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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 278,

For the Week ending April 30, 1881.

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THE DIVISION OF LABOR.

Since Professor Babbage wrote for the "Encyclopædia Metropolitana," a generation ago, his celebrated chapter on the economic advantages of the division of labor, the principles he laid down and illustrated have been discussed with endless iteration in every sort of industrial publication, and demonstrated over and over in every department of the mechanic arts.

They are fundamental truths, which each generation of artisans and manufacturers must learn, and learn to apply to the ever-changing needs of new trades, new processes, and new social and industrial conditions.

But when we have proved that division of labor is an essential condition of successful and economical production on a large scale, we have not by any means exhausted the subject. The workman is worthy of consideration as well as the beauty and cheapness of the article he helps to manufacture. Hence the subject of the division of labor may be approached from two opposite and to some extent irreconcilable positions; and since the exigencies of social and industrial life require a perpetual adjustment of and compromise between the more or less conflicting lines of policy dictated by the two divergent interests, it is to be expected that the problems involved in the division of labor will never be shelved as thoroughly settled and done with.

If regard is had only for rapid, perfect, and economical production, the utmost specialization of labor is to be desired, if need be with the extremest limitation of the operative scope of the workman. If the well-being of the artisan, and through him that of the society he helps to form, are the main consideration, a very different aspect of the case appears.

It is for the interest of society that every man shall be of the manliest sort; to this end there is no theoretical limit to the knowledge and skill desirable in the artisan, who would be at his best only when he knew everything worth knowing, and was able to do everything worth doing, or that society might need to have done. The natural limitations of human capacity and the brevity of the time at command for acquiring knowledge and skill compel a material scaling down of the theoretical standard. Except under the lowest and simplest conditions of living no man, however well endowed by nature, can make himself an epitome of his tribe. The savage, the requirements of whose life are few but imperative, must know everything and be able to do everything that his fellows know and do. To a less degree the same is true of the member of any primitive community. In such a social state no man varies far from the "average man," and each must be able to fill any place or perform any duty that may arise. There are but few things to be done; the scope of the life is narrow, and every man's knowledge and skill must be substantially coextensive with that of the community as a whole.

A corresponding capability on the part of any member of our more complex social and industrial communities would make him a prodigy of learning and trained ability as admirable to think of as impossible to realize. Division of industrial function, with a corresponding limitation of individual skill, must of necessity go hand in hand with progress toward civilization, and still more markedly through all the rising grades of civilization. So infinite in scope and variety have modern arts become that the division of duty and the narrowing of individual function are something marvelous. In many instances the skilled workman seems now to be but little more than a living link in some great chain of industrial processes, a little piece of some huge organization of men and machines. In this capacity the ideal workman is not the man who knows most and can do the greatest variety of work, but he who can perform his own allotted task quicker, surer, and altogether better than any one else. And to do the required duty with the speed and skill demanded may be possible only by such close and protracted application of the man to that one monotonous operation as to measurably spoil him for any other industrial duty.

Here the tendency of the division of labor would be fatal to humanity within the range of its influence were it not constantly being restrained and corrected by inventions which substitute machines of wood and metal for human machines.

In the classic illustration of Professor Babbage—the manufacture of pins—the division of labor had become so minute that each pin required the work of four men, four women, one boy, and one girl, or ten different operatives, each performing some one specific and sharply limited task. At this stage the American pin-making machine came in to do the work of all except the wire-drawers, setting the rest free for more comprehensive and, it is to be hoped, less monotonous labor. The same process of increasing specialization of labor, ultimately mitigated by inventions which take the place of special skill and make the specialist a machine tender instead of part of a machine, is going on in every branch of the industrial arts. The invention of automatic machines thus becomes the salvation of the laborer, relieving him of the narrower and more brutalizing forms of toil, and at the same time, by cheapening products, putting within the workman's reach and enjoyment such food and clothing, conveniences and luxuries as would otherwise be beyond the reach of the richest.

The division of labor is thus a necessary evil and the means of much good; and it rests largely with the artisan himself to determine whether the minute specializing of labor, which the perfection and highest economy of manufacturing necessitate in so many departments, shall dwarf him or help him to higher manliness. If the daily pressure which the factory brings to bear upon the workman, tending to reduce him to the industrial condition of a cog in a great wheel or a wheel in a great machine, is not resolutely offset by an effort on his part to broaden his mental life and increase his knowledge and skill in other divisions of industry than the one he is specially engaged in, the chances are that his manhood is doomed. If his ambition is satisfied by the ability to perform one operation, or one limited round of operations fairly well, and he is willing to spend his life in that way, he must not expect to enjoy much of the life of a free man.

One of the great industrial problems to be solved by the American people is how to adjust the relations of machinery and minutely divided labor, so as to secure on the one hand the best and cheapest productions, and on the other hand to counteract the tendency of specialization to narrow the scope and value of the workman's life. Our operatives are also citizens and sovereigns; and society cannot afford to spoil the citizen to save a fraction of a cent on a yard of cotton or a few dollars on the price of a ship or an engine.

THE STUDY OF ANIMAL MOTIONS.

The instantaneous photographic views of horses and other animals in motion taken for ex-Governor Stanford of California, by Mr. Muybridge, of San Francisco, have been illustrated and repeatedly referred to in this paper. Mention has also been made of the zoogyroscope, devised for studying the pictures taken. Improvements in this instrument have brought out several curious features in the phenomena produced. For instance, a larger number of slits in the zinc disk than there are figures on the glass one will increase the rapidity of the motion of the figures. Owing to this peculiarity, two figures may be placed on the same glass disk and will appear to be traveling at different rates of speed.

It is announced that the photographs taken at Palo Alta are being prepared for publication in a large and costly volume, which cannot fail to be an extremely valuable contribution to the science of animal motion.

Facsimiles of the photographs are also being prepared for use in the zoogyroscope, for presentation before the scientific bodies of this country and Europe.

These investigations have a practical as well as scientific value. The revelations which they have made in relation to the position of the feet of a horse while running, the San Francisco *Bulletin* says, have persuaded some California trainers and horse breeders to make important changes in their methods, from which they expect to get much faster time. They represent that the results thus far have been very satisfactory. By the construction of a track around a large tent, and the arrangement of cameras so as to take an impression of the animal moving over the track from various points at the same moment, some valuable pictures for the guidance of artists have been obtained. All degrees of fore-shortening of the same animal are represented in these pictures. A perfect skeleton of a horse was also imported from the East, which was taken apart and supplied with artificial ligaments to its joints. This skeleton was then made to assume the position of the living horse, as shown in the various photographs of the latter taken, and it was then exposed to the camera. Through the aid of the zoogyroscope, this skeleton is made to go through all the movements of the living animal in his various gaits of cantering, pacing, running, trotting, and walking, presenting a peculiar but intensely interesting picture, especially to the veterinary surgeon, who is thus afforded a practical opportunity of determining the effect of motion on the various joints.

THE ELECTRIC LIGHT IN AKRON, OHIO.

A novel, and thus far successful, experiment in electric lighting, was inaugurated in Akron, Ohio, April 9.

The town is lighted by two groups of lamps, one supported by an iron tower rising 208 feet above the street, the other by a wooden mast on the observatory of Buchtel College, about 40 feet higher than the tower lamps. Each group consists of four lamps of 4,000 candle power each, or an aggregate light of 32,000 candle power.

The chief novelty of the system is the tall tower, made of boiler plate in 55 sections, each 50 inches in length. At the bottom the diameter of the tower is 3 feet; at the top, 8 inches. The tower is steadied by six wrought iron guys reaching to the top. Over the lamps is a five-foot copper reflector, which serves also as a hood. Thirty feet from the street is a wrought iron balcony, to which the lamps are lowered for trimming.

The entire electric circuit is 9,110 feet, the conducting wire being of copper. The total cost of setting up the system, including boilers, engines, etc., was $11,317, and the cost of running the lights a year is estimated at $1,580. The cost of the iron tower was $1,609.

The light promised from these two centers is to be equivalent to bright moonlight, over a circuit of half a mile radius from each group of lights, or two circular areas each one mile in diameter. It is thought that four more centers of illumination would supply the entire city. From 300 to 400 or more street gas lamps will be displaced by the electric lamps now in operation.

THE *American Architect* refers to a survevor's blunder, by which a substantial brick hotel has been built in the suburbs of Philadelphia on a lot distant forty feet from the one bought for the purpose.