A CASE OF BILATERAL MOTOR APRAXIA WITH DISTURBANCE OF VISUAL ORIENTATION.

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It has been only within the last few years that the motor disturbance known as "apraxia" has claimed much attention, or been fully investigated; and even yet very few well-marked instances of the condition have been described in English literature. In fact, it is mainly through the careful summary of the work of Continental authors, published seven years ago by Dr. S. A. K. Wilson, that apraxia is known to English readers.

Apraxia is a complicated condition, but in its simplest terms it consists in inability to combine simple movements into complete purposive acts; in other words, it is a condition in which a patient in whom the power of voluntary movement is intact, or at least not seriously affected by palsy, ataxia, or sensory loss, is yet unable to perform certain actions, or is incapable of employing objects—as a knife or a key—correctly, even though he is aware what is required of him, and though he recognizes the use and the nature of the object. Liepmann, to whom our knowledge of the condition is largely due, has defined motor apraxia as incapacity for subjectively purposive movements of the limbs, with conservation of the power of movement.

Apraxia may be of different degrees of severity, and may affect the limbs of only one or of both sides; its only manifestation may be the inability to protrude the tongue, to which Hughlings-Jackson originally drew attention in hemiplegic patients, or the patient may fail in most actions he is requested to attempt. Usually, however, he succeeds in some acts and fails in others—as a rule, in the most complicated and less familiar.

Many factors may contribute to this complex functional disturbance, especially mental impairment with affection of memory and attention, sensory loss, and agnosia or inability to recognize objects; but in the case described here the intellectual state was moderately good, there was no affection of sensation, and no form of agnosia. Vision, it is true, was affected, but its disturbance obviously stood in no causal relation to the apraxia.

The patient, Pto. M., aged 27, was admitted to a base hospital on November 2nd, 1914, with the history of having been wounded in the head by a shrapnel bullet some days previously. On admission he was in a dull and confused state; he was unable to remember his number or regiment, how he was wounded, and what happened to him during the several days that elapsed between the infliction of the wound and his arrival at the base. There was no paralysis, and the range and the power of the movements of all his limbs were normal; there was no obvious ataxia. The right knee-jerk was, however, brisker than the left, and the plantar response on this side was extensor. Tactile and painful stimuli were appreciated naturally and localized correctly everywhere, and there was apparently no loss in his sense of position. There was no optic neuritis.

The wound of entry was a small puncture 23 cm. behind the nasion (nasion toinion = 34 cm.) and 7 cm. to the right of the middle line; there was no exit wound, but a round shrapnel bullet could be felt under the scalp 4 cm. above and 4 cm. behind the upper margin of the attachment of the left pinna. An x-ray examination revealed a small gap in the skull under the wound of entry and several fragments of bone deep in the brain substance along a track leading from it. The bullet had apparently just broken through the skull in the left temporal region, and was removed, together with several fragments of bone, by Lieutenant Colonel Sargent a few days later. It was a spherical lead ball .12 mm. in diameter. It was dropped into sterile broth, but produced no growth. A clean circular opening, only slightly larger than the missile, was found in the squamous bone. The entrance

wound was not touched till several weeks later, when a few fragments of bone, which had probably been extruded from the brain, were removed from dense fibrous tissue at the bottom of a shallow sinus.

His condition improved rapidly after his admission to hospital; no weakness or paralysis developed, the reflexes became normal, and all forms of sensation remained unaffected. His hearing was also normal, but there was a complicated disturbance of vision which will be described in detail later. He rapidly regained almost the entire use of his intellectual faculties; he had been apparently an intelligent man, had been educated at a first-class school and trained as an engineer; before enlistment he was employed as a draughtsman. His memory for the past was evidently fair, but there was a blank, which gradually diminished, for events that occurred during a considerable period before the infliction of the wound. On the other hand, his retentiveness, especially to visual impressions, was much impaired. His general attention was always fair, though at first he tended to tire easily. At no time, however, during the three months he was under observation could his behaviour and conduct be described as normal: it rather resembled that of an intelligent child, and he was in fact always treated by his fellow patients and by the nurses as an interesting child would be. He was always too facile, laughed unnecessarily and often inappropriately; and on one occasion, when another patient near him died, he burst into tears and asked to be moved into another ward. He was always extremely good tempered and never moodish. One striking feature was the fact that he rarely showed any signs of irritation or natural annoyance when he failed to perform simple actions on request or spontaneously.

There was considerable disturbance of speech when he was first admitted, but it became gradually less; in the first place he stuttered, but according to his own statement he was subject to this in childhood, and, apart from this, he had no obvious difficulty in uttering words. He could understand speech and even complicated orders fully, or failed to do so only when his power of retaining the whole sentence was at fault. He always comprehended, for instance, and reacted intelligently to any joke made at his bedside. He had, however, some difficulty in calling up words, especially names, but even then succeeded in expressing himself fully by the substitution of a word or of an explanatory phrase. He never used wrong words.

He was from the first able to read and comprehend short sentences, but had great difficulty in following consecutive words and lines owing to his visual trouble; during the whole time he was under observation he had, however, considerable difficulty in reading individual letters aloud. He was quite unable to write even single letters, and on attempting it only made an unintelligible scrawl—most often a rough circle—but as he was equally incapable of drawing a line or any simple object, although he was a draughtsman by profession, this inability was obviously due to his apraxia rather than to a specific agraphia. Between two and three months after the infliction of the wound, when most of these observations were recorded, his speech defect was almost negligible.

In spite of the fact that there was no weakness, ataxia, or sensory disturbance in any of his limbs, he showed from the first day he was in hospital a peculiar motor disability, which consisted essentially in an inability to perform certain even simple purposive actions and to use objects and instruments which were quite familiar to him and which he recognized correctly. At first, for instance, he had even difficulty in feeding himself, in performing movements to order, and in using even the simplest tools, as a pencil or knife, but with time this inability gradually diminished, apparently largely owing to constant practice and steady application, for he certainly relearned first those actions of which he had most need, as lighting a cigarette.

The nature of this disability can be most easily conveyed by describing his attempts to execute actions of various kinds. Here, however, it is advisable to emphasize again that he always had a clear idea of what he was required to do, and that he never showed any signs of agnosia, or inability to recognize the use and nature of objects which he perceived either by vision or by touch. Further, he was never satisfied with the execution of a wrong action or with the misuse of an instrument, as a patient with

aphasia, agnosia, or general mental impairment may be. On the other hand, he was always anxious to explain his mistakes and failures, generally saying, "I have forgotten how to do it," or "That is something like what you wanted me to do, but it is not quite right; I can't remember exactly."

An attempt to analyse his difficulties by further introspection yielded no reliable facts.

The motor disability was equally pronounced in his two hands, and involved the movements of his legs too; it was usually more prominent when the action required the use of two hands than in those which he could perform with one alone; when given, for instance, a knife and fork he always focussed his attention on and directed his efforts to the one first, and only after he was satisfied with the result attempted to grasp the other or use it appropriately. His disability could be excellently illustrated by handing him a pencil and asking him to draw a line, any simple object, or form a letter; at first he had great difficulty in taking hold of the pencil correctly, and when he suc-

ceeded, or after he had learnt to do so, he would bring its point slowly to the paper and then hesitate as though perplexed as to how to use it. If urged to complete the drawing or letter he would suddenly make an irregular scrawl, which frequently resembled an O or C, and if then asked what he had drawn, would smile and remark, "No, that's not what I wanted to do, that is like an O (or C)." The result was the same whether he was asked to write a letter or draw a straight line or a pipe, yet he always recognized these figures when drawn and shown to him; on one occasion, when he had formed a circle in his attempt to sketch a pipe, he pointed out that it was like the opening of the bowl of the pipe, but it was not what he intended to draw. He succeeded no better in his attempts to copy simple linear figures.

The following table illustrates his efforts to perform certain actions about two months after the infliction of the wound; the actions required of him are given in the left column, his attempts to execute them in the right.

1. *Actions to Order.*

A. Put out your tongue	...	...	Well performed (formerly unable to do this, showed teeth, and grinned when this order given).
B. Cough	...	...	Well performed.
C. Smell	...	...	No movement at first; succeeds when piece of soap put in front of him; when this is removed, fails.
D. Yawn	...	...	Opens mouth, makes whistling movements.
E. Whistle	...	...	Opens mouth, puts out tongue.
F. Put right hand on top of head	...	...	At first brings hand to chin; then to nose; then holds it in front of him, says, "This is my right hand," and slowly brings to top of head.
G. Put left hand on top of head	...	...	Identical with last.
H. Put right thumb into mouth	...	...	Identifies thumb, then puts forefinger into mouth; recognizes mistake. Says, "No, that's my thumb"—holding thumb with left hand; eventually puts left thumb into mouth.
I. Turn eyes to right	...	...	Looks straight in front of him, then looks to left, finally turns eyes to right.
J. "Eyes right" (uttered sharply as a military order).	...	...	Well and quickly performed (at first had no more success with this than last order).
K. "Salute"	...	...	Brings hand smartly to forehead giving correct military salute. (Has been able to perform this military act almost from the day of admission.)

2. *Ability to Recognize and Use Various Objects when Shown Them.*

A. Shown a key	...	...	Names correctly; describes use "to put in lock," fumbles with key for nearly a minute, holds in many attitudes, then, holding by ring at last makes correct movement with hand.
B. Use of knife and fork	...	...	Fail; to get either knife or fork correctly into hand, grasps in various positions; first puts fork in left hand, knife in right, then changes about; even when they are placed correctly in hands fails to make correct movements.
C. Unbutton coat	...	...	Slow and clumsy, but succeeds; tendency to "tear out" button.
D. Button coat	...	...	Correct with right and left hands.
E. Shuffle a pack of cards	...	...	Takes hold of cards aimlessly, one or two at a time; makes no attempt to shuffle.
F. "Shoulder arms," when given piece of wood to represent rifle.	...	...	Takes "rifle" first in one hand, then in the other; holds against right shoulder, then to left, performing various movements, all incorrect, with unengaged hand; makes no intelligent attempt even when shown correct method by observer.
G. Given a book upside down; told to read from it.	...	...	Says, "Oh, this is upside down"; endeavours to rectify error, turns over pages, holds book on end, looks along it, fumbles with pages; says, "No; I can't do it." When book put right way up by observer and given him, says, "Yes; that's right," and proceeds to read.
H. Open matchbox and remove three matches.	...	...	This correctly performed after some fumbling and hesitation. (He was quite unable to do this for some days after admission, but, being an ardent smoker, has since had plenty of practice.)
I. Light cigarette in his own mouth with one of the matches.	...	...	Some difficulty in finding which is right portion of box to strike on; first strikes wrong end of match; commences by lighting cigarette at about its middle, then very nearly burns his moustache, finally succeeds, and puffs away contentedly.
J. Replace unlighted matches in box	...	...	Experiences much difficulty; first attempts to stuff them into unopened box, then opens box holding it upside down, at last finds interior of box and replaces matches in a very clumsy fashion.

3. *Representation of Use of Objects Without Being Shown Them.*

A. Movement of key in lock	...	...	Performs well, rotates hand correctly.
B. Shake hands	...	...	Holds right hand out, fingers extended, rotates arm (as in turning key in lock).
C. Given a bowl, make movement of eating from it with an imaginary spoon.	...	...	Quite unable to perform. (Succeeds if given a spoon with bowl.)
D. Make movement of brushing teeth.	...	...	Catches hold of chin, then says, "No; I had an idea, but I have lost it." Makes various incorrect attempts, and says, "No; it's no use."
E. Make movement of turning handle of a barrel organ.	...	...	Holds out right hand as in B, rotates (again as in turning key in lock).
F. Make movements of washing hands.	...	...	Succeeds only if a piece of soap and water in basin are given him.

4. *Imitation of Certain Movements made by Observer.*

A. Make a fist	...	...	Correct right and left hands.
B. Hold hands in prayer attitude	...	...	Brings right hand to right side of face, says, "No; that's wrong"; recognizes attitude when shown him by observer, says, "Yes; it's in the picture you see everywhere"; then performs it correctly.
B. Repeated	...	...	Caught hold of chin, then extended both hands in front of him, saying, "I thought I was going to do it."
C. Hold piece of wood horizontally with either hand.	...	...	Takes object, fumbles with it for a time, then places it vertically; unsatisfied with this position, and eventually gives up the attempt.
D. Catch nose with hands; first right, then left.	...	...	Correct.
E. Put right finger in ear	...	...	Hesitates; first puts hand on top of head, then correct.

5. *Performance of Various Expressional Movements.*

A. Smiling, looking cross, looking sad, surprised, etc.	...	...	Normally performed, both to order and also in reaction to surroundings.
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6. *Conventional or Actions and Activities of Ordinary Life.*

- A. Throw a kiss Correct.
 B. Beckon Waves whole hand in an indefinite manner. Says, "No, that's wrong; I can't get it right."
 C. Dressing Fails completely to put on pyjama jacket. Likewise fails with trousers, putting both legs into one trouser leg, unable to extricate himself without assistance, although he makes violent efforts.

7. *Performance of Certain Reflexive Movements.*

- A. When ear is tickled with a feather, patient puts up hand to remove the stimulus automatically, though when ordered to put finger in ear is unable to do so.
 B. If a hair is pulled, or if he is pinched, he brings his other hand readily to the spot stimulated, and withdraws the part stimulated.

Lower Limbs.

When his lower limbs were investigated, a condition very similar to that which affected his arms was found—that is, he had difficulty in performing purposive actions to order, imitating those made by the observer, and in employing his legs in more complex acts, as in putting on his trousers. When told to bring his right heel to his left knee, for instance, he merely crossed his feet; and when asked to put on a sock, was unable to do so, not only because of the apraxia of his arms, but mainly because he failed to hold his foot in a proper position. Similarly, on one occasion when, after walking about the ward, he was told to sit on his bed, he placed his hands on it, then turned his back away from the bed, and, after some hesitation, began to sit down in this direction.

REMARKS.

These descriptions give an idea of his condition as it was about two months after the infliction of the wound. During the following month a certain amount of improvement occurred, especially in performance of actions in which he had had practice—as in getting his smoking materials together and lighting a cigarette. Further, it was found that he could be taught by daily practice to perform actions in which he could not at first succeed; he became able to turn a book which was given to him upside down into the correct position when he was made to do so several days in succession.

The tests recorded above show that there was no tendency to misuse or mistake objects, and no trace of agnosia; further, it was evident that he was never satisfied with his mistakes or with one action when another was required of him. Although he frequently explained his failures by saying, "I have forgotten how to do it," it was evident that they were not due to lack of attention or loss of memory, for his general attention was always fairly good, and, apart from a deficient retentiveness of visual impressions, his memory was not seriously impaired.

There was at no time any trace of tonic perseveration or that difficulty in relaxing muscles that he had contracted voluntarily, which has been often associated with apraxia; and it was only in the early stages of his illness that he showed any tendency to repeat actions which he had just performed when requested to do something else (clonic perseveration).

VISUAL DISTURBANCE.

When the patient first came under observation a disturbance of vision was noticed, but its nature could not be properly investigated till his general condition had improved. The most striking feature was his difficulty in looking straight at the observer's face or at any object held in front of him; when asked to do so, he generally stared open-eyed in a wrong direction and then moved his eyes about in an irregular manner, most commonly towards the ceiling, saying, "Sometimes I can see quite well, but often I cannot see what I want to look at." On the whole he seemed to see better the less effort he made. Further, even when he could see and recognize an object, he usually failed to take hold of it directly.

At present, three months after the infliction of the wound, these troubles persist, though they are less pronounced than they were. The optic discs are normal; his central vision is now $\frac{2}{3}$ in each eye, and he can recognize the movement of fingers in all parts of each half of his visual fields. Perimetric examination is not easy owing to his difficulty in keeping his eye directed on the fixation point; but repeated observations have shown he can recognize a white object 10 mm. square to the normal peripheral limits in both eyes. There is, however, some

amblyopia in both lower right quadrants, which reaches to within 10 degrees of the fixation point. In this amblyopic area he frequently says, "There is something moving, but it is not plain, and I don't know where it actually is." No defect in visual acuity can be discovered in the left halves of the visual fields, and the fields for red and green are normal in extent to both sides of the fixation point.

Although there was no ocular palsy, for several weeks after his injury he was frequently unable to move his eyes to order in any given direction, even though he understood fully what was required of him, and still he often makes mistakes or succeeds only after several attempts; when on one occasion he was asked to look upward toward the ceiling as he was sitting erect, he pointed correctly to it with his hand, but moved his eyes first to the right, then to the left, and finally downwards. His eyes are, however, always turned accurately towards an unexpected noise made to one side of him, and he generally succeeds in obeying the military command of "Eyes right" or "Eyes left" when either is suddenly given to him.

He is still unable to follow accurately with his eyes a finger or any other object moved in any direction; they generally remain for a moment directed towards the position in which he originally fixed it, and may either fail to follow it at all, or they may be later suddenly jerked towards the direction in which it was moved. Similarly he fails to keep his eyes fixed on a spot, as on the observer's eyes, when his head is passively rotated to either side.

The difficulty in fixing or bringing into central vision objects in front of him is passing off, but he frequently fails still to look directly into the observer's eyes or at any object when asked to do so; often he merely opens his eyes, stares in a wrong direction, and then swings his eyes irregularly about in search of it. Even when there can be no doubt that he knows the position of the object in space at which he should look, as his own hand, for instance, he often fails to bring his eyes directly to it. The tendency for his eyes to deviate from the object he has fixed is now less than it was.

Further, there is frequently no reflex blinking, withdrawal of the head or other general reaction when a hand or other object is suddenly swung towards his eyes, either from in front or from either side, or to any other threatening action on the part of the observer. And when a light is suddenly turned on to one side he does not, as a rule, turn his eyes to it with the accuracy and promptitude of a normal person.

He still does not succeed in taking hold of an object held in front of him and in his line of vision with precision and accuracy. This defect is more clearly seen when he is asked to touch a spot on which his eyes are directed; several records were taken by asking him to bring his finger to a black dot on a sheet of paper held in various planes of space in front of him, and it was found that the error was equally great in all directions. This defect cannot be attributed to ataxia of his limbs—that is, to disharmony in the range and time of the components of the movement, as there is no evidence of this as he handles or attempts to use objects; nor can it be wholly due to the motor disability described above, as he can bring his finger accurately to the tip of his nose, even when his eyes are closed. Further, there is no demonstrable loss in the sense of position or of passive movement to which "sensory ataxia" could be due. Despite the inaccuracy and awkwardness of his movements he can, however, always succeed in reaching any object which is at the moment in central vision. On one occasion, when he was not aware he was under observation, he wished to get a box of matches from his locker in order to light a cigarette; he sat up in bed, turned his head and eyes

towards the locker, stared vacantly at one spot for a moment, then slowly and deliberately moved his eyes into other directions, until, after several seconds, the matchbox came into his central vision; then he put his hand out to take hold of it, but did not succeed in doing so accurately on the first attempt.

He does not present any trace of visual agnosia—that is, an inability to recognize and distinguish by their visible characters objects he can see. From the first, too, he recognized ordinary symbols, as the plus, subtraction, and the multiplication signs, an arrow pointing direction, etc. That he can recognize letters and read has been already pointed out. Further, he recognized at once the well-known visual illusion of the truncated pyramid, saying, "That's a box; it changes according as your eyes catch it, sometimes I can see it open, sometimes the other way."

His visual memory, too, is at least not seriously affected; he can from memory describe the form of familiar objects—as a pipe; give a minute description of his father, and tell how he would reach his bedroom at home. He is evidently a strong visualist, and speaks of having "a good picture" of incidents which occurred while he was in the trenches, as of a German attack by fire. His colour memory is apparently also intact; he can remember the colours of the football shirts worn by a local team, and describes the sky as "blue as a rule, with clouds of different colour, and it is often red at sunset, especially in stormy weather."

On the other hand, his visual retentiveness is very defective; when he is shown in succession four objects which he can recognize and name, he is, as a rule, unable to name them again or describe them in correct order after an interval of thirty seconds; and after the same period he is unable to recollect the number or arrangement of four or five dots which he had seen on a sheet of paper. He is much more retentive to auditory impressions, as words or sentences repeated to him.

Another prominent symptom is his inability to localize, or at least recognize correctly, the relative positions of objects placed in front of him. He has always been much confused as to which is right or left, and even after daily testing he has remained uncertain which is his right and which his left hand, and his difficulty in describing whether one object is to the right or to the left of another is consequently not surprising; but it was found that when he looked at two objects he was uncertain whether two similar objects which were immediately uncovered were in the same relative positions, or if their positions had been changed when he closed his eyes for a moment. This held whether the test objects were side by side, one above the other, or one nearer to him. (These tests were carried out by silver and copper coins of the same size, and by squares of green and white paper.) The most remarkable errors were made when he was asked to say which of two objects was the nearer to him; even when they were separated by 10 to 15 cm., at a distance of half a metre from his eyes he made many mistakes; the explanation he offered spontaneously was, "I can only look at one at a time"; when his finger was moved from one to the other he could, however, recognize their relative positions at once.

Similarly, he often fails to distinguish the difference in length of two lines, even when it is considerable, and frequently calls the shorter the longer, or vice versa, though their lengths may be in the proportion of two to three. This is especially so when they are not drawn parallel and close to one another. An attempt was made to determine whether this failure is dependent on a defect in the execution of, or on a disturbance of the proprioceptive impulses initiated by, his ocular movements, by comparing his replies when he was allowed to look at the lines for some time and range his central vision over them, with those he gave when the lines were exposed for only a moment, but his difficulty in fixation made reliable conclusions impossible. But, though he is unable to estimate the relative lengths of two lines, he can always recognize accurately and without delay whether a rectangular quadrilateral figure is a square or not; this is apparently due to the fact that he sees the figure as a whole and recognizes its shape at once, as he can a drawing or an illustration, while to compare the lengths of two lines he must move his eyes from one to the other.

When an object is held up to one side of the point he is at the moment fixing, he always fails to take hold of it or even point in its direction if he does not look at it directly; if, for instance, the observer's arms are outstretched from his side, and the patient is asked to point to the moving fingers of one or other hand he usually only brings his own hand to the observer's face or shoulder. As there is neither ataxia or serious sensory disturbance in his arms, this failure can be due only to his inability to orientate and localize correctly objects in the extra-central portions of his fields of vision; in fact he states not infrequently that though he can see the object he is not sure where it is. This was clearly demonstrated during examination with the perimeter; he frequently said he was only aware that "something white was moving somewhere" as the test object was brought towards the fixation point, and frequently made gross errors when he attempted to point to or describe its position; on one occasion, for instance, he described it in the left lower quadrant when the object was in the right upper quadrant.

There is obviously, then, a loss of the local signature of visual impressions identical with that loss which as a result of cerebral lesions often leads to disturbance in the localization of tactile stimuli.

He frequently fails to recognize moving objects by extra-central vision, in portions of the visual fields in which he is certainly not blind, especially when two are presented simultaneously to him, one to each side of the fixation point, as the observer's fingers for instance. The proportion of such stimuli which he misses is variable, and increases as he tires or when his attention flags. A similar inability to recognize, with the constancy that a normal person can, the presence of objects outside central vision is occasionally seen as a one-sided phenomenon with lesions of the post-central portion of the opposite cerebral hemisphere.

That objects outside his central vision do not readily excite attention is seen in many other tests too. When asked to read, for instance, he was at first frequently satisfied to pick out a few individual words from a page, and he still has difficulty in following the lines in the normal manner. Now he occasionally takes up the daily paper, which he can read intelligently, though only slowly and with difficulty, due, he explains, to the fact, "I start to read a column, but soon skip some lines, or I may get on to another column." It is remarkable that even when only one of a row of letters which he was asked to read was exposed to him, he frequently failed to fix it, saying, "I'm not looking at it now, I have lost it"; and that immediately afterwards he read correctly and with scarcely any hesitation the following title, which contained words certainly unfamiliar to him, "Histological and Experimental Observations on the Destruction of Tumour Cells in the Blood Vessels."

He also makes very poor attempts at exploring with his eyes any large surface presented to him; if, for instance, he is shown the page of a journal on which there are a few widely-separated illustrations, he often says there is only the one on which his eyes first fall, and rarely succeeds in detecting them all. Similarly, when he is asked to count or to point to four or five coins placed irregularly and at some distance apart on a board in front of him, he is generally content with indicating one or two, and makes no attempt to run his eyes over the whole surface to make sure that those only are present which he had seen at the first glance. This failure is obviously not due only to the right-sided hemiamblyopia, for he fails as often to pick out objects to the left as to the right of the point to which his eyes are directed; it seems, in fact, that his attention to visual impressions tends to be arrested or occupied by any object that is at the moment in central vision. If, on the other hand, he is asked to count coins or other objects arranged in a close series in front of him he usually starts at any part of the series to count to right or left, but soon becomes confused and begins to enumerate again those which he had already included in his count; he can, however, count them accurately if he is allowed to take each in succession into his hand. Similarly, though he often fails to count by vision alone fingers held at some distance apart in front of him, he succeeds if he is allowed to run his hand over them.

These and other tests indicate that not only do objects outside central vision fail to excite his attention

although he is not blind to them, but that he is also unable to orientate or localize in space the positions of objects seen in the peripheral parts of the retina, and the relative positions of those that come in succession into central vision.

This case consequently presents an apraxia of the oculo-motor movements similar to that described in the limbs, a defect in visual localization and orientation, and a failure of objects that stimulate the peripheral parts of the retinae to excite attention and the appropriate ocular movements.

Although his lower limbs are apraxic in imitating movements made in front of him, in attempting movements to order, and especially in more complex actions, as in putting on his trousers, he can now walk easily, but proceeds only in short, shuffling steps, as though not confident of himself. His gait is, however, not ataxic. If left alone, he quickly deviates from the direction in which he wishes to go and runs into objects even though he is aware they are present. When, for instance, he is asked to walk between two rows of beds, he frequently turns to the right or to the left and walks up against one; it is noteworthy that he more commonly deviates to the left, though the left halves of his visual fields are certainly unrestricted. Even when urged to keep his eyes to the ground and avoid obstacles, he often does not succeed; he has even run up against a wall or against a large screen which stands in the ward. He can, however, walk straight to a person or an object some distance away if urged to keep his eyes fixed on it, provided there are no obstacles in the way.

When he was brought into a large room in which a few chairs had been placed, and ordered to walk to a point which could be reached without encountering any serious obstacle, he almost invariably walked into a chair and then pulled up suddenly as if surprised at its presence, even though he had seen it and pointed to it before he started. After hesitating for a moment, as though uncertain how to get round it, he usually shuffled towards one side with side-steps, very much as a crab does when it meets a stone, frequently retraced his steps when almost around it, and after he had evaded it often set out in a wrong direction towards his goal. He explains his difficulty by saying, "I don't look where I am going and I can't always go where I want to," but if his movements are carefully observed it is obvious that it is chiefly due to the fact that visual impressions of the obstacles do not readily excite his attention.

An equally striking phenomenon is his inability, or at least his great difficulty, in finding his way about. When he is taken some distance from his bed he is unable to make his way to it again, even though he may see it and point correctly to it. On one occasion, for instance, he was brought about five yards from his bed, to reach which he had only to take a single right-angle turn, but though he indicated it correctly and recognized the patient in the adjoining bed, he turned to walk in a wrong direction when told to go to it. This happened even after the correct route had been pointed out to him. On another occasion, when taken into the next ward, he failed to return through the open door when asked to do so.

Although inattention to visual impressions certainly contributes to it, this inability to find his way about must be attributed chiefly to loss of spatial orientation and to inappreciation of direction and of the spatial relations of objects which he can see and recognize by vision.

SITE OF THE LESION.

The exact extent and position of the anatomical lesion which produced these symptoms is naturally of great interest. It may be assumed with considerable probability that the shrapnel ball had taken a direct course between its entrance and its exit, for in other cases of similar nature we found this to be the case.

Taking the points corresponding with entrance and exit wounds in this case, the brain was entered in the posterior and upper part of the right supramarginal gyrus, and we have reason to believe that the track passed through the dorsal part of this hemisphere, perforated the falx $1\frac{1}{2}$ cm. dorsal to and 1 cm. in the front of the posterior margin of the splenium of the corpus callosum, entered the left hemisphere in this position, passed just dorsal to

Wernicke's field in front of the knee of the optic radiations, and made its exit in the inferior part of the left supramarginal gyrus in front of the posterior end of the Sylvian fissure.

Experience has shown that the area of destruction and secondary change produced by such a missile is generally of considerable extent. The track would probably admit a finger.

Finally, it may be remarked that in several of the recorded cases of apraxia, and of disturbance of visual orientation and localization, the lesions corresponded more or less closely in position to that probably present in this patient.

MENTAL CONDITIONS FOLLOWING STRAIN AND NERVE SHOCK.*

BY

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THE following is a brief sketch of the work which is being done in the Red Cross Military Hospital, Maghull, in connexion with the mental and nervous disturbances occurring among those who have experienced the strains and shocks of a shorter or longer period at the seat of war.

The results produced on the nervous system by shocks of varying severity have frequently been described in detail, and it would be superfluous to collect again and classify the phenomena associated with a disturbance of the sensory and motor systems, of the vasomotor system, of the different organs of the body, and of all the functions of the mind.

Judging from the reports recently published in France—and these are fully corroborated by our own experience—it seems improbable that examination of the cases invalidated from the war will add very much to our knowledge of the symptomatology of these conditions. On the other hand, such an opportunity to investigate a large number of those suffering from psychic disturbances during the early stages of the illness has never been provided before. In this early period the patient is capable of co-operating effectively with the physician, and it is thereby rendered possible to go beyond the mere symptoms and to discover the psychic cause which has led to the determination of the form assumed by the disease and in many cases to trace the various stages through which the illness may have passed. This will perhaps be more easily appreciated if a series of cases is briefly described.

In the first place, the disturbances referred to above may appear in an intense form as the result of a shock, and, as in civil life, they will gradually disappear after a short period of rest and quiet in a hospital. But unfortunately the number of cases which recover so easily is limited. After several weeks or months in a hospital, and when most of the outward manifestations of shock may have disappeared, the patients will still complain of a changed feeling in themselves; there is produced an alteration in their personality which to them is something mysterious and for which they can find no satisfactory explanation. They confess to a slight loss of control and ask, "What is it that makes me so irritable at a little noise or at being brushed against by another patient as he passes me? I used not to be like that." As a result of this and of their inability to explain it to themselves, they suffer from a condition of anxiety, of apprehensiveness which is very troublesome and may form the starting-point for a more serious illness.

In some cases the physical expression of a special emotion, such as fear or terror, persists for a long time without much change. This condition is usually associated with an emotional state produced by the constant intrusion of the memory of some past incident. An example of this is seen in the case of a man who, after a charge, was placed on outpost duty. It was dark and he was in a state of considerable tension. He heard a noise,

* I have to thank the Medical Research Committee for the interest taken in the work of the hospital and for the assistance rendered in bearing the expense of circulating among the medical officers engaged on military cases of nerve shock a memorandum which has formed the basis of this paper.