

stations. Another feature of the weather was the sudden changes which occurred in the humidity of the air, which were perhaps most striking on June 18, on which day at many places a higher temperature was observed than has been noted for many years. On that day thunderstorms occurred over the greater part of the eastern districts of Scotland, accompanied with dense clouds and a close atmosphere. At a very large number of places not a drop of rain fell. At a few places a heavy, short-continued shower fell, but the air cleared and dried so suddenly that in three minutes all effects of the rain were gone; and everything looked as parched and dried up as before the rain. On the morning of this day the isobars for 9 a.m. revealed the existence of a local shallow depression extending from Ochertyre, north-eastwards towards Aberdeen, where atmospheric pressure was lower than on either side of it. Here the thunderstorm was severest, and rain fell most generally. At Lednathie, Forfarshire, the storm and rainfall were all but unprecedented. The rain commenced at 12.50 p.m., and ceased at 1.30 p.m., and during these forty minutes there fell 2.24 inches. Mr. Morison, the observer, remarks that "the appearance of the rain while falling was like bright small streams falling straight down"—a description which will recall to some of our readers what they have often noticed during the torrential downpours of the tropics.

The state of many of our rivers attests only too strongly to the persistence and severity of the drought. On Sunday last the level of the Tay was fully half an inch beneath the deep cut made in the red sandstone rock at Perth on June 30, 1826, to mark the unprecedented lowness of the river at that time. The Thames in its upper reaches is covered with high grown rushes and great floating masses of weeds, and nearer London it is reported to be lower than it has been in the memory of the oldest boatman.

NO LANGUAGE WITHOUT REASON—NO REASON WITHOUT LANGUAGE.

AS I found that you had already admitted no less than thirteen letters on my recent work "The Science of Thought," I hesitated for some time whether I ought to ask you to admit another communication on a subject which can be of interest to a very limited number of the readers of NATURE only. I have, indeed, from the very beginning of my philological labours, claimed for the science of language a place among the physical sciences, and, in one sense, I do the same for the science of thought. Nature that does not include human nature in all its various manifestations would seem to me like St. Peter's without its cupola. But this plea of mine has not as yet been generally admitted. The visible material frame of man, his sense-organs and their functions, his nerves and his brain, all this has been recognized as the rightful domain of physical science. But beyond this physical science was not to go. There was the old line of separation, a line drawn by mediæval students between man, on one side, and his works, on the other; between the sense-organs and their perceptions; between the brain and its outcome, or, as it has sometimes been called, its secretion—namely, thought. To attempt to obliterate that line between physical science, on one side, and moral science, as it used to be called, on the other, was represented as mere confusion of thought. Still, here as elsewhere, a perception of higher unity does not necessarily imply an ignoring of useful distinctions. To me it has always seemed that man's nature can never be fully understood except as one and indivisible. His highest and most abstract thoughts appear to me inseparable from the lowest material impacts made upon his bodily frame. And "if nothing was

ever in the intellect except what was first in the senses," barring, of course, the intellect itself, it follows that we shall never understand the working of the intellect, unless we first try to understand the senses, their organs, their functions, and, in the end, their products. For practical purposes, no doubt, we may, nay we ought, to separate the two. Thus, in my own special subject, it is well to separate the treatment of phonetics and acoustics from higher linguistic researches. We may call phonetics and acoustics the ground floor, linguistics the first story. But as every building is one—the ground floor purposeless without the first story, the first story a mere castle in the air without the ground floor—the science of man also is one, and would, according to my opinion, be imperfect unless it included psychology, in the widest meaning of that term, as well as physiology; unless it claimed the science of language and of thought, no less than the science of the voice, the ear, the nerves, and the brain, as its obedient vassals. It was, therefore, a real satisfaction to me that it should have been NATURE where the questions raised in my "Science of Thought" excited the first interest, provoking strong opposition, and eliciting distinct approval, and I venture to crave your permission, on that ground, if on no other, for replying once more to the various arguments which some of your most eminent contributors have brought forward against the fundamental tenet of my work, the inseparableness of language and reason.

I may divide the letters published hitherto in NATURE into three classes, unanswerable, answered, and to be answered.

I class as unanswerable such letters as that of the Duke of Argyll. His Grace simply expresses his opinion, without assigning any reasons. I do not deny that to myself personally, and to many of your readers, it is of great importance to know what position a man of the Duke's wide experience and independence of thought takes with regard to the fundamental principle of all philosophy, the identity of language and thought, or even on a merely subsidiary question, such as the genealogical descent of man from any known or unknown kind of animal. But I must wait till the Duke controverts either the linguistic facts, or the philosophical lessons which I have read in them, before I can meet fact by fact, and argument by argument. I only note, as a very significant admission, one sentence of his letter, in which the Duke says: "Language seems to me to be necessary to the *progress of thought*, but not at all necessary to the mere act of thinking." This sentence may possibly concede all that I have been contending for, as we shall see by and by.

I class as letters that have been answered the very instructive communications from Mr. F. Galton, to which I replied in NATURE of June 2 (p. 101), as well as several notes contributed by correspondents who evidently had read my book either very rapidly, or not at all.

Thus, Mr. Hyde Clarke tells us that the mutes at Constantinople, and the deaf-mutes in general, communicate by signs, and not by words—the very fact on which I had laid great stress in several parts of my book. In the sign-language of the American Indians, in the hieroglyphic inscriptions of Egypt, and in Chinese and other languages which were originally written ideographically, we have irrefragable evidence that other signs, besides vocal signs or vocables, can be used for embodying thought. This, as I tried to show, confirms, and does not invalidate, my theory that we cannot think without words, if only it is remembered that words are the most usual and the most perfect, but by no means the only possible signs.

Another correspondent, "S. T. M. Q.," asks how I account for the early processes of thought in a deaf-mute. If he had looked at p. 63 of my book he would have found my answer. Following Prof. Huxley, I hold that deaf-mutes would be capable of few higher intellectual mani-

festations than an orang or chimpanzee, if they were confined to the society of dumb associates.

But, though holding this opinion, I do not venture to say that deaf-mutes, if left to themselves, may not act rationally, as little as I should take upon myself to assert that animals may not act rationally. I prefer indeed, as I have often said, to remain a perfect agnostic with regard to the inner life of animals, and, for that, of deaf-mutes also. But I should not contradict anybody who imagines that he has discovered traces of the highest intellectual and moral activity in deaf-mutes or animals. I read with the deepest interest the letter which Mr. Arthur Nicols addressed to you. I accept all he says about the sagacity of animals, and if I differ from him at all, I do so because I have even greater faith in animals than he has. I do not think, for instance, that animals, as he says, are much longer in arriving at a conclusion than we are. Their conclusions, so far as I have been able to watch them, seem to me far more rapid than our own, and almost instantaneous. Nor should I quarrel with Mr. Nicols if he likes to call the vocal expressions of pain, pleasure, anger, or warning, uttered by animals, language. It is a perfectly legitimate metaphor to call every kind of communication language. We may speak of the language of the eyes, and even of the eloquence of silence. But Mr. Nicols would probably be equally ready to admit that there is a difference between shouting "Oh!" and saying "I am surprised." An animal may say "Oh!" but it cannot say "I am surprised;" and it seems to me necessary, for the purpose of accurate reasoning, to be able to distinguish in our terminology between these two kinds of communication. On this point, too, I have so fully dwelt in my book that I ought not to encumber your pages by mere extracts.

I now come to the letters of Mr. Ebbels and Mr. Mellard Reade. They both seem to imagine that, because I deny the possibility of conceptual thought without language, I deny the possibility of every kind of thought without words. This objection, too, they will find so fully answered in my book, that I need not add anything here. I warned my readers again and again against the promiscuous use of the word "thought." I pointed out (p. 29) how, according to Descartes, any kind of inward activity, whether sensation, pain, pleasure, dreaming, or willing, may be called thought; but I stated on the very first page that, like Hobbes, I use thinking in the restricted sense of adding and subtracting. We do many things, perhaps our best things, without addition or subtraction. We have, as I pointed out on p. 20, sensations and percepts, as well as concepts and names. For ordinary purposes we should be perfectly correct in saying that we can "think in pictures." This, however, is more accurately called imagination, because we are then dealing with images, presentations (*Vorstellungen*), or, as I prefer to call them, percepts, and not yet with concepts and names. Whether in man, and particularly in the present stage of his intellectual life, imagination is possible without a slight admixture of conceptual thought and language, is a moot point; that it is possible in animals, more particularly in Sally, the black chimpanzee at the Zoological Gardens, I should be reluctant either to deny or to affirm. All I stand up for is that, if we use such words as thought, we ought to define them. Definition is the only panacea for all our philosophical misery, and I am utterly unable to enter into Mr. Ebbels's state of mind when he says: "This is a mere question of definition, not of actual fact."

When Mr. Ebbels adds that we cannot conceive the sudden appearance of the faculty of abstraction together with its ready-made signs or words, except by a miracle, he betrays at once that he has not read my last book, the very object of which is to show that we require no miracle at all, but that all which seemed miraculous in language is perfectly natural and intelligible. And if he adds that

he has not been able to discover in my earlier works any account of the first beginnings of language, he has evidently overlooked the fact that in my lectures on the science of language I distinctly declined to commit myself to any theory on the origin of language, while the whole of my last book is devoted to the solution of that problem. My solution may be right or wrong, but it certainly does not appeal to any miraculous interference for the explanation of language and thought.

There now remain two letters only that have really to be answered, because they touch on some very important points, points which it is manifest I ought to have placed in a clearer light in my book. One is by Mr. Murphy, the other by Mr. Romanes. Both have evidently read my book, and read it carefully; and if they have not quite clearly seen the drift of my argument, I am afraid the fault is mine, and not theirs. I am quite aware that my "Science of Thought" is not an easy book to read and to understand. I warned my readers in the preface that they must not expect a popular book, nor a work systematically built up and complete in all its parts. My book was written, as I said, for myself and for a few friends, who knew beforehand the points which I wished to establish, and who would not expect me, for the mere sake of completeness, to repeat what was familiar to them, and could easily be found elsewhere. I felt certain that I should be understood by them, if I only indicated what I meant; nor did it ever enter into my mind to attempt to teach them, or to convince them against their will. I wrote as if in harmony with my readers, and moving on with them on a road which we had long recognized as the only safe one, and which I hoped that others also would follow, if they could once be made to see whence it started and whither it tended.

Mr. Murphy is one of those who agree with me that language is necessary to thought, and that, though it may be possible to think without words when the subjects of thought are visible things and their combinations, as in inventing machinery, the intellectual power that invents machinery has been matured by the use of language. Here Mr. Murphy comes very near to the remark made by the Duke of Argyll, that language seems necessary to the *progress of thought*, but not at all necessary to the mere act of thinking, whatever that may mean. But Mr. Murphy, while accepting my two positions—that thought is impossible without words, and that all words were in their origin abstract—blames me for not having explained more fully on what the power of abstraction really depends. So much has lately been written on abstraction, that I did not think it necessary to do more than indicate to which side I inclined. I quoted the opinions of Aristotle, Bacon, Locke, Berkeley, and Mill, and as for myself I stated in one short sentence that I should ascribe the power of abstraction, not so much to an effort of our will, or to our intellectual strength, but rather to our intellectual weakness. In forming abstractions our weakness seems to me our strength. Even in our first sensations it is impossible for for us to take in the whole of every impression, and in our first perceptions we cannot but drop a great deal of what is contained in our sensations. In this sense we learn to abstract, whether we like it or not; and though afterwards abstraction may proceed from an effort of the will, I still hold, as I said on p. 4, that though *attention* can be said to be at the root of all our knowledge, the power of abstraction may in the beginning not be very far removed from the weakness of distraction. If I had wished to write a practical text-book of the science of thought, I ought no doubt to have given more prominence to this view of the origin of abstraction, but as often in my book, so here too, I thought *sapienti sat*.

I now come to Mr. Romanes, to whom I feel truly grateful for the intrepid spirit with which he has waded through my book. One has no right in these days to

expect many such readers, but one feels all the more grateful if one does find them. Mr. Romanes was at home in the whole subject, and with him what I endeavoured to prove by linguistic evidence—namely, that concepts are altogether impossible without names—formed part of the very A B C of his psychological creed. He is indeed almost too sanguine when he says that concerning this truth no difference of opinion is likely to arise. The columns of NATURE and the opinions quoted in my book tell a different tale. But for all that, I am as strongly convinced as he can be that no one who has once understood the true nature of words and concepts can possibly hold a different opinion from that which he holds as well as I.

It seems, therefore, all the more strange to me that Mr. Romanes should have suspected me of holding the opinion that we cannot think without pronouncing or silently rehearsing our thought-words. It is difficult to guard against misapprehensions which one can hardly realize. Without appealing, as he does, to sudden aphasia, how could I hold pronunciation necessary for thought when I am perfectly silent while I am writing and while I am reading? How could I believe in the necessity of a silent rehearsing of words when one such word as "therefore" may imply hundreds of words or pages, the rehearsing of which would require hours and days? Surely, as our memory enables us to see without eyes and to hear without ears, the same persistence of force allows us to speak without uttering words. Only, as we cannot remember or imagine without having first seen or heard something to remember, neither can we inwardly speak without having first named something that we can remember. There is an algebra of language far more wonderful than the algebra of mathematics. Mr. Romanes calls that algebra "ideation," a dangerous word, unless we first define its meaning and lay bare its substance. I call the same process addition and subtraction of half-vanished words, or, to use Hegel's terminology, *aufgehobene Worte*; and I still hold, as I said in my book, that it would be difficult to invent a better expression for thinking than that of the lowest barbarians, "speaking in the stomach." Thinking is nothing but speaking *minus* words. We do not begin with thinking or *ideation*, and then proceed to speaking, but we begin with naming, and then by a constant process of addition and subtraction, of widening and abbreviating, we arrive at what I call *thought*. Everybody admits that we cannot count—that is to say, add and subtract—unless we have first framed our numerals. Why should people hesitate to admit that we cannot possibly think, unless we have first framed our words? Did the Duke of Argyll mean this when he said that language seemed to him necessary for *the progress of thought*, but not at all for the mere act of thinking? How words are framed, the science of language has taught us; how they are reduced to mere shadows, to signs of signs, apparently to mere nothings, the science of thought will have to explain far more fully than I have been able to do. Mr. Romanes remarks that it is a pity that I should attempt to defend such a position as that chess cannot be played unless the player "deals all the time with thought-words and word-thoughts." I pity myself indeed that my language should be liable to such misapprehension. I thought that to move a "castle" according to the character and the rules originally assigned to it was to deal with a word-thought or thought-word. What is "castle" in chess, if not a word-thought or thought-word? I did not use the verb "to deal" in the sense of pronouncing, or rehearsing, or defining, but of handling or moving according to understood rules. That this dealing might become a mere habit I pointed out myself, and tried to illustrate by the even more wonderful playing of music. But, however automatic and almost unconscious such habits may become, we have only to make a wrong move with the

"castle" and at once our antagonist will appeal to the original meaning of that thought-word, and remind us that we can move it in one direction only, but not in another. In the same manner, when Mr. Romanes takes me to task because I said that "no one truly thinks who does not speak, and that no one truly speaks who does not think," he had only to lay the accent on *truly*, and he would have understood what I meant—namely, that in the true sense of these words, as defined by myself, no one thinks who does not directly or indirectly speak, and that no one can be said to speak who does not at the same time think. We cannot be too charitable in the interpretation of language, and I often feel that I must claim that charity more than most writers in English. Still, I am always glad if such opponents as Mr. Romanes or Mr. F. Galton give me an opportunity of explaining more fully what I mean. We shall thus, I believe, arrive at the conviction that men who honestly care for truth, and for the progress of truth, must in the end arrive at the same conclusions, though they may express them each in his own dialect. That is the true meaning of the old dialectic process, to reason out things by words more and more adequate to their purpose. In that sense it is true also that no truth is entirely new, and that all we can aim at in philosophy is to find new and better expressions for old truths. The poet, as Mr. A. Grenfell has pointed out in his letter to NATURE (June 23, p. 173), often perceives and imagines what others have not yet conceived or named. In that sense I gladly call myself the interpreter of Wordsworth's prophecy, that "the word is not the dress of thought, but its very incarnation." F. MAX MÜLLER.

The Molt, Salcombe, July 4.

ON THE PRESENCE OF BACTERIA IN THE LYMPH, ETC., OF LIVING FISH AND OTHER VERTEBRATES.¹

I FIRST noticed bacteria in the blood of a roach (*Leuciscus rutilus*). This roach, for some hours before it was removed from the water, had been occasionally swimming on its side at the surface—an indication that it was in an exhausted condition. Immediately after the fish was killed, a drop of blood was taken from the heart by a sterilized pipette (with all the necessary precautions) and examined. The blood was found to contain a considerable number of slender motionless bacilli, measuring from 0.003-0.008 micromillimetres in length. On an average, four bacilli were visible in the field at a time, with Zeiss's F objective and No. 1 eye-piece. The peritoneal fluid which was next examined contained so many bacilli that it was impossible to count them; the bacilli were usually lying amongst large granular lymph-cells, and they were longer and more slender than those in the blood. Similar bacilli were found in the lymphatics, spleen, liver, and kidney, and they were abundant in the muscles in contact with the peritoneum, while very few were found in the muscles under the skin of the trunk, and still fewer in the muscles near the tail. The intestine was crowded with similar bacilli to those found in the body-cavity, and, in addition, there were a number of large and small bacteria and micrococci. Bacilli also were found in the walls of the intestine and in the bile-duct. Believing that there was some relation between the diminished vitality of the above roach and the numerous bacilli in the tissues, I examined a considerable number of healthy roach in the same way, and also other freshwater fish, e.g. trout (*Salmo trutta*), perch (*Perca fluviatilis*), carp (*Cyprinus auratus*), and eels (*Anguilla vulgaris*). In all the healthy specimens examined, with the exception of the trout, bacilli were found in the

¹ Abstract of Paper by Prof. J. C. Ewart, read before the Edinburgh Royal Society on June 6.