

LANGUAGE.

BY PROF. ERNST MACH.

COMMUNICATION by language is not only a necessary condition of the origin of science, it is also the source from which the element of *comparison* in science has sprung. I may be permitted, therefore, without making the slightest pretension to authority on questions in which I have not made original studies, to state my views concerning the origin and development of language and its significance for scientific thought.

We find ourselves in the possession of speech as soon as consciousness appears ; to a child this is so much a matter of course that it is frequently much astonished at hearing that babies are obliged to learn to talk. As soon as the facts have wrung from us this admission we naturally inquire: Who *first* taught language? Who *invented* it? If we have outlived the ingenuous period which looks upon language as a gift of the gods, the first explanations that naturally present themselves are the rationalistic theories which regard language as an ingenious invention, and which attribute to men not yet in possession of language a far higher degree of intelligence than they even now exhibit. We learn from linguistic science that one and the same language exhibits different stages of development, that different languages exist which are related to one another and which are therefore presumably of common origin, and lastly that there are languages which show widely varying degrees of complexity in their structure. The weightier and more promising question with respect to the development of language is thus forced into the foreground, that of the origin is relegated to the rear, and the resolution of the latter found to be identical with that of the former. In addition, we can readily observe the development of speech and thought in our own persons. And from the fact of our all having so abundant material for obser-

vation immediately at hand, both philosophical and psychological science have fortunately been placed in a position to compete successfully with positive research in this domain.

Traces of the ancient ingenuousness still linger in the question which is now so frequently put as to the *origin of human speech*, as if human speech ever had at any definite place or time a precisely determinable beginning! From the modern scientific point of view a totally different conception of the problem must be entertained. Whence, pray, should human language have been developed, if not from the animal language of our ancestors! And no unbiassed person can entertain the slightest doubt that animal language actually exists. Every species of animals, particularly such as have social habits, has its accurately distinguishable cries of warning, allurements, attack, etc. The origin of the purely reflex sounds uttered and determined by the human organism accordingly require no explanation whatever; for sounds of this character were already possessed by our animal ancestors.

The undeniable and stupendous differences between animal language and human language are as follows. Animal language has at its command only a small number of sounds, and these are employed to express situations and emotions (fear, joy, anger) which while different are extremely general in character and are accompanied by corresponding activities which in their turn also are extremely indeterminate (flight, the search for food, attack). These activities are then more precisely determined by the actual situation. Animal language, further, is largely innate and is learned only in a minute degree by imitation. The very reverse is true of human language. The belief that animal language is absolutely invariable is not borne out by the facts; the belief is refuted alone by the circumstance that related animal species employ systems of sounds of which any one is easily recognisable as a variation of the other.

The cries of the house dove, the wild dove, and the turtle dove may be cited as examples.¹ But the power of producing the phonic *elements* of language is also inborn in man, being part of the heredity of his organs of speech; and it is even permissible to assume a difference of races in this particular.² The combinations of

¹ To obtain an idea of the extent to which the cries of animals are inborn and the extent to which they are a product of imitation, I once proposed to a celebrated physiologist the plan of interchanging the eggs of house doves and turtle doves brooding some distance apart. But the experiment could not be carried out from our inability to obtain birds which were brooding simultaneously.

² A colleague of mine, a Jew, assured me that he was able to recognise a Jew by the sound of

sounds only are learned. And the situation here is precisely what it is in the case of movements, which are innate in animals in far more enduring combinations than in man.¹ Man is born "younger," so to speak, and consequently with more capacity for adaptation.

It is customary to say that the language of animals is inarticulate. I am curious to know what ground there may be for such a contention. Many of the sounds uttered by animals and repeated by them on similar occasions, and in the same order, admit quite easily of being reproduced by our letters; and in the case of the other sounds for which this is impossible, owing to the fact that we possess no characters for sounds that do not accord with our organs, an acoustic or phonographic transcription might be resorted to. If we examine the facts closely, we are constrained to admit that we are situated with respect to the language of animals precisely as we are with respect to any human language that is unintelligible to us, and that the word *inarticulate* merely means no more than not-English, not-German, and not-French. We might with equal reason call the movements of animals inarticulate because they do not correspond precisely to ours.

Animals are not credited with sufficient intellectual capacity to form a language; that power is supposed to be wanting to all creatures except to man. But is it found in man as the result of a sudden miracle, or has it been produced in him by gradual development? If the latter assumption is true, and it will be the one most likely to be accepted to-day, then the germs of human intelligence must have existed in some form in animals also. Let it be remembered that the slightest possible *difference of degree* will account for everything. A man whose capacity for work produces but a trifle more than is necessary to supply his wants is assured of a constant improvement in his condition, whereas he is almost certain to be ruined by the slightest difference in the opposite direction. Similarly, a species of animals or race of men the range of whose intellectual variations is so narrow that they can never rise above a certain level will be incapable of development, whereas a very slight

a single word, even without seeing him. I believe that I may assert the same with reference to Slavs. And while entire words are certainly not innate, as Psammetichus (Herodotus ii, 2) be lieved, certain characteristic phonic elements are nevertheless inborn in every race.

¹Young animals perform the movements characteristic of their species at a very early age and after the manner of a piece of mechanism. The sparrow is observed to hop only, for the reason that he moves mostly from branch to branch on trees where this sort of movement alone is possible. The lark, on the other hand, is seen to run only. Might it not be possible to confine several generations of sparrows to level ground, and in this manner to teach them to run? Such a transformation of habits would doubtless be effected more easily than an anatomic one, and yet would have sufficient weight with respect to the Darwinian theory. The experiment is allied in character to that mentioned above with the doves.

average but constant excess of intelligence entailing effects not entirely effaced in the following generations, is a certain guarantee of continued evolution.

The underestimation of the intelligence of animals has been a commonplace for centuries. On the other hand, we now not infrequently meet with instances of ingenuous overestimation of the intelligence of animals which are quite as unfounded. I myself raised a warning voice against this overestimation.¹ Any great development of the intelligence of animals is impossible for the reason that it would be both unnecessary and useless in their simple sphere of life. Long ago I observed the mechanical regularity with which beetles always creep *upwards* on a stalk, no matter how often they are turned round, just as other insects fly mechanically towards the *light*, etc. Since that time, the curious and instructive experiments of Jacques Loeb on the heliotropism of animals have appeared, which throw a flood of light upon the mechanics of the lower organisms. But Sir John Lubbock who annihilated in so exact and praiseworthy a manner the illusions respecting the intelligence of bees and ants, appears to me to assert altogether too much intellectual power on the part of dogs.²

I am accordingly of the opinion that the view which assumes a qualitative difference between animal and human intelligence is a relic of an old superstition; I am able to see a *quantitative* difference, a difference of degree only, in the animal scale including man,—a difference that assumes enormous proportions with the distance of the single members apart. The lower we descend the weaker the *individual* memory becomes and the shorter the series of associations at the command of the animal. A similar difference exists between children and grown people. In like manner, I see a quantitative difference only between the *language of man* and the *language of animals*. The same difference exists even between human languages of different degrees of development. Even in the most

¹ *Analysis of the Sensations* (German ed. Jena, 1886. Page 79. English Trans., Chicago, 1897 page, 82-83.)

² Lubbock takes boxes bearing the inscriptions (!) Bread, Meat, Milk, and succeeds in training his dog to *distinguish* them—but unquestionably by the aid of some other characteristic than the inscription. An instance of the common overestimation of the intellect of dogs is the following. A young dog learns to "beg" for sugar. One day it is observed that while alone in the room with a canary-bird which has a piece of sugar attached to its cage the dog of its own accord begins to "beg" for it. This act is interpreted as an appeal to the canary-bird, whereas it is nothing but a simple association of the movement with the sight of the sugar. Think of the number of analogies and of the long series of associations which would have to be at the disposal of the dog if this interpretation were correct! It would be in the position of the negro who begs from a fetish what it is impossible to receive from a fetish. Paradoxical as it may sound, a far higher degree of intellect is required for so colossal a piece of stupidity than is at the disposal of a dog.

highly developed human languages it happens that the full meaning of some utterance is determined entirely by the situation ; while it is well known that languages in a low stage of development very frequently have to have recourse to gestures to be understood, so that when spoken in the dark they are partly unintelligible.

As I take it, then, the right course to pursue is to suffer the question as to the origin of language to rest for the time being and in its place to propound the question of how *animal language* has been developed into the *greater wealth* and *greater precision* of *human language*. In this manner, the discontinuity between speaking and not-speaking, which forms the main difficulty of the problem, will be removed, and it will be discovered that the discontinuity never existed in the manner which has been assumed. Lazar Geiger,¹ to whom we owe the most luminous of the contributions to this subject, does actually pursue his investigations along these lines, although reversions to the old form of the inquiry are not wanting in his works. And when these reversions do occur, the most singular and most inept solutions make their appearance. I agree with Noiré² that the manner in which Geiger conceives the origin of the first language-cry is absolutely incomprehensible in the case of a man of Geiger's ability. I am further of the opinion that Noiré has made the most important advances over Geiger. Great merit is to be accorded to Noiré's book even though one does not share his Kantian-Schopenhauerian point of view and though one cannot assume with him the abrupt difference between animal and human intelligence. And although Noiré also in consequence of this latter circumstance sometimes reverts to the old form of the inquiry, his results nevertheless remain valid for the question under discussion.

It will be admitted by every one that sounds expelled unconsciously from the human organism could never have acquired meaning and significance as *phonic symbols* save in the event that things which are observable and have been observed *by men in common* are designated by them. It will furthermore not be doubted that in the beginning of civilisation the employment of a *symbol*, or even anything like an appreciation of it, could not have been possible save where *extremely strong common interests* required some *common activity* which readily lent itself to the apprehension of all. The *symbol* under such circumstances will associate itself with the *activity*, with the *sensory result* of the activity, and with the sensorily perceptible

¹ Geiger, *Sprache und Vernunft*. Stuttgart. 1868.

² Noiré, *Ursprung der Sprache*.—*Das Werkzeug*.—*Logos*.

medium or *instrument* of the same. I think that this will be immediately accepted by every one, no matter what his philosophical or scientific position is. The results of my own speculations upon the import of language, of concepts, and of theories, in my own special department of physics, which I undertook without a knowledge of either Geiger or Noiré, point to the same results.¹

The evolution of language, accordingly, is associated step by step with the various forms of activities involved in labor in common. In the precise measure in which the pursuits and industries of men are perfected is the sphere and power of language augmented. It is not to be denied that in higher stages of development events and objects of lesser importance form the occasion for the invention of new terms, just as in family life we frequently observe some chance word uttered in jest acquiring the office of a permanent symbol. But for this to be accomplished the value and import of speech must have already been known from use; there are requisite to it a certain freedom and disburdenment which are certainly wanting in the beginning of civilisation.²

The principal value of language is contained in the fact of its being a medium for the communication of thoughts; and the very circumstance that language compels us to describe the new in terms of the known, or at least to analyse the new by comparison with the known, is the source of a distinct gain, not only for the person addressed but also for the person who speaks. A thought is frequently rendered much more clear by our imagining ourselves called upon to communicate it to others. Language has also a great value for solitary thinking. The sensory elements enter into the most manifold combinations and in these different combinations possess the most varied interests. A word embraces everything that is of importance for some single sphere of interest, and draws forth all the images connected with this sphere, as if they were beaded upon a string. It is remarkable that we can employ word-symbols correctly without having full consciousness of all the images which are symbolised by them, just as we can read correctly without scrutinising each single letter closely. In like manner, we never suspect the existence of a portrait in a portfolio bearing the inscription "Landscapes," even though the contents of the portfolio be not familiar to us.

The ever-recurring view that language is indispensable for every species of thought I must regard as an exaggeration. This

¹ Compare, for example, my *Analysis of the Sensations*, English translation, p. 160 et seq.

² Compare Marty, *Ursprung der Sprache*. Würzburg, 1875.

did not escape the notice of Locke even, who declared that inasmuch as language scarcely ever accorded completely with the facts, it might on occasions constitute even a drawback to thinking. Visualistic thought, which is concerned exclusively with the association and comparison of images, and with the recognition of their agreement or their difference, can be carried on without the intervention of language. For example, I observe an apple on a tree too high for me to reach; I remember that on a former occasion by some good chance I came into possession of another apple by means of a forked branch broken from a tree; I notice a branch of this kind on the ground near me, but see at once that it is too short. This process may be gone through without ever so much as a single word's occurring to me. I am accordingly unable to believe that monkeys, for example, never employ sticks to accomplish certain ends, and never construct bridges by throwing trunks of trees across brooks, for the mere reason that they are not in possession of language and consequently of any concept of *form*, or of any concept of sticks and trees, as of *isolated* movable things which may be sundered from their environment. On the contrary, it may be shown that the inability to make inventions rests upon an entirely different foundation. In saying this, I am far from denying that images also are invested with greater clearness by descriptions in language, and by the accompanying decomposition of their parts into simple and more familiar elements. In abstract conceptual thought language is of course indispensable.

Thinking without words is at least partly realised in every instance where a newly invented concept appears *as the result of thinking*, that is wherever there is new scientific development.

The importance of language for conceptual thought is best observed by an examination of the formation of words and symbols that have been reached in full consciousness during the course of the development of science.

The concept of "exponent" originated in Descartes's having written a multiplied by itself n times, a^n ; at any rate, the concept received for the first time by this act of Descartes an independent standing, and was made capable of further development. Here was really given for the first time the starting-point from which the concepts of negative and fractional exponents and of continuously varying refractive indices and of logarithms were reached. The entire body of algebraic symbols, which is a product of conscious and designed invention throughout, is instructive in other respects also. We learn to operate mechanically with this system without having

constantly present before our minds the full significance of the operations involved. In like manner words also are joined associatively with one another without our possessing in consciousness all the precise images that correspond to them. Like algebra, language involves a temporary disburdenment of thought. In the measure in which our scientific terminology is carried nearer to Leibnitz's ideal of a Universal Character, which is a process actually taking place, the high advantages of such a system will be vividly felt.¹

¹ Compare *Science of Mechanics*, Chicago, 1893, p. 482.