Some notes on Vision & Military Effiwiency.

A Thesis
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by

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6th BLACK WATCH.
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The purpose of these notes is to examine and discuss some aspects of military efficiency, as far as this is affected by the vision of the soldier. The personal experience which gave rise to the notes was twenty months work in charge of an ophthalmic centre, first at Bury St. Edmund's, then Ipswich and finally Norwich, all in the Eastern Command.

In Britain the science of military ophthalmology is in its infancy. In continental countries, on the other hand, there is a considerable literature on the subject. In these countries conscription has been in vogue for many years, and what might be called a physical survey of the male population is taken each year as the lads reach a certain age. In Germany especially has valuable experimental work been done upon the subject of the vision required for various military duties. Owing to having been stationed in provincial towns, it has not been found possible to study the foreign literature with the care and thoroughness which the subject demands. However references to the conditions in the chief European countries will be found in the subsequent notes.

Britain, relying as she has done in the past chiefly upon the Navy, has been satisfied hitherto with an exceedingly proficient but small standing army. For this army more recruits have presented themselves than have been required, so that it has been possible to maintain rigid rules as regards entrance, and to exclude many men who were quite fit to work and earn their living in civil life. This rigid standard has been applied in the past to eyesight, as it has been to the other physical qualities of the soldier.

Through most of our nation's history fighting has been at close quarters, and physical valour and strength were the qualities chiefly sought in the soldier. The lethal weapons, such as they were, did not allow or require any great precision of aim, so that sight was much less important to the soldier than when accurate firearms came into common use. As late as 1837 in one continental army ability to distinguish a person at 10 feet was counted adequate vision for military purposes (British Journal of Ophthalmology, Jan. 1918.)

In 1863 the standard of vision demanded was based on the ability of the soldier to see a black bullseye 3 feet in diameter on a white ground at 600 yards distance (Official Optical Manual, Longmore.) This was the origin of the test dots so long in use. Longmore, somewhat mechanically to our ways of thinking, said that if a man could see a circular bullseye target of 3 feet diameter at 600 yards he could see a dot 1/5th inch diameter at 10 feet. The reasoning was — as 3 feet is to 600 yards so is 1/5th in. to 10 feet. Thus Longmore arranged test cards of a white colour with numerous black dots upon them, each dot having a diameter of 1/5th inch. For many years the army vision test was to count a certain number of these dots exposed at 10 feet distance. The rationale was that these dots at 10 feet formed a retinal image the same size as did the 3 feet target at 600 yards. The whole question of the vision test about this time (1870) was very vague. An official circular sent out said, "The medical officer will adhere strictly to the necessity that the vision of the

recruit should be sufficiently good to enable him to see clearly."
(Longmore.)

The dot card test was manifestly a very rough and ready method, but it found support on several grounds. The medical officer who made the test did not need to have any special knowledge of Ophthalmology, and the test was a convenient one for illiterates. In 1884 Longmore notes that 13·8% of the recruits presenting themselves were illiterate.

The testing by the dots at 10 feet was in some cases fallacious because the accommodation might come into play at that distance.

Gradually Snellen's test types came into use and the dots are practically never used now.

For some years before 1914, and in the earlier part of the present war, the visual standard for General Service was as follows:-

R $\frac{6}{24}$ L $\frac{6}{24}$

or $\frac{6}{6}$ with one eye and $\frac{6}{36}$ with the other.

(Swanzy (Disease of the Eye Edition XI))

On Sept. 30 1915 the following minimum standards were laid down (glasses not being allowed) W.O. Letter 27/Gen. No./4583 (A.M.D. 2)

(a) R $\frac{6}{24}$ or better L $\frac{6}{24}$ or better.

(b) R $\frac{6}{24}$ or better L $\frac{6}{60}$

(c) R $\frac{6}{60}$ L $\frac{6}{24}$ or better.

(a) & (b) were "fit" for General Service.

(c) was fit for R.A.M.C. A.O.C. A.S.C. and as a driver in R.A. or R.E.

From the commencement of the war there has been a strong feeling among a few Ophthalmologists and others, that the British standard of vision was unnecessarily high, seeing the use of glasses was prohibited during the test. But only lately and slowly has any concession to this feeling been made on the part of the authorities. On Sept. 15 1914 Mr. Tennant (Under Sec. of State for War) was pressed on the matter in the House of Commons, and stated that the Army Council did not see their way to relax the regulations regarding Eyesight. However so many men with defective vision presented themselves that it soon became evident that, though men using glasses were not to be taken for General Service, they must be made use of in the lower grades, and Mr. Tennant, in defending the General Service standard without glasses, acknowledged that this was being done. So that during part of 1915 and 1916 and the earlier months of 1917 the classification of recruits was as follows; as far as the Eye Test went.

Category

A. (General Service)	R $\frac{6}{24}$ L $\frac{6}{60}$ without glasses.
B I. (Garrison duty abroad)	Sight fit for shooting with glasses
B II	Sight fit for labour abroad
B III	Sight fit for sedentary work abroad.
C I (Home defence)	Sight fit for shooting with glasses.
C II	Sight fit for labour at home
C III	Sight fit for sedentary work at home
Reject	

The following Table gives the causes of putting (for defects of vision) 704 men in categories lower than A (General Service) The Eye Specialist was not responsible for any who could pass the General Service standard. He only had referred to him the failures.

Table showing the visual defects of 704 recruits which kept them from passing into the General Service Category.

I.	B I & C I.	Myopia	198
		Hypermetropia	17
		Mixed Astigmatism	2

II	B II & C II.	Myopia	139
		Hypermetropia	33
		Lenticular opacities ...	28
		Mixed astigmatism	8
		Corneal opacities	20
		Choroidal degeneration ...	3
		Crossed diplopia ...	1
		One eye "good", the other's sight being less than 6/60 (and not improved by glasses) or lost altogether.	158
III	B III & C III	Lenticular opacity ...	3
		Corneal opacity ...	4
		Myopia	19
		Hypermetropia	1
IV.	Rejected:-	High Myopia with fundal changes	21
		Chronic dacryocystitis ...	1
		Retinitis pigmentosa ...	2
		Cataract	9
		Mixed astigmatism	1
		Detached Retina	5
		Vitreous opacities	1
		Corneal opacities	9
		High tension	1
		Choroiditis	8
		Optic atrophy	8
		Hyperaemia of Optic nerve ...	2
		Old Iritis	2

The BI Myopes formed 28% of the total of 704. The general standard adopted for these was corrected vision of $\frac{6}{12}$ in the Right Eye with Myopia not over 5D. These men would have been included among General Service men in any Continental Army.

The B II Myopes were those who had a higher myopia than 5 D, or who could not be corrected as to the right eye up to $\frac{6}{12}$

The fewness of the cases marked Hypermetropia under B I and B II (& C I & C II) is due to two causes. (a) Many hypermetropes could read R $\frac{6}{24}$ & L $\frac{6}{60}$ and so pass into the Army without further question. (b) Hypermetropes constituted the large majority of that group in B II & C II., which are said to have one good eye, the sight of the other being reduced below $\frac{6}{60}$, (or lost,) and not improved by glasses. The majority of these were hypermetropes with strabismus and amblyopia. In the case of recruiting it would be advantageous if an oculist could examine every case and not only those who fail to come up to standard. Because, especially with hypermetropia, there are men who will pass the test easily, and yet who will give trouble later on. All armies seem to give more attention to the question of myopia than to that of hypermetropia. A hypermetrope under 40 might easily pass the General Service test, and yet find that his defect became manifest after exhaustion or debilitating conditions. These conditions would not affect the sight of a myope to the same degree. A number of ophthalmic surgeons have referred in various articles to this question of Hypermetropia in the Army. Adams (Transactions of the Ophthalmological Society Vol. 35) points out how in the trenches shell explosion and constant strain make manifest even small hypermetropic errors. Many men with high errors become quite helpless, and hypermetropes

often complain in regard to shooting that the longer they aim the worse they shoot. If they can aim and shoot quickly they shoot well, but if they delay the target becomes blurred.

The only place in the present army regulations where I have seen hypermetropia specifically alluded to is in the regulation for testing the eyesight of candidates for the aviation service. It is there laid down that men passed as pilots must not have more than 2 D Hypermetropia, because it has been found that accommodation is sometimes affected at high altitudes. In this set of cases noted on the Table I did not find any instance of Toxic amblyopia, though several of these presented themselves at the ophthalmic centre from among the serving soldiers (see Table p. - 36) Capt. C. F. Harford R.A.M.C. gave a somewhat similar Table of Recruits and their visual defects in the British Medical Journal Aug. 4 1917. His cases were seen at another centre in the Eastern Command.

When one speaks of these men being those who presented defective sight it must be understood that all who could see $\frac{6}{24}$ with R.E. and $\frac{6}{60}$ with L.E. were passed into the General Service category as far as vision was concerned. Many of these doubtless had refractive errors, and probably a number of them had diseased conditions of the eye. I cannot state exactly how many cases came up to standard (i.e. saw R.E. $\frac{6}{24}$ L.E. $\frac{6}{60}$) while these 704 defective cases were passing through, but as far as I

can calculate these 704 formed only 7% of the total number of recruits examined by the Recruiting Board during the period. The majority of these recruits were seen at Bury St. Edmund's, Suffolk. This is an agricultural community, so that this accounts for what must be looked upon as the low amount of visual defect. The majority of these Suffolk men had lived an open air life, and few of them came from industrial centres where they would have been more liable to eye injuries.

Among these recruits a number of would be malingerers were detected, and doubtless others were not detected.

In the early months of the war men wanted to get into the army and more than one plan was adopted to hoodwink the doctor. One was the learning from friends outside the letters on Snellen's card, or learning them while another part of the physical examination was being carried through. Another source of fallacy was allowing the recruit to cover a better eye with his own hand while the worse eye was being tested. The better eye (to judge from the report of vision on many a medical history sheet) must have assisted the defective eye.

When conscription came in malingering naturally took the opposite form and an effort to appear worse than actually was the case had to be met. There are many tests for malingering. The following I found most useful when one defective eye was alleged.

(1) Using the trial frame, put a plain glass lens before the"bad" eye. Use some low + and - lenses before the "good" eye and then put a high + before this eye. Then if the recruit does read, all he reads is by the "bad" eye.

(2) Bishop Harman's diaphragm Test. I do not think any man can know how many letters on the card here he can read if he alleges blindness in one eye, but really can see with both.

(3) The "Friend Test", with red and green letters. The "Friend" letters in glass can be placed against a window, or let into the shutter of a dark room. Using a plain red glass in one eye of the trial frame and a plain green glass in the other eye of the trial frame if the whole word "Friend" is read then both eyes are effective.

Before A.C.I.211 came into force (allowing glasses to be worn by General Service men) it was generally known that if a man required glasses to see the letters he would not be put in class A. So men sometimes readily read the required letters if a trial frame with a plus and minus lens (neutralising one another) were used. It was also common knowledge that a man for General Service had to read 3 lines ($\frac{6}{24}$) so I have commonly used a card the first line of which was one letter ($\frac{6}{36}$) the second $\frac{6}{24}$ 2 letters and so on in this fashion.

D ($\frac{6}{36}$)

H.D. ($\frac{6}{24}$)

T.B.L. ($\frac{6}{18}$)

So that in not a few cases a man has read $\frac{6}{24}$ (H.D.) thinking he was not reading the 3rd line in Snellen's type.

Another useful card is to have letters cut out from several cards and posted irregularly on to a new plain card. Beside each letter there could be a faint note telling whether it were $\frac{6}{36}$ / $\frac{6}{18}$ or whatever it might be. By using this card a man could sometimes be induced to read more thanwith the regulation card.

The whole question of malingering is a difficult one, and will assume greater importance if we continue conscription after this war, as seems certain. The examination of the malingerer wants brought to it the judicial mind. There should be fairness, no softness, but no vindictiveness. Because one man is a malingerer others need not be. Soldiers are not a quarry for hunting. If a batch have to be examined. and one man can be shown up as a malingerer, this usually has a healthful effect on the sight of would-be deceivers.

The question of defective vision where there is no objective disease or defect in the eye is a difficult one. This is a condition fairly frequently met with. H. Wright Thomson speaking of the children in Glasgow Schools says that 14% of the total number of children examined had defective visual acuity without refractive error or fundus change. (Glasgow Medical Journal September 1907) Because of this condition a serious injustice may be done to soldiers. This kind of case is specially provided

for in France. Reports are called for from the civil authority as to the recruit's vision before he was called up, and the man is held over for a time to have the question gone into (Revue Générale d'ophthalmologie Feb. 1906) Temporary exemption is also given in France for cases of disease which is likely to get well, such as chronic, and especially granular conjunctivitis, also Keratitis, Corneal Ulceration, and Opacities of the cornea which seem capable of improvement.

In peace time when our new national service scheme gets into working order, we will have to develop some such plan as the French one noted above. Because the Amblyopic eye is one of the main bugbears of the ophthalmologist to a Recruiting Board. All the time the Eye Specialist is up against men who do not want to be improved, and are anxious to obstruct and hinder the examination at every point. A report sent with the recruit telling what his sight has been in civil life will be of great value. In time it might be possible to use the reports made by School Medical Officers. Any marked discrepancy between the vision at School and that in the recruiting room would put the eye Specialist on his guard. This reference to school vision should be easy when the succeeding generations of boys come up for examination at the specified age, and would make the way of the malingerer, as of the transgressor, hard.

A point which has been raised in the Army, and in Parliament many times since the war began is whether any man who can earn his living in civil life can be made use of in the Army. The typical army man is apt to answer this in the affirmative. My experience is that there are men who come up to the visual standard but who have some slight chronic condition of the eyes on the ground of which they can report sick, and they do this frequently. Men of this type spend a large part of their time in hospital, if they were in civil life the inducement of high wages would probably draw from them more useful work for the nation than the Army discipline can possibly do. Recruiting Medical Officers are well to take this fact into consideration. Such cases are chronic dacryocystitis, slight chronic conjunctivitis, healed corneal nebulae which may break down or old Iritis. Wallace (Transactions of the Ophthalmological Society Vol. 37) deals with this matter. Two of his cases illustrated this point. One man had been 400 days in the Army and had spent 300 in hospital. Another had been 92 days in the Army and had spent 90 in hospital.

For the first six or eight months of the War the vision of recruits was probably their worst examined physical faculty, and the result is now seen in many men who are in the Army. For example this day that I am writing I examined a man who required - 22 D sphere in R.E. and - 21 D sphere in L.E. to see $\frac{6}{24}$.

In January 1916 ophthalmic centres were started all over the Country, and since then examinations of the vision have been more adequately attended to. The Ophthalmic Centres were usually dual in function. The Officer in charge was Eye Specialist both to the local recruiting Board and to the Military Hospital. It was quite essential that each recruiting Board should have an Eye Specialist attached to it. The standard for General Service (R $\frac{6}{24}$ L $\frac{6}{60}$) was such that many men could get into the Army, and yet have serious disease of the Eye. The ideal thing would be for the Eye Specialist to examine every case. The practice however in most Recruiting Boards has been that only those cases which fell below the General Service standard were referred to the Eye Specialist. The Eye Specialist's task was to support or disprove the alleged vision of the recruit, and to report whether the sight could be improved by glasses. All this was noted upon the Recruit's medical history sheet. Particular note was also taken of any abnormal condition of the Eye. This is of great value if a soldier is discharged and claims a pension for some eye condition. One is safe in saying that large numbers of discharged men are in receipt of pensions for eye conditions which were present before enlistment. I have seen many pensioners with oldi Retitis, choroiditis, lenticular opacities, and I have been confident, though proof was lacking, that the origin of these was anterior to the war. Had an ophthalmic examination been made and the result noted on the Medical History Sheet on enlistment these

things could not have happened. For example a man was sent to me for the usual six monthly examination while in receipt of a pension. He had a small exactly central corneal opacity in each eye. This man had been wounded and claimed that his sight was perfect before he got the wound. One felt that it was next to impossible that these two symmetrical corneal opacities could have arisen from wounds. Yet this man because of his eye condition alone had been going on for months receiving 16/- a week as pension.

Of course many men who have long had defects have only become conscious of them during the war. And they should not be accused of bad faith when they make the assertion that the condition has arisen during the war. Many men have for the first time realised their defective vision when put on to the rifle range. Also a large number of men have become conscious of their difficulty of seeing at night since they joined the Army, and have had to take part in night operations.

To continue the chronological account on page 5 the standards there noted were in force till February 1917. Traquair and Paterson of Edinburgh wrote in the Lancet of 6th May 1916 an article strongly urging that the visual standard for the British Army should be lowered and that men with glasses should be used in General Service. This led to correspondence in the Medical Press and In Feb 1917 A.C.I. 211 was issued. It read as follows:- "The standard of vision laid down in W.O. letter 27/ Gen. No./4583

(A.M.D.2) of 30th Sept. 1915 republished with A.C.I 1051 of 1916 is hereby cancelled and the following substituted.

(a) If a man's vision is $\frac{6}{24}$ in one eye without glasses and his right eye can be brought up to $\frac{6}{12}$ with glasses he will be considered fit for Category A.

(b) If a man haslost one eye or has completely lost the sight of one eye he will not be considered fit for Category A.

This A.C.I. is not a very clear one. Some M.O's at ophthalmic centres have interpreted it as meaning that the sight must in every case for A be $\frac{6}{12}$ in the R.E., with glasses if necessary. This can hardly be the meaning when the apparent purpose of the A.C.I. was to include more men in the General Service Category. But an authoritative explanation is being sought from the War Office, and is alleged to be forthcoming some time. These categories, though no longer used for recruits (since the Ministry of National Service has taken over recruiting) are still in use by travelling Medical Boards in categorising men in the Army at present. It is a question whether this A.C.I. 211 achieved much in the way of getting more fit men for Category A. It applies chiefly to anisometropes who probably could not use glasses with comfort when they got them, having one eye a good deal better than another. My experience was that this A.C.I. brought few men into A.

The next change in the visual standards came when the Ministry of National Service took over the Recruiting Boards in November 1917 The minimum standards of vision allowed by the new recruiting authority are:-

Grade I: With one eye, either R or L. $\frac{6}{24}$ without glasses. R.E. $\frac{6}{12}$ with glasses if necessary. L.E. may be less than $\frac{6}{60}$ but the eye must not be totally blind or missing. Both eyes must have good fields of visi on as tested by hand movements. Strength of glasses not to exceed spherical, 8 D: cylindrical, 4 D: Spher-cyl , 8 D in highest meridian.

Grade II With one eye either R or L $\frac{6}{60}$ without glasses R.E $\frac{6}{18}$ with glass if necessary. L.E. may be less than $\frac{6}{60}$ but the eye must not be totally blind or missing. Both eyes must have good fields of vision as tested by hand movements. Strength of glasses not to exceed spherical, 10 D: cylindrical, 6 D: Spher-cyl 10 D in highest meridian.

Grade III either R.E.$\frac{6}{60}$ with or without glasses and L.E. less or nil. Or R.E. less than $\frac{6}{60}$ or nil, and L.E. $\frac{6}{60}$ with or without glasses. The better eye must have a full field of vision, as tested by hand movements. Strength of glasses not to exceed: Spherical 15 D; cylindrical 6 D Sph. cyl. 15 D in highest meridian.

In all grades the eyes must be free from progressive or recurrent disease.

As there was dubiety about this Instruction a further letter was sent on Jany. 5th 1918 to the civilian Presidents of Recruiting Boards .

Ministry of National Service

Jan. 5th, 1918

"A man fit in all other respects may be placed in Grade I if the vision of the left eye is at least $\frac{6}{24}$ without glasses while that of the Right may be less than $\frac{6}{60}$, but the eye must not be totally blind nor missing, and the field of vision for each eye must be good, special attention being called to the vision by noting on the A.F.B. 178 (Medical History Sheet) in the space for remarks that the sight of the Right Eye is not good enough for rifle shooting. Similarly a man otherwise fit may be placed in Grade II if the vision of the Left Eye is at least $\frac{6}{60}$ without glasses and improvable to $\frac{6}{18}$ with glasses, while that of the right may be less than $\frac{6}{60}$, but the eye must be neither totally blind nor missing and the field of vision of each eye must be good. As in Grade I a note must be made on A.F.B. 178 that the sight of the Right Eye is not good enough for Rifle Shooting."

The purpose, as far as I can learn, of this instruction is to use in Grade I men who have a good left and poor right eye for front line work other than shooting. There is no suggestion that these men should shoot off the left shoulder.

The members of the National Service Recruiting Board are civilians. The Eye Specialist is not in constant attendance. Recruits who fail to come up to standard or have any doubtful eye condition are put on one side, and such cases are collected and sent to the Eye Specialist for examination. The arrangement seems on the whole to be working well though it hasnot been long in operation. It must however cause difficulty not to have on the Board (as under the Army Recruiting System) an Eye Specialist ready to examine and give an opinion on any doubtful case at once, especially when in country districts men have comea long distance. While these changes have been going on in the Army and Ministry of National Service Ophthalmologists outside the Army have not been inactive. The Council of the Ophthalmological Society of the United Kingdom appointed a committee in May 1917 to consider "the standard of vision desirable for the performance of different duties in the British Army." This Committee's Report is to be presented at the May (1918) Meeting of the Ophthalmological Society, but it is published in the Jan. (1918) Number of the British Journal of Ophthalmology.

The standard recommended for Grade I (General Service) is practically identical with the Ministry of National Service standard for recruits (original instructions) the Ophthalmological Society's standard for a soldier who will not have to shoot is the same as for General Service except that it does not matter which eye has the better vision.

The vision recommended by the Ophthalmological Society for garrison duty at home or abroad is practically identical with Grade 2 of the Ministry of National Service.

The Committee of the Ophthalmological Society, feeling that many problems in military ophthalmology awaited solution, and that at once experimental work should be undertaken, offered (Aug. 4 1917) to collaborate with the War Office in investigations, but this offer has not been accepted.

The question may be asked what has been the practice in other armies regarding standards of vision, and the matter may be discussed whether our standards or theirs are the better, in a time of war when all available men are needed.

Paterson & Traquair give the following Table in their article in The Lancet, May 6th, 1916.

TABLE OF ARMY SIGHT TEST.

Table Showing the Visual Standards for Recruits in the Chief European Armies. (Paterson and Traquair.)

-	Amount of Short Sight (Myopia) allowed.		Standard of Corrected Vision.		Remarks.
	Combatants.	Non-combatants.	Combatants.	Non-combatants.	
Germany.	6·5D. For landsturm no limit if standard of corrected vision attained.	-	1/2 in better eye. Other eye may have minimal vision. For Landsturm vision = 1/4. If one eye has vision = 1/2 the other may be blind.	-	Vision with glasses (corrected vision) counts.
Austria.	6D.	Above 6D. no limit if standard of corrected vision is attained.	Group 1, 1/2 in each eye. Group 2, 1/2 in one; 1/4 in other.	1/4 in one; 1/10 in the other.	Vision with glasses counts.
France.	7D.	Above 7D. no limit if standard of corrected vision attained.	1/2 in one eye 1/20 in the other.	1/4 in one eye; 1/20 in the other.	Vision with glasses counts.
Italy.	7D.	-	1/3 in each eye, or 1/12 in in one eye if the other has 1/1 (full vision.)		Vision with glasses counts.
Great Britain.	No amount specified, but according to vision required highest amount possible is about 2·5D.	No amount specified, but according to vision required highest amount possible is about 2·5D. in better eye and 3·5D. in worse eye.	No correction allowed for general service. Uncorrected vision must be 1/4 in each eye, or 1/4 in the right eye with 1/10 in the left.	Uncorrected vision must be 1/4 in better eye, 1/10 in worse eye. The better eye may be the left.	Vision without glasses counts. For home service, garrison service, and garrison service abroad, glasses are allowed within unspecified limits.

These standards are peace standards (except Great Britain) The standard for Great Britain is no longer correct. It was altered by A.C.I. 211 1917, as already explained, and also by the Ministry of National Service Instructions. The regualtions in continental armies as to forms of refractive error other than myopia follow similar lines (Paterson & Traquair). These continental standards being those of peace time, probably any alteration in them during the war has been in the direction of lowering rather than of raising them. There are continental ophthalmologists of repute who would lower the standard even beyond that noted on Paterson & Traquair's Table. Feilchenfeld (Deutsch Med.Wochen Schrift 1915 translated by Traquair ophthalmoscope Nov. 1916) writes "If eyes are otherwise healthy no error of refraction causes unfitness for field service, provided the corrected vision is adequate." This must be one third, or better, in the better eye. This is going a length which would not find general support amongst soldiers or ophthalmologists. The first desideratum required of a man with refractive error in modern war is that he should be able to find his way about without his glasses. If Feilchenfeld's suggestions were adopted men would be in the front line who did not fulfil this condition.

Grosz (quoted in the ophthalmoscope August 1916) expresses the opinion that the standard of vision should be lowered, and that for permissible myopia increased. He thinks that myopes

of 8 D and astigmats of 2 D to 3 D should not be excluded, nor men with one third (corrected) vision. This standard suggested by an Austrian Ophthalmologist will be seen to be lower than the official one given in Paterson & Traquair's Table.

, Considering the high standard of vision so long demanded in the British Army, it is instructive to note the French standards in 1906 (Revue Générale D'Ophthalmologie)

(1) Armed service V.A. at least $\frac{1}{2}$ for one eye V.A. $\frac{1}{20}$ for the other eye. (Glasses if necessary).

(2) Auxiliary Service: between $\frac{1}{2}$ and $\frac{1}{4}$ for one eye. V.A. = $\frac{1}{20}$ for the other eye. (Glasses if necessary.)

(3) V.A. in the worse eye less or equal to $\frac{1}{20}$ (that of the other being worse than $\frac{1}{4}$ after correction) meant exemption and discharge.

The examination tables place at 5 metres.

For armed service myopia allowed up to 7 D if the corrected vision comes up to that required (1) For auxiliary service more than 7 D Myopia allowed if glasses bring up the vision to that required (2) There is no limit to the amount of hypermetropia or of astigmatism if the glasses bring the vision up to that required for (1) or (2). In each case it is the corrected vision which is paid attention to.

Weekers writes more recently of the French and Belgian standards (Annales d'oculistique Jan. 1916)

Before the War General Service Standard

Belgium V.A. in one eye better than $\frac{1}{2}$.
In the other better than $\frac{1}{10}$.

France: V.A. in one better than one half
In the other better than $\frac{1}{20}$.

(In each case glasses used if necessary)

After the war began (writes Weekers) Belgium adopted the French Standard for the worse eye.

In face of what has been said regarding the difference between British and Continental standards of vision, the question arises whether we should not further lower our standard and whether (in the matter of wearing glasses) the concession granted by A.C.I. 211, and latterly by the National Service recruiting instructions, is adequate.

The first point which strikes an observer is that the continental armies have been larger than ours and have been raised by conscription, the men of the country being examined for military service when they reached the appropriate age. Also on the continent, notably in Germany, much experimental work has been done in the matter of military ophthalmology. Further, these continental countries are not likely to allow into their General Service Category men who would not prove useful and safe there.

So that if we followed the practice of people more experienced than ourselves we would lower our usual standard. In the present war also we should not have few, but many standards because never has there in any war arisen such a specialisation of duty.

That men may be used to the best advantage there is much need of diverse standards for diverse sorts of service. The standard for one branch will not be the best for another branch. This is evidently felt even in Germany. Feilchenfeld (quoted by Traquair in the Ophthalmoscope Nov. 1916) complains that in Germany there is no intermediate grade between men fit for full field service and men fit for labour which can be utilized by the ophthalmic surgeon. It may be said generally that if a man has no disease and has vision enough to find his way about without glasses no defect of vision should debar him from General Service if his corrected vision in either eye comes up to $\frac{6}{12}$. (Left shouldered shooting will be spoken of later.) As regards a man finding his way about it may be said that a man sees a great deal more than he sees clearly. A reviewer in the Ophthalmoscope Jan. 1916 points out that a myope of - 2.5 D with an uncorrected vision of $\frac{6}{60}$ is hardly handicapped at all in his perception of the nature of a country-side. There is such a thing as form sense as distinguished from visual acuity. What an eye fixes in the distance it has visual acuity for. For surrounding objects it has form sense. Ametropes often have good form sense though their visual acuity may be poor. Their form sense may be sufficient to give them a general idea of their surroundings. The Test by Snellen's Types has its limitations. Though a man may not be able to read the letters in a certain line he may be able to see that letters are there and to distinguish white from black (see Fergus "the Ophthalmological Review Aug. 1913). When standards and regulations

are laid down rigidly the factor of intelligence is apt to be left out of account. In more than one test it was found that those who wore glasses shot better than those without glasses because of greater intelligence. Curry (quoted Ophthalmoscope 1916) examined 271 soldiers. Those who saw best, shot best, and those who wore glasses shot better than those without! A man with worse sight but better intelligence will often shoot more successfully than a man with better sight but less acute intelligence. A report by Grow (Ophthalmology Oct. 1912) is interesting in this regard. He examined 270 men of the U.S. Navy. The standard demanded/gun layers and pointers is $\frac{20}{15}$ in one eye, and $\frac{20}{20}$ in the other. That is on entering the service. A number of the men examined had more vision than $\frac{20}{20}$. Any reduction of visual acuity was almost always accompanied by astigmatism and correction of this brought the vision up to standard or better. Astigmatism of less than 0.75 he found to be of no account, but greater astigmatism than this gave trouble in sighting. The practical bearing of these findings was that $\frac{20}{15}$ visual acuity excluded all cases of astigmatism and myopia which by any chance could interfere with accurate aim. Some hypermetropes amongst the 270 complained of ocular fatigue. On this account Grow would exclude any men with more than 3 D Hypermetropia. He found that exceptional vision is no guarantee of good shooting. As a matter of fact 29% of the men examined failed to meet the requirements, and yet

these had had several years of experience and made excellent scores. The man who had held the record for gunnery work in the entire fleet had $\frac{20}{18}$ in one eye with a corneal nebula, and Hypermetropia of 4.25 D in the other. An instructive case, illustrative of the same point that intelligence and the power to appreciate the visual field can to a certain degree make up for visual acuity, was sent to the Ipswich Ophthalmic Centre. The vision and glasses required were as follows:-

R.V. $\frac{6}{18}$ partly $\bar{c}$ + 0.5 sph. $\bigcirc$ - 2 cyl 180° = $\frac{6}{9}$

L.V. $\frac{6}{18}$ - 2 cyl 180° = $\frac{6}{9}$

This man was a"first class shot" without glasses.

Under the Ministry of National Service Regulations there is the demand for $\frac{6}{24}$ in one Eye for General Service. This means that with Myopia there must only be - 2.5 D, or thereby, whereas Germany allows - 6.5 D, Austria allows - 6 D, France allows - 7 D and Italy - 7 D, (Paterson & Traquair's Table p 22)

Long before this present war the question of admitting soldiers who required glasses was under discussion. The idea was, probably rightly at the time, rejected, though one may say in passing that men who just came up to the old R $\frac{6}{24}$ L $\frac{6}{24}$ standard would have been made much better shots in many cases if they had worn correcting glasses. Many arguments were used during the middle 19th Century against lowering the visual standard and

allowing men requiring glasses into General Service, but the all sufficient one was that for the small army enough men could be got who had better vision. The only reference I can find in the early papers is in the Army Regulations for musketry instruction (1884) It is there laid down that short-sighted men may, when firing, use spectacles, but that spectacles may not be worn in the ranks. Officers were allowed to use glasses in undergoing the dot test (Longmore: Official Manual) But the situation has completely changed now when the nation is in arms and every available man is required. Against the wearing of glasses by men in general service it may be argued that there is difficulty in replacing broken glasses, that the eye may be injured when the glasses get broken during wear, that men who largely depend on their glasses may injure them in order to avoid service. This last difficulty is however faced in regard to false teeth and hernia trusses. Men requiring these have not been debarred from general service. If men thought they would have a journey to the base every time their glasses were injured, no doubt this would frequently happen. The Belgians (Annales d'oculistique Oct. 1917) have overcome this difficulty by having ophthalmic centres close up to the front line. They have one type of glass which allows of every interchange of lenses. The lenses are circular so that the Eye Specialist himself can easily change the axis when necessary. As regards the criticism that in warfare glasses broken may injure the eyes of the

wearer, I think it is the general experience of eye surgeons that comparatively seldom is an eye injured when glasses are broken. The British, like the Belgians, have ophthalmic centres close up to the front line. But curiously it is the practice at these front line ophthalmic centres only to supply spheres. Cylinders have to be sent for to the base. As pointed out by Paterson & Traquair the British visual standard is by far the highest in Europe, and excludes from the fighting line large numbers of men who are freely used in the armies of the chief continental powers. Feilchenfeld (quoted Ophthalmoscope Nov. 1916) puts it clearly when he says that, though the supplying of spectacles may be looked down upon, by the work of oculists a whole army has become fit for field service.

Many men now in the army have not worn glasses in civil life when they should have done so. This may have been because the nature of their work rendered the wearing of glasses difficult (e.g. if moisture was apt to condense on them, as in the case of stokers, or cooks). In some cases men did not wear glasses because they found employers unwilling to engage them if they wore glasses. Weekers (Annales d'Oculistique Oct. 1917) was much struck by the fact that a third to a half of the men who came to his Ophthalmic Centre had never worn glasses, though they were doing work where glasses would have been of the utmost value.

There remains a further question, namely that of the Right Eye as the shooting eye. A.C.I. 211 of 1917, and the new national service instructions and the recommendations of the Ophthalmological Society's committee, all insist on the Right Eye being the one to be improved sufficiently for shooting, i.e. up to $\frac{6}{12}$ if glasses are used. The standard laid down in A.C.I. 211 though no longer applicable to recruits is used in grading men already in the army. This insistence on the Right Eye has lost many men for General Service. Britain and Switzerland (Scherer quoted, Ophthalmoscope Jan. 1916) are the two countries which lay stress on the right eye. As far as I can find from men sent to the Ophthalmic Centre there is no unanimity amongst musketry instructors regarding shooting from the left shoulder. A few allow it, the majority forbid it. It is alleged that if firing is done in close order the man working from the left shoulder gets in his neighbour's way. But men now-a-days seldom fire in close order. For a man working from the left shoulder the gun lock is not so easy to work, and the rate of firing is bound to be delayed. The face too may be injured by the bolt slipping, or by cartridges which are being ejected. A feasible suggestion would be to have a left-eyed squad who would all shoot from the left shoulder and thus not get in one another's way. Some men blind, or very defective in the right eye shoot well from the right shoulder. For instance Private A presented himself at the Ophthalmic Centre. The vision in Right Eye was reduced to Hand movements due to old Keratitis. The

vision in Left Eye was $\frac{6}{9}$. He shot from the right shoulder and was a "first class shot". Another man Private B was seen. His vision and refraction were as follows :-

R Less than $\frac{6}{60}$ - 12 D not improved

L $\frac{6}{18}$ - 1 sphere ⊃ - 2 cyl = $\frac{6}{9}$

Corneal opacity in R.E.

This man shoots from the Right Shoulder; is a second class shot, and was awarded the Military Medal in France.

For shooting from the right shoulder when the left eye is the effective eye the face has to be pressed close against the rifle. A man who wears glasses should not attempt to shoot in this fashion as the kick of the rifle might injure the glasses.

The continental nations, who have studied military ophthalmology as we have not done, allow left shouldered shooting. We should allow it and thus free a considerable number of men for General Service. Many questions regarding shooting are under discussion and still undecided. Guiestous & Coulland (Revue Generale d'Ophthalmologie Feb. 1907) examined a number of riflemen in a certain French Regiment. They came to the conclusion that shooting is an act of monocular vision, that good shooting is compatible with dim, or even abolition of vision in one eye, that the shooter as a rule uses his best eye, closing the other unless it is amblyopic, and that a rifleman, as regards choice of shoulder, should be allowed to shoot as he pleases. This all supports the contention that men who have only one good eye, whether right or

left, should be passed for General Service. This is of course leaving out of account what weighs with some, and what, but for the urgency, would weigh with all - namely the sending of a one-eyed man into danger.

In contradistinction to the above expressed idea (and the one acted on in our army) namely, that even though a man has two good eyes he should only use one in shooting, is the suggestion which has long been gaining ground that the best shooting is done when both eyes are left open. Even as long ago as 1875 Longmore wrote in his official optical manual "It is doubtful whether aiming with the left eye closed is advantageous under all circumstances, especially when the object aimed at is not a fixed one at a given distance, as it is in Target Practice. Binocular vision gives a more vivid impression, a better sense of direction and rate of motion, such as an enemy running or riding in an open landscape." The late R. W. Doyne was also an advocate of shooting with both eyes open. (Ophthalmoscope March 1915) He points out how a gun or rifle can be aimed in two ways (1) by muscular sense and general judgment with both eyes open (2) by aligning the rear sight, the foresight and the target. This latter is the classical method

of Army Instructors. But Doyne and others believe that a great advance can be made in teaching soldiers to fire with both eyes open. This avoids spasm of the focussing muscle, and gives greater illumination of the target. The soldier could easily be taught to fire in this way as students are taught to keep both eyes open in using the ophthalmoscope and microscope. In the present method of aiming by alignment it stands to reason that the eye cannot focus the two sights and target at the same time. Each one of the points is fixed in turn. Finally it is the bull's eye which is seen by direct vision. The two sights furnish diffusion images seen by indirect vision.

There are a number of lesser but important points in regard to vision and shooting which could well have been taken up by the Committee of the Ophthalmological Society with the military authorities, had the latter been willing. Such a point is the position of the rear sight on the rifle. O'Connor (Ophthalmology 1915 quoted in the Ophthalmoscope) holds strongly that the rear sight should be as close to the eye as possible. This would leave only two points to align - target and point sight. It would do away with the strain of accommodating The front sight need not be accommodated for. It can be seen as a diffusion image. There is a greater field of vision if the peep sight is quite close to the eye. Also side lights are avoided and there would be increased accuracy of aim because of the increased distance between the two sights. As

the distance between the sights is increased the length of rifle barrel could be lessened without lessening the present accuracy of aim.

Another minor point which could be gone into at an investigation is whether special glasses should be used for shooting. It has long been recognised that in shooting a man does not look through the optical centre of his lens, but through the upper and inner part of it. The suggestion is made (Henker, Archives of Ophthalmology 1915) that the test for shooting glasses should be made while the man in question is looking along the rifle and fixing the target. It is proposed to give all the astigmatism and as much sphere as will make the target distinct. This is rather a counsel of perfection as the glasses would cause confusion, greater or less, when the head was raised from the rifle and used for searching the field of vision for the object to be shot at, and the glasses might have to be changed for anything but the actual shooting W.Wallace (Trans. of Ophthal. Soc. of U.K. Vol. 37) points out that this using the upper and inner part of the glass to look through for shooting accounts for the fact that a man looking along a rifle with glasses does not see so well as when holding the head erect. This can be proved by making a soldier with glasses look a-long a rifle at Snellen's types. He will read one line or even two lines worse than his usual vision.

Ophthalmic Centre Work.

It has been stated that the Medical Officer in charge of an Ophthalmic Centre had only part of his time taken up with examining recruits (while the R.A.M.C. was still responsible for this part of the recruiting scheme) His further duty was, and is to treat eye cases in the local military hospital and see and report on all eye cases referred to here by medical officers of units in his area. These men are sent in for a great variety of complaints. Of course, the majority come to find whether their sight can be improved by glasses. The following Table shows the ocular defects of 788 men who were examined at the Ophthalmic Centre Norwich.

Myopic astigmatism ...	215
Hypermetropic astigmatism ...	143
Simple Myopia ...	102
Mixed Astigmatism ...	69
Amblyopia in one eye ...	65
Simple Hypermetropia ...	44
Corneal opacity ...	29
Emmetropic cases ...	28
Lenticular opacities ...	13
Conjunctivitis ...	10
Presbyopia ...	9
Choroidal defects ...	8
Aphakia from needling of congenital cataract)	7
One eye enucleated ...	6
Atrophic changes in optic nerve	5
Irregular astigmatism	5
Suppurative Keratitis	5
Keratitis punctata	1
Chalazion ...	2
Vitreous opacities ...	1
Corneal ulcer ...	1
Glaucoma ...	1
Retinitis pigmentosa ...	3

Old Iritis	...	...	3
Nystagmus	...	...	2
Dislocated lens		...	2
Congenital Ptosis		...	1
Toxic Amblyopia		...	3

Many men who have not been conscious of eye defect in civil life find that in the Army their eyes give them trouble. This perhaps is due to the necessity of seeing to shoot, or it may be caused by the nervous strain of war. In the home camps I am satisfied that eyes often begin to give trouble owing to reading in defective light, such as the average tent and many huts provide.

In the above Table an interesting point arises as regards hypermetropia. The percentage of Hypermetropes who came to the Ophthalmic Centre during the period when the above statistics were taken was almost 24%. The percentage of recruits (p 5) who failed for general service because of Hypermetropia was 7%. The larger number coming later on as soldiers to the Ophthalmic Centre tends to show how Hypermetropia may not be a bar to reading the types required for general service, but gives trouble later on when shooting has to be done and the general strain of military life borne.

As regards the myopes, I made some investigation regarding etiology along the line suggested by Edridge Green (Lancet 26 1918) Edridge Green makes the point that myopia is due to heavy strain causing obstruction to the outflow of lymph from the eye. The

lengthening of the eye he alleges is due to increased intraocular tension which comes on with exercise, after a weakening illness, or due to severe coughing. On the other hand J.A. Wilson writing in the "Lancet" Feb. 16 1918 holds that "Myopia is much more frequent amongst those who do no heavy work and take no violent exercise." One of his points is the much greater frequency of myopia amongst women than men.

I questioned a considerable number of myopes who were sent to the Norwich Ophthalmic Centre. A large number alleged that their defect of sight came on after a serious illness in childhood or youth. I could not however establish exercise or athletics in any way as a definite factor in the etiology of myopia. If several officers in charge of Ophthalmic Centres were to question and make notes on the myopes who present themselves later for testing this theory of Mr. Edridge Green could be accumulated.

Another question which presents itself is whether men who have nystagmus should be accepted for General Service.

The feeling of Medical Officers is against such men being taken, even if their vision comes up to standard.

Capt. Frank Thomas (Trans. of Ophthalmological Society Vol.35) writes of a battalion largely composed of Welsh Miners. A considerable proportion of these men had nystagmus. His opinion was that they were absolutely useless for soldiering. Some of them were fair shots standing, but recumbent, or in any strained position they were hopeless shots. He found that such men were in danger of shooting to the side and injuring their comrades. He would even

exclude men who appeared to have recovered, and in whom the oscillations had ceased. Others who took part in the discussion indicated that 67 men in each regiment had to do "donkey work", and that men with nystagmus could be taken in for their non-shooting work. But even the low grades of miners nystagmus, which are only elicited by raising the eyes, and are absent during steady fixtation should debar a man from a place in the front line, although his vision does reach standard.

Oliver (Lancet April 1915) writing of a Tyneside battalion states that over 60% of his men were minersa large number of cases of nystagmus appeared after the men had been some time in billets. This was thought to be due to the longer time spent in the light of day. But it had not been noticed that there was any increase of nystagmus when the miners had been above ground during a strike. One of the awkward things which Oliver notes is that the nystagmus was often not present at the primary examination. The sight was usually bad, one of Oliver's men walked into the plate-glass window of a shop. The general conclusion is that men who show nystagmus should not be taken for General Service, and it is doubtful whether they should be admitted to the Army in any capacity.

As regards the general work of the ophthalmic centre men whose sight can be adequately improved by glasses have glasses prescribed for them. The prescription is made out and signed by the examining Eye Specialist, and sent to the Army Spectacle Depôt. In about a week the glasses come to the Ophthalmic Centre and the soldier is sent for. The Eye Specialist verifies the glasses and sees that they suit the man. The latter then signs a receipt for them. The system works well.

To each Centre is attached an optician who has the rank of corporal, or sergeant. He does the clerical work and the frame fitting. The glasses are of good quality with large spherical glasses. When the soldier gets his glasses, a slip with a prescription is pasted on his Medical History Sheet for future reference. Formerly a similar slip was pasted in the soldier's pay book. This good practice has fallen into disuse. It was a useful and work-saving plan for ophthalmologists abroad, because the soldier has his pay-book with him, whereas his Medical History Sheet he does not carry with him. In the early months of the Army Spectacle Department there was a limit set to the lenses which might be prescribed, a sphere more than 6 D was not given. But now practically any lens which will render a man efficient is provided. Though any single sphere or any single cylinder less than 1 D is not provided, officers often come for examination. At first glasses were

provided for them free as for the men, but now they have to purchase their own. A good many Presbyopes present themselves. But the instructions are that glasses for Presbyopes must only be given to men who are engaged on close work for the Army e.g. in an orderly room. Another piece of work for the Ophthalmologist is that amongst pensioners. This is naturally a field of work which will extend greatly. The majority of the pensioners appear six-monthly for a reconsideration of their pension. The work for the Medical Officer is one of great difficulty and responsibility. Justice must be done to the soldier, and yet the Nation's money must not be squandered. The case of a man claiming a pension for a condition which existed before the man enlisted has been touched on on p. 15.

A field of enquiry which could well be taken up by the joint committee suggested to the War Office by the Ophthalmological Society is the question of the compensation which should be given for various ocular injuries and defects. To take an instance "What should a man have as compensation for the loss of an Eye?" The pension papers which Medical Officers had to fill up had till recently the awkward question, "To what extent is his capacity for earning a full livelihood in the general labour market lessened at present?" If the man who had lost one eye were a labourer one could say his ability had not been reduced at all. Probably the fair thing in these cases would be to give not 50% of the full pension, as the army authorities suggest, but to give less and reconsider the whole question if for any

cause there was failure of sight in the other eye. Officers at Ophthalmic Centres find that most men who have lost an eye come complaining of the other one. Clausnizer (quoted in Ophthalmic Review 1910) asked the question "Does monocular vision cause injury to the eye used?" He dealt with 313 cases. The majority of these had had one eye enucleated. A few were cases of unilateral blindness from injury. All these cases had been observed for a year or more. It is striking that not one of these cases had had any injury to the remaining eye over, in some instances, a long period of years. Clausnizer's conclusion after watching these cases was that continued use of one eye has no injurious effect on that eye. In 3.7% of his cases there was a diminution of visual acuity ~~with~~ in the remaining eye, but in no case could he put this diminution down to the eye being the one eye. He considers that 20% to 25% is sufficient compensation, instead of the 50% which is commonly allowed. Of course if a man's occupation requires a special perception of depth then the compensation should be greater as this perception of depth is less in the case of one-eyed men.

Zeeman discusses the same question of monocular vision (quoted Ophthalmoscope Aug. 1. 1914) He asks why is it that the vision with two eyes is better in most people than the vision with one. It may be due to there being a slight astigmatism, and to the one eye seeing one part of the object clearly, and the other eye another part, or it may be that fixation is more steady and

less difficult with two eyes than with one. At the same time he considers that the increased effort to estimate depth, which has to be made monocularly, is not more than an average healthy man is able to make.

Night Blindness.

A question which is continually coming before an ophthalmologist in military life is the question of night blindness. Men every day are sent to Ophthalmic Centres with this complaint. Due to the amount of night work, and due perhaps also to the strain and depressing circumstances of trench life, many men have become conscious of their poorness of night vision who were not aware of it before. Of course a certain number of men use the complaint, or the alleged complaint as an excuse, but in a large proportion of cases it must be agreed the complaint has a foundation. The Text Book teaching is that night blindness may occur with Retinitis Pigmentosa, other degenerations of the fundus, or with no perceptible fundal change at all. Exposure to strong light is said to be a cause and "it is probable that in many if not most instances defective nutrition of the system plays the chief rôle in rendering the patient liable" to this trouble (Swanzy) Thus night blindness has frequently been found in patients suffering from scurvy. Ophthalmic Surgeons who have written on night blindness as seen during the present war have not reached unanimity as to etiology.

Grosz (quoted in the Ophthalmoscope Aug. 1916) writes of night blindness in tne Austrian Army. Some few of his cases showed retinitis pigmentosa, but the majority had normal vision, full field and no fundus change. He considers the condition to be a torpor of the retina due to hardship and insufficient nourishment. On the other hand Feilchenfeld (translated in Ophthalmoscope Nov. 1916) states that, except in the case of miners, he has not found true night blindness, unless there was corroborative evidence in the fundus. It seems to be a common experience that more night blind cases present themselves during the winter when there is more darkness and the conditions of life are more distressing and trying. Weekers wrote of Belgian soldiers (quoted in the Ophthalmoscope Aug. 1916) out of a large number of patients seen during eight months of 1915 10.2% complained of night blindness. Of his 409 cases 47 were affected before the war. There was often some degree of external irritation of the eye present. Errors of refraction were very common. 73.2% presented ametropia of more than 1 D. The majority of the men were in good general condition and signs of depression were the exception. He considers that the cases were genuine and that many of the cases arose during the campaign. He looks upon nervous strain and overwork as the main factor in etiology. He corrected errors of refraction, advised dark glasses during the day, and tried to arrange for a rest and a variation in diet.

Other writers do not think that the war has caused more night blindness, but has only led to its discovery. (Ophthalmic Record April 1916 quoted in Ophthalmoscope June 1916) In contradistinction to Feilchenfeld (see before) who would not support a complaint of night blindness without corroborative fundal evidence, other oculists notably Weekers, found many cases without fundal change. A number of Weekers' cases were officers who were obviously not malingering because they were desiring promotion and presented themselves for examination because of this. Birch Hirschfeld (quoted in Annals of Ophthalmology Jan. 1917) writes that out of 140 of his cases 108 had suffered before the war but said the condition was aggravated by the war. 32 cases first noticed the trouble during military service. In 9 cases there had been loss of blood and in five gastro-intestinal disturbances. In these cases he counted the prognosis good. The majority of his cases were myopic. 38 cases had fine pigment accumulation, and 27 were poor in pigment. These latter he counted chronic cases with a poor prognosis.

Ziemssen (quoted in Archives of Ophthalmology Vol. XLVI No. 6) is opposed to the idea that there is a special "war night blindness", and thinks that nutrition cannot be blamed. Lochlein (quoted after Ziemssen) considers that the nervous strain is the great factor in causing night blindness. An oculist of experience from the Western Front expressed the opinion that night blindness was a symptom of the physical condition which, in its more usual manifestation, we call scurvy. He considered that the lack of

fresh vegetables in the diet at the front was the greatest etiological factor, and that the supplying of lime juice generally as a ration, and not only on the recommendation of the Medical Officer, would do much to reduce the number of these cases..

I have notes on 36 cases which came complaining of night blindness. The defects were as follows:-

Myopia	...	...	4
Myopic astigmatism		...	8
Hypermetropic astigmatism			4
Hypermetropia			1
Mixed Astigmatism		...	3
Retinitis pigmentosa		...	2
No defect present		...	12
Choroiditis		...	1
Following concussion		...	1

In the cases of retinitis pigmentosa the fields were much limited, especially with reduced illumination, and there was a history in the family of trouble in seeing at night. My impression (though I have not collected enough cases to establish this) is that night blindness is commoner among dark, than among fair people. The men complaining of night blindness who have reported at the ophthalmic centre (of whom the above 36 are just a specimen few) were men in the comfortable conditions of home service, and neither malnutrition nor depressing nervous influences could be looked upon as factors in the etiology. Some satisfactory test for malingering with this complaint is needed. At present the ophthalmic officer has to ask for a report in not a few cases from the man's N.C.O. as to the genuineness of the condition in actual night

operations . Even where there was no defect found, there was no ground for questioning the man's bona fides. More than one patient had suffered injury owing to his difficulty of seeing at night. Some tests could be used such as reading Snellen's type in a reduced light, taking the visual field in a reduced light, or telling the time on a luminous watch in the dark room. The Moorfield's dark room lamp with its different strengths allows of stating the results got with certain definite amounts of illumination.

Beaumont (Malingering, Jones & Llewellyn reviewed B.J. of Ophthalmology March 1918) suggests a test with the Edridge Green Lamp which sounds useful.

"The patient sits with his back to the lantern holding a sheet of white note-paper in his hand, in such a way that the light falls upon it through the smallest perforation of the diaphragm of the lamp with an opaque glass in front of it. The perforation is increased in size until the paper is sufficiently illuminated for the patient to see it. The size of the perforation is noted, and then reversed examination is made, beginning with a full light which is gradually reduced until the paper is no longer seen. A note is made of the results, and the patient told to return on the following day, when a repetition of the test is made. The variations on the two days will be inappreciable in night blindness but extensive in malingering."

In support of my impression that night blindness is commoner among dark than among fair people is an article by Hepburn (Transactions of Ophthalmological Society Vol. 30) where he discusses the question whether night blindness is commoner among albinos. His conclusion is that night blindness is commoner among people with darker fundi.

Aviators

Another important question waiting for solution at the hands of military Ophthalmologists is that of the vision of aviators.

The present standard is

Pilots	Better Eye	$\frac{6}{12}$	with correction	$\frac{6}{6}$
	Worse "	$\frac{6}{18}$	" "	$\frac{6}{12}$
Observers	Better Eye	$\frac{6}{18}$	" "	$\frac{6}{9}$
	Worse	$\frac{6}{18}$	" "	$\frac{6}{12}$

This is probably unnecessarily high in the worse eye. America, having a larger field to draw upon, naturally has stricter standards for the aviation recruits.

Cormor (the Military Surgeon Jan. 1917) says without perfect vision a candidate for the aviation service is not to be considered.

C.P. Small Chicago (quoted in British Journal of Ophthalmology 1917 p. 498) lays down the following requirements for the aviation service.

(1) Uncorrected $\frac{20}{20}$ vision in each eye.

(2) Binocular vision

(3) Absence of nystagmus

(4) Normal muscle balance

(5) No pupillary irregularity when dilated.

(6) Normal media, fundi, fields and colour sense.

Other examiners did not consider accurate colour vision, binocular vision and examination under a mydriatic a necessity. The reviewer of Small's paper speaks of three aviators on the Western front who have considerable mixed astigmatism, and do not wear their correction while flying, though this correction gives $\frac{6}{6}$. Each one of these three has been decorated for good work. In one the better eye, uncorrected has $\frac{6}{9}$ and the other two $\frac{6}{12}$. The vision of the worse eye being $\frac{6}{18}$, $\frac{6}{36}$ and $\frac{6}{12}$ respectively. It is thus obvious that successful flying can be done with vision below the normal. Good near vision and rapid adaptation to different illuminations is necessary. This is to be able to read the various instruments and then to look out, especially in night flying. A low myope with $\frac{6}{12}$

uncorrected would be more useful than a hypermetrope who has $\frac{6}{5}$, because it has been proved that high altitudes may affect the power of accommodation. Realising this the authorities have laid it down that candidates with more than 2 D Hypermetropia will not be accepted as pilots.

To judge by the aviators sent to the Ophthalmic Centre from the Norwich Training Aerodrome, landing is where trouble chiefly arises. For this one would think that good binocular vision is essential. But I have not found that men who make bad landings have defective binocular vision. Men with any tendency to epiphora or lachrymation should be excluded from the aviation service. Among men sent to the ophthalmic centre because they were poor fliers I have inseveral cases found this to be the only ocular fault. H. G. Anderson F.R.C.S. has been associated with flying men as a medical officer and gives his experiences in the "Lancet" (March 16 1918) His opinion is that an aviator should have $\frac{6}{6}$ in each eye and normal colour vision - the same standard as is demanded of an executive officer in the Royal Navy. In France and America (as before noted) this standard is insisted on for fliers. Anderson makes the suggestion that men with defective vision should be employed as observers and then they may be able to fly quite successfully, their visual judgment having been adapted by their previous air experience. Anderson emphasises the great disadvantage of concealed hypermetropes, and of heterophoria, as tested by Maddox rod.

Perfect colour vision is counted essential for picking out hostile machines, recognising signal lights, and in judging the nature of landing grounds. In the discussion following Anderson's paper a number of speakers emphasised the need in aviators of perfect colour vision and also stereoscopic vision, and the danger of heterophoria. As I write (March 1918) the new air medical service is just being formed, There is perhaps no field where more ground waits to be opened up than in this service. The members of it will be required to live and fly with the flying men. Very many general medical matters, as well as questions of vision await investigation.

Motor Transport Another specialised service in the Army is that of Motor Transport. A.C.I. 73 of 1918 states that it has been decided that the standard of vision for A.S.C. (M.T.) drivers will be not less than $\frac{6}{18}$ in one eye, and $\frac{6}{60}$ in the other eye, provided the field of vision is normal. This is a very important matter as in the Army hitherto men with very inadequate vision have been driving motors. This used to be thought a suitable line of work for men whose vision did not allow of their going into the front line. A.C.I. 73 (above) makes no mention of the question of night blindness in these motor drivers, surely a point of the utmost importance. The state of things in civil life is even worse. McHoul (B.M. Journal Sept. 16. 1916) examining recruits in London was struck by the gross defects of vision in Taxi-cab drivers. He thought,

and with much justification, that street accidents must often be due to these defects. He suggested that the sight of Taxicab drivers should be examined before license, and yearly thereafter. The investigation of the night sight of these drivers is important in the present darkened state of our streets.

A Committee of the French Ophthalmological Society recommended (Ophthalmic Review 1909) that motor drivers in civil life should have vision in both eyes a minimum visual acuity in each eye of 0.2 without glasses, a full field and perfect mobility of the eyes.

Some test for night blindness such as reading types and taking fields with various degrees of illumination should be added to the examination of Army Motor Drivers.

The foregoing notes lead to several general conclusions. One of these is that our visual standard for General Service is still too high. $\frac{6}{24}$ being demanded in one eye excludes many men from General Service who would be placed in that Category in continental countries where military Ophthalmology has been studied as it has never been in this country. "The soldier who is to shoot should have $\frac{6}{12}$ (corrected) in one eye, either right or left. Men who are blind in one eye should not be refused. Left eye shots and those who shoot with both eyes open have been found to be good marksmen and are accepted in the French Army and probably others" (British Journal of Ophthalmology January 1918)

The National Service for recruits is an improvement on

what existed before but even it is not satisfactory. The insistence of $\frac{6}{24}$. in one eye, and the R.E. the one to be improved, means a loss of many men for general service. And there is marked loss in the men for Garrison service abroad. Formerly the regulation for this Category was that a man should be "able to shoot with glasses" Now in Grade II of the National Service instructions $\frac{6}{60}$ in one eye without glasses is demanded. Let us consider the following case:-

R $\frac{5}{60}$ $\widehat{c}$ - 4 sphere = $\frac{6}{6}$

L $\frac{5}{60}$ $\widehat{c}$ - 4 sphere = $\frac{6}{6}$

By the instructions in vogue when the Army had the duty of examining the recruits a man with this vision would go into B1 (Garrison service abroad). The demand for this class was that the man should be "able to shoot with glasses". Now according to the new instructions for the examination of recruits this man will go into a Labour Grade because neither of his eyes has a vision equal to $\frac{60}{60}$ unaided. In continental armies the above man would be passed for General Service. Much can be said in criticism of A.C.I. 211 still in vogue for grading soldiers in the army. This A.C.I. which allows men to reach the General service standard with glasses has probably resulted in few men being obtained for the General Service Group. This is the opinion of Wallace (transactions of the Ophthalmological Society Vol. 37) who was Inspector of Ophthalmic Centres in the Eastern Command during 1917. It was the conclusion I came to myself with

my more limited experience.

A man with the following vision and correction would theoretically pass into the General Service Category, but it is doubtful whether he could wear his glasses.

R $\frac{3}{60}$ $\bar{c}$ - 3 sphere = $\frac{6}{9}$

L $\frac{6}{9}$

A man with the above vision has been so long accustomed to use his left eye that it will confuse him to insist on glasses and the use of the R.E. in shooting. Cases like the above should be not only allowed but encouraged to shoot from the left shoulder.

If a man can shoot without glasses he should be allowed to do so. Wallace points out that if a man wears his glasses and looks along a rifle as for firing at Snellen's Types he will see a line, or even two lines less than he sees when looking straight. This is due to looking through the upper and inner part of the lens.

Taylor (British Journal of Ophthalmology March 1918) makes the suggestion that all men with $\frac{6}{60}$ in each eye without glasses should be admitted to the General Service Category, that they should be improved with glasses if possible, and that further grading should be left to their instructors. Taylor points out that amongst his cases he had 22 N!C!O's whose vision R.E. was $\frac{6}{60}$ or less. These men must have proved themselves efficient and

useful to have been awarded their stripes.

His opinion is that we cannot lay down hard and fast standards according to what a man can read on Snellen's Types, because it is the practical test at work which finally determines a man's usefulness.

In the Eye Test the question of intelligence, willingness to see, and co-operation with the prescribing oculist if glasses are required are all important.

Under the Conscription Act we are up against many men who do not wish to see and who will do their utmost to deny improvement with glasses which from retinoscopy appear suitable.

Much work remains to be done in the region of Military Ophthalmology, and collaboration between Eye Specialists and the Military Authorities would be the best way to forward this work. The Committee of the Ophthalmic Society could carry out the inquiry, facilities being given by the military authorities, were the latter willing. The experience of officers in charge of Ophthalmic Centres regarding malingering, night blindness and a number of other conditions could be collected and compared. Much could be learned by having teams of men with and without refractive error, and with and without glasses shooting at targets, still and moving, of different shapes and sizes; notes to be taken and critically compared.

As Weekers (Annales d'oculistique Oct. 1917) suggests it would immensely facilitate organisation in the time of war if a systematic examination of the human material could be conducted during the years of peace. As a nation we are practically certain to go on having conscription. In the event of any future war there will be mobilisation of the whole nation for military or civil work. There will be little or no exempting. There will be instead a sorting out of the population into various categories according to capacity. This classification should be done in peace time because the hurry of war mobilisation precludes anything like a careful examination and classification. What is wanted is a system of the utmost elasticity by which the Army Authorities can know what material is available, and where it can be found. We are concerned with the means of getting the best out of our mass of material, and much depends upon a man's grading according to vision. If this classification were carried out in peace time and all men of suitable age allocated to different types of military and civil work on the basis of eyesight and other physical qualities then it will not take two or three years to evolve a policy in the next war, as it has done in this.

The whole question of the vision required for different branches of the service has not been gone into by competent authorities. It is well known that in the regular R.A.M.C few,

if any men have had any special experience in Ophthalmology because before 1914 men with defective eyes were not taken into the Army, or if taken were not retained. Only by calling in oculists, whose life has been given to these questions, can the matter be adequately dealt with. It is a matter of regret that the military authorities have not seen their way to accept the offer of the Ophthalmological Society and conduct a joint enquiry. Possibly better counsel will later on prevail.