value contributed by protective foods, which is largely due to the inclusion of a liberal allowance of milk throughout the whole period of growth. The diets for children between the ages of 1 and 3 contain rather more than three-quarters of their total calories in the form of protective foods: those for children between 3 and 7 contain rather more than two-thirds, and this proportion is diminished in the pre-adolescent age to rather less than one-half. This insistence on a high proportion of protective foods is really the essence of the scheme for securing good nutrition. It runs directly counter to the attitude not infrequently adopted in some quarters that as long as a diet contains enough of the essential food constituents to prevent symptoms of deficiency diseases there is no point in worrying about its make-up.

There was recently published by Mr. Rowntree in his book *The Human Needs of Labour* a dietary scale, "representing a standard below which no class of worker should be forced to live," for a family of man, wife, and three children under 14. I made a rough analysis of this diet, and calculated that even if each child received more than his share of the protective foods in proportion to his man-value equivalent, less than one-quarter of his food intake would be derived from such protective foods—and even then more than half of the protective foods would be composed of cheap cuts of meat and condensed skim milk. It is true that even a diet such as this compares most favourably with diets consumed in many parts of the world. To take just one instance, Dr. Aykroyd has recently carried out a survey of diets in South Indian villages. Among the poorest group the diet averaged 1,664 calories per unit of man-value, and 95 per cent. of the calories were derived from cereals. The children forced by poverty to live on such diets showed only too frequently gross manifestations of deficiency diseases and general malnutrition, while the children brought up on the diets suggested by Mr. Rowntree might escape without immediate obvious symptoms of food deficiency other than slight indications of rickets, poorly developed teeth susceptible to decay, and a general physique below their potential optimum. All who have tried to put into practice the modern principles of nutrition, whether on experimental animals or children, would agree, I think, that it is worse than useless to lay down as a standard any diet which is likely to produce imperfect development and suboptimal states of nutrition. It is true that mere pious expressions concerning the make-up of the ideal diet will not enable the poor to buy the food best calculated to promote perfect nutrition. Fixing a dietary standard which approaches the ideal for promoting good nutrition at least draws attention to the urgency of the practical problem of trying to bridge the gap between the ideal and the actual, whereas an admittedly low standard merely encourages complacent individuals and authorities to continue their policy of *laissez-faire*.

Our discussion is concerned with the physiological, not the economic, bases of nutrition, and it would be out of order for me to pursue further the sociological and political implications of dietary standards. It will suffice to remind you that the Health Organization of the League of Nations is deeply concerned with the economic, agricultural, and political problems involved in attempting to supply a sufficiency of health-promoting foods for the populations of mankind. Our own Government Departments are already tackling the same problem, and a perusal of the first report of the Ministry of Health's Advisory Committee on Nutrition will show that these practical aspects of the situation are receiving serious attention.

THE ROLE OF HETEROPHORIA IN BINOCULAR DISHARMONY WITH SPECIAL REFERENCE TO AIR PILOTAGE*

BY

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To confine this paper entirely to the domain of the air would be like writing the final lines of a book without considering the framework of the first chapter. The condition that we style heterophoria must be age-old, but the contest for mastery of the air is, within practical limits, an event of our generation. Racing through space does not itself produce heterophoria, but heterophoria may severely affect safe aerial manœuvre. Therefore let us consider first the part that heterophoria may play in binocular disharmony upon the ground. Furthermore, let us confine ourselves to this condition, ignoring at once all other visual states that are so wont to wriggle into the picture, such as squints of small degree, transient diplopias that are so often the precursors of insular sclerosis, and pareses and paralysees of the ocular muscles.

Symptomless and Symptom-producing Heterophoria

We cannot have discord where there is no rivalry. The processes of evolution have so shaped the visual pathway that only some check in the maze of development, or some unreasonable assault through the demands of modern life upon the binocular function, can create a symptom-producing situation. We may speak of heterophoria under two headings: (1) inherent (slight; marked); (2) acquired. Leaving out all questions of refractive and pathological states, the one great predisposing cause of inherent heterophoria is *dominant macular reception*. This may occur without rivalry, in which case symptoms as opposed to signs do not arise in later life; or it can be present in a slight degree (in this case with rivalry), thus creating a potential source of trouble, according to the visual destiny of the individual.

Heterophoria may be acquired at any stage in life from school age to the presbyopic period, either superimposed upon a dominant macular reception of slight degree or arising as a condition primarily induced by the circumstances of everyday life. To differentiate the one from the other is sometimes a matter of a little difficulty. In this the age of onset of symptoms helps. The man who has *acquired* heterophoria without the influence of an inherent condition tends to complain of ocular discomfort early in the process. So strong has been his binocular conception that he is awake to the first falter. There is another approach to the problem—namely, by an examination with the stereoscope of the binocular reception rate, and also the appreciation of depth. On the stereoscope such a case will demonstrate rapid alternation with those charts designed for the examination of simultaneous binocular perception, will readily appreciate simple depth, and will proceed to give a good account with the more exacting charts. All this is in direct opposition to the *acquired* heterophoria with an inherent foundation. It is a natural corollary (in these cases) that symptoms are proportionate to the primary strength of the binocular chain. Much that can be labelled heterophoria diagnostically is quite symptomless, and is the outcome of a strong inherent tendency.

* Read in opening a discussion in the Section of Ophthalmology at the Annual Meeting of the British Medical Association, Belfast, 1937.

In the innumerable occupations that shape the intricate design of modern life there are two things that prey for ever upon us. One is the call for prolonged concentration at close range, while the other is a natural worry with regard to the eventual outcome of our endeavours. Any cause that irritates the mind may easily hinder the smooth running of the former and add a new load to the latter. We are now treading the nightmare path of psychology, but not without reason.

The part that heterophoria may play in the induction and maintenance of a psychological state is not sufficiently emphasized. Too many times has the association been demonstrated for any doubt to remain. It is a matter of experience that the most intense headaches can be produced by heterophoria, headaches that act not only as a handicap at work but may actually confine the sufferer to his bed. If the ability to maintain an occupation depends upon detailed and accurate work, the carrying out of which in turn produces the ocular symptoms, the picture is then complete.

It is wrong to hold that all sufferers from heterophoria are constructed with the addition of a strong functional element in their mental architecture; but it is right to maintain that very many symptomatic cases are definitely unstable. A typical example of this is well shown in a female patient, aged 35, who for several years had confined herself to her house. Her condition bordered on panic. She requested that I should leave my consulting-room door ajar so that she could run from the house if she found the strain too great. She had three to four intense headaches every week. These began in the morning and worked up during the day. Her vision was:

Right	...	6/18	$\frac{-0.5 \text{ Sph.}}{-0.75 \text{ Cyl.}}$	= 6/6	15°
Left	...	6/60	$\frac{-1.25 \text{ Sph.}}{-1.25 \text{ Cyl.}}$	= 6/24	70° (partial amblyopia)

She was found to have 14 prisms of hyperphoria. With the addition of suitable prisms (she had had correction without prisms before) she improved greatly. Within a month she was walking in the country and was beginning to tolerate the presence of crowds and traffic. The dragging in her left eye was relieved. She was unsuitable for training.

The Symptom-producing Phorias

Of all the phorias that produce suffering hyperphoria easily holds the field. This is explainable on the grounds that the binocular vision is quickly strained above the horizontal plane. No doubt this constitutes a big factor in the production of miner's nystagmus. The Bishop Harman test demonstrates this very prettily. In vertical latent deviation there is little latitude, and subconscious control rapidly gives place to central conscious effort. Where these two meet there also lies the evil of their plotting. It may be remarked that certain of the hyperphorias are symptomless, which is perfectly true, for they are of the marked inherent type.

Exophoria with weakness of convergence constitutes the second group of symptom-producing cases. Here the occupation of the sufferer influences the picture. I would quote the case of a very busy solicitor who was about to leave his practice on account of his inability to give long hours to the close study of his cases, owing entirely to this condition.

Ocular rivalry cases are a further variety, while cyclophoria enters the field not so much as a primary condition

but as an unpleasant addition usually to hyperphoria. It is present as a result of overaction of the torsion group of muscles, and its discovery is a warning not to show undue optimism with regard to prognosis.

Heterophoria in Relation to Flying

It is from this world of our civilization that we are asked to select our pilots of aircraft. Many of the potential causes of disharmony have been met with by the men in their studies and duties upon the ground. The ledger clerk, the draughtsman, the engineer, the man who follows an occupation calling for monocular estimation—all these have encountered the strain for varying periods. It is remarkable how rare it is to discover gross defects. It says much for the strength and the latitude of the binocular function.

The extent of the various deviations allowed for acceptance in the Royal Air Force is the result of long study, but cannot even yet be said to have reached finality. The subject is exceedingly involved. There is, for example, the problem of false panoramic conception, which has produced itself for solution and upon which work is now being done. In the past it was considered that the exophoric had a tendency to stall his aircraft, while the esophoric would come down heavily upon his wheels. But it is not by any means a simple process of fitting theory to facts. When the landing of an aircraft is affected by the presence of heterophoria in the pilot it is more usual for a general mixing of high and low approaches to take place. The explanation lies in the fact that an error in landing of one type results in an overaction by way of correction at another attempt, and as there is no stable point of reference the whole affair becomes erratic.

The cases of real interest are always those of pilots who have flown successfully and then suddenly experience difficulty with the final stages of their approach. An approach which errs within so small a degree as plus or minus five feet can end in a nasty accident, usually by the propeller catching the ground and turning the aircraft over. Repetition of these events calls for a very careful examination of the binocular state. Here it is wise to tread with caution. The disharmonies that heterophoria may produce in air-pilotage are well known and proved, but on these very grounds a false jump to conclusions must be carefully avoided. Every discovered phoria with a history of flying trouble is not for certain the absolute root cause. Mental and physical fatigue; the first indication of some illness of slow onset; a growing dislike to flying; neurasthenia—all these must be eliminated. It usually happens that the pilot with a pure ocular muscle defect is anxious to return to the full duties of his branch, and resents the visual handicap which is confining him to the ground. It may be asked, How does such a state come about in a healthy man on active service? The answer is that heterophoria may occur as a result of prolonged fatigue from concentrated flying, from tropical asthenia, from malaria, or from head injury. It is not by any means a condition that tends to persist once the primary cause, illness or accident, has cleared up, but there undoubtedly are times when heterophoria remains as a genuine state and requires active attention. It is usually found that such a condition is of the inherent type, which has been kept within bounds in a body physically and mentally sound, but that the constitutional upheaval has left its mark in a potentially weak spot. It is necessary always to form an opinion as to the optimum time to attack the condition by exercises. And it is easy

to be led astray. Let me quote two examples where I carried out quite useless treatment. The first was many years ago. The case was that of an officer with much flying experience. He passed through my hands in a purely routine manner. He had heterophoria of the exophoric type, far outside the permitted limits. He underwent a course of training, and admittedly showed much improvement, coming now well within the necessary standards. He had had, however, no particular trouble with his flying. On his return to aircraft he discovered that he had to face the situation from a new angle, and that flying was not nearly so simple. He was thankful when, in due course, he relapsed into his old state, in which he was perfectly happy. He was one of those cases of inherent heterophoria with dominant muscular reception, and it was I who from inexperience produced disharmony. There was another case, that of an officer with heterophoria of the esophoric type. From his history and from the clinical findings there was every reason to undertake training. This went well—in fact, too well. He began to develop gastritis. The clouds broke and revealed his mental landscape. He had acquired a growing distaste for flying. His faulty judgement of distance no doubt added fuel to this, but his training had again prepared him for the air. Therefore he transferred his discomfort lower down. I speak of these cases merely to emphasize the fact that we must always be prepared to stumble over them.

Treatment

It is not proposed to enter into any details, but rather to stress certain points that are wont to be omitted. In the first place, symptomless heterophoria is far better left alone. To obtain the ideal in binocular vision is a very worthy aim, but the sleeping dog is better left asleep.

In symptom-producing cases no time is wasted that is spent on a complete survey of the patient's mental framework. With regard to the order of attack our greatest lever is the stereoscopic sense. The more years one passes in the study of these cases the more one is inclined to relegate a special pathway to the realm of stereoscopic appreciation which, if intact, is ready always to answer to the call of stimulation. To reach it, and to use it to the best advantage, it is essential first to develop equal macular reception and then to work for a space upon simple stereoscopic pictures. I am now experimenting with a rotating stereogram made for me by Messrs. Theodore Hamblin. The idea here is to widen and strengthen the stereoscopic sense through those angles of the perimetric arc that are not specifically employed in this fashion. Usually after two weeks the road is open for the use of the amblyoscope, or one of its near relations.

I feel that the worst service we can do to this promising bud on the tree of ophthalmology is to fret round it with exaggerated care. Let us confine its nomenclature to reasonable proportions and tear aside the veil of mystery that is being drawn about it. To-day ophthalmic surgeons are divided into two groups upon the merits of orthoptic treatment—namely, those who consider it most valuable and those who do not. Both are right. The reason why this division exists is because too little time is given to analysis and too much to empirical treatment. The great variety of binocular disharmonies that are arranged under the group heading of heterophoria are very real conditions, carrying with them often extreme suffering. The relief that can be given by orthoptic treatment in a great number of these cases is too well established for argument.

The Use of Prisms

Prisms for dealing with symptom-producing heterophoria should be limited to two conditions:

1. As a means of helping cases that have occurred as the result of cerebral concussion. Sometimes an eye-shade is necessary as a temporary measure where there is troublesome diplopia. This temporary ocular occlusion can do no harm to the binocular receptive rate in adults. If the prognosis is favourable this does not last much over a month. Then a *full prism correction* is valuable, and may be demanded in both horizontal and vertical directions, at one and the same time. Reductions (in strength) are usually necessary in periods of two to three months. Then after the *safe interval*, which should be six months, possibly longer, training can commence. During the preliminary stages of training the prisms should be retained in balanced proportion to the progress of the case. Then training will take the upper hand, and the prisms can be safely discarded. Should, however, a residual and intractable hyperphoria remain, a safe rule is to prescribe such prisms as will relieve one-half to two-thirds of the uncorrected deviation. The remainder is nearly always mastered by the muscle tone which has been imparted through training.

2. As a means of relieving an inherent or acquired symptom-producing hyperphoria. Sometimes prisms, or indeed operations, may become the only means of affording relief. In other cases most valuable results may be achieved by a combination of training and prisms correction. Once more reductions are made in prism strength during treatment. If a complete cure is effected so much the better, but candidly I think this ideal is rarely attained in the higher deviations. Then, again, it may be necessary to take up part of the strain by prisms. Never is it wise to give full balance in this manner, as some *active* vertical adjustment helps to maintain stability. It is most important to distribute the prism power suitably between the two eyes. It is not enough to divide this equally.

Always should the greatest care be exercised in selecting that which can be cured or markedly benefited from that which cannot.

O. Devold, F. Batt, K. Closs, and J. Backer (*Norsk Mag. Laegevidensk.*, July, 1937, p. 899) undertook in 1934 and 1935 a goitre survey of the inland district of Modum in Norway. They examined 4,560 of the 11,000 inhabitants. The measurements of the thyroid followed Hunziker's technique, and in many cases iodine determinations of urine collected over twenty-four hours were undertaken. The iodine content of the drinking water and of the milk and eggs was also estimated, and the findings were compared with iodine analyses of urine, drinking-water, milk, and eggs in Oslo. It was found that the iodine content of the urine and drinking-water was considerably lower in Modum than in Oslo. In 65.6 per cent. of all the persons examined some enlargement of the thyroid was found, the figures for the two sexes being 57.1 per cent. for men and 73 per cent. for women. The largest number of goitres were found in school children; in women it was most common between the ages of 20 and 29 in farming areas. Only 58 per cent. of the whole industrial population showed signs of goitre, as compared with 72 per cent. of the farming population. One reason for this might be that in the farming districts only 15 per cent. of the population ate fish at least once a week, whereas 63.5 per cent. in industrial areas ate fish once weekly or more often. Parous women suffered more often and from larger goitres than did nulliparae. The incidence of goitre increased with decrease in the social status of the inhabitants, and incomplete forms of cretinism were found. The authors conclude that prophylactic medication with iodine-containing sodium chloride would be more rapidly effective than a revolution in agricultural menus to include more sea fish and provide seaweed as cattle fodder and manure.