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AND JOURNAL OF PSYCHOLOGICAL SCIENCE.

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No. 313.—(VOL. XIII.—No. 8.) LONDON: FRIDAY, AUGUST 23, 1878. Published Weekly: Price Twopence.

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"THE SPIRITUALIST" NEWSPAPER:

A Record of the Progress of the Science and Ethics of Spiritualism.

PUBLISHED WEEKLY, PRICE TWOPENCE.
ESTABLISHED IN 1869.

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The Spiritualist Newspaper.

A Record of the Progress of the Science and Ethics of Spiritualism.

No. 313.—Volume Thirteen; Number Eight.

LONDON, FRIDAY, AUGUST 23rd, 1878.

THE INTERLINKED RINGS.

Mr. Gillis sends word to Mr. Christian Reimers that M. Aksakof and Professor Boutlerof are away from St. Petersburg; that he has had the grain of the rings laid bare, and will send enlarged photographs which he says "will sufficiently prove the genuineness of the phenomenon."

What is wanted is a certificate properly drawn up and signed by a few scientific men, to the effect that they have examined the bare grain of each ring under the microscope, and that the rings contain no artificial joint. A botanist and zoologist should certify of what wood and ivory the rings are made, and the botanist should specially report whether there is any abnormal grain in the wood, such as would be produced by slow growth round the ivory ring, on the principle pointed out by Sir Charles Isham.

Until this documentary evidence is forthcoming the fact of the interlinking will not be sufficiently well established for presentation as an unquestionable phenomenon to the outside world, nor will it till then be unreservedly accepted by Spiritualists. The delay in such authentication is probably due to its being vacation season, and most of the professors at Leipzig and St. Petersburg absent from the Universities.

ANIMAL INTELLIGENCE AND COMPARATIVE PSYCHOLOGY.*

BY GEORGE J. ROMANES, M.A., F.L.S.

Mr. President, My Lords, Ladies, and Gentlemen,—"Animal Intelligence" is a subject which has always been of considerable interest to philosophical minds; but, as most of you are probably aware, the interest attaching to this subject has of late years been greatly increased by the significance which it has acquired in relation to the theory of "Descent." The study of "Animal Intelligence" being thus, without question, fraught with high importance to the science of our time, in adducing before this illustrious assembly some of the results which that study has yielded, I shall endeavour to treat them in a manner purely scientific. I shall try, as much as possible, to avoid mere anecdote, except in so far as it is desirable that I should put you in possession of a few typical facts to illustrate the various principles which I shall have occasion to expound. I shall seek to render apparent the more important of the issues which the subject, as a whole, involves, as well as the considerations by which alone these issues can be legitimately settled. I shall attempt to state my own views with the utmost candour; and if I shall appear to ignore any arguments opposed to the conclusions at which I shall arrive, it will only be because I believe those arguments to admit of easy refutation. And, in order that my exposition may be sufficiently comprehensive, I shall endeavour to point out the relations that subsist between the intelligence of animals and intelligence of man. The aim and scope of the present lecture will therefore be to discuss, as fully as time permits, the facts and the principles of "Comparative Psychology."

As human intelligence is the only order of intelligence with which we are directly acquainted, and as it is, moreover, the highest order of intelligence known to science, we may most conveniently adopt it as our standard of comparison. I shall therefore begin by briefly detailing those principles of human psychology which we shall afterwards find to be of the most essential importance in their bearings on the subject which I have undertaken to discuss.

When I allow my eyes to travel over this vast assembly, my mind receives, through their instrumentality, a countless number of impressions. So far as these impressions enter into the general stream of my consciousness, they constitute what are called perceptions. Suppose, now, that I were to close my eyes, and to fix my attention on the memory of some particular perception which I had just experienced—say the memory of some particular face. This mental image of a previous perception would be what is called an idea. Lastly, suppose that I were to analyse a number of the faces which I had perceived, I should find that, although no two of them are exactly alike, they all bear a certain general resemblance to one another. Thus, from the multitude of faces which I now perceive, it becomes possible for my mind to abstract from them all the essential qualities of a face as a face; and such a mental abstraction of qualities would then constitute what I might call my abstract idea of a face in general, as distinguished from my concrete idea, or *memory, of any face in particular.*

Thus, then, we have three stages: 1st, that of immediate perception; 2nd, that of ideal representation of particular objects; and, 3rd, that of a generalised conception, or abstract idea, of a number of qualities which a whole class of objects agree in possessing. It will be convenient to split the latter division into two subdivisions, viz., abstract ideas which are sufficiently simple to be developed without the aid of language, and abstract ideas which are so complex as not to admit of development without the aid of language. As an instance of the former class of abstract ideas we may take the idea of food. This is aroused in our minds by the feeling of hunger; and while the idea when thus aroused is clearly quite independent of language, it is no less clearly what is called an abstract idea. For it is by no means necessary that the idea of food which is present to the mind should be the idea of some special kind of food; on the contrary, the idea is usually that of food *general*, and this idea it is which usually prompts us to seek for any kind of food in *particular*. Simple abstract ideas, therefore, may be formed without the assistance of language; and for this reason they are comprised within what Lewes has called "the logic of feelings." But abstract ideas of a more elaborated type can only be formed by the help of words, and are, therefore, comprised within what Lewes has called "the logic of signs." The manner in which language thus operates in the formation of highly abstract ideas is easily explained. Because we see that a great many objects present a certain quality in common, such as redness, we find it convenient to give that quality a name; and, having done this, we speak of redness in the abstract, or as standing apart from any particular object. Our word "redness" then serves as a sign or symbol of a quality as apart from any particular object of which it may happen to be a quality; and having made this symbolical abstraction in the case of a simple quality, such as redness, we can afterwards compound it with other symbolical abstractions, and so on until we arrive at verbal symbols of more and more complex qualities, as well as qualities further and further removed from immediate perception. By the help of these symbols, therefore, we climb into higher and higher regions of abstraction; by thinking in verbal signs, we think, as it were, with the semblance of thoughts, and by combining these signs in various ways, and giving the resulting compounds distinctive names, we are able to condense into single words, of signs, an enormous amount of meaning. So that, just as in mathematics, the symbols which are employed contain, in an easily manipulated form, the whole meaning of a long calculation, so in all other kinds of reasoning the symbols which we call words contain, in an abbreviated form, vast bodies of signification. Indeed, any one who investigates this subject cannot fail to become convinced that it is wholly impossible to over estimate the

* An evening lecture read before the British Asseciatien for the Advancement of Science, Dublin, 1878, under the presidency of Mr. William Spottiswoode, F.R.S.

value of language as thus the handmaid of thought; for, as we have seen, in the absence of language it would be impossible for thought to rise above the very simplest of abstract ideas, while in the presence of language it becomes possible for us consciously to predicate qualities, and so at last to feel that we are conscious of our own consciousness.

So much, then, for our classification of ideas. We have, first, simple ideas, or ideas of particular perceptions; and, secondly, abstract ideas, or ideas of general qualities; and the latter class I have subdivided into those which may be developed by simple feelings, and those which can only be developed by the aid of signs.

Now, with regard to ideas themselves, I need only add that they are the psychological units which compose the whole structure intellectual. They constitute, as it were, the raw material of thought, which may be elaborated by the faculty into various products of thought. Once formed, they present an essential property of occurring in concatenated series; so that the occurrence of one idea determines that of another with which it has been previously joined. This principle of the association of ideas, manifested as it is by the ultimate units of intellectual structure, is by far the most important principle in psychology: it is the principle which renders possible all the faculties of mind—memory, instinct, judgment, reason, emotion, conscience, and volition.

COMPARATIVE PSYCHOLOGY.

We are now in a position to investigate the facts of Comparative Psychology; and, in order to do so thoroughly, I shall begin by considering what I may term the psychological basis of mind. There is no reasonable doubt that all mental processes are accompanied by nervous processes; or, to adopt the convenient terms of Professor Huxley, that psychosis is invariably associated with neurosis. The nature of this association, according to the best lights of our present knowledge, is probably as follows:—Nerve-tissue consists of two elementary parts—viz., nerve-cells and nerve-fibres. The nerve-cells are usually collected into aggregates, which are called nerve-centres, and to these nerve-centres bundles of nerve-fibres come and go. The incoming nerve-fibres serve to conduct stimuli or impressions to the cells in the nerve-centre; and when the cells thus receive a stimulus or impression, they liberate a discharge of nervous energy, which then courses down the out going nerve-fibres, to be distributed either to other nerve-centres or else to muscles. It is in this way that nerve-centres are able to act in harmony with one another, and so to co-ordinate the action of the muscles over which they preside. This fundamental principle of neurosis is what physiologists call the principle of reflex action; and you will perceive that all it requires for its manifestation is an incoming nerve, a nerve-centre, and an outgoing nerve, which together constitute what has been called a nervous arc. Now there can be no reasonable doubt that in the complex structure of the brain one nervous arc is connected with another nervous arc, and this with another almost *ad infinitum;* and there can be equally little doubt that processes of thought are accompanied by nervous discharges taking place now in this arc and now in that one, according as the nerve-centre in each arc is excited to discharge its influence by receiving a discharge from some of the other nerve-arcs with which it is connected. Again, it is almost certain that the more frequently a nervous discharge takes place through a given group of nervous arcs, the more easy will it be for subsequent discharges to take place along the same routes—these routes having been thus rendered more permeable to the passage of subsequent discharges. So that in this physiological principle of reflex action we no doubt have the objective side of the psychological principle of the association of ideas. For it may be granted that a series of discharges taking place through the same group of nervous arcs will always be attended with the occurrence of the same series of ideas; and it may be further granted that the previous passage of a series of discharges through any group of nervous arcs, by making the route more permeable, will have the effect of making subsequent discharges pursue the same course when started from the same origin. And if these two propositions be granted, it follows that the tendency of ideas to *recur* in the same order as that in which they have previously occurred, is merely a psychological expression of the physiological fact that lines of reflex discharge become more and more permeable by use. We thus see that the most fundamental of psychological principles—the association of ideas—is merely an obverse expression of the most fundamental neurological principles—reflex action. But here we have an important qualification to take into account. All reflex action, or neurosis, is not attended with ideation, or psychosis. In our own organisation, for instance, it is only cerebral reflexes which are so attended; and even among cerebral reflexes there is good reason to believe that the greater number of them are not accompanied by conscious ideation; for analysis shows that it is only those cerebral discharges which have taken place comparatively seldom, and the passage of which is therefore comparatively slow, that are accompanied by any ideas, or changes of consciousness. The more habitual any action becomes, the less conscious do we require to be of its performance; it is, as we say, performed automatically, or without thought. Now it is of great importance thus to observe that consciousness only emerges when cerebral reflexes are flowing along comparatively unaccustomed channels, and therefore that cerebral discharges which at first were accompanied by definite ideas may, by frequent repetition, cease to be accompanied by any ideas. It is of importance to observe this fact, because it serves to explain the origin of a number of animal instincts. These instincts must originally have been of an intelligent nature; but the actions which they prompted, having through successive generations been frequently repeated, became at last organised into a purely mechanical reflex, and therefore now appear as actions which we call purely automatic, or blindly instinctive. Thus, for instance, the scraping of graminivorous birds in earth and stones was no doubt originally an intelligent action, performed with the conscious purpose of uncovering seeds; but by frequent repetition through successive generations the action has now become blindly instinctive. This is shown by the following experiment. Dr. Allen Thomson tells me that he hatched out some chickens on a carpet, where he kept them for several days. They showed no inclination to scrape, because the stimulus supplied by the carpet to the soles of their feet was of too novel a character to call into action the hereditary instinct; but when Dr. Thomson sprinkled a little gravel on the carpet, and so supplied the appropriate or customary stimulus, the chickens immediately began their scraping movements. Yet, for aught that these chickens can have known to the contrary, there was as good a chance of finding seeds in the carpet as in the thin layer of gravel. And numberless other cases might be given to prove that animals acquire instincts by frequently repeating intelligent actions, just as we ourselves acquire, even in our individual lifetime, an instinct to wind our watches—an instinct which may become so pronounced as to assert itself even when a man is in the profound unconsciousness of apoplectic coma.

Thus we are able to explain all the more complicated among animal instincts as cases of "lapsed intelligence." But, on the other hand, a great many of the more simple instincts were probably evolved in a more simple way. That is to say, they have probably never been of an intelligent character, but have begun as merely accidental adjustments of the organism to its surroundings, and have then been laid hold upon by natural selection and developed into automatic reflexes. Take, for instance, the action of so-called "shamming dead," which is performed by certain insects and allied animals when in the presence of danger. That this is not a case of intelligent action we may feel quite sure, not only because it would be absurd to suppose that insects could have any such highly abstract ideas as those of death and its conscious simulation, but also because Mr. Darwin tells me that he once made a number of observations on this subject, and in no case did he find that the attitude in which the animal shammed dead resembled that in which the animal really died. All, therefore, that "shamming dead" amounts to is an instinct to remain motionless, and therefore inconspicuous, in the presence of enemies; and it is easy to see that this instinct may have been developed by natural selection without ever having been of an intelligent nature—those individuals which were least inclined to run

away from enemies being preserved rather than those which rendered themselves conspicuous by movement.

So that we thus see how animal instincts may arise in either of two different ways; for, on the one hand, they may arise from the performance of actions which were originally intelligent, but which by frequent repetition have become automatic; and, on the other hand, they may arise from survival of the fittest preserving actions which, although never intelligent, yet happen to have been of benefit to the animals which first chanced to perform them. But now let it be observed that although there is a great difference between these two kinds of instincts, if regarded psychologically, there is no difference between them if regarded physiologically; for, regarded physiologically, both kinds of instincts are merely expressions of the fact that particular nerve-cells and fibres have been set apart to perform their reflexes automatically—that is, without being accompanied by intelligence.

THE IDEAS OF INSECTS.

So much, then, for what I have called the physiological basis of mind. Passing on now to our review of "Comparative Psychology," the first animals in which, so far as I can ascertain, we may be quite sure that reflex action is accompanied by ideation, are the insects. For Mr. Darwin has observed that bees remember the position of flowers which they have *only several times* visited, even though the flowers be concealed by intervening houses, &c. Sir John Lubbock also has shown that, *after a very few individual experiences*, bees are able to establish a definite association between particular colours on paper and food; and further that, *after a very few lessons*, a bee may be taught to find its way out of a glass jar. These observations would seem to prove that the grade of intelligence is higher in some articulata than it is among the lower vertebrata. For many of you will probably remember the experiment of Professor Möbius, which proved that a pike requires three months to establish an association of ideas between particular kinds of prey and the fact of their being protected by an invisible wall. This fact was proved by the pike repeatedly dashing its nose against a glass partition in its tank in fruitless efforts to catch minnows which were confined on the other side of the partition. At the end of three months, however, the requisite association was established, and the pike having learned that its efforts were of no use, ceased to continue them. The sheet of glass was then removed; but the now firmly established association of ideas never seems to have become disestablished, for the pike never afterwards attacked the minnows, though it fed voraciously on all other kinds of fish. From which we see that a pike is very slow in forming his ideas, and no less slow in again unforming them—thus resembling many respectable members of a higher community, who spend one half of their lives in assimilating the obsolete ideas of their forefathers, and through the other half of their lives stick to these ideas as to the only possible truths; they can never learn when the hand of science has removed a glass partition.

As regards the association of ideas by the higher vertebrated animals, it is only necessary to say that in all these animals, as in ourselves, this principle of association is the fundamental principle of their psychology; that in the more intelligent animals associations are quickly formed, and when once formed are very persistent; and, in general, that so far as animal ideation goes, the laws to which it is subject are identical with those under which our own ideation is performed.

THE IDEAS AND EMOTIONS OF THE VERTEBRATA—A DOG'S HORROR OF THE SUPPOSED "SUPERNATURAL."

Let us, then, next ask, How far does animal ideation go? The answer is most simple, although it is usually given in a most erroneous form. It is usually said that animals do not possess the faculty of abstraction, and therefore that the distinction between animal intelligence and human intelligence consists in this—that animals are not able to form abstract ideas. But this statement is most erroneous. You will remember the distinction which I previously laid down between abstract ideas that may be developed by simple feelings, such as hunger, and abstract ideas that can only be developed by the aid of language. Well, remembering this distinction, we shall find that the only difference between animal intelligence and human intelligence consists in this—that animal intelligence is unable to elaborate that class of abstract ideas, the formation of which depends on the faculty of speech. In other words, animals are quite as able to form abstract ideas as we are, if under abstract ideas we include general ideas of qualities which are so far simple as not to require to be fixed in our thoughts by names. For instance, if I see a fox prowling about a farmyard, I cannot doubt that he has been led by hunger to visit a place where he has a general idea that a number of good things are to be fallen in with, just as I myself am led by a similar impulse to visit a restaurant. And, to take only one other instance, there can be no question that animals have a generalised conception of cause and effect. For example, I had a setter dog which was greatly afraid of thunder. One day a number of apples were being shot upon the wooden floor of an apple-room, and as each bag of apples was shot it produced through the rest of the house a noise resembling that of distant thunder. My dog became terror-stricken at the sound; but as soon as I brought him to the apple-room and showed him the true *cause* of the noise, he became again buoyant and cheerful as usual. Another dog which I had used to play at tossing dry bones to give them the appearance of life. As an experiment, I one day attached a fine thread to a dry bone before giving him the latter to play with; and after he had tossed the bone about for a while as usual, I stood a long way off and slowly began to draw it away from him: so soon as he perceived that the bone was really moving on its own account his whole demeanour changed, and rushing under a sofa he waited horror-stricken to watch the uncanny spectacle of a dry bone coming to life. I have also greatly frightened this dog by blowing soap-bubbles along the floor; one of these he summoned courage enough to touch with his paw, but as soon as it vanished he ran out of the room terrified at so mysterious a disappearance. Lastly, I have put this dog into a paroxysm of fear by taking him into a room alone and silently making a series of horrible grimaces. Although I had never in my life hurt this dog, he became greatly frightened at my unusual behaviour, which so seriously conflicted with his general idea of uniformity in matters psychological. And I could give numberless other instances of the formation by animals of general conceptions, or abstract ideas.

JUDGMENT AND REASON OF ANIMALS.

Of course in thus claiming for animals the power of forming general conceptions, I mean only such general conceptions as can be arrived at by the logic of feelings. So far, then, as the logic of feelings can carry them, I maintain that the intellectual operations of animals are indistinguishable from those of ourselves. Having thus shown that animals possess the faculty of abstraction, I shall now go on to show that they possess the faculties both of judgment and of reason. My friend Dr. Rea, the well-known traveller and naturalist, knew a dog in Orkney which used to accompany his master to church on alternate Sundays. To do so he had to swim a channel about a mile wide; and before taking to the water he used to run about a mile to the north when the tide was flowing, and a nearly equal distance to the south when the tide was ebbing, "almost invariably calculating his distance so well that he landed at the nearest point to the church." In his letter to me, Dr. Rea continues, "How the dog managed to calculate the strength of the spring and neap tides at their various rates of speed, and always to swim at the proper angle, is most surprising."

So much, then, for judgment. For some good instances of reasoning in animals I am also indebted to Dr. Rea. Desiring to obtain some Arctic foxes he set various kinds of traps; but, as the foxes knew these traps from previous experience, he was unsuccessful. Accordingly he set a kind of trap with which the foxes in that part of the country were not acquainted. This consisted of a loaded gun set upon a stand pointing at the bait. A string connected the trigger of the gun with the bait, so that when the fox seized the bait he discharged the gun, and thus committed suicide. In this arrangement the gun was separated from the bait by a distance of about 30 yards, and the string which connected the trigger with the bait was concealed throughout nearly its whole distance in the snow. The gun-trap thus set was

successful in killing one fox, but never in killing a second; for the foxes afterwards adopted either of two devices whereby to secure the bait without injuring themselves. One of these devices was to bite through the string at its exposed part near the trigger, and the other device was to burrow up to the bait through the snow at right angles to the line of fire, so that, although in this way they discharged the gun, they escaped with perhaps only a pellet or two in the nose. Now both of these devices exhibited a wonderful degree of what I think must fairly be called power of reasoning. I have carefully interrogated Dr. Rea on all the circumstances of the case, and he tells me that in that part of the world traps are never set with strings: so that there can have been no special association in the fox's mind between strings and traps. Moreover, after the death of fox number one, the track on the snow showed that fox number two, notwithstanding the temptation offered by the bait, had expended a great deal of scientific observation on the gun before he undertook to sever the cord. Lastly, with regard to burrowing at right angles to the line of fire, Dr. Rea justly deemed this so extraordinary a circumstance, that he repeated the experiment a number of times, in order to satisfy himself that the direction of the burrowing was really to be attributed to thought and not to chance.

THE EMOTIONAL LIFE OF ANIMALS.

I could give several other unequivocal instances of reasoning on the part of animals which I have myself observed; but time does not permit of my stating them. Passing on, therefore, to the emotional life of animals, we find that this is very slightly, if at all, developed in the lower orders, but remarkably well developed in the higher; that is to say, the emotions are vivid and easily excited, although they are shallow and evanescent. They thus differ from those of most civilised men in being more readily aroused and more impetuous while they last, though leaving behind them but little trace of their occurrence. As regards the particular emotions which occur among the higher animals, I can affirm, from my own observations, that all the following give unmistakable tokens of their presence:—Fear, affection, passionateness, pugnacity, jealousy, sympathy, pride, reverence, emulation, shame, hate, curiosity, revenge, cruelty, emotion of the ludicrous, and emotion of the beautiful. Now this list includes nearly all the human emotions, except those which refer to religion and to the perception of the sublime. These, of course, are necessarily absent in animals, because they depend upon ideas of too abstract a nature to be reached by the mind when unaided by the logic of signs. Time prevents me from here detailing any of my observations or experiments with regard to the emotional life of animals, so I will pass on at once to the faculty of Conscience. Of course the moral sense as it occurs in ourselves involves ideas of high abstraction, so that in animals we can only expect to meet with a moral sense in a very rudimentary form; and, therefore, even if it is true that no indications of such a sense are to be met with in animals, the fact would not establish any difference in kind between animal intelligence and human. But I am inclined to believe that in highly intelligent, highly sympathetic, and tolerably well-treated animals, the germs of a moral sense become apparent. To give two instances. I once shut up a Skye terrier in a room by himself while I went to a friend's house. The dog must have been thrown into a violent passion at being left behind, for when I returned I found that he had torn the window-curtains to shreds. He was in great joy at seeing me; but as soon as I picked up one of the torn shreds of the curtains the animal gave a howl and ran screaming up the staircase. Now this dog was never chastised in his life, so that I can only explain his conduct as an expression of the remorse which he suffered at having done in a passion what he knew would cause me annoyance. So far as I can interpret the facts, his sympathetic affection for me, coupled with the memory of his misdeeds, created in his mind a genuine feeling of *repentance*.

The other instance I have to narrate occurred with the same terrier. Only once in his life was he ever known to steal; and on this occasion, when very hungry, he took a cutlet from a table and carried it under a sofa. I saw him perform this act of larceny, but pretended not to have done so, and for a number of minutes he remained under the sofa with his feelings of hunger struggling against his feelings of duty. At last the latter triumphed; for he brought the stolen cutlet and laid it at my feet. Immediately after doing so he again ran under the sofa, and from this retreat no coaxing could draw him. Moreover, when I patted his head he turned away his face in a ludicrously conscience-stricken manner. Now I regard this instance as particularly valuable from the fact that the terrier in question had never been beaten, and hence that it cannot have been fear of bodily pain which prompted these actions. On the whole, therefore, I can only suppose that we have in these actions evidence of as high a development of the ethical faculty as is attainable by the logic of feelings when unassisted by the logic of signs—that is to say, a grade very nearly, if not quite, as high as that with which we meet in low savages, young children, many idiots, and uneducated deaf-mutes.

This allusion to savages, children, idiots, and deaf mutes, leads me to the next division of my subject.

THE INTELLECT OF THE HIGHER ANIMALS COMPARED WITH THE STUPIDITY OF THE LOWER SAVAGES.

St. George Mivart has said that an interesting book might be written on the stupidity of animals. I am inclined to think that a still more interesting book might be written on the stupidity of savages. For it is a matter of not the least interest how much stupidity any number of animals may present, so long as some animals present sufficient sagacity to supply data for the general theory of evolution; while, on the other hand, it is of the utmost importance for the science of this century to ascertain the lowest depths in which the mind of man is known to exist as human. Now there is no doubt that the interval which separates the most degraded savage from the most intelligent animal is, psychologically considered, enormous; but, enormous as it is, I cannot see any evidence to show that the gulf may not have been bridged over during the countless ages of the past. Abstract ideas among savages are mostly confined to such as may be formed by the logic of feelings; so that, for instance, according to the observations and the judgment of Mr. Francis Galton, the ideas of number which are presented by the lowest savages are certainly in no degree superior to those which are presented by the higher animals. Such ideas as savages possess seem to be mainly those which, as in animals, are due to special associations. On this account there is in them, as in animals, a remarkable tendency to act in accordance with performed habits, rather than to strike out improved modes of action. On this account, also, there is, as in animals, a strong tendency to imitation as distinguished from origination. Again, as in animals, so in savages, the reflective power is of an extremely undeveloped character, and quite incapable of sustained application. And, lastly, the emotions of savages, as of animals, are vivid, although, as contrasted with the emotions of civilised man, they are in a marked degree more fitful, impetuous, shallow, and transitory. So that altogether I think the lowest savages supply us with a most valuable transition stage between mind as we know it ourselves, and mind as we see it manifested by the higher animals.

INFANT PSYCHOLOGY.

With regard to children, it is to be expected, on the general theory of evolution by inheritance, that if we were attentively to study the order in which their mental faculties develop, we should find that the historical sequence is, as it were, a condensed epitome of the order in which these faculties were developed during the evolution of the human species. And this expectation is fairly well realised. Very young children present only those lower faculties of mind which in animals we call instincts. With advancing age, the first indication of true intelligence seems to consist in the power of forming special associations. Memory thus appears early in life; and long before a child is able to speak, it links together in thought ideas of objects which it finds to be associated in fact. Again, the emotions begin to assert their presence at a very early period, and attain a high degree of development before any of the characteristically human faculties can be said to have appeared. Moreover, in young children we meet with nearly all the

emotions which I have named as occurring in animals, and their general character is much of the same kind. In more advanced childhood the emotional life of children more resembles that of savages. With regard to the more purely intellectual faculties, language is largely intelligible to a child long before it is itself able to articulate; but soon after it is able to articulate, the faculty of abstracting qualities and classifying objects by the aid of signs begins its course of development. Thus, for instance, I have lately seen a child who belongs to one of the best of living observers, and who is just beginning to speak. This child called a duck "quack," and by special association it also called water "quack." By an appreciation of the resemblance of qualities, it next extended the term "quack" to denote all birds and insects on the one hand, and all fluid substances on the other. Lastly, by a still more delicate appreciation of resemblance, the child eventually called all coins "quack," because on the back of a French sou it had once seen the representation of an eagle. Hence to this child the sign "quack," from having originally had a very specialised meaning, became more and more extended in its signification, until it now serves to designate such apparently different objects as "fly," "wine," and "shilling." And as in this process we have the initiation of the logic of signs, so we have in it the potentiality of the most abstract thought. Accordingly, soon after a child begins to speak, we find that reason of a properly human kind begins to be developed.

Upon the whole, then, the study of infant psychology yields just the kind of results which the general theory of evolution would lead us to expect. But in comparing the intelligence of a young child with that of an adult animal we are met with this difficulty—that as the bodily powers of children at so immature an age are so insufficiently developed, the mind is not able, as in the case of animals, to accumulate experiences of life. In order, therefore, to obtain a fair parallel, we should require a human being whose mental powers have become arrested in their development at an early age, while the bodily powers have continued to develop to mature age, so serving to supply the aborted human intelligence with full experiences of life. Now, the nearest approach that we have to these conditions is to be found in the case of idiots. Accordingly, in anticipation of this lecture, I have sent a table of questions to all the leading authorities on idiocy, and the answers which I have obtained display a very substantial agreement. Through the kindness of those gentlemen I have also been able to examine personally a number of the patients who are under their charge. In particular I have to express my obligations to Drs. Beech, Crichton Browne, Langdon Down, Ireland, Maudsley, Savage, and Shuttleworth. On the present occasion I can only pause to state the leading facts which have been elicited by this inquiry.

THE PSYCHOLOGY OF IDIOCY.

As there are all degrees of idiocy, the object of my inquiry was to determine the order in which the various mental faculties become enfeebled and disappear as we descend from the higher to the lower grades of imbecility. On the general theory of evolution we should expect that in such a descending scale the characteristically human, or the more recently developed, faculties should be first to disappear, while those faculties which man shares with the lower animals should be more persistent. And this expectation I have found to be fairly well realised. Beginning from below, the first dawn of intelligence in the ascending scale of idiots, as in the ascending scale of animals, is invariably to be found in the power of associating simple concrete ideas. Thus there are few idiots so destitute of intelligence that the appearance of food does not arouse in their mind the idea of eating; and, as we ascend in the scale idiotic, we find the principle of association progressively extending its influence, so that the mind is able, not only to establish a greater and greater number of special associations, but also to retain those associations with an ever-increasing power of memory. In the case of the higher idiots, as in the case of the higher animals, it is surprising in how considerable a degree the faculty of special association is developed, notwithstanding the dwarfed condition of all the higher faculties. Thus, for instance, it is not a difficult matter to teach a clever idiot to play dominoes, in the same way as a clever dog has been taught to play dominoes, viz., by teaching special associations between the optical appearance of the facets which the game requires to be brought together. But the idiot may be quite as unable as the dog to play at any game which involves the understanding of a simple *rationale*, such, for instance, as draughts. And similarly many of the higher idiots have been taught to recognise, by special association, the time on a watch; but it is remarkable that the high power of forming special associations which this fact implies occurs in the same minds which are unable to perform so simple a calculation as this:—If it is ten minutes to three, how many minutes is it past two? Thus, it will be seen that among idiots as among animals, the faculty of forming special associations between concrete ideas attains a comparatively high degree of development. Let us then next turn to the faculties of abstraction and reason. Prepared as I was to expect these faculties to be the most deficient, I have been greatly surprised at the degree in which they are so. As regards the power of forming abstract ideas which depend on the logic of signs, it is only among the very highest class of idiots that any such power is apparent at all; and even here it is astonishing in how very small a degree this power is exhibited. There seems, for instance, to be an almost total absence of right or wrong as such; so that the faculty of conscience, properly so called, can rarely be said to be present. Most of the higher idiots, indeed, experience a feeling of remorse on offending the sympathies of those whom they love, just as did my dog on tearing the window-curtains; but I have been able to obtain very little evidence of any true idiot whose action is prompted by any idea of right and wrong in the abstract, or as apart from the idea of approbation and disapprobation of those whose good feeling he values.

Again, the faculty of reason is dwarfed to the utmost—so much so that the investigator is most of all astonished at the poverty of rational power which may be displayed by a human mind that in most other respects seems well developed. I can only wait to give you one example, but it may be taken as typical. A boy fourteen years of age, belonging to the highest class of undoubted idiots, could scarcely be called feeble-minded as regards many of his faculties. Thus, for instance, his powers of memory were above the average, so that he had no difficulty in learning Latin, French, &c. Moreover, he could tell you by mental calculation the product of two numbers into two numbers, such as 35 by 35, or of one number into three numbers, such as the number of days in nine years. His powers of mental calculation were, therefore, quite equal to those of any average boy of his age. Yet he was not able to answer any question that involved the simplest act of reason. Thus, when I asked him, how many sixpences there are in a sovereign, he was quite unable to answer. Although he knew that there are two sixpences in a shilling, and twenty shillings in a sovereign, and could immediately have said that twice twenty are forty, yet he could not perform the simple act of inference which the question involved. Again, I asked him, if he could buy oranges at a farthing each, how many could he buy for twopence? He thought long and hard, saying, "I know that four farthings make a penny, and the oranges cost a farthing each; then how many could I buy for twopence? Ah! that's the question, and there's just the puzzle." Nor was he able by the utmost effort to solve the puzzle. This boy had a very just appreciation of his own psychological character. Alluding to his powers of forming special associations and retaining them in his excellent memory, he observed, "Once put anything into my head and you don't get it out again very easily; but there's no use in asking me to do puzzles."

Lastly, the emotional life of all the higher idiots, as of all the higher animals, is remarkably vivid as compared with their intellectual life. All the emotions are present (except perhaps that of the sublime and the religious emotions), and they occur for the most part in the same order as to strength as that which I have already named in the case of animals. But, more than this, just as in animals, children, and savages, so in idiots, the emotions, although vivid and keen, are not profound. A trivial event will make the higher

idiots laugh or cry, and it is easy to hurt their feelings with a slight offence; but the death of a dear relative is very soon forgotten, while the stronger passions, such as Love, Hate, Ambition, &c., do not occur with that force and persistency which properly entitle them to be called by these names.

Upon the whole, then, with regard to idiots, it may be said that we have in them a natural experiment wherein the development of a human mind is arrested at some particular stage, while the body is allowed to continue its growth. Therefore, by arranging idiots in a descending grade, we obtain, as it were, an inclined plane of human intelligence, which indicates the probable order in which the human faculties have appeared during the history of their development; and on examining this inclined plane of human intelligence, we find that it runs suggestively parallel with the inclined plane of animal intelligence, as we descend from the higher to the lower form of psychical life.

THE MENTAL CONDITION OF UNEDUCATED DEAF MUTES.

I have only time to treat of one other branch of my subject. Believing, as I have said, that language, or the logic of signs, plays so essential a part in developing the higher intellectual life of man, it occurred to me that a valuable test of the truth of this view was to be found in the mental condition of uneducated deaf-mutes. It often happens that deaf and dumb children of poor parents are so far neglected that they are never taught finger language, or any other system of signs, whereby to converse with their fellow creatures. The consequence, of course, is that these unfortunate children grow up in a state of intellectual isolation, which is almost as complete as that of any of the lower animals. Now when such a child grows up and falls into the hands of some competent teacher, it may of course be educated, and is then in a position to record its experiences when in its state of intellectual isolation. I have therefore obtained all the evidence I can as to the mental condition of such persons, and I find that their testimony is perfectly uniform. In the absence of language, the mind is able to think in the logic of feelings, but can never rise to any ideas of higher abstraction than those which the logic of feelings supplies. The uneducated deaf-mutes have the same notions of right and wrong, cause and effect, and so on, as we have already seen that animals and idiots possess. They always think in the most concrete forms, as shown by their telling us when educated that so long as they were uneducated they always thought in pictures. Moreover, that they cannot attain to ideas of even the lowest degree of abstraction, is shown by the fact that in no one instance have I been able to find evidence of a deaf-mute who, prior to education, had evolved for himself any form of supernaturalism. And this, I think, is remarkable, not only because we might fairly suppose that some rude form of fetishism, or ghost-worship, would not be too abstract a system for the unaided mind of a civilised man to elaborate, but also because the mind in this case is not wholly unaided. On the contrary, the friends of the deaf-mute usually do their utmost to communicate to his mind some idea of whatever form of religion they may happen to possess. Yet it is uniformly found that, in the absence of language, no idea of this kind can be communicated. For instance, the Rev. S. Smith tells me that one of his pupils, previous to education, supposed the Bible to have been printed by a printing-press in the sky, which was worked by printers of enormous strength—this being the only interpretation the deaf-mute could assign to the gestures whereby his parents sought to make him understand that they believed the Bible to contain a revelation from a God of power who lives in heaven. Similarly, Mr. Graham Bell informs me of another, though similar case, in which the deaf-mute supposed the object of going to church to be that of doing obeisance to the clergy.

On the whole, then, from the mental condition of uneducated deaf-mutes we learn the important lesson that, in the absence of language, the mind of a man is almost on a level with the mind of a brute in respect of its power of forming abstract ideas. So that all our lines of evidence converge to one conclusion. The only difference which analysis can show to obtain between the mind of man and the mind of the lower animals consists in this, that the mind of man has been able to develop the germ of rational thought which is undeveloped in the mind of animals, and that the development of this germ has been due to the power of abstraction which is rendered possible by the faculty of speech. I have, therefore, no hesitation in giving it as my opinion that the faculty of speech is alone the ultimate source of that enormous difference which now obtains between the mind of man and the mind of the lower animals. Is this source of difference adequate to distinguish the mind of man from the mind of lower animals in kind? I leave you all to answer this question for yourselves. I am satisfied with my work if I have made it clear to you that the question whether human intelligence differs from animal intelligence in kind or in degree, hinges entirely on the question whether the faculty of speech has been of an origin natural or supernatural. Still, to be candid, when the question occurs to me—Seeing that language is of such prodigious importance as a psychological instrument, does not the presence of language serve to distinguish us in kind from all other forms of life? How is it that no mere brute has ever learned to communicate with its fellows by words? Why has man alone of animals been gifted with the Logos? I say when this question occurs to me, I feel that although from the absence of pre-historical knowledge I am not able to answer it, still when I reflect on the delicacy of the conditions which, on the naturalistic hypotheses, must first have led to the beginning of articulate language—conditions not only anatomical and physiological, but also psychological and sociological—when I thus reflect, I cease to wonder that the complicated faculty of speech should only have become developed in *Homo sapiens*.

THE DAWN OF THE SCIENCE OF PSYCHOLOGY.

Ladies and gentlemen, I have now given you an organised epitome of the leading results which have been obtained by a study of the facts and the principles of Comparative Psychology; and as in doing so I have chiefly sought to address those among you who are interested in science, I fear that to some of you I must in many places have been very hard to follow. But as a general outcome of the whole lecture—as the great vivifying principle by which all the facts are more or less connected, and made to spring into a living body of philosophic truth—I will ask you to retain in your memories one cardinal conclusion. We are living in a generation which has witnessed a revolution of thought unparalleled in the history of our race. I do not merely allude to the fact that this is a generation in which all the sciences, without exception, have made a leap of progress such as widely to surpass all previous eras of intellectual activity; but I allude to the fact that in the special science of Biology it has been reserved for us to see the first rational enunciation, the first practical demonstration, and the first universal acceptance of the doctrine of Evolution. And I allude to this fact as to a fact of unparalleled importance in the history of thought, not only because I know how completely it has transformed the study of Life from a mere grouping of disconnected observations to a rational tracing of fundamental principles, but also because it is now plainly to be foreseen that what the Philosophy of Evolution has already accomplished is but an earnest of what it is destined to achieve. We know the results which have followed in the science of Astronomy by the mathematical proof of the law of gravitation; and can we doubt that even more important results will follow in the much more complex science of Biology from the practical proof of the law of Evolution? I, at least, can entertain no doubt on this head; and forasmuch as this enormous change in our means of knowledge and our modes of thought has been so largely due to the almost unaided labours of a single man, I do not hesitate to say, even before so critical an audience as this, that in all the history of science there is no single name worthy of a veneration more profound than the now immortal name of Charles Darwin.

Do you ask me why I close this lecture with such a panegyric on the Philosophy of Evolution? My answer is—If we have found that in the study of Life the theory of Descent is the keynote by which all the facts of our science are brought into harmonious relation, we cannot doubt that in our study of Mind the theory of Descent must be of an importance no less fundamental. And, indeed, even in this

our time, which is marked by the first opening dawn of the science of Psychology, we have to look with eyes unprejudiced to see that the Philosophy of Evolution is here like a rising Sun of Truth, eclipsing all the lesser lights of previous philosophies, dispelling superstitions like vapours born of darkness, and revealing to our gladdened gaze the wonders of a world till now unseen. So that the cardinal conclusion which I desire you to take away, and to retain in your memories long after all the lesser features of this discourse shall have faded from your thoughts, is the conclusion that Mind is everywhere one; and that the study of Comparative Psychology, no less than the study of Comparative Anatomy, has hitherto yielded results in full agreement with that great transformation in our view of things, which, as I have said, is without a parallel in the history of thought, and which it has been the great, the individual glory of this age and nation to achieve.

HATE MORE DEVELOPED THAN LOVE AMONG ANTS.*

BY SIR JOHN LUBBOCK, BART., M.P.

One of the most surprising points connected with ants is that while those in one nest never appear to quarrel—at least, I have never seen a dispute—every stranger is, in some kinds at least, regarded as an enemy, even when belonging to the same species. For instance, in our common black ant (*F. fusca*), if an ant of the same species, but belonging to another community, is introduced into the nest, she is at once regarded as a stranger and attacked. Nay, not only are all the ants in a nest thus known to one another, but they are remembered, even after a long separation. Huber tells us that some ants which he kept separate for four months, and then brought together again, recognised one another with every sign of joy; but he did not repeat the experiment, and in such matters it is not safe to argue from a single observation. Moreover, M. Forel, who has devoted years to the study of ants, tells us that the actions which Huber supposed to be marks of joy and affection were, on the contrary, signs of fear and hatred.

Under these circumstances I determined to repeat Huber's experiment, though in a different manner. I separated one of my nests into two halves, and then, after some months, put some of the ants back among their old friends. I have already mentioned that a stranger from another nest thus introduced was invariably dragged out or killed. And here, let me say, that though this species also drags its own friends about under certain circumstances, there is no mistaking whether the ant thus treated is a friend or an enemy. If a *F. fusca* wishes to carry away a friend, say to a place of security, she seizes her by the mandibles, and the other ant then rolls herself into a ball, and is thus carried. On the contrary, if the ants are enemies the one seizes the other by a leg or an antenna. The ant thus treated would, on neutral ground, show fight, but if she is in a strange nest, she makes no resistance. Another mode by which the treatment of the friends differed from that of strangers was nearly equally clear. In order to be able to distinguish the ants introduced into the nest, I marked them with a spot of paint. Now, in the case of a friend, the ants generally removed the paint, while in that of an enemy they seldom did so. Last, the conduct of the ant introduced into the nest was also very different in the two cases. The friend joined her old companions, though I never could see any signs of those long conversations which might have been expected in intelligent beings after a long separation. On the contrary, a stranger introduced into a different nest avoided the other ants, ran uneasily about, and escaped from the nest as soon as possible. The differences, therefore, were very marked, and without troubling you with the details, I found, to my great surprise, that even after a year of separation, an ant restored to her old companions was obviously recognised, and treated as a friend; perhaps, however, I ought rather to say as an "acquaintance;" for though they certainly hated their enemies, I could not satisfy myself that they loved their friends. For instance, I took six ants from one of my nests, put them into a small bottle, tied a bit of muslin over the mouth, and put it close to the nest, but I regret to say that, as far as I could observe, the ants did not take the slightest notice of their imprisoned sisters.

Perhaps I shall be told that this experiment was not to the point, because in nature ants would never find their friends imprisoned in glass bottles with muslin over the mouth. I therefore took three strange ants from another nest, and treated them in the same way. The difference was most marked. A number of ants came out in a great state of indignation, and worked without intermission for hours, until they had bitten through the muslin and driven the strangers away. It would seem, therefore, that they hate their enemies much more than they love their friends.

It would be interesting to know how ants thus distinguish their friends. Several modes might be suggested. It might be by smell, or by some sign, or by actual recognition. I made some experiments, therefore, to see whether ants would recognise their friends when they were insensible, and therefore incapable of giving any sign. Firstly, I used chloroform. But this did not answer. The ants did not return to consciousness. They were practically, and were treated as, dead ants. I then tried intoxication. Close to where a number of my ants (*d. flavus*) were feeding I placed 55 intoxicated ants—25 from the same, 30 from a different nest. I have already mentioned that most of my ants were prevented from roaming beyond the limits assigned to them by a moat. Now of these intoxicated ants, 20 of the friends were carried back into the nest, where they probably slept off the effects of the spirit; while of the strangers 28 were picked up and thrown into the water. I should mention that the power of recognition, under these circumstances, was not perfect, because five of the friends were thrown into the water. It may be, however, that these fell into the hands of stern teetotallers; and at any rate the numbers seem to prove that ants can distinguish friends from strangers, even when they are insensible.

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I have made a number of experiments as regards the senses of ants, with which I will not trouble the section. I may, however, observe that their sense of smell is very delicate, though much more so I believe in some species than in others. As regards sight, I have been able to satisfy myself that they are capable of distinguishing colour; that they are, for instance, very sensitive to violet. On the contrary, I have never observed any proof that they are capable of hearing. To ascertain if possible whether ants have the power of summoning one another by sound, I tried the following experiments. I put out on the board where one of my nests of *Lasius Flavous* was usually fed, six small pillars of wood, about 1½ inches high, and on one of them I put some honey. A number of ants were wandering about on the board itself in search of food, and the nest itself was immediately above, about 12 inches from the board. I then put three ants to the honey, and when each had sufficiently fed, I imprisoned her and put another; thus always keeping three ants at the honey, but not allowing them to go home. If, then, they could summon their friends by sound, there ought soon to be many ants at the honey. The results were as follow: Sept. 8th, began at 11 a.m.; up to three o'clock only seven ants found their way to the honey, while about as many ran up the other pillars. The arrival of these seven, therefore, was not more than would naturally result from the numbers running about close by. At three we allowed the ants then on the honey to return home. The result was that from 3.6, when the first went home, to 3.30, 11 came; from 3.30 to 4, no less than 43. Thus, in four hours, only seven came; while it was obvious that many would have wished to come if they had known about the honey, because in the next three-quarters of an hour, when they were informed of it, 54 came. On the 10th Sept. we tried the same again, keeping, as above, three ants on the honey, but not allowing any to go home. From 12 to 5.30, only eight came. They were then allowed to take the news. From 5.30 to 6, four came; from 6 to 6.30, four; from 6.30 to 7, eight; from 7.30 to 8, no less than 57. On the 23rd Sept. we did the same again, beginning at 11.15. Up to 3.45, nine came. They were then alowed to go home. From 4 to 4.30, nine came;

* A portion of a paper read last Friday, before a department of Section D of the British Association for the Advancement of Science. Dublin, 1878.

from 4.30 to 5, 15; from 5 to 5.30, 19; from 5.30 to 6, 38. Thus in 3½ hours nine came; in two, when the ants were permitted to return, 81. Again, on Sept. 30th, tried the same arrangement, beginning at 11. Up to 3.30, seven ants came. We then let them go. From 3.30 to 4.30, 28 came; from 4.30 to 5, 51 came. Thus in four hours and a half only seven came, while when they were allowed to return no less than 79 came in an hour and a half. It seems obvious, therefore, that in these cases no communication was transmitted by sound.

THE PENUMBRAL REGION BETWEEN THE KNOWN AND THE UNKNOWN.*

BY WILLIAM SPOTTISWOODE, M.A., D.C.L., F.R.S.

Mathematics may be found ruling and governing a variety of subjects. It is as the supreme result of all experience, the framework in which all the varied manifestations of nature have been set, that our science has laid claim to be the arbiter of all knowledge. She does not indeed contribute elements of fact, which must be sought elsewhere; but she sifts and regulates them: she proclaims the laws to which they must conform if those elements are to issue in precise results. From the data of a problem she can infallibly extract all possible consequences, whether they be those first sought, or others not anticipated; but she can introduce nothing which was not latent in the original statement. Mathematics cannot tell us whether there be or be not limits to time or space; but to her they are both of indefinite extent, and this in a sense which neither affirms nor denies that they are either infinite or finite. Mathematics cannot tell us whether matter be continuous or discrete in its structure; but to her it is indifferent whether it be one or the other, and her conclusions are independent of either particular hypothesis. Mathematics can tell us nothing of the origin of matter, of its creation or its annihilation; she deals only with it in a state of existence; but within that state its modes of existence may vary from our most elementary conception to our most complex experience. Mathematics can tell us nothing beyond the problems which she specifically undertakes; she will carry them to their limits, but there she stops, and upon the great region beyond she is imperturbably silent.

Conterminous with space and coëval with time is the kingdom of mathematics; within this range her dominion is supreme; otherwise than according to her order nothing can exist; in contradiction to her laws nothing takes place. On her mysterious scroll is to be found written, for those who can read it, that which has been, that which is, and that which is to come. Everything material which is the subject of knowledge has number, order, or position; and these are her first outlines for a sketch of the universe. If our more feeble hands cannot follow out the details, still her part has been drawn with an unerring pen, and her work cannot be gainsaid. So wide is the range of mathematical science, so indefinitely may it extend beyond our actual powers of manipulation, that at some moments we are inclined to fall down with even more than reverence before her majestic presence. But so strictly limited are her promises and powers, about so much that we might wish to know does she offer no information whatever, that at other moments we are fain to call her results but a vain thing, and to reject them as a stone when we had asked for bread. If one aspect of the subject encourages our hopes, so does the other tend to chasten our desires; and he is perhaps the wisest, and in the long run the happiest among his fellows, who has learnt not only this science, but also the larger lesson which it indirectly teaches, namely, to temper our aspirations to that which is possible, to moderate our desires to that which is attainable, to restrict our hopes to that of which accomplishment, if not immediately practicable, is at least distinctly within the range of conception. That which is at present beyond our ken may, at some period and in some manner as yet unknown to us, fall within our grasp; but our science teaches us, while ever yearning with Goethe for "Light, more light," to concentrate our attention upon that of which our powers are capable, and contentedly to leave for future experience the solution of problems to which we can at present say neither yea nor nay.

It is within the region thus indicated that knowledge in the true sense of the word is to be sought. Other modes of influence there are in society and in individual life, other forms of energy beside that of intellect. There is the potential energy of sympathy, the actual energy of work; there are the vicissitudes of life, the diversity of circumstance, health, and disease, and all the perplexing issues, whether for good or for evil, of impulse and of passion. But although the book of life cannot at present be read by the light of science alone, nor the wayfarers be satisfied by the few loaves of knowledge now in our hands, yet it would be difficult to overstate the almost miraculous increase which may be produced by a liberal distribution of what we already have, and by a restriction of our cravings within the limits of possibility.

In proportion as method is better than impulse, deliberate purpose than erratic action, the clear glow of sunshine than irregular reflection, and definite utterances than an uncertain sound; in proportion as knowledge is better than surmise, proof than opinion; in that proportion will the mathematician value a discrimination between the certain and the uncertain, and a just estimate of the issues which depend upon one motive or the other. While on the one hand he accords to his neighbours full liberty to regard the unknown in whatever way they are led by the noblest powers that they possess; so on the other he claims an equal right to draw a clear line of demarcation between that which is a matter of knowledge, and that which is at all events something else, and to treat the one category as fairly claiming our assent, the other as open to further evidence. And yet, when he sees around him those whose aspirations are so fair, whose impulses so strong, whose receptive faculties so sensitive, as to give objective reality to what is often but a reflex from themselves, or a projected image of their own experience, he will be willing to admit that there are influences which he cannot as yet fathom or measure, but whose operation he must recognise among the facts of our existence.

* The conclusion of the Presidential Address to the British Association for the Advancement of Science. Dublin: 1878.

A *SEANCE* IN GLASGOW.

(From the "Glasgow Weekly Mail," August 17th, 1878.)

A select company of Glasgow Spiritualists and friends held a *séance* in the Hall, Trongate, last week, in course of which several manifestations of a character remarkable enough to challenge publicity were evolved. The "circle," when completely formed, consisted of an inner and an outer ring, the company numbering altogether about fifty. The inner ring was made up of pronounced Spiritualists, who are, of course, friendly to the appearance of the "spirits," and who thus guard their spiritual wards from delicate intrusion or insult at the hands of sceptical strangers. One of the four corners of the little hall was partitioned off by a covering of dark-green cloth for the use of the officiating "medium," who remained ensconced within during the whole performance. This interesting centre of operation was invested by the sitting circles, and the ordinary light having been put out, the young lady-medium—an English girl by birth—entered the curtained recess. The room was now almost completely dark, the only light allowed coming from a shaded side-lamp, which was still further toned down to a becomingly grave aspect by the dull red-coloured paper which enwraps it. The "circle" were then requested to join hands and sing. Hands were joined and psalm tunes were chanted, but the spirits did not respond; Sankey's "Sweet by-and-bye" was then rendered, and a movement of the curtain put everybody on the alert. Suddenly the curtain was partly withdrawn, and a ghastly white face, wrapped in white linen, appears, and as suddenly withdraws. This incident was repeated half-a-dozen different times, and at length, at the urgent request of the director of the circle, the whole body of the supernatural visitor was distinctly revealed, dressed in grave-clothes, too, and articulating speech in a broad and unmistakably Scotch Doric voice. "Is that you, George?" queries one of the inner circle of sitters. "Deed, ay! It's jist me," responds George, in a voice sunk to a "deid hearseness." George, who, by the way, was a tailor when in the flesh, was suffering badly from that painful affection of old age, a "roostit thrapple." He spoke as if he had recently caught cold, and the supposition is not an unlikely one, as the "circle" have lately interviewed him, it seems, inconveniently often. George then surveys his legs melo-dramatically, and shakes his ghastly head over their painful thinness, declaring them with a serious head-shake to be "jist skin and bane." "Can ye no better them awee?" queries one of the group. "I'll try," said George, who seems from the first supernaturally anxious to please, and making his dexter leg spin round and round a dozen times like a housewife handling a porridge stick, he

gravely asks the general company if "that's ony decenter;" and the general company, who seem to share with George the amiable desire to please, accede to the questionable fact. Presently there is a clicking noise heard inside the curtained space, and George, on being questioned anent it, declares it to be "Sambo," a well-known negro spirit, who, according to Geordie's ludicrous statement, is "busy makin' himsel' up," and who, according to the same authority's continued statement, "is jist greetin' his een oot that he's no gettin' appearin' first." Presently George withdraws, and on the expiry of a few minutes, during which the company vigorously sing, Sambo's head is thrust between the parted curtains, his face as black as night—the mouth grinning like the slit in a post-office letter box. He nods the general company into apparent extensive recognition, disappears, reappears, and repeats the nodding business. It should be stated that before George appeared a little negro girl of tender years spoke through the medium, although not visible, and asked after the health of a large number of the "inner circle," the stereotyped reply of the parties whose health was inquired after being—"Thank you, I'm very well, Sisy; how are you?" to which the invisible spirit of "Sisy" replied in each case, "Bootiful." The third manifestation was the most remarkable and startling of all. Two children of seemingly tender years stepped before the curtain, one of them being the alleged spirit of the daughter of a gentleman present, who asked if he might be allowed to touch her hand that night. An inclination of the little head acceding to the request brought the parent over to where the manifestation stood. A tiny little hand, tremulous with luminosity, was laid gently within the hand of the assumed parent, and a fervent "God bless you!" from the father brought the manifestations to a close. Whatever may be said about the reality or the reverse of the exhibitions, there could be no doubt entertained regarding the deep sincerity of the parent. The quiver in the voice of the gentleman bespoke the intensity of his feelings. It is but justice to the parties interested to state that the place portioned off for the use of the "medium" was, beyond suspicion, free from claptrap trickery. There were apparently no possible aids to deception to be found there. Admitting the honesty of the *modus operandi*, and the sincerity of the parties interested in the truth and success of the manifestations, the supernatural element must be accounted for on other grounds.

SPACE OF FOUR DIMENSIONS.

Although Professor Zöllner and others have obtained knots in endless cords in the presence of spirit mediums, it does not necessarily follow that his explanation is right, or that the fact proves the existence in reality of the hypothetical four dimensions in space of the mathematician. Mr. William Spottiswoode's mind has been so much exercised on this subject that he made the following remarks in his opening presidential address to the British Association at Dublin:—

If both in geometry and algebra we occasionally make use of points or of quantities, which from our present outlook have no real existence, which can neither be delineated in space of which we have experience, nor measured by scale as we count measurement; if these imaginaries, as they are termed, are called up by legitimate processes of our science; if they serve the purpose not merely of suggesting ideas, but of actually conducting us to practical conclusions; if all this be true in abstract science, I may perhaps be allowed to point out, in illustration of my argument, that in art unreal forms are frequently used for suggesting ideas, for conveying a meaning for which no others seem to be suitable or adequate. Are not forms unknown to biology, situations incompatible with gravitation, positions which challenge not merely the stability but even the possibility of equilibrium—are not these the very means to which the artist often has recourse in order to convey his meauing and to fulfil his mission? Who that has ever revelled in the ornamentation of the Renaissance, in the extraordinary transitions from the animal to the vegetable, from faunic to floral forms, and from these again to almost purely geometric curves, who has not felt that these imaginaries have a claim to recognition very similar to that of their congeners in mathematics? How is it that the grotesque paintings of the middle ages, the fantastic sculpture of remote nations, and even the rude art of the prehistoric past, still impress us, and have an interest over and above their antiquarian value; unless it be that they are symbols which, although hard of interpretation when taken alone, are yet capable, from a more comprehensive point of view, of leading us mentally to something beyond themselves, and to truths which, although reached through them, have a reality scarcely to be attributed to their outward forms?

Again, if we turn from art to letters, truth to nature and to fact is undoubtedly a characteristic of sterling literature; and yet in the delineation of outward nature itself, still more in that of feelings and affections, of the secret parts of character and motives of conduct, it frequently happens that the writer is driven to imagery, to an aualogy, or even to a paradox, in order to give utterance to that of which there is no direct counterpart in recognised speech. And yet which of us cannot find a meaning for these literary figures, an inward response to imaginative poetry, to social fiction, or even to those tales of giant and fairyland written, it is supposed, only for the nursery or schoolroom? But in order thus to reanimate these things with a meaning beyond that of the mere words, have we not to reconsider our first position, to enlarge the ideas with which we started; have we not to cast about for some thing which is common to the idea conveyed and to the subject actually described, and to seek for the sympathetic spring which underlies both; have we not, like the mathematician, to go back, as it were, to some first principles, or, as it is pleasanter to describe it, to become again as a little child?

Passing to the second of the three methods, viz., that of manifold space, it may first be remarked that our whole experience of space is in three dimensions, viz., of that which has length, breadth, and thickness; and if for certain purposes we restrict our ideas to two dimensions as in plane geometry, or to one dimension as in the division of a straight line, we do this only by consciously and of deliberate purpose setting aside, but not annihilating, the remaining one or two dimensions. Negation, as Hegel has justly remarked, implies that which is negatived, or, as he expresses it, affirms the opposite. It is by abstraction from previous experience, by a limitation of its results, and not by any independent process, that we arrive at the idea of space whose dimensions are less than three.

It is doubtless on this account that problems in plane geomentry which, although capable of solution on their own account, become much more intelligible, more easy of extension, if viewed in connection with solid space, and as special cases of corresponding problems in solid geometry. So eminently is this the case, that the very language of the more general method often leads us almost intuitively to conclusions which, from the more restricted point of view, require long and laborious proof. Such a change in the base of operations has, in fact, been successfully made in geometry of two dimensions, and although we have not the same experimental data for the further steps, yet neither the modes of reasoning, nor the validity of its conclusions, are in any way affected by applying an analogous mental process to geometry of three dimensions; and by regarding figures in space of three dimensions as sections of figures in space of four, in the same way that figures in plane are sometimes considered as sections of figures in solid space. The addition of a fourth dimension to space not only extends the actual properties of geometrical figures, but it also adds new properties which are often useful for the purposes of transformation or of proof. Thus it has recently been shown that in four dimensions a closed material shell could be turned inside out by simple flexure, without either stretching or tearing; and that in such a space it is impossible to tie a knot.

Again, the solution of problems in geometry is often effected by means of algebra; and as three measurements, or co-ordinates as they are called, determine the position of a point in space, so do three letters or measureable quantities serve for the same purpose in the language of algebra. Now, many algebraical problems involving three unknown or variable quantities admit of being generalised so as to give problems involving many such quantities. And as, on the one hand, to every algebraical problem involving unknown quantities or variables by ones, or by twos, or by threes, there corresponds a problem in geometry of one or of two or of three dimensions; so on the other it may be said that to every algebraical problem involving many variables, there corresponds a problem in geometry of many dimensions.

There is, however, another aspect under which even ordinary space presents to us a four-fold, or, indeed, a manifold, character. In modern physics, space is regarded not as a vacuum in which bodies are placed and forces have to play, but rather as a plenum with which matter is co-extensive. And from a physical point of view the properties of space are the properties of matter, or of the medium which fills it. Similarly, from a mathematical point of view, space may be regarded as a *locus in quo*, as a plenum, filled with those elements of geometrical magnitude which we take as fundamental. These elements need not always be the same. For different purposes different elements may be chosen; and upon the degree of complexity of the subject of our choice will depend the internal structure or manifoldness of space.

Thus, beginning with the simplest case, a point may have any singly infinite multitude of positions in a line, which gives a one-fold system of points in a line. The line may revolve in a plane about any one of its points, giving a two-fold system of points in a plane; and the plane may revolve about any one of the lines, giving a three-fold system of points in space.

Suppose, however, that we take a straight line as our element, and conceive space as filled with such lines. This will be the case if we take two planes, *e.g.*, two parallel plaues, and join every point in one with every point in the other. Now the points in a plane form a two-fold system, and it therefore follows that the system of lines is four-fold; in other words, space regarded as a plenum of lines is four-fold. The same result follows from the consideration that the lines in a plane, and the planes through a point, are each two-fold.

Again, if we take a sphere as our element, we can through any point as a centre draw a singly infinite number of spheres, but the number of such centres is triply infinite. Hence space as a plenum of spheres is four-fold. Aud generally, space as a plenum of surfaces has a manifoldness equal to the number of constants required to determine the surface. Although it would be beyond our present purpose to attempt to pursue the subject further, it should not pass unnoticed that the identity in the four-fold character of space, as derived, on the one hand, from a system of straight lines, and on the other from a system of spheres, is intimately connected with the principles established by Sophus Lie in his researches on the correlation of these figures.

If we take a circle as our element, we can around any point in a plaue as a centre draw a single infinite system of circles; but the number of such centres in a plaue is doubly infinite; hence the circles in a plane form a three-fold system, and as the planes in space form a three-fold system, it follows that space as a plenum of circles is six-fold.

Again, if we take a circle as our element, we may regard it as a section either of a sphere, or of a right cone (given except in position) by a plane perpendicular to the axis. In the former case the position of the centre is three-fold; the directions of the plane, like that of a pencil of lines perpendicular thereto, two-fold; and the radius of the sphere one-fold; six-fold in all. In the latter caso, the position of the vertex is three-fold; the direction of the axis two-fold; and the distance of the

plane of section one-fold; six-fold in all, as before. Hence space as a plenum of circles is six-fold.

Similarly, if we take a conic as our element we may regard it as a section of a right cone (given except in position) by a plane. If the nature of the conic be defined, the plane of section will be inclined at a fixed angle to the axis; otherwise it will be free to take any inclination whatever. This being so, the position of the vertex will be three-fold; the direction of the axis two-fold; the distance of the plane of section from the vertex one-fold; and the direction of that plane one-fold if the conic be defined, two-fold if it be not defined. Hence, space as a plenum of definite conics will be seven-fold, as a plenum of conics in general eight-fold. And so on for curves of higher degrees.

This is, in fact, the whole story and mystery of manifold space. It is not seriously regarded as a reality in the same sense as ordinary space; it is a mode of representation, or a method which, having served its purpose, vanishes from the scene. Like a rainbow, if we try to grasp it, it eludes our very touch; but, like a rainbow, it arises out of real conditions of known and tangible quantities, and, if rightly apprehended, it is a true and valuable expression of natural laws, and serves a definite purpose in the science of which it forms part.

Again, if we seek a counterpart of this in common life, I might remind you that perspective in drawing is itself a method not altogether dissimilar to that of which I have been speaking; and that the third dimension of space, as represented in a picture, has its origin in the painter's mind, and is due to his skill, but has no real existence upon the canvas which is the groundwork of his art. Or again, turning to literature, when in legendary tales, or in works of fiction, things past and future are pictured as present, has not the poetic fancy correlated time with the three dimensions of space, and brought all alike to a common focus? Or once more, when space already filled with material substances is mentally peopled with immaterial beings, may not the imagination be regarded as having added a new element to the capacity of space, a fourth dimension of which there is no evidence in experimental fact?

Professor Huxley, in speaking on the causes of evolution to the Anthropological Department, said:—

When I first knew the British Association the *locus* of disturbance in it was the Geological Section. All sorts of terrible things about the antiquity of the earth, and I know not what else, were being said there, which gave rise to terrible apprehensions—terrible apprehensions! The whole world, it was thought, was coming to an end, just as I have no doubt that, if there were inhabitants in Antrim in the middle of the tertiary epoch, when those great lava streams burst out, they would not have had the smallest question that the whole universe was going to pieces. Well, the universe has not gone to pieces. Antrim is, geologically speaking, a very quiet place now, as well cultivated a place as one need see, and yielding abundance of excellent produce; and so, if we turn to the geological section, nothing can be milder than the proceedings of that admirable body. All the difficulties that they seem to have encountered at first have died away, and statements that were the horrible paradoxes of that generation are now the commonplaces of schoolboys. At present the *locus* of disturbance is, I hear, to be found in the Biological, and more particularly in the Anthropological sections. History repeats itself, and precisely the sort of terrible apprehensions which were expressed by the aborigines of the Geological section in long, far back time is at present expressed by those who attend our deliberations. The world is coming to an end, the basis of morality is being shaken, and I don't know what is not to happen if certain conclusions which appear probable are to be verified. Well, now, whoever may be here thirty years hence—I certainly cannot—but, depend upon it, whoever may be speaking at some meeting of this department of the British Association thirty years hence will find, exactly as the members of the Geological section have found, on looking back thirty years that the paradoxes and conclusions, and other horrible things that are now thought to be going to shake the foundations of the world, will by that time have become parts of everyday knowledge, and will be taught in our schools as accepted truth, and nobody will be one whit the worse. The considerations which I think it desirable to put before you in order to show the foundations of the conclusions at which I have very confidently arrived, are of two kinds. The first is a reason based entirely upon philosophical considerations, namely, this—that the region of pure physical science, and the region of what specially constitute humanity, and those other matters in which we are more particularly interested, are apart, and that the conclusions reached in the one have no direct effect in the other. If you acquaint yourself in the slightest degree with the history of philosophy, and with the endless variations of human opinion that have taken place, you will find that there is not a single one of those speculative difficulties which at the present time torment many minds as being the direct product of scientific thought, which is not as old as the times of Greek philosophy, and which did not then exist as strongly and as clearly as they do now, and arise out of considerations connected with merely philosophical ideas. Whoever admits these two things, as everybody who looks about him must do, whoever takes into account the existence of evil in this world and the law of causation—has before him all the difficulties that can be raised by any form of scientific speculation. These two points have been occupying the minds of men ever since man began to think. . . . Palæontology tells us, if we go back in time, that the great majority of animals have had a past history, that they occurred in epochs of the world's history far removed from the present, and when we have acquired all that knowledge which we may enumerate under the heads of anatomy, physiology, and distribution, there remains still the problem of problems to the zoologist, which is the study of the causes of those phenomena, in order that we may know how those things came about. All these different forms of knowledge and inquiry are legitimate subjects for science, there being no subject which is an illegitimate subject for scientific inquiry, except such as involves a contradiction in terms, or is itself absurd. Indeed, I don't know that I should go quite as far as that at present, for, undoubtedly, there are many benighted persons to whom topics that are at present the subjects of inaugural addresses will become what we have been in the habit of calling by hard names. If we have four dimensions of space we may have forty dimensions, and that would be a long way beyond my powers of imagination. I should, therefore, not like to draw too closely the limits as to what may be contradiction to the best established principles.

THE DIVINING ROD.

Mrs. De Morgan once communicated to this journal an instance of the use of the divining rod, in which other than subjective phenomena were manifested, for the rod bent and twisted in an abnormal way under the eyes of critical spectators, in addition to being successful in its anticipated results. We have received the following letter on the same subject:—

To the Editor of "The Spiritualist."

Sir,—In Vol. X., p. 292, Mrs. S. E. De Morgan gave a very interesting account of the divining rod. I happened to be looking over Vol. XIV., p. 47, of *The Cottage Gardener* for 1855, and found an account given on the same subject, from which I send you an extract for publication, if you think it would add to the pleasure of the readers of your valuable paper.

The editor commences by stating:—

"We are quite as sceptical as to the truth of this mode of discovering the treasures of the earth as any of our readers can be, but our scepticism is founded upon that unstable consideration that we cannot explain why the dowsing fork is influenced as is alleged. Such consideration is unstable, because the world must be universally sceptical about everything if nothing were to be believed the causes of which could not be explained. Why the magnet points to the north, who can say? Why sealing-wax becomes electric by friction, who can explain? Why one rose is scentless and another perfumed, who can tell?

"Rhabdomancy, or divination by a rod, is no modern invention, for obscure allusions to it are found even in the Old Testament, and its efficacy in discovering springs of water and veins of metal has had believers among those whose names are favourably known in the annals of science.

"George Agricola, the German metallurgist of the sixteenth century, John Sperling, and Theodore Kirchmaier, Richelet, and Morhoff, the well-known chemist, were all believers in the power of the divining rod. M. Thouvenot and the Marquis le Gendre published works in which they explained the power; whilst our own countryman, Price, in his *Mineralogia Cornubiensis*, in 1778, records many instances of the rod's successful employment. Even Linnæus bears testimony to the same fact, for he relates that, hearing his secretary extolling the virtues of his divining rod, he concealed a purse containing 100 ducats under one of the plants of crowfoot, or buttercup, growing in a meadow. The company, with Linnæus, so trampled over the meadow, that Linnæus could not detect where he had hidden his ducats. His secretary's wand pointed out the place, and Linnæus winds up his statement with the observation—'Another such experiment would suffice to make me a proselyte.'"

Mr. Phippen relates the following as facts within his own knowledge:—

"The next fact we shall mention took place on the premises of Mr. Arthur Phippen, the well-known surgeon, who resides at Wedmore, near Wells, in Somersetshire. On Tuesday, the 10th September, in the present year, a person named Charles Adams was brought from Rowberrow, near Shipham, to dowse for water. Adams is forty-three years of age, and has practised dowsing since he was thirteen, in the course of which time he has been accessory to the sinking of upwards of 100 wells. To prepare for his experiment, he went to a hedge, accompanied by our correspondent, and cut from it a forked white thorn twig of this year's growth, about eighteen inches long in each stem. He then entered the garden, and walked about, with his apparatus projected in the usual way, to search for water. He had walked but a few paces over the soil, when the fork was repelled, and the position of the spring discovered. This spring he traced east and west to a considerable distance, until he arrived over a covered well, of the existence of which he was totally ignorant, and there the instrument became so much agitated that it required a strong pressure to keep it down.

"All the spectators, including a reverend divine and our correspondent, successively held one of the branches or stems, and every one of them was convinced by the resistance made to his effort that the ceremony was no delusion. The next experiment was made in the kitchen, the floor of which is covered with stone, and under which there are no springs. In the absence of Adams three hats were placed, crowns upwards, on the floor, at equal distances, and under the centre hat were placed three silver spoons. Adams was then called on to exhibit. To the two empty hats the dowsing fork was immovable, but when held over the centre hat, which covered the spoons, it was driven back towards the breast of the operator, just as when the presence of water was indicated. There was still another experiment on the same occasion. The three hats were placed again on the floor, the first covering a small diamond pin, the second three silver spoons, and the third a gold watch, chain, and seals. The first and second hats produced a powerful effect on the dowsing fork—that which covered the diamond pin being by far the more powerful, while that which covered the watch, chain, and seals was but slight, being hardly perceptible to the different witnesses of the exhibition. Adams, who is a very sober, industrious man, can produce testimonials of his ability and success in the extraordinary process from many persons of the highest respectability in the county of Somerset.

"We will add but one fact more to those which we have already

stated. The experiment took place on the premises of Mr. John Barrow, one of the magistrates of the district, a gentleman in every way superior to the influence of vulgar prejudice, but at the same time too enlightened to shut his eyes with obstinate incredulity against anything capable of experimental proof. On Monday, the 9th of September last, in the presence of Mr. Barrow himself, of our correspondent, and of several other gentlemen, Thomas Tyler, of Latchem, a village near Wedmore, a man seventy years of age, performed the same operation, that of dowsing for water, with the same success.

"Amongst other experiments which proved the success of the *Virgula Divina*, or divining or dowsing rod, in the discovering water, coal, and ores, Adams, the dowser, to whom we have before alluded, stated that he had recently been sent for by the Rev. Mr. Foster, at his seat near Lodbury, in Gloucestershire, to give advice on the subject of procuring water, that gentleman having sunk a well full sixty feet in depth without arriving at a drop of water. Upon dowsing Adams quickly discovered a spring within six feet of the wall of the well, which spring he conjectured to be about twenty feet under the surface, and on descending to that distance in the well he perceived oozing of water from the side. He accordingly recommended his employer to make an arch, of three feet by two feet in width, and six feet in length, from the spot in the well whence the water oozed, and that being accomplished, the workmen found an abundant supply of excellent water, which speedily filled the well to the extent of forty feet." X.

Northwitch, August 16th, 1878.

A CATHOLIC PRIEST ON SPIRITUALISM.

(*From "The Nottingham Daily Express," August 12th.*)

A lecture was delivered at the Roman Catholic Church, Leen-side, Nottingham, on Sunday evening, by the pastor, Canon Harnett, on the much-debated subject of Spiritualism. The lecturer began by saying that the local press had, during the past week, called attention to the subject by the publication of a long letter, in which the writer expatiated on its advantages, and this was the reason why he ventured to bring the subject before his congregation. It is often stated in these days of incredulity that there is no devil, or, if there be, that he lacks the power to interfere in human affairs. Those who made such statements showed how much they needed instruction on the relations existing between the invisible and visible world. The Catholic Church leans to few things more decidedly than to [the close, constant, and universal action of supernatural influences on the inward and outward man. These influences are often manifested by accompanying signs. From the days of the Apostles down to our own there have been frequent indications of God's abiding presence and working in His church—the Communion of Saints. Take away what may be called the fabulous and the doubtful, and there is still sufficient to show, in the words of the Psalmist, that God is "wonderful in His saints." The life of St. Mary Magdalene, of Pazzi, exhibits a picture of extraordinary communion with the supernatural world, yet she is but one specimen of what may be seen in hundreds upon hundreds of the lives of saints venerated in the Catholic Church. Not less certain and continuous are the agencies of the spirits of darkness among men on earth. The natural qualities and powers of a pure spirit are far beyond what we possess, even beyond what we can comprehend. The spirit of man pent up in a body is clogged and bowed down by the material mass which it animates. It sees, hears, thinks, knows, acts through matter. Within its own plastic clay-cage it works at will, but outside the bars of that cage it can do nothing. Not only is it hampered in its power of action on outward objects, but even in the exercise of that faculty which is proper and essential to itself, and which we call understanding or intellect, outside the region of matter, it can rise but little, and see but dimly. Not so a pure spirit which is perfect in every attribute of his nature, not needing time to grow up to his full height of knowledge and power. His intelligence embraces an immense extent of objects, and the whole world is open to his keen glance. He can move from place to place without the least fatigue and with a rapidity far exceeding that ascribed to the motion of light. His power over matter is very great, acting on it in an endless variety of ways. He can assume visible forms, and produce sensible effects of the most extraordinary kind, far surpassing any human power. In attributing these natural powers to pure spirits all theologians of every school are agreed. They also maintain that the pure spirits, or angels, who kept not their principality, while in their fall losing all grace for ever, yet retained their natural gifts unimpaired. The visible effects, however, of diabolical agency on a stupendous scale are not so common, because they cannot use that natural power except by Divine permission. God sometimes permits them to exercise that power for the trial and greater merit of good men, and for the punishment of the wicked. Of the former kind we have examples in the lives of S. Mary Magdalene, of Pazzi; S. Francis, of Assisi; S. Francis Xavier; S. Peter, of Alacantara, and many others. But no example is more striking than that recorded in the Bible itself in the Book of Job. Numerous other examples of the extraordinary power of evil spirits are found in the Scriptures both of the Old and New Testament. The malignity of the rebel angels is very great; they have lost all goodness and are now confirmed in evil; their constant sin is the direct and formal hatred of God; they hate His justice, which lies so heavy on themselves. They hate man, and have the power of inflicting on him great evils. They try to work out his destruction by their immediate action on him, and by exciting creatures to do him mischief. As regards the infliction of bodily injury, they require a special commission of God. It is the common opinion held by Roman Catholic theologians that each individual has a guardian angel, as well as a particular evil spirit; and the ministry of the former is to preserve from bodily and spiritual harm, to pray for us, to offer our prayers to God, and to combat the evil spirits and to restrain their power. The preacher then went on to describe Spiritualism, and asserted that its efficient cause is altogether preternatural, and its end is to do mischief to men, and especially to destroy the Christian religion.

Correspondence.

[*Great freedom is offered to correspondents, who sometimes express opinions diametrically opposed to those of this journal and its readers. Unsolicited communications cannot be returned; copies should be kept by the writers. Preference is given to letters which are not anonymous.*

THE WORDS OF A GHOST VERIFIED.

Sir,—The following extract is copied from an old edition of *Elisha*, by F. W. Krummacher, published, I believe, by the Religious Tract Society thirty years ago or more:—

"By the death-bed of a highly venerated lady, tried through a series of many years, a confirmed disciple of our Lord, there was seated a friend similarly disposed. The conversation, sweet and delightful to both, enlarging especially upon the hopes of Christians, turned at length upon the individual mutual recognition of the perfected righteous. After they had both of them exchanged their thoughts together upon this point, the invalid concluded the discourse with the observation that she was quite contented to leave the decision of such questions to approaching eternity; upon which, nevertheless, her friend replied that she would fain wish to learn something more clearly as regarded the life of the blessed, and expressed to her sick friend a wish that, if it was possible to do so after her departure from this world, she would in some way make it known to her.

"Struck almost with terror, her friend inquired, 'My dear friend, what is it you demand from me?' 'Well, well, I did not mean what I said so very seriously. Assuredly I do believe with you that nothing will be wanting to us above of that that can make us truly happy and blessed.' Saying which she kissed the lips of her dying friend and left her.

"A few days after this conversation the pious sufferer departed for her spirit home, and her friend was sincerely grieved at her loss, but yet with a joyful hope of seeing her again, and gradually she lost sight of the conversation touching the recognition above spoken of.

"Early one morning, whilst she was still reposing in bed, it happened that suddenly, from within the room adjoining, the door of which was half open, a bright gleam of light burst upon her. As she looked up towards it she beheld standing before her, adorned in celestial glory, her departed friend, who, looking at her with a smile of inexpressible sweetness, said, 'Yes, truly do we meet and recognise above! Oh! what joy did we experience when yesterday our beloved S—— entered amongst us!' After saying which she vanished.

"Trembling in every limb, the lady sprung up, not knowing how she felt—whether she was dreaming or awake. She, however, kept secret within her own breast the scene she had just witnessed, and made inquiry here and there whether a person of the name her friend had mentioned was living in the town or its neighbourhood, and had lately died.

"Nobody, however, could give her the information. She therefore made up her mind that what she had witnessed must have been merely a vision, which had been produced by the recollection of her conversation with her departed friend upon the subject of personal recognition in heaven. Accordingly the whole affair was suffered to pass without further notice.

"It happened, about a fortnight after the imagined morning dream, as she was perusing the columns of some daily journal, her eye caught the following announcement:—'It has pleased the Almighty Arbiter of life or death to summon to the dwelling of Eternal Peace, on the —— of ———, our never-to-be-forgotten father, friend, and brother S——, after a life devoted to the Saviour.' This notice was dated from a place many miles distant from our friend's abode.

"Struck with the utmost surprise and agitation, the lady scarcely ventured to trust her eyes. She read the passage over and over again. Certainly there was the same name which on the aforesaid morning had been announced to her by the lips of the radiant messenger, and the same day of decease which her friend had denoted to her as the day of his entry into heaven.

The affectionate survivor could therefore no longer feel a doubt of the reality of that sweet vision. The invisible world had indeed been unveiled before her view." F. G. Theobald.

Lewisham, London, S.E.

OPINIONS ABOUT OCCULTISM AND SPIRITUALISM.

Sir,—Believing that comparatively few among the great body of Spiritualists have read those very remarkable and most interesting volumes, edited by Mrs. Emma Hardinge Britten, entitled *Ghost Land* and *Art Magic*, I wish, in view of questions bearing upon the relative potency, the tendencies, and distinguishing characteristics of Occultism, as studied and practised in Europe, and of what we call modern Spiritualism, to make a few quotations from the former of these works, showing to what conclusions their author had, after years of study and experience, arrived.

We have the assurance of Mrs. Britten, whose veracity will not, I think, be questioned by intelligent Spiritualists, that the writer referred to was all he professes to have been, and is, in every way, entitled to our fullest confidence.

In her introduction to *Ghost Land*, the editor says:—"The Chevalier de B—— was, as I well know, a member of several Oriental and European societies, where he had enjoyed the privilege of initiation into the ancient mysteries, and opportunities for the study of Occultism rarely open to modern investigators. I had myself witnessed many evidences of this gentleman's wonderful powers as a seer and adept in magical rites, no less than what is now called 'mediumship,' for every conceivable phase of spirit power."

Of himself, he says (*Ghost Land*, page 334):—"I need hardly say my purpose was achieved when I mastered the secret of true occult power. . . . All this, and much more that I am pledged not to reveal, and which in our present corrupt and licentious condition of society would prove a curse rather than a blessing, and convert the earth into pandemonium rather than heaven, I learned, proved, tried, and practised."

So much for the author's knowledge of the nature and scope of occult studies and powers.

As to the moral influence of these studies, he says that the learned men in Germany with whom he was associated as pupil and mesmeric sensitive, in their eager striving for hidden knowledge and power, eliminated as far as possible all human feeling from their hearts and lives.

On page 40 we find the following:—"As the experiments of these grave gentlemen were neither pursued in fun nor mischief, but solely with a view to evolve the *rationale* of a psychological science, I must confess that they followed out their experiments without remorse or consideration for the feelings of others." And again, page 47:—"Somehow they all seemed to me to be men without souls. They were desperate, determined seekers into realms of being with which earth had no sympathy, and which, in consequence, abstracted them from all human feelings or human emotions." And on page 73, the beloved "master" of the writer, his instructor and guide in occult lore and practice, gives the following reply to the sad and anxious question of his young pupil:—"What think you of the death, or rather murder, of Constance Müller, my master?" "Science must, will, and shall have its martyrs, Louis, and woe to the progress of the race when idle emotion erects itself to match the interests of science."

Constance Müller was a beautiful girl who had been murdered by a Russian nobleman, much given to the study of occult arts, "for the purpose of proving whether her atmospheric spirit, violently thrust out of the body in the vigour of vitality, could not continue hovering around the scene of death, and make manifestations palpable to the sense of sight and sound."

Of course, no one supposes that the study and practice of magical arts necessarily leads to moral results as disastrous as those indicated above; but when asceticism and estrangement from the common interests of humanity are essential to the attainment of knowledge which is to be kept secret, and of powers not in themselves helpful, either practically or in the way of education and general enlightenment, to the mass of mankind, the tendency of such a life can hardly be healthful, mentally or morally.

I will not fill space with words of my own, weightless as compared with those of the learned and experienced writer from whom I quote, but will simply extract marked passages, as I find them in *Ghost Land*, leaving my readers to arrange, connect, and reflect upon the statements made.

Page 92, I find:—"No page of retrospect excites in me more surprise than the inferiority of the results obtained through magical processes, when compared with those which seem to arise spontaneously, as an organic peculiarity of certain individuals." . . . . "Any powerful 'spirit medium' of this present day could have displayed more phenomena by aid of a dancing table in five minutes than many of these really earnest students could have evolved by magical processes in five times five years of profound occult experiments." . . . . "The sum of all, to my apprehension, is that man, to obtain this boon, must be born *a natural magician*, or in more familiar phrase, 'a good spirit medium.' Also that clairvoyance, clairaudience, seership, and all those spiritual gifts by which human beings can attain the privilege of communion with spirits, consist in certain organic specialities of constitution, naturally appertaining to some individuals, and latent in others, though susceptible of unfoldment by modes of culture. I believe that forms, rites, and invocatory processes, fumigations, spells—in a word, the science and practice of magic—may be applied as means to aid in this communion, and are especially potent in enabling the operators to exercise control over lower orders of spirits than themselves; but I affirm that they are inoperative to open up the communion as a primary means, and that without the services of a good seer, clairvoyant, or spirit medium, magical rites alone cannot succeed in evolving spiritual phenomena."

Page 324:—"I know, too, that without circles, invocations, or formulæ of any kind, my own beloved friends could reach me from the far side of that mystic river, on the shores of which they had disappeared from my straining eyes, but from whence they have all returned, one after the other, keeping watch and ward over my stormy life, with even more than the fidelity of their earthly care and tenderness."

"In scaling these tremendous ladders of knowledge, I have experienced many a fearful fall, paid many a heavy penalty. Again and again I have returned from these awful pilgrimages with a wounded, bruised, and wayworn spirit; but ever, as I come, I have found rest, peace, and consolation in the loving ministration of earth's enfranchised spirit friends. I have learned to believe that communion between the denizens of this planet and her spirit spheres should constitute the highest, purest, most normal and healthful exercise of our soul's religious faculties. Mortals have but an imperfect realisation of this sublime truth amidst the folly, fanaticism, wrong, and imposture that have disgraced the movement miscalled Spiritualism—a movement which has served to externalise much of the darkest features of human nature, but, as yet, has been permitted to do little more than point to the mines of unwrought treasure that lie in the possibilities of that communion. As yet it is all too redolent of human shortcomings. I dare not pause now to hint at what we may hope for in the better day of spiritual communion, when its *modus operandi* shall be understood by science, and its sublime revelations be received in the spirit of religious reverence."

If the foregoing extracts be deemed worthy of the space they occupy, and prove acceptable as throwing light upon vexed questions, I will add, at a future time, such as I have at hand from *Art Magic*, and which are, I think, even more striking and suggestive than those I have now given.

Louisa Andrews.

3, York-road, Brighton.

The offices of the National Association of Spiritualists will be reopened on Monday, 26th inst.

The belief in another world, in the nearness of that world, and in a channel of communication between the two, is a belief which has existed in all times and places, and among all the nations of the earth. It is one of the primal faiths of man, instinctive and intuitive, and therefore natural to the human race.—*Bacon*.

Extraordinary Memory.—A little guide to Uckfield, Buxted, and neighbouring places, says:—"Before we pass away from Buxted we must notice that singular character, George Watson, the Sussex calculator, who was born in this parish in 1785. His powers of memory and calculation were truly wonderful, but in other respects he was almost an idiot. He was a farm labourer, extremely ignorant, and unable to read or write; yet he could rapidly perform difficult calculations in arithmetic. The most extraordinary circumstance, however, was his power of recollecting the events of every day from an early period of his life. Upon being asked upon what day of the week a given day of the month occurred, he would immediately name it, and also mention where he was, and what was the state of the weather. His replies were invariably correct."

Weak Witnesses.—A distinguished lecturer recognised at Mrs. Bennett's *séance* in Boston his own departed wife fully materialised—would swear it was her—but when convinced by overwhelming evidence that a confederate personated his beloved companion, he reluctantly admitted that his senses had been completely deceived. A promising young journalist, trained in his profession to habits of close observation and penetrating scrutiny, saw a lovely Indian maiden at Mrs. Bennett's, fell in love with her, and they were betrothed, he presenting her with a beautiful ring, and believing he had a spirit bride. When this poor fellow saw the metamorphosis of his lovely Indian into a very common flesh and blood confederate of Bennett, and beheld the trap-door which was an essential part of the transformation scene, he received such a shock as but few can recover from and retain their senses.—*Religio-Philosophical Journal*.

The Abolition of Cabinet Seances.—The *Religio-Philosophical Journal* of Chicago shows its appreciation of the wise steps taken in England in the direction of abolishing cabinet *séances* by the following paragraph:—"It appears from the London *Spiritualist* of June 5th that Mr. Rita, who is now holding *séances* in London, is a most remarkable medium for physical manifestations. Several prominent gentlemen and ladies were present at a *séance* held by him, in a darkened drawing-room, which he had never before entered, and his hands were firmly held by two sitters. Under these conditions phosphorescent lights were produced, musical instruments were carried about the room, and materialised spirit hands touched everybody present. Though the hands of all the sitters were interlinked throughout the *séance*, a materialised form showed itself four or five times over the centre of the table, robed in white, and holding a light in one of its hands. A *séance* under such conditions, two of the sitters holding the hands of the medium, cannot otherwise than be satisfactory. Where is there such a medium in this country?

BOOKS ON SPIRITUALISM, PSYCHOLOGY, MESMERISM, ANTHROPOLOGY, AND BIOLOGY,

Representing the English and American Literature of Spiritualism, obtainable of W. H. Harrison, *Spiritualist* Newspaper Branch Office, 38, Great Russell-street, Bloomsbury, London, W.C.

[For purposes of mutual convenience the above office has been rented on the premises of the National Association of Spiritualists, but the Association and *The Spiritualist* Newspaper and publishing business are not in any way connected with each other.]

THE DEBATABLE LAND, by the Hon. Robert Dale Owen, formerly American Minister at the Court of Naples. A standard work containing interesting and well-authenticated facts, proving the reality of spirit communion. It also contains an elaborate essay defining the author's views of the relationship of Spiritualism to the Christian Church. 7s. 6d.

FOOTFALLS ON THE BOUNDARY OF ANOTHER WORLD, by Robert Dale Owen. An excellent book of absorbing interest, replete with well-authenticated narratives, describing manifestations produced by spirits. 7s. 6d.

REPORT ON SPIRITUALISM, by the Committee of the Dialectical Society. This committee consisted of literary, scientific, and other professional men who investigated Spiritualism for two years without engaging the services of any professional medium, after which they published the report. Original edition, 15s.; moderately abridged edition, 5s.

RESEARCHES IN THE PHENOMENA OF SPIRITUALISM, by William Crookes, F.R.S. The best work ever published to scientifically demonstrate the reality of some of the physical phenomena of Spiritualism, 6s.

MIRACLES AND MODERN SPIRITUALISM, by Alfred Russell Wallace, F.R.G.S. This book contains a masterly argument in reply to Hume's "Essay on Miracles." It also records a large number of interesting spiritual manifestations, and contains some of the personal experiences of Mr. Wallace. 6s.

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