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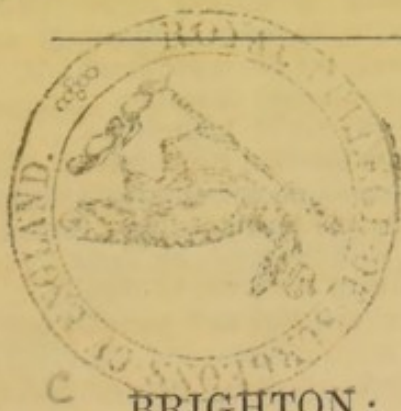
ON
THE ORGANS OF THE SENSES
AND THE
CEREBRAL FACULTIES CONNECTED
WITH THEM.

AN ESSAY READ BEFORE THE
BRIGHTON AND SUSSEX NATURAL HISTORY SOCIETY,
JANUARY 12TH, 1860,

And Published at the especial request of the Members present.

BY
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ON THE ORGANS OF THE SENSES, AND THE CEREBRAL FACULTIES CONNECTED WITH THEM.

There are many mysteries in the study of the Inanimate Creation. We encounter in it, at every step, a thousand things, whose nature is hidden from us; and often-times can do no more, than discover, and demonstrate, the bare existence of incomprehensible secrets. But we feel, that they have a termination. We can everywhere distinctly touch ground. We know there are defined boundaries about us, though we cannot ascertain their extent; and are conscious, that all we seek to unravel, is contained within itself.

It is quite another thing when we come to investigate Creation endowed with Life. This has like mysteries with the other; but its boundaries, where they seem at first to narrow, suddenly widen out again, and are lost in infinity. We can discover no termination. At a single step, we find ourselves in a fathomless abyss, from the confines of the material world; and the transition is totally viewless and imperceptible.

I. We experience this, in a remarkable degree, in the study of those parts of the living body which we call the **ORGANS OF THE SENSES**. In no structures, perhaps, in the Animal Kingdom, is displayed more nice contrivance, or a more delicate organization. Nowhere can we find organs of so high a stamp, whose physical functions are as capable of accurate demonstration.

A. Their *Structure* is of admirable beauty. It is, in all of them, upon a strict unity of plan. They each consist of two essential parts:—1st. A *Mechanical Apparatus*, calculated for the purpose of isolating, and defining, external impressions, and of transmitting them:—and 2nd. A *Conductor of Nerve*, whose peripheral expansion is in contact with the Mechanical Apparatus, the other extremity either terminating in the brain, or being in direct communication with it.

1. The *Mechanical Apparatus*, however modified, is always characterised by one peculiar element,—a plexus or network of capillary vessels, with which it invariably stands in very intimate relation. In other respects, it is of various construction, according to the kind of Impression it is intended to transmit; and it is much more complicated in the organs of some senses than of others. In the organs of Taste and Smell, it merely consists of a soft layer of mucous membrane, investing the spread extremities of the Nerve. The organ of Touch has the Nerve, for the most part, invested with skin instead of mucous membrane; and its Mechanical Structure is more complex, from its occupying a wide extent of surface, whose different parts vary in their texture, appendages, and properties. But the Senses of Hearing and Sight have the Mechanical Apparatus highly organized, and complicated

to a very great degree. In the lower forms of animal life, however, the organs of these more delicate Senses are of far simpler Mechanical construction; much more resembling the organs of Touch, Taste, and Smell, in ourselves, than the higher organs of which they are, in reality the analogues.

2. Similar points of resemblance and variation are observable in the form and disposition of the *Conductor of Nerve* belonging to the organs of the Senses. These Nerves all communicate at one extremity with the Mechanical Apparatus, at the other with the Brain, either directly, or through the spinal cord; they can each be traced, when followed to the utmost in the substance of the Brain, to one or other of the portions of grey matter, in which their ultimate fibres communicate with the colored corpuscles or nucleated nerve-cells peculiar to the ganglionic structure; and every one of them, at its peripheral termination, where it comes in contact with the Mechanical Apparatus, is in close relation with the network of capillary vessels just now spoken of: the plan in each being the same, but the details varying according to the function to be subserved.

B. The same general unity which characterises the structure of the Organs of the Senses, marks their *Uses* also. They are all destined, to convey what we denominate Impressions, from the outward, material world, to the minds of living beings; and they therefore constitute a series of links between the visible and invisible world, between substance and spirit, mortality and immortality.

1. The *Impressions* just named, are all of analogous origin, being immediate resultants from what we term the properties of matter; and from all such properties, and those only, as appear to consist in action. Light, color, sound, mechanical movement, caloric, and those chemical, cosmical, and mechanical processes which impart tastes, smells, and sensations, are not substantive existences, but active workings, living expressions of the forces both of organic and inorganic matter, all probably partaking of the vibratory or pulsatory nature which has in some of them been demonstrated. And all these actions, thus parallel in their nature, are such, that when imparted by the appropriate mechanical apparatus to the appropriate nerve, something characteristic of each action takes place in the nerve and the parts it leads to, which something we call an Impression.

2. The *Mode in which Impressions are communicated* by their respective organs, is especially distinguished by its uniformity. Every suitable outward action that impinges on the mechanical apparatus proper to either organ of sense, imparts to it an impulse which it conveys to the nerve. It is of minor importance whether such impulse has to traverse an inch or more of optical media, or a delicate chain of bones attached to a tympanum, skin or mucous membrane half a line in thickness, or several inches of hair, whiskers, or claw; the main fact is, the transmission of the impulse through a suitable apparatus to the nerve. Up to this point it does not appear that the respective impulses become changed in their nature. The mode of their transmission so far is as perfectly intelligible and demonstrable as the nature of the impulses themselves. But when the nerve receives them, all such demonstration ceases; the impulse can be traced in its own shape no farther; we cannot shew what takes place; the process of transmission inwards,

though not positively hidden, becomes obscure ; and it is only a matter of inference, that what we denominate an Impression, consists in or arises from some change or action set up in the Nerve by the impulse communicated to it. The Impression, thus originating at the peripheral expansion of the Nerve, is conducted by it to whatever part or parts of the Brain its fibres terminate in, and cannot be followed as a vital action beyond this, its final destination.

3. As it is only such outward processes as are communicated to suitable nerves, that succeed in making the impressions necessary for mental recognition, it is certain that many similar processes go on which are never recognized, simply because they are never communicated to the fitting nerves, and it is conceivable that many processes may go on in nature which we have no nerves adapted to receive impressions from, consequently, that as far as those processes are concerned, creation is to us silent and dark. It is, I say, conceivable ; but it is not demonstrable ; and as to any direct mental recognition of such processes, it can neither be proved, nor even its probability asserted. It is, in fact, quite imaginary ; as are also all supposed communications with any physical power in the universe, which do not come in by the channels of sense.

For it cannot too clearly be borne in mind, First, That the organs of the senses transmit to us a vast number of outward impressions, known as *Objective*, sometimes in an extremely subtile manner, sometimes without our being conscious of them, so that we constantly find impressions in our minds without being at all aware whence they come ; Secondly, That an equally vast number of impressions, which seem exactly as if they had been sent inwards in the usual way as correct representations of outward things, arise from mere altered action of the nervous tissue itself, not set up by impulses duly communicated through the appointed apparatus, but by injury, disease, or changed vital action of any kind, either directly or indirectly affecting any portion of nerve involved in the production or conduction of the impressions in question ; impressions so arising being called *Subjective* ; and Thirdly, That as the perfect production of impressions from without is entirely dependent on the correctness both in kind and extent of the action set up in the nervous tissue, and as this action must be presumed to be very delicate in its nature and therefore easily deranged, a large proportion of impressions must be produced which do not strictly and completely tally with the impulses sent inwards, so that impressions may, so far as they are objective, be deficient, exaggerated, or fallacious, and subjective parts may be so joined on to them, that it is impossible for the mind to distinguish one from the other. These three enormous sources of fallacy, coupled with the strange effects of "natural magic," are amply sufficient to account for all the involuntary mistakes and misrepresentations, and all the sincere reports of the supernatural and the improbable, which abound in the history of our modern era.

These conclusions naturally result from the certainty of a well-ascertained property of nervous tissue ; namely, that it is not endowed with general sensitiveness ; but that each part receives and communicates its own peculiar kind of impression, and no other, whatever stimulus or disturbances it may be exposed to. Thus, if the optic nerve be irritated, injured, or interfered with by any diseased action,

pain is not produced, but impressions of light; some change in the nerve being caused, which differs more in degree than kind from that induced by impressions communicated to it in the legitimate way. So the auditory nerve, however irritated, communicates sounds only, and not sensation; and in like manner with all the rest, which observe strictly the same law, as has been repeatedly proved by abundance of evidence derived from the phenomena both of health and disease.

II. This general sketch of the Structure of the Organs of the Senses, their Uses, and the nature of the Impressions they communicate, shews their complete analogy with one another in all leading points: subject only to modifications in accordance with the particular conditions and requirements of each. They present, moreover, the same distinctions of clearness and mystery. It is, in each instance, the Mechanical Apparatus, and its Use, and the passage of Impulses through it, that we can understand; it is, in each instance, in the Conductor of Nerve that we can perspicuously trace those Impulses no farther, and where the tract of obscurity commences; and it is always at the Brain that we are stopped in our research by total darkness.

A. I am not sure that these latter Analogies are not more striking than the others. It seems so strange that light and darkness should thus (so to speak) stand side by side; that we should be able to carry our investigations so lucidly up to a certain point, and then be stopped on a sudden as if by a wall. But although we can trace the Impression physically no farther, it is not lost. It re-appears instantly in what appears to be a spiritual part of our being; and it is to this re-appearance that I now wish to direct attention.

Impressions of Sense seem to have two existences. They are seen as actions whose force and description we can estimate, in the Organs of the Senses; and they present themselves also not less certainly to our inward consciousness. In each situation, we can investigate and examine them; but we know not how they pass from one to the other.

I. It may, however, be of use, to examine closely the borders of this tract of darkness; to try and measure, as it were, the extent at least of the obstacle that stays our progress, and press as closely in upon it as we can. To effect this, it is better to take for examination the Impressions of one particular sense; and perhaps those of the Sight are most available for the purpose.

A Visual Impression, in its passage from without inwards, is first transmitted through the different media of the optical apparatus, which, according to the laws of light, forms it into a distinct image, projected on the expansion of the optic nerve. The nerve then receives it, in some way which we cannot understand, and sends it on to the great nervous centre, the Brain; and we then know no more of it, till we find it in the Mind.

In this direction we can proceed no farther; but, setting out from where the Impression seems to re-appear in our minds, we find it as a condition or action purely impalpable, yet universally recognized, and one that we can dispose or treat as we like, and dismiss it, and recall it again, whenever we please. That is to say, we perceive the object, we can at will either continue or cease to do so, and can also at will afterwards recall the feeling experienced. This perceiving of an object clearly involves some kind of action, which not being physical, we must

I suppose call mental; the power of exerting which we must therefore speak of as a mental faculty; and the act of doing so as *Perception*. Now vision may take place without perception. Images of outward things may be duly projected on the retina, corresponding changes (whatever they consist in) may be set up in the retina, and communicated by the optic nerves to the brain, and may there produce their appropriate effects on its vital functions or actions; and yet not be perceived by the mind. The person may be unconscious of them, partially conscious of them, or completely so. It appears, then, that the last material trace of an optical impression, consists in some change in the living action of the appropriate portion of the brain; and that the earliest mental trace of it consists in an act of attention, by which the person becomes conscious of this change; and between the two an act of perception takes place. It is of secondary moment whether the mental part of the action be aroused by volition from within, or by the intensity, suddenness, or other striking property of the images from without; the main fact is, the act of perception being the first mental step, leading on to other intellectual processes.

Thus is marked out the whole known progress of a Visual Impression in its passage inwards to the mind—Without, it can be traced distinctly as an optical image, to the spot where it impinges on the retina, and can be recognised as a vital action, proper to the nervous tissue, but whose nature is not understood, up to the nervous centre. Within, we find it received as an Impression, by a perceptive faculty, whose action seems to consist in a consciousness of the change propagated to the nervous centre. And it is between this consciousness, and this vital change in the nervous tissue, both of which we can partly understand, that the obscurity lies; since we are utterly at a loss to know, how that which is purely immaterial and spiritual, can act or be acted on in connection with even the vital conditions of substantial matter. This, then, is the exact measure of the obstacle; from inward consciousness to what I suppose we must call bodily sensation: this the question raised, How do we become conscious of the ultimate nervous change? a question which it is impossible to answer. We may vary the terms and expressions, but I do not think we can go closer than this.

2. In like manner, the impressions proper to the other senses can in each instance be clearly demonstrated up to the point of impinging upon the peripheral developement of their appropriate nerves, and can be traced as some description of nervous change or action as far as the innermost nervous centres:—they can as clearly be recognised in the mind at the moment of their perception:—so that, in each case, from one of these two acts to the other, is the exact measure of whatever is obscure and unknown in the process of transmitting impressions from the outer world to our minds. This process, so far as we can appreciate, is instantaneous; therefore the unknown part of it is not a matter of time or space; nor can any mechanical or chemical force be traced in it.

The act of perception appears to consist, in mental consciousness of some induced state or action of nervous tissue. We do not perceive objects themselves, or their properties, but the condition of the nerves to which they give origin. That this is so, we become satisfied more by reflection than anything else. It is most obvious in the sense of touch, and in common sensation: wherein feelings of various kinds, simulating

those caused by external impressions, are often produced by constitutional and unknown causes. The fact, also, that the other special nerves, when inflamed, congested or irritated, communicate feelings like those of impressions derived from without, proves the same. Nor must we forget the production of seeming sights, sounds, smells, tastes, and sensations, of various kinds, without external cause, merely from morbid conditions of the brain. From this proposition necessarily flow several interesting conclusions.

The situation where such change goes on, must be, the peripheral expansion and conductor of nerve, and the part or parts of the brain with which it is connected. There must therefore be an appropriate portion of the brain for every external impression, that is to say, where the nervous change peculiar to that impression, takes place. We are not in a position to say which these portions are; it is very possible that some of the superficial delineations of Phrenology may ultimately be found correct; it is possible that there may be successive steps or processes of mere primary perception, or rather of the nervous changes which being observed constitute perception, just as the white fibres of some of the nervous conductors can be traced first to a small grey centre of ganglionic matter, then, with the addition of many new fibres, to a larger grey centre, and so onwards; it is still more possible that there may be the greatest difficulty in determining what portion of the grey central matter is the true ultimate destination of any particular fasciculus of the white conducting fibres; but the uncertainty of these details, important as they are, cannot be held to invalidate the main proposition to which all facts seem to lead us, which is, that each particular set of the expressive nervous changes so often alluded to, takes place in its own particular part of the brain.

From hence it follows, that differences in perceptive power between man and man, are not psychical, but cerebral; not peculiarities attached to the powers (whatever *they* may be) of his immortal spirit, but true corporeal faculties after all; expressing to us nothing, one way or the other, of his spiritual capacities, but merely furnished to the soul for its allotted time, as a glass to see through darkly, and wherewith to discern such limited parts of creation as are appointed for it. For although it is very possible that the psychical or true spiritual powers of one individual may differ from those of another, we have no physiological evidence of the fact, and the contrary is also equally possible. And we must not assume that of which we have no sort of indication. Whereas we have distinct evidence of great and endless differences between the nervous powers of individuals. Different brains and sets of nerves vary exceedingly in their size, configuration, perfection of structure and developement, degree of nutrition, and the like; and according as each portion of brain is larger or smaller, more or less perfect in its organisation, more or less active in itself, and more or less supplied with the conditions to make it active, so are the nervous changes (or whatever name we please to call them by) peculiar to its own set of impressions, more or less powerful, perfect, intense, or continuous, and obtrude themselves upon our consciousness, retire from it, or are voluntarily observed, accordingly.

Of the nature of these changes nothing certain is known. But there is every reason to believe, that they are not statical alterations,

but actions set up ; and that as long as this action is maintained, so long may the impression it gives the idea of be perceived, and no longer, For it will presently appear, that every one of the properties from which the true primary perceptions are derived, are dynamical, and not statical ; and that existences are merely inferred by the mind from actions perceived or felt. Moreover, vascular activity and determination seems to accompany the presence of impressions, and vascular quiescence their absence, a fact of which we often take advantage in the treatment of disease. *Change*, therefore, is hardly a proper term to apply, except so far as it implies *something going on*.

It is, then, from these changes or actions, when set up in the appropriate portions of the brain, that we learn all that the organs of sense communicate. Without them the material universe would be to us a blank. It is of them that we first become conscious, interpreting their sensations as color, sound, pressure, or whatever the feeling gives us the idea of. And this arrangement is singularly free from uncertainty and variation in its working. We can imagine the sights and sounds and movements taking place in the material universe, to have been of exactly the same nature many thousand years ago that they are now ; but it is excessively wonderful to reflect, that their accurate recognition was entirely dependent on certain delicate actions being set up in precisely the same manner in the brains of so many hundred generations of men, so far removed from us both by time and distance. Yet the most ancient written chronicles contain expressions and imagery, which, allowing for differences in language, customs, and climate, shew that nature appeared to man in those days the same as at present : and in the oldest monuments and works of art existing, some of them wrought 3,000 years ago, we note by the beauty and color and obvious intentions of the work, nay, even by its very imperfections, the identity of human perceptions in distant ages, with our own.

The influence of these actions in the nervous tissue upon the mind, is not confined to that limited portion of them of which we take cognizance by a complete act of perception. There is an immense amount of partial, imperfect, involuntary, unconscious perception, the measure of which probably infinitely exceeds that which is perfect and conscious, and the effects of which, in communicating outward things to our minds, oftentimes in a distorted shape, even aping the supernatural, or as vivid impressions very wide of truth, or disguised as presentiments, intuitions, and coincidences which seem mysterious, it is almost impossible to estimate. Doubtless, the amount varies immensely according to the mental habits of the individual. But in any case the mind receives from without a vast number of imperfectly perceived impressions, wherewith it is largely fed by the organs of sense, and which influence it probably to a greater degree than we are aware of. Furthermore, another very large portion of the impressions coming from without, is never noticed by the mind at all. Such Impressions may be communicated to their proper nerves, and the usual changes in the nervous conductors and centres may be set up ; yet no perception take place ; the individual is not conscious of the change ; takes no heed of it ; is not aware of the numerous images, sounds, or sensations, which have been duly and fully presented to him ; yet these are brought, so to speak, in contact with the mind ; and doubtless produce effects upon it, even

while remaining in the state of *unperceived Impressions*. Whether they contribute to cause mental irritability, or weariness, or unexplained dislikes, or those feelings of mental comfort and satisfaction which sometimes arise without obvious occasion, may be matter for consideration. The main point is, that of the numerous impressions communicated from without to the nervous centres, many remain unperceived, very many more are imperfectly perceived, and only a limited portion receive full mental recognition, and deserve the name of *Perceptions*:—and the mind receives materials from impressions in each condition.

These attempts to come up as closely as possible to the unknown process whereby outward Impressions are communicated to the mind, seem only to result in an extended understanding, or glimpse of an understanding, of the bodily and physiological actions concerned; and in what almost appears like a diminution of our knowledge, or presumed knowledge, of the physical or mental actions. For if the views just put forth be admitted as having in the main some semblance of truth, then those powers of perception which we are accustomed to speak of as mental faculties, and to regard as pertaining to our spiritual part, must be considered as owing all their extent of range and diversity of capacity, not to any diversity of spiritual capacity, a thing whereof we have, so far as I know, no proof or knowledge either for or against, but to physiological differences in certain changes effected in nervous tissue, differences in the kind of change, in the degree or extent of change, and in the perfection and sustainment of it. The pure act of perception or consciousness of these things is mental, or at all events beyond the range of physiology; but its differences in kind, extent, and perfection are owing to diversities in the form, breadth, and degree of perfection, in which these impressions are by the nervous system presented to the individual consciousness, and are therefore physiological.

As far as this view is concerned, then, we have no evidence that the spiritual part of our nature is endowed with separate faculties to receive separate sets of impressions, or that it turns itself in different directions to seek for and receive them; but rather that the different impressions of the things of time and sense come to it, being brought to it through the delicate organization of the nervous system. Therefore, in speaking of the Mental Perceptive Faculties immediately connected with the Organs of the Senses, it will be understood that the capabilities of two actions are implied;—first, of the setting up of some nervous change; and secondly, of the spiritual recognition of such change:—and that, as we have no proof of differences in the capacity of recognition, and very great proof of differences in the powers of setting up the nervous changes, the differences in mental perceptive faculties between one individual and another, must in the present state of our knowledge be regarded as differences in the cerebral portion of his nervous system, and not in his spiritual powers; and consequently, that those faculties will vary (as we find they do) with his bodily state; will grow with his growth; will fail with his bodily decay; and that at the time of his dissolution they will cease, and in so doing make also to cease those differences in perceptive capacity, and consequently in the intellectual powers that depend on perception, which exist in this life between man and man.

Finally, to turn to the consciousness, or purely spiritual cognizance of the nervous changes alluded to, there is not, speaking physiologically, any evidence that there are separate spiritual powers for recognising the several nervous changes pertaining to the respective senses. Moreover, without actual evidence, there is physiological ground for surmising, that the truly spiritual or psychical power of perceiving these changes is one only, whatever its essence. For however diverse the nature and origin of impressions of sense, by whatever wonderfully contrasted apparatus they are transmitted from without inwards, they still, strictly adhering to the analogies dwelt on in the commencement of this essay, are ultimately communicated to a tissue of uniform appearance, structure, chemical constitution, and vital properties; and they are all equally expressed in that tissue by some impalpable kind of change or action. Thus there may be no more difficulty, in the spiritual part of our being recognising such things by a single faculty or power of consciousness, than is experienced by the eye in recognising different gradations of color and shadow, or by the touch in acquainting itself with the vast variety of substances which are presented to it in so many different conditions.

If the communications through the organs of sense were one by one absolutely cut off, until not one was left, there would be no way whatever by which we could receive any information from the material universe; in fact, such a condition, which supposes the cessation of all common as well as special sensation, amounts to the cessation of bodily life; an occurrence in which source after source of outward information is more or less rapidly cut off, silence and darkness, coldness and stillness, take the place of the sounds and colors and the warmth and motion of this outer world, and whatever is purely spiritual within us, set free from the closed circle of physical perceptive powers in which it has been on every side environed without outlet, and to the range of which, vast and wonderful as that seems, it has been strictly confined, finds itself at once freed from that circle, divested of those physical faculties, and consequently of all the powers, limitations, and imperfections, that belong to them, or arise out of them, and whatever its life may then consist in, whatever its powers of knowledge or feeling, whatever its state, without any characteristics capable of recognition by inference derived from physiological analogy, other than a presumed sense of personal identity, and a moral tendency to rest or unrest imparted by the tenor of its actions here.

B. It is now necessary to apply these statements to the particular senses, to see what perceptive powers are attached to each; understanding as included in such powers, a cerebral capacity of taking on certain actions, expressive of outward things, and a power of psychical recognition or consciousness of those actions. It is to the cerebral capacities that I now propose to confine myself, capacities, which for the present purpose I shall take the liberty to call *Receptive Faculties*, as receiving some impulse from without which sets up the characteristic action, in contradistinction from that which is actively perceptive and conscious in noticing these actions from within. The business, then, is, to enquire what *Receptive Faculties* are connected with each of the organs of the senses.

1. The *Sense of Sight* is by some persons imagined to be connected

with Receptive Faculties for the three properties of Form, Size, and Color. But of all these faculties, only that for impressions of Color can strictly be held to pertain of necessity to the Organ of Sight. For perception of Form and Size may take place through the organ of Touch nearly as well in some respects as through that of Sight; and as in each case the mind's appreciation of them is derived from other impressions (when through the Touch from the impression of resistance, when through the Sight from impressions of light and color) so Form and Size do not class in with those primary impressions, and are not the subjects of those receptive faculties, of which alone we are at present in search. In fact, any idea of an outward thing which is capable of being derived from more than one organ of sense, is not one of these primary and elementary impressions. Furthermore, such primary impressions will always be found to represent or result from some physical action; from the cognizance of which actions, existences are inferred; our elementary perceptions being of dynamics, and those of statical properties being a step beyond. So, Impressions of Color, and of Light and Darkness, are the only ones pertaining absolutely to the sense of Sight. Form, and Size, as well as the perception of objects by the so-called "organ of individuality," are inferred from them by mental processes, which, more or less perfectly, according to the capacity of the person for each, come to be effected so rapidly and instinctively as to be mistaken for mere acts of perception.

Color is the first thing which children notice and admire; and attracts savages, idiots, and uneducated minds of all sorts. Light and its privation, with their numerous modifications, proves equally attractive to minds in a primitive state. Whereas Form and Proportion are appreciated in a less instinctive and universal manner, only by educated or by naturally superior minds, and after some experience and observation of the appearances presented by the external world.

Clearly, then, the only Receptive Faculties strictly pertaining to the Sense of Sight, are, one for Impressions of Color, and another for those of Light, Darkness, and their modifications.

With regard to the latter, the impression of them is manifestly distinct from that of Color. The child's first perception of the things around him is that of a confused mass of light and dark and colored objects. The colors first attract his gaze and give him pleasure: and then he begins to notice, as his perceptive powers improve, the shadows of objects, and the varying degrees of light which fall on each; and these it is that indicate to him the forms of things, distances, proportions, and perspective, which by slow steps he learns. Color, and the degree of light, the only primary impressions communicated through the organ of vision, alone delineate all these different points. Form is thus perfectly indicated; the outline of things consisting in nothing more than the line or limit at which some of the endless modifications of light and color abut on one another. Outline is therefore not a primary but an inferred perception. The size of objects is expressed to the eye, like form, by the abutment on each other of the different colors or shadows; the sight encountering and recognising another color or shadow at its line of contact with that first observed. So that it is the mere discriminative recognition of the respective colors or degrees of light in certain situations and directions, where each is, and

where it is not, or rather where something else takes its place, which imparts the ideas of form and size, with their consequents, distance, space, and perspective.

Mr. Nunneley, in his recent very able work "On the Organs of Vision," says (page 33) that color "is the only idea for the conception of which we are absolutely dependent upon the eye." But, with all due deference, I must submit that the idea of pure light and shadow, one equally belonging to the eye alone, is absolutely distinct from that of color. I do not say whether the two things are distinct, but that the ideas of them are; for the impression of color comes to the mind as one of quality, whereas that of light and shadow is one of degree. For in those persons in whom the perception of color is remarkably deficient, we do not necessarily find a deficient perception of objects generally, or their form or size, but often the reverse, which must be expressed to such minds by the simple and primary perception of light and shadow. It is true that the two faculties, often present together, are sometimes wanting together; but it is not very uncommon to meet with persons scarcely able to tell one color from another, who yet can distinguish the softest shadows expressing the form of a piece of sculpture, or the finest architectural tracery, or even who have attained no slight proficiency as engravers or draughtsmen.

Of this, Dr. George Wilson, of Edinburgh, in his "Researches on Color-Blindness," names the following curious instances:—Mr. A. could distinguish the light of the signal-lamps on a railway a long way off, but could not, till he was close upon them, tell whether they were red or green. Mr. E. says, "I am an engraver; and, strange as it may appear, my defective vision is, to a certain extent, a useful and valuable quality. Thus: an engraver has two negative colors to deal with—i.e., white and black. Now, when I look at a picture, I see it only in white and black, or light and shade, or, as artists term it, the effect. I find, at times, many of my brother engravers in doubt how to translate certain colors of pictures, which to me are matters of decided certainty and ease. Thus to me it is valuable." Mr. F., an artist, who in the same way considers that his crayon drawing is the better for his color-blindness, has, when his crayons have been displaced, represented trees with their foliage in red chalk, and put pink crests to the waves of the sea. Admiral G., partially color-blind, recommends that each flag of a given color should be of a particular shape to know it by. Professor H. has sketched in sap-green, believing that it was sepia. Mr. K., an artist, had a pupil who copied a brown horse in bluish-green, painted the sky rose-color, and roses blue. Mr. M., who is a good draughtsman, painted a face muddy-green. And a young lady in a drawing class was obliged to distinguish colors by tasting them. In these instances of color-blindness, there seems no deficiency in the power of perceiving light and shadow, but rather the contrary, as they appear to have been persons fully capable of appreciating form, size, and perspective.

In letting the eye wander over a variety of objects, if the attention is turned to color, the tints alone of the objects are perceived, while the light and shadow are comparatively disregarded. And we cannot then seek for the latter alone without being conscious of a momentary act of attention being required, to turn the mind from the idea of *color* to

that of the *degree of light*. The latter is then sought for in all the different objects around, colors being disregarded, and not to be noted without a separate effort, while the light and shadows alone are dwelt upon. Where no effort either way is made, and the attention is not directed to light or color in this separate manner, but the individual is simply looking about in an ordinary way, both are instinctively noted simultaneously, as far as the capacity exists for each.

It thus appears, that two Receptive Faculties or Capacities pertain to the Sense of Sight: one for equally combined colors in the form of white light, the other for colors unequally combined or separately. That these capacities are practically distinct, the phenomena of color-blindness just quoted, examples of which could be readily multiplied, furnish proof; but to assert this is not to affirm a total absence of connection between them. For it is conceivable, that as white light is composed of the three primary colors, and as sensations of all kinds are each represented in its own special point in the brain, so there may be in the brain three separate points where the impressions of red, blue, and yellow, are set up, that according as these points of nervous tissue are capable of more or less combined or separate action, so the combined or separate tints are more or less perfectly represented, and that it is the proportionate and consentaneous action of all three points at once which imparts the notion of pure white light, and the degree of such action the gradation of the light. Should this, on further investigation, prove correct, color-blindness would consist in the incapacity of each separate color-point of nervous tissue to act separately, though it might still be able to act in equable combination with the others, so as to impart the impression of light.

2. *The Sense of Hearing* is often popularly supposed to be connected with faculties for Time and Tune. But ideas of Time, or Succession, may be derived through the Eye as well as the Ear; nay, even by the Touch, Taste, or Smell. It is therefore not a primary perception; but, comprising the idea of "parts in succession," takes rank with the notions of space and direction, which comprise the idea of "parts in extension."

The Faculty for receiving impressions of Tune, then, appears to be the only one acknowledged to be connected with that sense which takes cognizance of Sounds. But a Sound, using the term simply to signify anything audible, certainly possesses something more than the property of Tune. If we listen to an orchestra, we can not only distinguish the Pitch of the different notes, but also from which particular instrument each proceeds. We can pick out any instrument, and follow it through all the others; and that, not by reason of the high or low notes it gives forth, for it may be in unison with several other instruments; but we seem to know it by a different *kind* or *Quality* of sound. In fact, the sounds of all musical instruments are notoriously different. The same note in the same octave, may be given forth; and though the degree of loudness and sustainment may be the same in each, the difference is still evident. Even two instruments of the same description, may possess different kinds of tones. Here, then, is brought forward a new element:—that of *Quality*.

Similar facts may be observed in the Human Voice. Voices may

possess the same Pitch ; and yet, laying aside all considerations of loudness, inflection, sustainment, or order of succession of tones, there may be a decided difference between them. We all know that there are rough voices and smooth voices, thin wiry voices and those which are full and sonorous ; just as there are high and low voices which differ only in pitch. Then, as to miscellaneous sounds, such as one hears in a town, for instance :—there may be hissing sounds and rattling sounds, dull sounds and sharp sounds, and the sounds of rumbling, roaring, hammering, ringing, scraping, rubbing, blowing, and of all the vast variety of processes which are going on. The prominent character in all these is *Quality*. Tone is put out of the question ; and in listening to them, we hardly attend to it. In fact, they are what are properly termed Noises, in contradistinction to Tones.

In the Voice, however, something more is to be observed, besides Pitch, and besides quality. I refer to what are called Articulate Sounds. Their nature seems so peculiar, that they almost appear to constitute an independent class. A certain letter, or word, may be pronounced in every variety of musical pitch, and by voices of different qualities, yet still remain the same letter or word. The letter S, for example, is still the same letter, whether spoken high or low, or with an agreeable or disagreeable voice. There are, it is true, voices that seem to have the quality of hissing, and then the letter, or its analogues, will be modified accordingly. Other letters, such as D, or G, will be also modified by voices according to their Qualities of softness or hardness. And there are other modifications produced by Quality of Voice, of which the labials, B, P, and M, present, perhaps, the best instances. These things, shew a marked affinity, between certain letters, and Quality, as an attribute of Sound. Now we have already seen, that Noises are those peculiar Sounds in which Quality is the predominating property ; and this would lead us to surmise, that Noises and Articulate Sounds differ rather in degree than in kind, and that the former may possibly be only an imperfect form of the latter. The very letters, too, just referred to, have so strong resemblances to certain Noises, that they might almost be called identical ; and a great number of words in all languages, have very significant likenesses to many Tuneless Sounds proceeding from the inanimate world.

If these considerations do not prove an identity of nature, they at least demonstrate an affinity so very close, that we shall probably commit no great error, in placing together Noises and Articulate Sounds in a single class, distinguishing their chief characteristic property by the word *Quality*.

According to this view, Sounds possess two properties—First, *Tune, Tone, or Pitch*, which is carried to its highest degree of perfection in Music ; and secondly—*Quality*, the predominating property in Noises, which exists in its most elaborate and perfect form in Articulate Sounds. And to receive each of these impressions, communicated inwards by the ear, there must be two separate Receptive powers ; the existence of which may almost be proved by common observation ; since we find great differences in people, in their power of discriminating the *Pitch* and *Quality* of Sounds. Some persons can estimate the Pitch of a Sound correctly, who have but vague ideas of its Quality, and very imperfect powers of distinguishing apart noises which have any resemblance to each other.

3. The next *Sense* is that of *Feeling*, or *Touch*. Its organ is the general surface of the body, varied and modified in different situations according to functions and circumstances. It is most acute, and most adapted for general use, in the fingers; it likewise possesses great acuteness, for special purposes, at the inlets and outlets of the body; and it is, upon the whole, more perfect on the anterior surface, than posteriorly. The only known and established Faculty to receive the Impressions of this Sense, is one for the property of Weight or Resistance. This Faculty imparts ideas of softness, hardness, elasticity, roughness, smoothness, and even of the shape of substances, all which properties are known by the impression of Resistance imparted on coming in contact. The intimate texture of substances is known in the same way; thus we tell the difference between a gritty or a fine powder, or between cotton, linen, stone, wood, or metal. Substances of various conducting power impart another set of Impressions, indicating Heat or Cold. In feeling any substance, we form an estimate of its Temperature, independently of the sensation of Resistance it communicates. We recognize it as cold, warm, or hot, according to what our Touch informs us of. And from these two primary Impressions, of Resistance, and Temperature, arise all the ideas which result from the Sense of Touch; and there must therefore be two corresponding Faculties to receive them.

4. The tactile recognition of the properties of bodies, whereby through impressions of Resistance and Temperature we infer their form, size, texture, condition, and other qualities, is evidently totally distinct from *Common Sensation*. Neither the proper sense of touch, nor sight, hearing, smell, or taste, are any one of them concerned in the common sensations of bodily pain, pleasure, or nervous titillation, or in any of the various vital feelings experienced in the different states of health and disease, any further than as they contribute, to be mixed up with these feelings, the special impressions respectively belonging to them. To convince ourselves that this set of impressions is entirely distinct from those communicated by the other five senses, it is only necessary to enumerate the chief of them. Hunger and Thirst cannot surely be considered to be recognized through Touch or any other of the five senses. Yet they communicate most distinct impressions, which are received by a perceptive act, and which, like the impressions of the other senses, may afterwards be forgotten and recalled, and are capable of becoming the subject of reasoning, imagination, or dreams. The same may be affirmed of the feelings noticed during the performance of the functions of the pelvic viscera; of weariness and fatigue; of drowsiness; of the sense of excitement, irritability, or restlessness; in which, although sensations of temperature and pressure are sometimes largely and intimately mixed up, there is also present a distinct nervous sensation; and every one of which feelings must consist in its appropriate nervous change or action set up, both peripheral and in the brain, and may so become the subjects first of perception, and then of memory, reasoning, and imagination, as we may observe in our intercourse with people every day of our lives. Precisely the same may be affirmed of morbid feelings. Nausea, pains of every sort and description, shivering, vertigo, the sensation of being stunned on receiving a blow, and the

various sensations of depression, weakness, and irritability, (all powerful feelings, inflicting a world of misery on human kind, and all complicated feelings, whose description might occupy from this to the end of time,) are not one of them imparted through either of the five senses, and yet give rise to very various and distinct impressions, received, duly amplified, and presented by the cerebral organs like the rest, and noted by the like act of consciousness, thus exerting no small influence on the spiritual part of our nature, and therefore not to be omitted in a description of the channels of communication between this and the external world. All these feelings may, just the same as the impressions of sight, sound, and contact, either go on as mere bodily states not mentally recognised, or may become the subject of perception either by obtruding themselves upon the consciousness, or by the attention being turned to them. These conditions of action being precisely those which hold good in regard to the other senses, I question if the feelings referred to are not entitled to be called a sixth sense, that of simple *Sensation*, inasmuch as they comprise impressions entirely peculiar to nervous tissue, and representing a distinct set of properties of outward matter, namely, electricity, magnetism, chemical action, the actinic force, and the like.

The capacity of noting the impressions of common sensation, varies greatly in different individuals. Some persons are naturally sensitive to slight modifications of comfort and discomfort; others are made so by disease, or more often any of the numerous forms of luxury and bodily indulgence. Accompanying a heightened recognition of pleasurable sensation, is generally an increased sensitiveness to pain; a thing infinitely less felt by those of blunted capacities and uncultivated intellects. These diversities in sensitiveness may depend on peculiarities in the peripheral nervous developments or in the nervous conductors, but they are much more likely to be of cerebral origin, and to be associated with differences of disposition and of cerebral power.

5. The *Senses of Taste and Smell* have by some been regarded as a single Sense, intended to take cognizance of what is called Flavor. But, considering that there are many things which have Taste and yet absolutely no Smell, and so many others possessed of Smell and absolutely no Taste or a very different one; and also, seeing that either organ is capable of performing its function independently of the other; that one may be present, when the other is defective or wholly wanting: and, moreover, that the Nerves of Smell terminate in a totally different part of the brain from the nerves of Taste;—it seems more reasonable to regard the two as distinct. We must, however, note, first, a certain dependence which they have on each other, the perfection of either being impaired when the other is suspended; and, secondly, some peculiarities which they possess in common. One peculiarity is, the comparative simplicity of their mechanical apparatus, and its close resemblance to that of the organ of touch, the chief difference being that the peripheral extremities of the Nerves of Taste and Smell are invested with moist mucous membrane instead of dry skin. Another is, that each of these senses transmits to the mind the idea of one single property of matter only. And a third is, that the ideas transmitted partake less of the nature of simple perceptions addressed to the intellect, and more of that of sensations involving the notion of pleasure or pain.

The *Sense of Taste* takes cognizance of the property of sapidity alone

But the impressions it receives are not entirely simple, being mixed up with and modified by impressions of ordinary sensation and of touch. The property of Taste, however, isolated from these, is of its own nature perfectly simple, and indivisible into any subordinates, and imparts to the nervous centre a single Impression, received by a corresponding Faculty.

6. The *Sense of Smell* possesses equal simplicity; the property of smell being but one in its nature, and susceptible of no legitimate subdivisions. One Faculty alone, therefore, is required, to receive the Impressions of it.

7. These details seem to prove, that every Sense has its own specific connection with the mind by means of certain stated cerebral faculties or capacities of taking on appropriate actions which represent outward properties to our spiritual consciousness. They introduce, therefore, a list of primary perceptions and capacities of perception, some of which have not hitherto been recognised, and must be considered new. They also point out the cerebral and physiological nature of the perceptive powers; so suggesting the probability, that the more purely intellectual powers, as well as the sentiments and propensities, are likewise cerebral and physiological, and form no portion of the spiritual portion of our being.

III. In conclusion, it now only remains to recapitulate the principal points advanced.

1. The Organs of the Senses, so various in their structure and relations, are nevertheless formed on a strict unity of plan. Each comprises a *Mechanical Apparatus*, calculated for the purpose of isolating, and defining, certain physical forces from without, and of transmitting them; and a *Conductor of Nerve*, whose peripheral expansion communicates with the mechanical apparatus, and the other extremity with the brain.

2. The Functions of these organs, various as they appear, are in all precisely analogous. Forces arising from the material world, are transmitted by the Mechanical Apparatus to the Nervous Conductor, which then takes on, and communicates to the Nervous Centres, a corresponding state or action, which imparts to us what we denominate an Impression.

3. Completeness of this action or impression, and psychical consciousness of it, are necessary to constitute Perception.

4. Each portion of nervous tissue can only take on the action imparting its own kind of idea. Hence, when irritated, false impressions are set up, which we call Subjective.

5. All true impressions, even when fully formed in the nervous tissue, are not equally recognised by the consciousness. Some are fully perceived, some partially, and some not at all; yet in each condition they may influence the mind.

6. Subjective, incorrect, and imperfectly perceived impressions, are fruitful causes of improbable and "supernatural" perceptions.

7. There is a separate power or faculty in the nervous centre, for receiving (that is, taking on the action expressing) each of the elementary impressions transmitted inwards by the organs of the senses. Each Receptive Faculty, which is represented by its own point in the brain, varies in activity and power in different individuals.

8. Thus far, we have no evidence that the consciousness of one individual possesses a larger perceptive power than that of another.

9. But we have evidence that the cerebral receptive faculties, for setting up those actions in the nervous tissue which we interpret as impressions, differ most exceedingly in different individuals.

10. Hence differences in perceptive power, and therefore in whatever intellectual faculties depend on perception, are physiological, not psychical.

11. Therefore these differences are constantly affected by our bodily state, and must cease with our dissolution.

12. The *Sense of Sight* is connected with two faculties; one for receiving impressions of *Color*, and one for the *Degree of Light*.

13. The *Sense of Hearing* is connected with faculties for noting the *Tune* and the *Quality* of Sounds.

14. The *Sense of Touch* is connected with faculties for receiving impressions of *Weight or Resistance*, and *Temperature*.

15. The *Sense of Taste* is connected with a faculty for receiving its peculiar impressions; and the *Sense of Smell* in like manner.

16. *Common Nervous Sensation* is perhaps entitled to be called a sixth sense, seeing that it imparts a set of impressions peculiar to itself, representing electricity, magnetism, chemical and vital forces, and similar forms of action of outward matter.

17. All farther notions of the properties of matter are inferred from these primary ones, and are not directly received as impressions.

By whatever names the mental faculties for receiving them may be called, the primary perceptions now enumerated of smell, taste, resistance, temperature, tune, quality of sounds, color, light, and sensation, must constitute the elements of all the knowledge or impressions of whatever kind our minds receive from without, elements, not one of which can be with truth omitted from the catalogue, and out of which can be and are constructed the whole of the varied and complicated ideas derived by us from the outer material world. They are capable of such innumerable combinations and modifications (every shade of difference, either in kind or degree, expressing a different thing) that we are indebted to them alone for a knowledge of everything that is capable of being expressed in material language, whether it be *conventional language* uttered in sounds, gestures, signals, written signs, or any other act or thing agreed upon, or the *natural language of living beings* instinctively understood by all, or the *spontaneous language of inanimate matter*, with the endless reflections of them all in works of art. So innumerable and subtle are these combinations, that it is in no one's power to affirm, of any impression derived from without, that it has not been gathered from some expression of them. And there is no proof that any communication can take place between matter and mind, or between mind and mind, except through their medium.

Respecting communications between mind and mind, it is curious to observe how utterly and completely dependent they are on muscular contraction. While any power of this remains, while the hand can stir, or the lip or eye can move, or even while the motions of the iris last, so long can mind speak to mind, and tell its thoughts, its desires, and its wants; and it is not till every atom of voluntary movement stops, and the speaking eye is fixed in a gaze which has been compared to stone, that the latest power of expression or perception fades away for ever, and a final barrier is interposed.

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