Reference must be made to a very valuable Report on "Sanatoria for Consumption, and Certain Other Aspects of the Tuberculosis Question," by Dr. H. T. Bulstrode (1908), forming a supplement to the Report of the Medical Officer to the Local Government Board for 1905-06. Not only is there a detailed account of the various sanatoria in the kingdom; but there is also a most interesting description of the working of the System of Compulsory Insurance against Sickness in the German Empire, demonstrating the great importance of this movement in the campaign against tuberculosis. Dr. Bulstrode also discusses generally the various modes of causation of the disease, and the influences of notification and sanatorium treatment on its prevention.

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Reprint.

THE EYE IN SPORT.1

[The blocks illustrating this article were very kindly lent by Mr. C. B. Fry, editor of Fry's Magazine.—Ed.]

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The physiology of games, especially with regard to eyesight, brings to light so many facts, both interesting and useful, that the study is well worth the while of the practical sportsman whose object is to take up a game and waste as little time as possible in learning to play it. The attainment of this end is certainly accelerated by understanding those parts of the body that must be employed in playing these games, namely, the eyes, the brain, and the voluntary muscles.

Just as a man who drives a car, and, understanding the engines of it, knows what they can do and how they go wrong, is in a far better position than the man who can merely drive; so the man has the advantage who, in playing games, knows the functions, the capabilities, and the shortcomings of these same eyes, muscles, nerves, and brain. The knowledgable man always gets there first.

To start with the eyes. What are they? They are two small cameras set in our faces with the centres of their lenses about 2½ ins. apart, the centres of these lenses corresponding, of course, to the centres of the pupils. Now, with two cameras two images are formed, and at first sight it would seem that we must see double, a condition that actually does occur in certain morbid states, and is occasionally experienced by

1 Reprinted, by kind permission, from Fry's Magazine, March, 1908.
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those who indulge to excess in alcohol; for it is obvious that each retina, which is the focussing screen of these little cameras, sends a separate message through the optic nerve to those parts of the brain where what we see is realised and understood.

How is it, then, that such a difficulty does not occur? Simply in this way: one eye must manage the business of selecting the object, and the other eye, deferring to the first, focusses the same image selected by the more determined eye. The eye which is the master (or managing) eye, faces square on to the object, and the helping eye converges slightly towards the master.

The ignorance of most people with regard to the eyes, and the part played by them as special sense organs, can only be explained by the fact that great accuracy of vision is not now a vital necessity in the struggle for existence; if it were, the physiology of the eyesight would be common knowledge, and not the monopoly of the few.

That this general ignorance exists is clearly demonstrated by the methods with which mankind approaches games of skill. While much has been said and written, and much probably has still to be said and written, on the subject of games, and how to play them, unless the nature of these instructions is amended in a great measure, this question will still assuredly arise in the minds of those who, interested in games of skill, apply to their study a certain degree of intelligence—"How has the overwhelming importance of the eyesight come to be so neglected by those who instruct in the art of acquiring skill in games?"

The obvious answer is that these instructors know little about optics and the eyesight; and that science, unable to grasp the importance of playing a game with accuracy, has been slow to throw any light into the darkness. The Englishman desirous of attaining a high standard of skill in playing games is ready to sacrifice quite long periods of his lifetime in training the voluntary muscles of his body to perform complicated movements; but with a want of knowledge of facts which is quite pathetic, almost invariably ignores that great factor in practically all games of skill—the eyesight. Or else he accepts a mere rule of thumb. Take, for instance, the oft-repeated maxim of the experienced golfer to the tyro—"Keep your eye on the ball." This is said probably thousands of times in the course of the year, but probably not one of those who say it could explain how much more accurate it is to say "eye" than "eyes"; very few of them know that of the two eyes which Nature has dealt out to us, one is the "master eye," and that it is with this eye that we judge of the position of an object in space in relation to our own body.

The following simple experiment readily proves the existence of the "master eye," and enables one to determine in oneself which it is. Take a piece of notepaper, and in the centre of it cut out a small circle of about 1 inch in diameter; place the cut-out portion on the floor, and with both eyes open hold the paper at about arm's length, so that the white
object is visible through the hole. Now, first close one eye, say, the left, and if the object is still visible through the hole, then the right eye, which remains open, is the "master eye," for, if this eye is closed and the left now opened with the paper still held in the same position, the white object disappears from view, being hidden by the rest of the notepaper, the head being kept rigid the whole time. Of course, in the reverse case, if the white object disappears on the closure of the left eye, then the left eye is the "master." A consideration of this little experiment brings some exceedingly interesting points into notice, besides proving to oneself that the "master eye" exists, and telling one which eye possesses the

mastership. For, now get someone else to perform the experiment, and it will be observed that when the paper is held in position with both eyes open that the eye which will be found to be the "master" is in a straight line with the hole in the paper and the white object, the other eye being to one side of a line which joins the object and the hole, and which, being prolonged towards the face, of course reaches the "master eye."

To understand what this means, and why on closing the "master eye"
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the white object disappears, note that "master eye," hole, and object are all in the same vertical plane, while the secondary eye is 2½ inches wide of this plane.

What does all this involve, and how is it important? In most games of skill what is known as "aiming" is an essential factor, whether the instrument leaves the hand like a thrown ball, or be retained like a bat used to hit a moving ball.

Figs. 3, 4, 5, and 6 show the facts of the "master eye," i.e., here the right eye. If you look at an object with the aiming-intention in your mind with both eyes open (e.g., as at the centre of the lens of a camera), and if while looking you interpose a card with a hole in it between your face and the object, you cannot see the object unless the object is in the straight line between the "master eye" and the object. The line of aiming sight is left undisturbed if, as in fig. 3, both eyes are open and the hole is in the straight sight-line of the "master eye"; or if, as in fig. 4, the non-"master eye" is shut; or if, as in fig. 5, the card is moved clear of the sight-line of the "master eye" and the hole is opposite the non-"master eye." But if, as in fig. 6, the "master eye" is shut, then the non- "master eye" is artificially made the "master eye," and the line of its sight becomes the line of aim. Faults of aim occur when the sight-line of the real "master eye" is blocked, and the mind and hand work as though the line of aim were still the line of sight of the "master eye," when, in fact, the mastership has been artificially transferred to the other eye. The effect is that you see down one line and aim down another, and therefore your action is in the wrong vertical plane.

When we concentrate our gaze on some object with, say, the intention of throwing something at it, the "master eye" is the eye which locates the position of the object in space in relation to our own bodies, and in order to thus locate it we unconsciously place the "master eye," so that this eye is exactly plumb opposite the object, the other eye, as stated above, being a little to one side.

Now, by methods that will be explained later, the brain realises where
this object is by ascertaining first how far it is off by the state of the ciliary muscle of the lens which manages the focussing of the object on the retina; and, secondly, what vertical plane it is in by the condition of the muscles of the master eyeball which turn it this way and that.

Why is this vertical plane important? Because it is the one in which the muscles of the body have learnt to project anything if one wishes to hit an object.

Unconsciously the hand is made to travel in, or as nearly as possible in, this vertical plane which includes the object and the "master eye." Now this is easily proved. Get someone else to aim, assegai-fashion, with a long stick held above and behind the head; it will then be seen that in aiming one is endeavouring to bring the missile into the same vertical plane which includes the object and the "master eye." One generally aims in this fashion by moving the hand backwards and forwards, and it is most convincingly evident that the hand is manœuvring to get the instrument in exactly the same vertical plane as the "master eye" and the object. Try any series of experiments on these lines and this will be found universally true. Watch a boy throw a stone at a bird. He throws in such a manner that the hand in throwing cannot be brought into the same plane with the "master eye" when the head is erect upon the shoulders, so head and neck are bent over in order that the "master eye" shall be brought into the same vertical plane as the hand has to pass through in throwing; and from this position he is able to judge whether the object, the eye, and the hand are all in this very important vertical plane.

That we must speak of planes, and not merely about straight lines from the eye to object, is clear when we consider the most accurate of all aiming instruments, the rifle, the accuracy of which entirely depends upon two straight lines being in the same plane. The line joining the fore-sight and back-sight, and the line representing the centre of the barrel, are two straight lines one a little above the other in the same vertical plane, and it is in this plane that the projectile, or bullet, is forced to travel.

In aiming with a rifle one places the "master eye" in the same vertical plane as the fore-sight and back-sight, and then pointing it in the direction of the bull’s-eye one makes the "master eye" plane—this plane being now the same as that of the sights and the centre of the barrel—coincide with a vertical plane which cuts the bull’s-eye.

Now, the barrel, the eye, and the object being in one vertical plane, a correct elevation is the only requisite needed to cause the bullet to hit the centre. It is obvious that the vertical plane is the important one, for, while there is only one horizontal plane for the eyes, there are always two vertical, that is, in the ordinary position of the body.

We can now go on to discuss for what reasons the "master eye" is so important, and they are shortly these. In all of us one eye is generally
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the master, and the muscles of the body learn to adapt their movements to this eye, that is, to work in this "master eye" plane, a fact well shown by the way in which we generally fire a gun from the right shoulder; but it is found that, from several causes, usually fatigue, the "master-eyeship" is not constant for one eye, but is interchangeable.

If the right eye, ordinarily the master, becomes tired, the left eye takes on the duties of the "master eye"; but this throws complicated movements, such as aiming, quite out of gear; for the muscles have long accustomed themselves to act with the right eye as guide, and as we have

![Diagram](image)

**Fig. 7.**

Fig. 7 shows true aim with a rifle with both eyes open. The line of aim includes the back and fore sights of the rifle and the centre of the target. Fig. 8 shows true aim with the non-"master eye" shut. The shutting of the non-"master eye" makes no difference to the correctness of the line of aim. Fig. 9 shows the error that occurs when the "master eye" is shut (or blocked) and the mind thinks the line of sight and aim is still the same. The line of sight of the non-"master eye" is to the centre of the target, but the line of aim of the rifle is right off the target.

no means of knowing by sight alone which eye is acting as master, they will go on performing their duties as if the message to the brain with regard to the relative location of objects in space had come from the right or original master eye.

Now if we reflect on what has been written with regard to the vertical planes of the master and the secondary eye, it would at first appear that, supposing the secondary eye takes on the mastership, even then the muscles working as for the plane of the usual "master eye" will be working in a parallel vertical plane only 2½ in. from the original "master
eye" plane, so that the error in projection will only be one of 2½ in. on either side of the object. But that far greater confusion arises can be shown by this experiment.

Take a shot-gun, or a stick, and, raising it to the shoulder, aim at some object with both eyes open. Of course, by aiming, the muscles acting in the "master eye" vertical plane have put the "master eye," the gun, and the object all in this same plane.

If the gun be now fired you will hit the object. Without altering your aim or position in any way, shut your "master eye." What does your brain tell you now? What does the message from your secondary eye convey? This, that if the gun were fired you would not go near the object, but somewhere wide to the right or left, for the gun appears to be pointing quite on one side of the direction of the object. Of course, if you move your head so that the secondary eye is exactly behind the sights, you find that the gun is really pointing straight at the object; but the impression experienced in actual fact is one of wide error if for some reason the "master eyeship" be suddenly changed while one is aiming. For the secondary eye, suddenly locating the object, discovers the muscles acting in another vertical plane than its own, i.e., the original "master
eye” plane, and hence the first impression conveyed to the brain is that the muscles are acting all wrong, and in the subsequent mental and muscular confusion the bird is missed, or the batsman bowled, as the case may be. In a great many games with the tiring of the "master eye" and the change of mastership to the secondary, a state of affairs occurs exactly analogous to the above experiment. That erroneous impressions are conveyed, but can be correctly interpreted by the use of common sense or intelligence, is shown below, and this encourages one to think that "master-eyeship" errors could often probably be avoided or correctly interpreted.

They can.

A great difficulty in understanding the points under discussion will be removed if we take care to always realise that what we know of the world outside of our own bodies is the result of subjective impressions conveyed to the brain by the senses of seeing and hearing, etc., and that these impressions are not necessarily true. In fact, did we not use experience, and the reasoning faculties with which it has pleased Nature to invest us, we should be led astray into error by these sense organs of ours every minute of the day.

For instance, we see an explosion take place at a distance, we hear the concussion a few seconds later. If we relied merely on our subjective sensations we should think that the noise and explosion had nothing to do with each other, or we might argue that a thing has to explode some seconds before it can make a noise. By experience, and by using our reasoning powers, we know that neither of these suppositions is correct, but that the noise and the explosion are simultaneous. What has happened is, of course, that the subjective impressions have merely reached our brain at different times because they have travelled by different paths and made use of different special sense organs.

A method of finding out the "master eye" has long been known to gun-makers. They get one to aim at something and notice how one goes about it, and this at once tells them whether the right or left eye is the master. What they really observe is whether the muscles are acting in a right or left master eye vertical plane, but that they have a conception of this plane is very doubtful, and one is led to think that the method has been evolved by rule of thumb. That they find out the "master eye" is certain, but their method does not demonstrate the fact to the owner of the eye so clearly or so certainly as the little experiment at the beginning of this article.

Before proceeding to the practical application of these physiological facts, certain pastimes necessitate the consideration of another factor—motion, and the estimation of the rate of motion—those pastimes in which the objects are moving. We can conveniently subdivide games and sports into two classes on the above basis, namely, those in which the object aimed at remains still, such as billiards, golf, target shooting; and those in which the object moves, such as cricket, tennis, shot-gun shooting.
Now, to be able to hit a moving object we must be able to form an estimate of the speed with which it is travelling, its rate of motion, or, in common parlance, be able to "time" it. There are two ways in which this estimation of the rate of motion is arrived at; one with an optical, and the other with a muscular basis.

The first is dependent on the relative change in size of the projection of the image of an object on the retina; a thing which while it is looked at grows rapidly larger or smaller, we know to be approaching or receding rapidly; but, in the second method, another element comes in which involves a muscular sense, and this brings in a most important factor for error in the actual playing of games; for the impressions which we receive from muscles are notoriously dependent on whether these same muscles are fresh or fatigued.

It is obvious, therefore, that for practical purposes the second method of speed estimation is the more important to us. This estimation is arrived at in the following manner. When the eye gazes at, and focusses, a moving object, to keep this object in the field of vision the eyeball must be turned in the same direction in which the object moves in order to follow it, and it is the amount of work done by the extrinsic or locating muscles of the eyeball which (apart from the change in size of the object already mentioned) gives the brain the clue to the rate at which the object is moving. Thus, if the eye muscles have to move the eyeball quickly we know then that the object gazed at must be moving rapidly, and vice versa. Just such an estimate of exactly the same nature is arrived at roughly by anyone keeping a moving object on the finder of a camera; if the hands have to move the camera rapidly one knows the object is moving rapidly; the way the muscles have to act conveys the impression of rapid speed to our brain. A word as to this so-called nerve muscle sense. It is an impression, received by the brain and conveyed by the nerves running from working muscles, which informs the brain at what rate the muscles are working, and also how much energy they are expending. Similarly we can tell the difference when we lift up with our arms a 2 lb. weight or a 10 lb. weight, and we also know without looking at it whether we are moving it quickly or slowly.

How? By this same nerve muscle sense. But take notice how deceptive this nerve muscle sense is—how much heavier does a bag feel when we have carried it half a mile than when it was lifted from the ground at the beginning of the walk; yet we know that it is exactly the same weight, the seeming increase of weight is merely a subjective impression due to the effect of fatigue; surely a most obvious illustration of the liability of our subjective impressions to error. So, too, with our eye muscles; they also are subject to fatigue, and can lead our brains astray. The batsman, while he is fresh, with his eye muscles unfatigued, can follow the ball with his eye, and can instantaneously impart to the trained muscles of his body the necessary impulses to enable his bat to
strike the ball when he chooses. But observe, after a time his eye muscles become tired; what happens then? To move the eyeball at the same rate as he did at first in following the ball requires an effort; and though a ball may be coming towards him at the same pace as it did at the earlier part of his innings, his eye muscles, fatigued in their effort to keep up with the ball, give his brain an idea of relatively greater speed; his trained muscles obey, as they did when his eye was fresh, and he is inclined to hit at the ball before it has reached hitting distance.

Every day on a cricket field can be seen the unconscious efforts of bowlers to confuse or weary the eye muscles of a batsman who is set. It is quite evident that it is much less of an effort to play bowling which is all the same pace; the eye muscles as each ball comes down do the same amount of work, and give a relatively similar impression; but if balls are bowled at varying paces the eye muscles have constantly to change their rate of contraction, and this not only tends to tire them sooner, but it also tends to confuse by their sending to the brain widely different nerve muscle impulses.

Take cricket, now, for a discussion from the eye-sight point of view, recalling what has been said about the "master eye" and the vertical plane in which the muscles have a tendency to act, and about the estimation of the rate of moving objects with its liability to erroneous impressions. It is of great importance to a batsman to know which is his "master eye," for, owing to the position in which he stands while batting, he is skew-ways-on to the bowler who sends the approaching ball towards him; he has, in fact, to strain the position of his neck so as to turn both eyes directly on to the bowler and the ball which is to be struck, for unless he does so, should his right eye be the master and he bat right-handed, then the bridge of the nose will, intervening, unless he keep his face rigidly turned to the approaching ball, cut off the eyesight of the "master eye," causing the left to take on the mastership, and so get the batsman into all sorts of difficulties. It is convincingly evident on looking at photographs and action photographs of great batsmen that they tend to keep the face square to the ball, and play with the "master eye" and the bat in one vertical plane.

The fact that our two eyes are separated by the bridge of the nose is of curious importance for judging where the ball is when batting. have never heard its importance spoken of, or the importance of the "master eyeship" alluded to, by cricketers, but I have heard some appalling nonsense talked by cricketers about the "blind spot" on the wicket where it is the bowler's ambition to pitch his ball. They do not appear to have the faintest idea that it is a spot which can only exist by the body of the batsman being in such a position that he cannot look directly at the approaching ball, and that as it pitches some portion of his anatomy, generally the bridge of his nose, interposes between his trained localising eye, his "master eye," and the approaching ball. A practical application
of what this teaches us would be, whilst practising batting, occasionally to bandage the secondary eye, so that the trained "master eye" should be taught never to allow itself to be cut off from the ball.

In doing this the head will be found to be forced to turn rather more emphatically in different directions than it was when there was the secondary eye on the other side of the bridge of the nose ready to locate and look at the ball. The conscious or subconscious knowledge that to bat well one must always take care to look squarely at the ball is one of the paths which leads the batsman to become a first-class player—a failure to grasp this fact must have kept hundreds as fourth and fifth-

Figs. 12 and 13 show a common, but little known, effect in cricket of not acting in accordance with the true theory of the "master eye." The man to whom the head belongs is supposed to be playing forward to a straight ball pitching on the leg-stump. His stroke and his position are the same in both cases, except that in fig. 12 he has turned his head full face to the ball, so that his "master eye" (the right) gets a full sight of the ball; while in fig. 13 he has kept his head in the position (natural to the novice, but quite fatal), which, since the nose is interposed between the "master eye" and the ball, blocks out the real "master eye" and transfers the aim-sight to the non-"master eye." Until you try, you will be surprised how much the head must be turned to let the "master eye" see the ball. The effect of keeping the head as in fig. 13 is that your hands and bat act as though the line of the right eye were the line of aim, because this is their habit; while really the line of aim is quite different. This is the reason why batsmen so often miss the good-length ball pitching on the leg-stump. They talk of the "blind spot" on the wicket—the blind spot is not a spot at all, it is created by a false line of aim. In fig. 13 you see the ball, but you see it with the wrong eye, the eye which your hand and bat are not accustomed to work with. This counts for at least twenty per cent. of errors of batting.
rate bats, while they possessed all the other essentials, viz., coolness, quickness, swift decision, nimble wrists, &c., to enable them to become first-class. A few hours’ batting with the secondary eye intentionally put out of action by bandaging would have let a light into some of these batting failures that would have astounded them. Many a man has become first-class as a bat because he has grasped the necessity of looking straight at the ball; many have missed it by neglecting to do so. Of course, a right-handed batsman with a left “master eye” is anatomically better situated than if he had a right “master eye,” for in this case the “master eye” is in front of, and not rather behind, the nose.

If one is tempted to doubt that there be truth in the importance of realising the existence of a raised anatomical separation—the bridge of the nose—between the two eyes, let us turn for a moment, to study the relation of this and the “master eye” to hitting a golf ball. We must take as an axiom that the adage, “Keep your eye on the ball,” is of vital importance in golf, and that remissness in this particular is fraught with disaster to the player.

To the man who plays right handed, and who has a right “master eye,” what happens when this advice is not carried out can at once be rendered apparent by shutting the left eye when swinging with a club at a ball. It will then be found that if, as the club comes up over the right shoulder at the top of the swing, one allows the head to rotate a little in the same direction as the arms are travelling, i.e., from left to right, then suddenly the ball is completely lost to view, the bridge of the nose intervenes between the eye and the golf ball. If now the left eye be opened the ball is again apparent, but what the eye gets is a left or secondary eye impression, and this occurring during an actual swing tends to throw out the muscles and the aim in the manner explained in connection with “master eyeship.”

It is very apparent that what actually does happen when the head is allowed to rotate with both eyes open is that a sudden change of mental impression occurs full in the middle of the swing; a left eye impression is substituted for a right. The confusion is feebly and inadequately expressed by the rule-of-thumb man as a state of “not keeping the eye on the ball.” There is always in the beginner a tendency to allow the head to rotate in this fashion, partly owing to its going naturally with the swing of the arms and the shoulders, partly to some unconscious effort to give more force to the swing.

A little more lengthy and accurate explanation, such as, “Be careful that in swinging you do not let the direct vision of your ‘master eye’ be cut off by the bridge of your nose from the ball, and so allow your left eye to assume the mastership,” with a few words as to how and why this is important, would surely be fruitful of better results than the mere rule-of-thumb, “Keep your eye on the ball.”

A very practical deduction that one arrives at, if it be agreed that
there is reason and truth in the above matter, is that right-handed golfers and cricketers who are by nature left master-eyed, are anatomically thus in a better position to play these games than those who are right-master-eyed, the converse, of course, holding good. Statistics on this point would be very interesting; sufficient to be quoted in this article have not as yet been procured. It has, however, been found that people who are left-"master-eyed" and right-handed are markedly far worse shots in throwing at an object than those who are right-handed and right-eyed. The difficulty is (as with a cricketer and golfer) an anatomical one, it being easier in throwing to work with a right-eye right-hand vertical plane. To return to batting again, it will, as urged above, be more important to the right-handed right-eyed cricketer than to his left-eyed confrère to look squarely at the bowler. Try a similar experiment as recommended in swinging the golf club. Stand ready to bat, with the head as it would be in a natural, untrained position, and it will be found at once, by shutting and opening the left eye, that the vision of the right eye scarcely includes the bowler, who can, however, be seen by the left. If this position be retained while playing a ball, it follows that the ball will first be located by the left eye, and as it approaches nearer will come into the range of the right eye, which, if naturally the master, will assume the mastership, and the poor brain will have got both a left and a right eye impression of the approaching sphere, just as happened to the unfortunate golfer who allowed his face to turn and could not keep his "master eye" on the ball; result, in both cases, a certain amount of muscular confusion and possible disaster. It seems reasonable to impress on the right-eyed cricketer the necessity for turning the face square on to the bowler. Looking at the pictures of the great batsmen of the day when ready to face bowling, one is greatly struck by how much the neck is rotated over the advanced shoulder so as to obtain a very front-faced attitude. There seems in this a very practical value in understanding the "master eye-ship" in cricket.

Further, a word as to the way in which a knowledge of fatigue in producing erroneous impressions of the pace of balls may be turned to practical use.

It has been shown that with the tiring eye the pace of bowling appears relatively faster; it is then most reasonable in an innings where one finds one is beginning to misjudge balls to play a little slower at them than the mental impression would urge one to do. A practical piece of scientific common sense which might very well make an innings of sixty into one of a hundred. The natural tendency when one is obviously misjudging is to hit quicker than ever, to increase, in fact, the error produced by the mental impression. This is an explanation, of course, which applies to a batsman who has been in some time—long enough, in fact, for eye muscle fatigue to be the probable cause of the erroneous impressions.
Many more applications of the "master eyeship," etc., can be shown to apply to batting, but a relation of them would be tedious, and there is always an inclination in a study of this kind to explain all failures by something to do with the special subjects treated, though there are many factors entering. Besides, once put on the track of the matter, one can deduce the various applications.

However, a short space might be allowed to the bearing of what was called the "master eye" vertical plane, and the tendency the muscles have to bring the striking instrument into this plane; or, shortly, to make the planes of the acting muscles and the "master eye" coincide. It is stated by skilled exponents of cricket that the essential of playing any particular stroke is, first, to get the body into a position which renders the stroke the least constrained and easiest of performance, and then to play the stroke. We will accept this as correct. Now look at some action photographs of strokes being played by great batsmen, and it will at once become evident that beside putting their bodies in the easiest position to perform the stroke with their arms, they have also put their "master eye" in the easiest position for aiming at the approaching ball. That is, the "master eye" vertical plane and the plane of the swing of the bat have been approximately made one. This is very plainly illustrated in leg-glancing and on-and-off driving. Practical deduction—when putting your body in the most comfortable position to play a stroke, see that your "master eye" is as far as possible in such a position as to make your aim as accurate as possible.

Should there be readers of this who still regard vertical planes of muscular actions as myths, surely they would be converted by a short study of fielding. If a ball be thrown into the air, and we stand under it to catch it, and then, when caught, look down at the position of our hands, the centre of them will be found to be in the same vertical plane as one of our eyes, and that our "master eye"; their centre does not coincide with the centre of the body or the mid-point between the eyes. Watch another person take a high catch, and the same conclusion is arrived at. In this case the hands have unconsciously brought themselves into the vertical plane which included the "master eye" and the approaching ball. A practical deduction would seem to be that in fielding a "master eyeship" which remains constant is of importance, and should be cultivated. A tendency to drop high catches from a faulty position of the receiving hands might in some cases be remedied by closing the secondary eye when calculating the catch, and so obviating any "master eye" changing errors.

It is a reasonable conclusion that the popular term, "a good eye," is but a general way of describing a person who possesses a marked "master eyeship" constant to one eye.

Certain it is that many of those who are notoriously possessed of "a bad eye" can be shown to have a "master eyeship" that is easily interchangeable.
To the bowler the fact of a right or left-hand "master eyeship" would not apparently be of such importance, for he goes to his work with his face naturally looking straight towards the batsman, and to the spot on the wicket where he intends to pitch the ball. Herein he has the anatomical advantage of the batsman who is craning his head sideways to see where the ball is coming from.

Figs. 14 and 15 show how the "master eye" theory applies in golf. In fig. 14 the man is addressing the ball for a stroke, drive, approach or putt. He has a full view of the ball with his "master eye," the right. In fig. 16 the man has swung back his club to the top of its swing, and in doing so has made the mistake of turning his head with his shoulders and arms. The result is that the sight of his "master (or real aiming) eye" is blocked out by his nose, and the sight of the ball is limited to the left, i.e., the non-"master eye." Consequently, when he swings down at the ball his club is being guided, not by his "master eye," but by the other. His stroke is sure to be inaccurate, because his hands and arms are not in the habit of working together. Or, to put it another way, the mastership is transferred during the stroke from the real to the artificial "master eye." You address the ball with the right eye as master, and strike it with the left eye acting artificially as master. Therefore the inaccuracy of aim. Hence the dictum in golf, "Keep your eye on the ball," should be "Keep your "master eye" on the ball."

That the bowler who bowls with a coinciding "master eye" and hand-delivery-vertical-plane keeps a more accurate ball seems probable on the strength of what has been said.

The tendency to error in playing golf by not keeping the eye on the ball, or, as it has been explained above, by an unintentional substitution of one "master eyeship" for the other, only explains one of the eyesight difficulties to be overcome in this most fascinating game. To all who
have played is apparent: the great difficulty which actually exists of hitting the ball with a club clean and true, and not topping, schlaffing, or toeing.

In golf (unlike most other pursuits which involve sending something in a desired direction), at the moment of dispatching the object (the ball) towards the flag, the "master eye" vertical plane, in which are included the "master eye" and the ball, is at a right angle to the plane of swing of the hitting instrument and the direction in which it is desired that the ball shall travel. Here, in a word, are explained the reasons of the difficulties and possibly the charm of golf. If it were possible for our muscles to act and the club-head to swing in the same plane as the "master eye," half the difficulties of golf would disappear; as it is, our anatomical construction prevents this, so that golf remains a game in which the travelling club-head must come into the vertical plane of sight at right angles to it; the player derives no assistance from vision for the management of the proper direction and elevation of the travelling club-head, but depends solely on nerve-muscle sense.

Billiards is an admirable game for the illustration of the effect of "master eyeship," and of the tendency there is for muscles to act in what we have called the "master eye" vertical plane. It was, in fact, from this game that the theory of aiming, as put forward in the earlier part of this article, was first deduced. It must always be remembered that what is referred to only applies to the act of aiming, that is, driving the striker's billiard ball exactly against the selected spot on the object ball, and has no reference to side, bottom, or check, or any such technicalities which modify the way in which a stroke is played. In watching a billiard player taking an ordinary half-ball shot one notices several things. First, that the cue in aiming for the stroke is worked backwards and forwards in the same plane as one eye (the master), and that this plane includes the aimed-at spot on the object ball. Unlike a shot with rifle or long-bow (beyond point blank range), elevation does not come into effect for the billiard player, the slate of the billiard-table takes charge of this, so that the player on aiming straight has only to think of the working strength which he wishes to impart to the struck ball; quite enough to concentrate on for most of us who attempt this game. The coincidence of the various factors in the same vertical plane can probably be best observed by getting a player to drive a ball from baulk, say, over the spot, and watching him do this from the bottom of the table. Practical applications could be made somewhat as follows: A beginner should be instructed straight away to put and keep his cue in his "master eye" vertical plane whilst aiming at a ball, and not have to drift into this method, wasting time in harsh experience. The bright light on a billiard-table and the effort of watching the balls is undoubtedly a strain on the eye, and the astonishing way in which one sometimes absolutely misaims a stroke can easily be accounted for by a momentary change in
eye mastership; for exactly the same condition of things can arise as was described to illustrate the momentary mental confusion which can occur when aiming with a gun. It arises from the fact that we have a perception of the cue while we are aiming at a ball, just as we have one of the gun-barrel; the perception of the cue is, of course, more pronounced, because we are aiming at a stationary object. If the "master eye," hand, and cue are all in one plane, well and good; but if for any reason the "master eye" should change, what then? Fallacious impressions are enforced on the brain just as in aiming with a gun. Try this experiment, start aiming to play a ball at a certain spot with both eyes open, be sure of your aim, and then change your "master eyeship" by shutting your real "master eye"; it would now appear to you that you are aiming all crooked until you shift your secondary eye into the same plane as the cue and the ball—absolutely the same conditions are illustrated as were put forward in the gun-aiming experiment. A mastership which remains constant has much to do with correct aiming, and is therefore worth cultivating. So when obviously possessed of a marked tendency to misdirect the playing ball, a tendency many of us at times are subject to, we might well partially or totally close the secondary eye so as to prevent its doing too much in localisation.

In billiards we are always unconsciously thinking of the "master eye" vertical plane in relation to the angle that the played ball or the object ball will make when they impact in the same place. Natural angles are frequently spoken of, but are generally regarded as the angles made by the course of the driven ball and its subsequent deviation after impact; and yet a moment's thought will show that the course taken by the driven ball is really just an expression of the "master-eye" vertical plane; for it is the subjective existence of this plane in the mind which causes the driven ball to subsequently proceed on the course or direction desired.

With regard to shot-gun shooting it was naturally the first pastime to attract the attention of the writer when asked to write on the "master-eye." As mentioned before, the subject has long been recognised by gun-makers, who made a straight or cast-off stock according to whether the mastership be in the right or left eye, provided, of course, the gun be fired from the right shoulder. In investigating the question of "master eyeship" in this kind of shooting a great deal of interesting and practical information was gained. The probable existence of a change of mastership, and the method of describing it, was evolved from the following experience. In a discussion with a man who did a good deal of shooting I was told by him that up to a certain distance he was pretty sure of his shots, in fact, could shoot straight, but beyond this distance he could not hit anything, or, as he described it, he was bound to miss. Investigations of his eyesight appeared likely to bring to light interesting facts—they did. It was found that his right eye, which was the master, was to a certain extent short-sighted (he was quite unaware of this fact until he was tested), but the left eye possessed nearly normal vision.
The whole of his shooting difficulties were then explained right away. His right eye acted as master up to his limit distance of good shooting, but then, beyond this, its lens not being so well adapted for focussing a clear image of the object as that of the left eye, the mastership changed from the right to the left. Thus, without his knowing it, a perfectly erroneous impression was conveyed to him beyond a certain distance. For the nearer shot his muscles had been acting in a right-eye vertical plane, and for far shots there occurred a combination of this with a left-eye impression, a combination which had caused him for years really to aim several feet to the left of anything that he fired at. It is no wonder that he considered himself a bad shot for distant objects. The fact that for near objects the right eye was master, and for far the left, was easily proved by getting him to point quickly at near and far objects, taking note which eye vertical plane his muscles acted in. It was also seen that the distance at which the change of master eyeship occurred coincided accurately with the distance beyond which he said he could not hit anything.

A very practical result followed this discovery. Acting upon advice to try wearing a glass to correct the eyesight of the right eye whilst shooting, so that there should be no need for the left eye to assume the mastership, a marvellous improvement in his shooting occurred, and he became relatively as good a shot at distant objects as he had been at near ones.

There are doubtless numerous similar cases of a disability capable of a like simple and obvious remedy. Although in firing at a moving object one does not gaze along the barrel as in rifle shooting, yet it is impossible to fire a gun from the shoulder without a certain amount of consciousness of how the gun is pointing, because the length of the barrels and the nearness of the gun to the eyes necessitates its coming into the field of vision. Though the most sensitive part of the retina is occupied by the bird, or whatever it may be, the barrels necessarily claim a place on the retina, and having such a place make their presence felt, though perhaps we are unconscious, or only partly conscious, of this. Thus it is in the same way as in billiards, that if the "master eye" be not in the same vertical plane as the barrel, its impression of where the shot will be sent cannot be correctly gauged. An essential of good shooting is to be able to bring a gun up so as to cover exactly the point in space that the direction and rate of flight of the bird require. Hence, as urged before, correct impressions are of primary importance. A man firing in one vertical plane and localising objects with his eyes in another, might just as well shoot with a gun the barrels of which are set on crooked.

It is not contended that a knowledge of "master eyeship" will be a remedy for all bad shots, or for the unskilful exponents of most games—there are so many other factors to be fulfilled in good shooting and skilful playing; but there is no need for people with sound eyes, brain, and limbs to be such poor shots or players as are constantly met with.