in the self-preservation reflex, far more, especially in the primates, are either for "looking about" or to aid the various purposes for which fixation is used independently.

3. *To make pauses in the act of reading aloud.* (Group D.)—These are conditioned reflexes acquired by training.

REFERENCES

1. BLOUNT, W. P.—Studies of the movements of the eyelids in animals. *Quart. Jl. of Expl. Physiol.*, Vol. XVIII, Nos. 1 and 2, 1927.
2. CHAVASSE, F. B.—Worth's squint. Seventh edition, p. 14, 1939.
3. DUKE-ELDER, SIR W. S.—Text-book of Ophthalmology. Vol. I, p. 637, etc., 1932.
4. HALL, A. J.—"On the acts of closing and opening the eyes." *Brit. Jl. Ophthalm.*, p. 257, 1936.
5. HOLMES, GORDON.—*Trans. Ophthalm. Soc. U.K.*, Vol. L, p. 253, 1930.
———"Looking and seeing." *Irish Jl. of Med. Sci.*, September, 1936.
———"The cerebral integration of the ocular movements." *Brit. Med. Jl.*, Vol. II, p. 107, 1938.
6. JAMES, W.—Text-book of Psychology, p. 73, 1892.
7. PAVLOV, I. P.—Conditioned reflexes, pp. 12, etc. (Anrep's translation). 1927.
8. PLOMAN, ENGEL and KNUTTSON. *Acta Ophthalm.*, Vol. VI, p. 55, 1928.
9. PONDER, E. and KENNEDY, W. P.—"On the act of blinking." *Quart. Jl. of Expl. Physiol.*, Vols. I and II, p. 89, 1927.
10. RADEMAKER and GARCIN.—"Le réflexe de clignement à la menace." *L'Encephale*, Tome XXIX, I, 1934.

WORD BLINDNESS: ITS CAUSE AND CURE*

BY

RONALD HALL

OF H.M. FOREIGN SERVICE

DR. ORTON'S book "Reading, Writing and Speech Difficulties in Children" may be regarded as a standard work on word blindness. It seems, however, to do little more than describe this complaint without pointing to an effective remedy.

Dr. Orton records that Hinshelwood in 1917 produced a monograph on this subject in which it was asserted that word blindness was not due to defective vision. Hinshelwood, however, drew attention to two facts, namely (1) several cases of word blindness often occur in one family and (2) that symptoms displayed are very similar to those of adults who have lost the capacity to read because of brain injury, *i.e.*, damage to the angular gyrus of the dominant hemisphere. He therefore assumed a congenital defect of development of this area of the brain in word blind children.

Dr. Orton points out that there is no subsequent evidence to support this hypothesis as such areas of agenesis are rarer in the general autopsy service than is word blindness in children.

* Received for publication June 11, 1945.

Moreover as only one hemisphere is required for reading, and with children if one were damaged the other could probably be used, such areas of agenesis would to be operative require to be on both sides of the brain which is still rarer.

Summing up the position, Dr. Orton writes " Obviously there are multiple causes for a delay in learning to read " such as defects in vision, defects of hearing, general intellectual defect, and emotional disturbances. *" When, however, all such factors are excluded there remains a group of very considerable size in every school who have shown no evidence of any delay or abnormality in either their physical, mental or emotional development until they have reached school age and are confronted with reading and then they suddenly meet a task which they cannot accomplish."* He continues, " Functions other than reading but which incorporate a visual element are usually entirely normal. Visual recognition of objects, of places and of persons is quite normal, and interpretation of pictorial and diagrammatic material is frequently very good." Dr. Orton further points out that his experience acquired from visiting many schools shows that word blindness is the greatest scholastic handicap to otherwise normal boys as it prevents them making the grade necessary to enter a University or at times even merely a middle school. He further points out that with such children " spelling forms an almost insuperable obstacle."

While pointing to these very serious handicaps, Dr. Orton seems unable to suggest any more concrete method for overcoming word blindness than that which a more individual and sympathetic tuition of the boy or girl concerned may afford.

Having suffered from word blindness as a child and, incredible as it may seem looking back, being unable to read up to the age of fifteen (i.e., prior to puberty. Did one's altered thyroid functioning have something to do with this change?) I can speak from experience when I say what a terrible handicap this is for a child. Although in World War No. 1, I spent over three years at the Front, I can truthfully say that I never during those years experienced a fraction of the stark terror that I did as a boy at school during English lessons lest I should be called upon to read aloud and reveal to the whole class that I could not do so. Every possible device I could I used to kill time so that my turn to read aloud might not come before the lesson ended. I asked every possible question and then every possible question about the answer. Sometimes these tactics just saved me but not always. There must be many children who are to-day living a similar nightmare existence for a child's sensitivity and fear of ridicule are limitless. The lifting of this handicap raised me

from being nearly bottom at school to passing with ease top into a branch of the Civil Service where everyone who passed in below me had taken an honours degree at Oxford or Cambridge.

In my childhood my parents did what they could to help me, taking me to an ophthalmic surgeon who prescribed glasses, but these produced no effect whatever. It was also suggested that I should read words written in very large type but this also proved of no assistance. It was only years later as a young man, when reading Stout's *Manual of Psychology*, that I stumbled across what I believe to be an explanation of word blindness and a means of cure (although apparently not in any way grasped as such by Professor Stout himself).

The explanation seems to be that a person suffers from word blindness because he has an inadequately developed synthetic vision, at least for such objects as words, and cure seems to be to remedy this by practising analytic vision. This conclusion was arrived at by considering first tactual perception and then visual perception in the case of persons previously blind. In regard to tactual perception Stout writes:—

“It must be understood that the observations and experiments on which we rely are all made on blind persons who have already acquired considerable experience. Their spatial perception is therefore at the outset developed in some measure. What we can observe therefore is only the process by which greater precision and accuracy are acquired. It is fortunate for psychological purposes that spatial perception by touch frequently does not reach full maturity with nearly the same rapidity as spatial perception by sight. Hence, even in the adult blind, it is possible to observe it in the process of growth.

“The chief instrument used by the blind in perceiving the shape and size of objects is the hand, or rather the two hands. (1) The hand either open or closed, may touch simultaneously the parts of the object. This may be called ‘passive touch,’ because it does not involve active movement from one part of an object to another. It may also be called ‘synthetic touch,’ because it yields a total simultaneous impression of all or many parts of the object. (2) A portion of the hand, such as the finger-tips, may explore the parts and contours of the object by gradually moving over them. This may be called ‘active touch,’ because it essentially consists in active movement. It may also be called ‘analytic touch,’ because it analyses or breaks up into a series of successive impressions what synthetic touch presents as a simultaneous whole. Now the main lesson that we learn from study of the blind is that development in the definiteness of the perception of spatial order is essentially due to the intimate union and co-operation of synthetic and analytic touch.”

The above naturally leads to the question, may not development in the definiteness of the perception of letter order, or words, be essentially due to the intimate union and co-operation of synthetic and analytic vision? When we turn from tactual to visual perception we find that this is so, for Stout writes: "The apprehension of tactual space develops through a co-operation of active and passive touch. What we know about children, and about persons blind from early infancy who have recovered their sight by an operation, shows that the same is true of sight. In the case of an operation for congenital cataract, a boy could not count even as few as two objects by means of passive sight, although he had learnt to count by means of touch. When two objects were placed before him, and he was called on to say how many they were, using sight alone, he could do so only by fixing his eyes on each of them in turn. At the outset it was necessary for him to point to each of them successively with the finger. Pointing without touching was sufficient. At a later stage he was able to count merely by fixing his glance on each object in turn. This he did at first not by movements of the eye, but by lateral movements of the head. It was not till much later that he learnt to count a number of objects at a single glance."

Aldous Huxley, in his book, "Seeing Without Glasses," has laid great stress on the fact that *seeing is eye moving* (i.e., analytic vision) or the shifting of vision from one part of an object to another as otherwise the eye develops a mentally sightless stare.

Stout also points out that association is necessary to enable analytic vision to produce synthetic vision or the necessary fusion of scattered perceptions into one perception, for he writes, "Even more important is the fact that the binocular fusion (he is referring to stereoscopic effect, but it would seem equally to apply to seeing several letters as a single word) of disparate impressions so as to yield a single sensation is itself to a large extent determined by associative suggestion. It is not true that fusion and non-fusion depend only upon anatomical conditions—on the degree of disparateness of the retinal impressions. Retinal impressions equally disparate may or may not fuse. Whatever, in accordance with past experience, tends to suggest that we are looking at a single thing favours fusion."

Now from all this it seems possible to devise a working method for overcoming word blindness, namely, to acquire synthetic vision by means of analytic vision and association.

All words must be analysed or broken down into their smallest parts and then synthesised again by associations. As with the case of the man previously blind who can only see mentally one object at a time, so synthetic vision must in the first instance not

be called upon to extend beyond one letter at a time. Should difficulty be found in learning to recognise single letters, as Dr. Orton points out is sometimes the case, the interaction of tactual and visual perception might be utilised by a child being supplied with raised letters which can be felt by touch. Association might also be made use of by having (as advocated in Pitman's book on memory training) pictures of objects in the form of letters, *e.g.*, a snake forming the letter S.

Then when all letters are thoroughly known two-letter words only should be learnt. These should be learnt first of all by analytic vision, that is to say by splitting them up into, or regarding them as, two separate letters until sufficient synthetic vision is acquired to fuse them by association or see them as a single unit. Passages in books should then be read, picking out all known two-letter groups such as those underlined in "Now this is the best method." This is a form of analytic vision which by breaking down words will gradually extend synthetic vision so that it will gradually absorb even the longer words thus broken down. For "now" is no longer a meaningless collection of letters, it is the word "no" with a letter after it, that is to say in its written form it has acquired a definite personality which differentiates it from other words, and all thought has to move by way of differentiation.

When all two-letter words have been thoroughly mastered in this way the same procedure should be followed with three-letter words and then with four-letter words in order gradually to extend synthetic vision. If, however, this analytic form of gradually progressing is departed from and many-lettered words are sought to be memorised too soon the eyes will develop a kind of mental stare incapable of taking in the words which by differentiation and association have acquired no definite personality, or word blindness will result. When two-, three- and four-letter words have been thoroughly mastered, the important two- and three-letter limbs of words, which are not themselves actually words, should be learnt, and then passages in books read picking these out, *e.g.*, ly, ed, ing. (When doing this it is probable that words written in fairly small type may actually be easier to grasp than in unusually large type because, at least in so far as what is known as local sign is concerned, synthetic vision has less with which to contend.) It will be observed that by this analytic method we are learning to spell correctly even longish words because we are noticing the parts of which they are composed.

If it is frankly admitted that the above method will defeat word blindness, the question still presents itself, why do some people require to use such a method when most people can learn to read

without any method at all? The explanation may be that at least until puberty the word blind child is slightly hypothyroid so that although he sees a word its image does not, so to speak, eat into his senses and leave a lasting impression which association on a subsequent encounter can recall. Be that as it may the important point is that word blindness can almost certainly be overcome in almost every case merely by systematically developing synthetic vision by means of analytic vision.

THE ONE-EYED WORKER*

BY

JOSEPH MINTON, Major, R.A.M.C.

LONDON

THE eye injuries of this war and the ever recurring eye injuries in industry are adding thousands to the present mass of one-eyed people. What is the position of the one-eyed men and women in the labour market? What jobs should they take up? In this paper I shall attempt to answer these questions.

In the course of my investigations in 1938 on the employment of the one-eyed worker in industry I asked the Industrial Welfare Society to send out a questionnaire to its 750 member firms. This questionnaire asked for information about the employment of one-eyed men and women, their efficiency at work and their accident record. Replies were received from 398 firms which employed about 1,000,000 workers. The greater number of small firms stated that they did not require employees to pass eyesight tests and that they employed one-eyed workers. Other firms representing the same branches of industry as the above insisted on eyesight tests; some among these refused to employ one-eyed people; others selected them for special jobs only. From these replies I learned that one-eyed men and women are employed in mines, iron and steel works, in the manufacture of chemical and electrical goods, and also in the fine close work necessary in the manufacture of artificial silk yarn, woollen goods, etc. All firms which employed one-eyed workers were satisfied as to their efficiency at work and their accident record.

One-eyed people can be divided into two groups: (1) those who have lost an eye since childhood and (2) those who have lost the vision of an eye in adult life as a result of disease or injury. The first group are in no way handicapped and have full confidence in the carrying out of their work. One finds the men of this group

* Received for publication, March 1, 1945.