The Howell phoria chart measures the underlying optimally corrected vision. Preliminary findings in Formula 1 racing support this theory. That in some sports less total reliance on sensory information less sensitive but more robust visual system. Indeed it could be argued much better and are therefore less affected by binocular imbalance; a with binocular deficiencies, learn to judge depth using monocular clues the traditional shooting sense, is subsumed by the need to anticipate or
More surprisingly, it was found that the process of aiming in tennis in the speed of the bird, which apparently slows as distance increases. What was unexpected is that cross dominance may be an advantage in out of the Affordable Banger?1.

From the results it was possible to conclude that clay pigeon shooting is an aiming sport and relies on good vision in the dominant eye. What was less predictable was that it also requires good depth perception to judge the speed of the bird, which apparently slows as distance increases. What was unexpected that cross dominance may be an advantage in this sport (much higher incidence than in rifle shooting).

More surprisingly, it was found that the process of aiming in tennis to the speed of the ball, which apparently slows as distance increases. What was unexpected that cross dominance may be an advantage in this sport (much higher incidence than in rifle shooting).

A poignant aside, was that cross dominant athletes who had to cope with binocular deficiencies, learn to judge depth using monocular clues much better and are therefore less affected by binocular imbalance; a less sensitive but more robust visual system. Indeed it could be argued in some sports less that total reliance on sensory information directly from the eyes has the memory and improves reaction time. Pervasive feelings in formula 1 racing support this theory.

The overriding conclusion was that whatever the configuration of the athletes visual system, optimal correction was the single most important consideration in competitive sport. It may follow from this that the best form of eye exercise (impossible to duplicate in the laboratory) is playing the game in the real competitive situation with optimally corrected vision. Significantly, the proposed laws of sports vision may demonstrate a direct link between vision, occupation and behaviour for the first time and begin to bridge the gap between Sports Science and Optimetry. Based on the evidence of this research the following laws of Sports Vision are proposed:

1. The primary visual skills in sport are aiming and anticipation, upon which all other skills are based.
2. Visual performance is the combination of external factors in the development and maintenance of sporting performance throughout life. (Other external factors that can be influenced by coaching procedures include physiology, nutrition and psychology).
3. Sporting performance is more or less dependent (according to the visual requirements of the sport) on the maintenance of the normal, established retinal fields of the two eyes.
4. A deficiency in visual performance will inhibit the development of sporting potential through poor eye hand body co-ordination, but perfect eyes do not make a perfect athlete. This depends on innate physiology (nature) and psychology (the gift in the oyster, the will to win - nuremberg).

These laws apply where vision is the primary sense and would have special applications in monocular activities.

SPORTS VISION SCREENING
On route to these results, a battery of diagnostic screening tests has been developed. These are designed to measure any deficiencies in the key elements of visual performance and at the same time demystify to the player why each is individually important to their game. A key element in the athlete's acceptance of optometric advice is a full understanding of its purpose and benefits. They can be done individually for one player in the clinic, or given to a whole squad as part of a formal team screening.

Analytical tests measure a complex visual function, which represents a laboratory simulation of an aspect of the sport, which is visually important, like anticipation or hand eye co-ordination. If a team is being screened to find out who needs a full eye examination, performance on the analytical tests will be compared to the whole group and problems related to the diagnostic tests.

DIAGNOSTIC TESTS

Reflexometry
Objective measure of reflexive error, long sight short sight and astigmatism.

High and Low Contrast LogMAR Vision
Low contrast vision is a better predictor of visual performance in real conditions of poor light, mist, dirty balls and confusing background. Eye Dominance
This gives the characteristic for each player and the importance of ocular correction may vary according to the individual's eye dominance. A consideration of eye dominance has a great bearing on the fundamental visual skills of aiming and anticipation (depth perception).

Muscle balance
The Howell phoria chart measures the underlying tendency for the eyes to diverge or converge. Excessive divergence or convergence can be related to prescription and has a profound effect on anticipation.

The Brock String demonstrates and measures the effect of muscle balance (Fixation Disparity) at a cortical level in the central nervous system and is a powerful indicator of the need to prescribe a correction or exercises. It can also be used to measure the effect of therapy. Colour preference and light sensitivity (Eye Bright Test)
Colour preference is affected by light sensitivity. For instance, a liking for blue tints and a strong dislike of yellow, is diagnostic of clinically significant light sensitivity. In outdoor sports, inadequate protection of light sensitive eyes in particular, will measurably degrade visual performance in the long and short term.

ANALYTICAL TESTS

Anticipation Timing
Is measured using the Basen Anticipation timer (see below) a late response (measured to the nearest second of a second) is given a positive value and an early response a negative value. This is termed an analytical test which represents a complex visual task but one which is an important element of the game of cricket. Deficiencies in individual members of the squad compared to their peers may point to deficiencies in the elements of visual performance as measured by the diagnostic tests.

Eye Hand Coordination
Eye Hand Coordination measures peripheral awareness as well as hand eye reaction speed and can be a useful way of using vision to warm up.

FOLLOW UP OPTIONS

1. Each player will be given a copy of their individual report and recommendations and various modes of correction will be discussed, including contact lenses. It is important where possible, for the correction to be conducted in the same practice that the assessment was carried out in. In the sport vision assessment feedback is very important and some times intervention will have to be arranged out of session.

2. Eye Exercises
The term eye exercises are often misunderstood and may be subdivided into three separate areas:

ORTHOPICs: Established and optometrically proven exercises to remedy muscle imbalance and visual deficiency.

Visual calisthenics: Exercises designed to mobilise the extra-ocular muscles like Dynamic Fixation (see photo) and to some extent the intramuscular muscles in the same way that other major muscle groups may be trained.

The physical benefits are relatively easy to justify in terms of greater range of movement, increasing muscle tone and clearing of central vision. Eye movement is a powerful stimulant to a general physical warm up and could be used to prepare for competition.

Using instruments like a hand eye coordination machine (Saccadic Fixator see hand eye coordination above)

It is scientifically difficult to prove that this has any effect on sporting performance.

Therapy: this might include visual calisthenics but embraces a much broader understanding of the visual process to include for instance, visualisation and peripheral awareness, as well as the effects of behaviour on vision and vision on behaviour. This could be considered as a panacea given to all athletes regardless of visual deficiency. The scientifically supportable approach is to correct visual deficiencies and that the best form of eye exercise is playing the game competitively. However, the work of colleagues in this field needs to be supported and understood in view of the positive feed back received.

DIPLOMA IN SPORTVISION PRACTICE
The next phase of development in the UK will include the Diploma in sportvision Practice, which will take place at 5 venues throughout the country in August and September 2005. (see next page for details)

This will be followed by Sportfair 06 which was inaugurated in 2004 at the International conference centre Loughborough university where the coming together of the profession and industry is uniquely supported by Sport Vision's Holistic approach to Optimetry.

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REFERENCES
March 30 67-120
3. Griffiths GK 2002 Eye speed, medity and athletic potential Optimetry Today Vol 42:10 (see “articles” www.sportvision.co.uk)

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