THE PHENOMENA OF DOUBLE VISION AND DOUBLE TOUCH.

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It is not an agreeable task to attempt to confute the recognised theories of eminent physicists in the elucidation of certain well-known visual and tactual phenomena; but nevertheless it is a conscientious duty on the part of one who may discover that his experiences and investigations are not in accord with those so laid down. All experience and reasoning concerning the perception of direction and kindred perceptions, as of apparent distance, apparent relief, &c., have served to convince the author of this brief article that they arise from and are initiated by voluntary muscular contraction, and this whether in the case of vision or of touch; there does not exist a single instance of sense-perception in which it can be proved satisfactorily to him that a special nerve of sense has any office other than that of presenting to the mind an external entity, together with any attribute it may possess that is intrinsic and irrespective of perceptions springing from position. But, furthermore, physiologists have admitted that the perception of one form of apparent motion can only be determined by muscular contraction, as when the eyes follow the flight of a bird; and what is apparent motion but a modification of apparent direction? So that it would seem to be really a scientific project to reduce all like perceptions to one common standard of causation. This has already been my aim in the treatment of "erect vision,"¹ wherein it was indicated that images on the lower retina were influenced in their apparent direction by the recti superiores, and images on the upper retina by the recti inferiores, such results being dependent on the centres of motion of the ocular globes being intermediate between the retinal expansions and the insertions of these muscles respectively. One of the most readily interpreted phases of double and single vision tends to confirm the truth of the above indication, which is comprised in the statement that "any visible point or points whose ocular images are non-coincident with the retinal equators or with corresponding lines that are parallel thereto, are seen to be apparently duplicated, whilst images that are so coincident are (subject to conditions to be noted hereafter) seen as single." For example, if the corresponding images of objects in an ordinary stereoscopic slide be united by straight lines, it will be observed that such lines are parallel to each other and to the median straight line (this actually represents the retinal equator in the eye), hence they are seen single.

Let us examine the case of one such pair of images, situated, say, six degrees below the retinal equators. It is evident that the directive influences of the superior recti muscles will be equal in respect of both the images; hence these images are seen single because of the sympathetic "consent" that is in operation between the said muscles in respect of them. Further, any such pair of images give rise to a single binocular resultant, and by virtue of the muscular consent that is evidenced in the upward and downward movement of the eyeballs. Without this consent the image of a visible object might be six degrees below the retinal equator of one eye and twelve degrees below that of the other eye, so that the object would suffer an up-and-down displacement. It would be seen to be visually doubled because the directive influences of the superior recti would be necessarily unequal in respect of its images, and necessarily so unequal on account of the mechanically horizontal disposition of the bony orbits.

All this simplicity vanishes in the binocular vision of objects that are laterally disposed, and complexity is the result of the eyes being placed on different planes in relation to these objects, instead of in a uniform plane as in upward and downward vision. Muscular consent, to a degree, most certainly exists between the lateral movements of the eyeballs, and it may be laid down generally that the operation of this consent is causative of the single vision of objects in the lateral field, whilst non-consent implies double vision. But before proceeding further it is necessary to mention the conditions of single and double lateral vision as I have found them, whereon to base a legitimate inquiry—namely:

First, every visible point that is contained by the angle of binocular convergence or its extension (the opposite angle)

is seen to be doubled. Most surrounding objects are seen double during the abnormal act of squinting. I maintain that this is consequent on the great magnitude of the above angles during strabismus.

Second, every visible point that is contained by the exterior (lateral) angles of binocular convergence is seen single; hence most of the points of binocular vision are ordinarily perceived to be single on account of the magnitude of these angles being normally so great. I am well aware of the statement of Sir D. Brewster, reiterated by Le Conte in a very recent publication, that only one visible point (the point of binocular convergence) is seen single, and that the mind takes no cognisance of one of the duplicated spectra of other visible points. But, apart from the differing experience of Professor Wheatstone and other eminent witnesses (my experiments agree therewith), it would be well for the upholders of the foregoing tenet to explain wherefore it happens that duplicated spectra when present, as during strabismus, are so clearly defined.

Granting that the above conditions represent the reliable facts of binocular vision, it will be found that the following propositions appertain and are applicable to them—namely: (1) Images of external objects on the inner lateral halves of the retinae are influenced in their apparent direction by the recti externi vel abductors, and images on the outer retinae by the recti interni vel adductors. (2) Muscular consent is operative between the rectus externus of an eye and the rectus internus of the other eye, and this in so far that the contractions of these two sets of muscles agree in determining that an object shall be seen "to the right" or "to the left" of the median line of vision. Muscular non-consent, on the other hand, is operative between the two internal recti, because the contractions of these muscles determine that a lateral object shall be perceived both to the right and to the left of the median line of vision, and, for a like reason, there is a non-consensual operation between the two external recti—that is, inasmuch as the contraction of the right external rectus determines a direction to the right, whilst that of the left external rectus determines a direction to the left. (3) The images of a visible object that is contained by the angle of binocular convergence find themselves on the external retinae, are amenable to the directive influences of the internal recti, and are seen double; the images of an object that is contained by the extension of the above angle find themselves on the internal retinae, are amenable to the directive influences of the external recti, and are seen double; the images of an object that is contained by the right exterior angle of binocular convergence find themselves on the external retina of the left eye and on the internal retina of the right eye, they are amenable to the directive influences of consensual muscles—viz., the left internal rectus and the right external rectus, and are seen single; and, lastly, the images of an object in the left exterior angle have their *locus standi* on the left internal retina and the right external retina, both images are influenced by muscles which determine a direction "to the left," and the representative object of these images is seen with a single contour.

It has thus far been indicated that the absence of a vertical displacement of ocular spectra in double vision may be explained by the perfect consent subsisting between the two elevator and depressor muscles of the eyes respectively; and, further, that lateral displacement of ocular spectra (to right and left) in double vision is due to the non-co-operation subsisting between the lateral muscles of the eyes in respect of any given pair of retinal images of a single object, whilst single vision is a resultant of the co-operation between these muscles in respect of a pair of retinal images.

But such directions as "to the right" and "to the left" have no significance whatsoever excepting in so far that they be related to a recognised median direction, since a median position serves as a *point de départ* for all diverse directive perceptions. Thus, the median line of monocular vision corresponds with the optical axis, and is dependent on the play of the entire system of the ocular muscles on the punctum of the retina. Again, the median line of binocular vision corresponds with a line joining the encephalic centre of perception with the point of binocular convergence, and is dependent on the consensual play of the entire system of the ocular muscles of both eyes *inter se*. There is apparently a marked consent subsisting between the internal recti when the eyes converge on a given object, but this is deceptive; the right internal rectus, for instance, determines an object being seen to leftwards of the median line of monocular vision, whilst the left internal rectus determines an object

¹ Vide THE LANCET, March 17th, 1877.

being seen to rightwards of the monocular median line; there is, moreover, a coalescence of the two median lines of monocular vision for the formation of the median line of binocular vision; so that, as has been already indicated, the two internal recti are non-consensual muscles. Neither, lastly, should it be overlooked that there is a main directive median line proceeding from the encephalic centre of perception directly forwards; this is not of visual origin, being determined by the tactual muscles regulating the position of the body. When the eyes are converging on some object on the right side of the body, the median line of binocular vision is inclined at an angle to the main directive line; the main directive line, however, has no bearing on the phenomena of double vision, these being definable as being the relation that ocular spectra hold to the median line of binocular vision.

Before concluding with a recital of the details of such phenomena it will be expedient to treat of "double touch," inasmuch as the singular experience bears precisely the same relation to the special tactile sense that double vision does to the visual sense. Proning the right hand let us place two marbles in contact with the right and left margins of the index finger respectively; one of the marbles will be perceived to the right by the agency of the muscle moving the finger in this direction, the other to the left by the muscle moving the finger to the left, and the median line to which these diverse directions are related will be none other than a line bisecting the finger longitudinally.

In the well known experiment of double touch, the median directive line is one proceeding from the web of the index and middle fingers so as to separate them. The small marble is in contact with the right margin of the middle finger, which is under the directive influence of the muscle moving this finger towards the right, and it is in contact with the left margin of the index finger, which is under the influence of the muscle moving this finger towards the left. Since, therefore, the single marble is under influences determining directive perceptions both to the right and to the left, and seeing that these diverse directions hold relation to a median line that is common to both fingers, it will follow that there must be the perception of two marbles, as in the experiment with two actual marbles in contact with the index finger.

But, returning to a practical consideration of the facts of double and single vision, let us treat of them thus:—

First, as regards an object that is contained by the angle of binocular convergence, it will be seen to the left of the median line of the right eye and to the right of the median line of the left eye. These duplicate median lines of monocular vision become resolved into the single median line of binocular vision, and the object is under influences which determine directions both towards the right and towards the left; consequently, as with the marble, there will be a duplicate resultant perception.

Secondly, with regard to an object that is contained by the extension of the above angle, it is seen to the right of the median line of the right eye, to the left of the median line of the left eye, and both to right and left of the median line of binocular vision—i.e., duplicated.

Thirdly, with reference to an object that is contained by either of the exterior angles of binocular convergence, it will be seen to the right of the median line of the right eye if it be seen to the right of the median line of the left eye, and thus it will be seen to the right of the median line of binocular vision. So, similarly, with regard to an object that is seen to the left of the median line of each eye, it will be seen to the left of the median line of binocular vision.

Lastly, let us suppose that an object is seen four degrees to the left of the median line of the right eye, and eight degrees to the left of that of the left eye, it will be seen single and along a line of visible direction that is six degrees (the mean) from the median line of binocular vision, and this mean angle of six degrees will be formed at the encephalic centre of perception. There is, under these circumstances, the same composition of directive forces that is evidenced when the eyes are made to converge on a lateral object in the field of vision. Let the eyes converge on an object that is six degrees to the right of the main median line of direction; the left eye may perceive the object eight degrees to the right of the main line, and the right eye four degrees; but binocular vision will give it its correct value of six degrees, by virtue of muscular co-operation and the agency of the aforesaid directive composition.

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REMARKABLE CASE OF PERIODICAL PEELING OF THE CUTICLE.

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THE following interesting case, which occurred in my practice, is, I think, worthy of being placed on record.

M. J—, aged sixty-seven, a fairly nourished woman, of fair complexion, a native of Gloucestershire, came under my care in July last. The complaint from which she was then suffering was of old standing; but she stated that she had with this exception enjoyed good health from childhood. The only serious illness had been small-pox at the age of two years, and she has a large bronchocoele, which developed at the age of puberty. Subjoined is the history she gave me of her present illness, which is, according to her statement, identical with what she has suffered at intervals since childhood. At intervals of a month or six weeks the following occurrences manifest themselves:—After a day or two of slight feeling of malaise, the skin of every part of the body comes away in "casts," and the cuticle, which separates from the extremities, does so in one entire and sometimes unbroken piece, resembling a "glove" or "stocking." The new skin beneath has the appearance of ordinary skin after desquamation, and "lasts her," to use her own expression, for several weeks, when it begins to get irritable and inflamed. She has lately been going through one of these "changes," and I have had the opportunity of watching her daily. The first time I saw her, a week before the final "casting off," she was feeling unwell, and told me she was expecting a change of skin, and begged me to give her no medicine, as she had found that certain medicines that were prescribed for her at this stage made the skin fall off more thickly, and caused her pain, by leaving only a thin covering all over the body; at least, this was her experience. She was then suffering from slight rheumatic pains in her left elbow, for which I prescribed an anodyne liniment, which relieved her; but she was not able to continue it, as the peeling commenced where the liniment was applied, and the new skin was too tender to bear it. She was kept in bed, being cold weather, and in three days the desquamation became general; the skin of her nose, ears, and hands coming off as complete casts. The desquamated skin is of the thickness of the ordinary cuticle, and in places it is as tough as the lining of a hen's egg, and I have preserved the covering of the hands and feet in spirit. Now that the skin has come off she expresses herself as "quite well" again, and is able to get about, feeling far more comfortable in the new skin than in the old one. I questioned her closely as to her previous history and could gather nothing from it to throw any light on the cause of this extraordinary phenomenon. She has had a large family, and has healthy children; none of them having any appearance of her idiosyncrasy. The state of her menstrual functions was always good up to the change of life, seventeen years ago, and she did not associate this occurrence with the menstrual flow at any time, unless by accident. She states that she first remembers an attack of this kind at the age of seven years, and she was afterwards told by a medical man that it was from "catching cold after the small-pox." The phenomena of this disease are so unfamiliar to me, that I shall welcome any hints as to diagnosis, etiology, and treatment of the case.

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CASE OF SEVERE CUT THROAT;

WITH SOME REMARKS ON THE ADMINISTRATION OF
NUTRITIVE ENEMATA.

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W. T—, aged forty-three, a private in the 96th Regiment, of twenty-one years' service, a man of intemperate habits, and who had previously suffered from syphilis, having lost the greater portion of his palate from necrosis, was admitted to the Station Hospital, Ashton, on Sept. 27th, 1880, at 7 A.M., he having been found in a state of syncope, in one of the latrines, with his throat cut.

On examination of the wound it was found to extend from the posterior border of the left to the anterior border