere preservers or storehouses of collected wisdom, they learned by experiment and saw that there never need be a limit to advancement of knowledge. Its acquirement by direct attack soon took place in countless different directions, and in all civilized countries, and the whole orderly product received the title of "science." It is having such a broad influence that we need not expect man to move in cycles or circles. He is progressing rather in an ascending helix.

Without delving deeply into technology and material progress, I wish to introduce a few specific instances of this early perception. I have enjoyed noting the various ways in which men first commenced to express faith in progress. No other animal does it.

I like to think of pious old John Woolman, who would not allow his clothing business to expand lest it interfere with his spiritual growth, as being appreciative of progress. He believed it possible to "provide all men with an environment which will best develop their physical, mental and spiritual powers." This was not mere theory with him, for he sought to apply it when he helped prepare the way for changed treatment of the American Indians, and, over a century before the Civil War, fought earnestly for the freedom of the slaves.

Baron de Tocqueville, writing of the Americans in 1850, said:

> They have all a lively faith in the perfectability of man; they judge that the diffusion of knowledge must necessarily be advantageous and the consequences of ignorance fatal. They all consider society as a body in a state of *improvement,* humanity as a changing scene in which nothing is or ought to be permanent, and

they admit that what appears to them to-day to be good may be superseded by something better to-morrow.

He adds, cautiously, "I do not give all these opinions as true, but as American opinions."

Bearing on de Tocqueville's remarks, Mr. M. E. Tracy recently wrote in the *World Telegram:*

To a great extent, we Americans have cultivated an insatiable thirst for change and innovation. We want nothing so badly as new methods and new devices. We are intrigued by nothing more distinctly than the thought that there is bound to be something different just around the corner. The appetite for experiment, discovery and invention is in our blood.

Modern philosophers, like Bergson and John Dewey, have advanced about as far as people are yet willing to follow in this view of progress. It is a bit novel to think of the process of change as more important than any finished product. We have naturally a thought of the importance of arrival, the imminence of the millennium. But arrivals are only rising steps of immortal growth where the worth-while thing is climbing, not resting. Bergson, in Creative Evolution, says, "We change without ceasing. To exist is to change, to change is to mature. Duration means invention, the creation of forms, the continual elaboration of the absolutely new." There is no sign of fixed states here.

John Dewey has said, "The vanity and irresponsibility of values that are merely *final* and not also, in turn, means to the enrichment of other occupations of life ought to be obvious." The process of growth, of improvement and progress rather than the static outcome and result become the significant thing. "Growth itself is the only moral end." "Not perfection as a final goal, but the ever-enduring process of perfecting, maturing, refining, is the aim of living."

In 1895 Professor William James heard a Harvard teacher say, "All the fundamental conceptions of truth have been found by science, and the future has only the details of the picture to fill in." Professor Wilhelm Ostwald had just expressed the same thought in Leipzig. James vigorously denied this theme and said truly, "Our science is a drop, our ignorance a sea." Since 1895, radium and the x-ray have been developed, the atom broken down, the electron discovered, Einstein's generalization produced, the quantum conception provided. Our bones are now made visible, we communicate with Europe by radio, television is in sight, aeroplanes have become common, and we admit that we know less about the essence of time, space, gravitation and light than was known in '95. Truly our ignorance is a sea, our knowledge almost an evaporating drop. But the fortunate thing is that we are still changing.

We see new industrial experiments carried on all around us, but do we realize that they constitute progress, and that this is more than ever possible through the magnitude of the experiments and the facility with which they are made public? From the remote concentration of human physical efforts in Russia and the unprecedented trials in England's dole, to our own internal novelties in the way of unemployment relief and veterans' bonus loans, the world is trying changes. And it is too early to compare with certainty the effect of the underpayment of the one with that of the overpayment of the others.

Our international technical possibilities are like the sinews of the child, not easily broken, but not yet tested or developed. We use radio for mere amusement and noisy advertising, our wealth for armies and schemes for destroying our neighbors. We can not change at once, but we realize that there is a gradual tendency to get together and to live in peace.

Count Keyserling, in his Paris lectures on the domination of the machine age, looks at our present civilization in the United States as the "tragic misconception of the modern epoch traceable to a failure to recognize that man is essentially spiritual." He may be right. But all former civilizations were still more tragic misconceptions, if knowledge and truth are criteria. There has never before been a time when a man, speaking on the banks of the Seine, was heard in the reaches of the Trocadero through mechanical amplifiers, and his words published all over the world on the following morning. In fact, if the spiritual leadership of such a man were evident even to a very small number of his fellows, his voice could be instantly broadcast to the world by devices which mark, as plainly as anything does, our machine age.

The speed with which we are applying new knowledge seems dangerously rapid to some, but there is every indication that it will not be reduced. An individual, or a nation, may decide that it has experienced a too rapid mechanical progress, but, as long as others advance, there will be an increasing tendency to bring all people to whatever has apparently (at least temporarily) proved to be the most satisfactory condition. In other words, it has always been, and probably will always be, a changing scene, with new experiments pointing a way to better conditions.

There never was a time when so many people in one nation, or so many nations of the world, were trying to advance. There never was a time when technical and material progress was more constructively attempted and critically examined. There never was a time when any one's efforts for good were so quickly and so generally broadcast. There never was a time when youth was more earnest or fearless in seeking the essentials of truth. The accumulated data of all material progress never were so great and never so

uniformly appreciated. If one country slackens in gaining new knowledge, the whole world knows it at once. If another country, or even any individual in it, advances the science of some particular field but a trifle, the rest of the world begins at once to use it. Pavloff's experiments in Leningrad on salivating dogs are quickly coordinated with psychological researches in America, and these in turn with brain mechanics, and then operators in highly mechanized manufacturing plants are experimentally chosen, graded or discharged according to reflexes and psychological reactions.

Those who are interested in technical progress look at it as continuous, but do not necessarily overrate its importance. There must be a parallel advance for the higher values in man. Perhaps the best way to look at our materialism is just as we now look at its earliest examples, for we are but a very short way from what may be called our real beginning as thinkers.

All the early discoveries which first insured bare preservation through continued effort were augmented by technical discoveries like tool making, food growing, fire building and animal control. These in turn were followed by time-saving and time-integrating developments like writing and printing. Our present accessories in electricity, mechanics and electronics, important because of proximity, are only the latest added steps, not the last. They lead to new kinds of people with new kinds of minds. This is what man at every previous stage has devoutly sought for, earnestly fought for and generally acquired.

There are errors in scientific conclusions now, just as there have been in the past. Hardly a single scientific fact of one century remains adequate for the next. First the world is flat and the sun rises; then the world is round and the world goes around the sun. Then the whole system moves through infinite space towards Alpha Centauri, and then the space loses its infinite quality and adds a curvature. I don't expect to see the end of changes, nor will any one else, because the last man will insist on making them while he improves. Our conceptions, discoveries and uses of an unfathomable universe are certainly always flexible and subject to improvement.

I think the world is more anxious to go right than ever. It is more eager to develop intelligently and not stop at some temporarily agreeable state. It is learning that any conceivable fixed state is not worth while so long as we still possess the power to advance.

It is futile to expect a world which is already enlightened to the advantages of material knowledge, mechanical substitutes for physical labor, and the promise of freedom for better growth in the future, to reduce its efforts or change its direction.

Man *is* essentially spiritual, but his tokens of values, his media of exchange, the flowers of goodwill to others, call for material (even mechanical) devices. The Greek slave, the Egyptian fellah and the man-with-the-hoe developed into the modern, less-enslaved philosopher who sees that man is essentially spiritual. If there is one thing modern mechanical civilization can do, it is to free people from slavery and strew spiritual opportunity along their path.

OBITUARY

EARL DOUGLASS

MY good friend and coworker in paleontology, Mr. Earl Douglass, died Tuesday, January 13, 1931, in a hospital at Salt Lake City, Utah, following an operation due to an attack of influenza, and other complications. Mr. Douglass had not been in good health for a number of months, in fact he was not in robust health last October when I last saw him at his home in Salt Lake City. However, the sudden and critical turn to his illness came as a distinct shock to his family, his many friends and colleagues.

Mr. Douglass was born in Medford, Minnesota, October 28, 1862, the son of Fernando and Abigail Louisa Douglass. He studied in the University of South Dakota, in 1888, and later took his Bachelor of Science degree at the Iowa State College, Ames. He studied in the Agricultural College and Missouri Botanical Gardens, St. Louis, and attended the University of Montana, where he took his master's degree. From 1899 to 1900 he taught geology, physical geography and physics at the University of Montana. From 1900 to 1902 he had a fellowship at Princeton University under Professor W. B. Scott.

In 1902 Mr. Douglass joined the staff of the paleontological section of the Carnegie Museum. At this time began my acquaintance and pleasant association with him, which continued uninterruptedly for nearly thirty years. His life was exemplified by conscientious and diligent work in all his undertakings, which was but slightly rewarded.

Mr. Douglass married in October, 1905, Pearl C. Goetschius, of Alder, Montana. One son, Gavin Earl Douglass, was born of this union.

Mr. Douglass's most famous field work was in connection with the Carnegie Museum when he discovered in 1909, and continued work for twelve or thirteen years in, the Jensen Fossil Dinosaur Quarry on Green River, northeast Utah. This quarry was finally taken over by the United States Government and set aside as a national monument. After this the quarry was