# SUPPRESSION OF A BLURRED VISUAL INPUT BY NORMAL SUBJECTS CAN BE DEMONSTRATED USING THE VER

**N. JOLLY** DOBA(T)
**E. D. CORNELL** DOBA, DipAppSc(Cumb)
**J. A. BURNE** BSc(Hon), PhD(N.E.), DipEd
**E. S. G. HETTIARACHI** MB, BS(Ceylon) PhD(Edinburgh)
*Cumberland College of Health Sciences, N.S.W.*

**Abstract**

*Strabismus and anisometropia are generally accompanied by a sensory adaptation in the form of some suppression of the input from the affected eye. In this study identical images of less than 0.5° of visual angle were presented to the two eyes of normal subjects by means of a synoptophore and their positions adjusted until they became fused. A reversing checkerboard stimulus was added to the background field of either eye to obtain a monocular visual evoked response (VER) during binocular viewing of the fused synoptophore image. Defocusing of the synoptophore image to one eye by approximately 2 dioptres reduced (to 50%) the amplitude of the VER from the same eye. Occlusion of the unstimulated eye greatly increased response amplitude and eliminated the effect of defocusing. Most subjects were able to maintain a subjectively clear synoptophore image though the image to one eye was defocussed. The study confirms that under binocular viewing conditions normal subjects can effectively suppress an inferior input to one eye. It is proposed to use a similar technique to explore the suppressing abilities of strabismic and anisometropic subjects.*

**Key words:** *Sensory adaptation, synoptophore, defocussed image.*

## INTRODUCTION

When the eyes are normally aligned and able to produce a well focussed retinal image, these similar images are readily 'fused' and are then perceived as one. When the eyes are misaligned as in strabismus or one is affected by a large, uncorrected refractive error as in anisometropia, the retinal images then formed become more dissimilar and thus for the central retina are more difficult to perceive as a single image. Strabismic and anisometropic patients, in order to maximise their visual performance, commonly demonstrate a sensory adaptation to this condition whereby they cease to attend to or 'suppress' the inferior image from the affected eye.

If the eyes of normal subjects are presented with totally dissimilar retinal images (i.e. SP slides) using a haploscopic device the images are not perceptually fused and there appears to be no definite preference for one input over the other, both images finding some representation in consciousness i.e. retinal rivalry. In the present experiments a method is used to investigate the abilities of normal subjects to suppress when confronted with similar images, one of which has been defocussed using artificial lenses to produce a simulated refractive error.

## METHOD

Subjects were screened by orthoptists to establish visual acuity and stereopsis.

The synoptophore was modified so that a patient could simultaneously view the reversing checkerboard, placed behind the synoptophore,

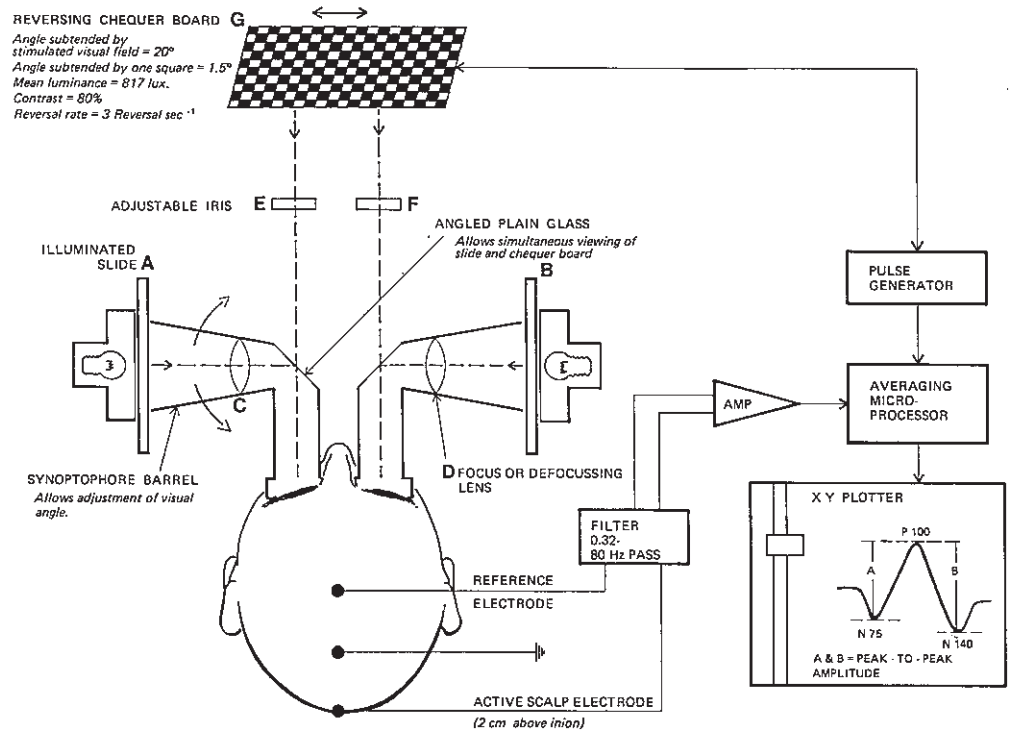


*Figure 1:* Experimental arrangement.

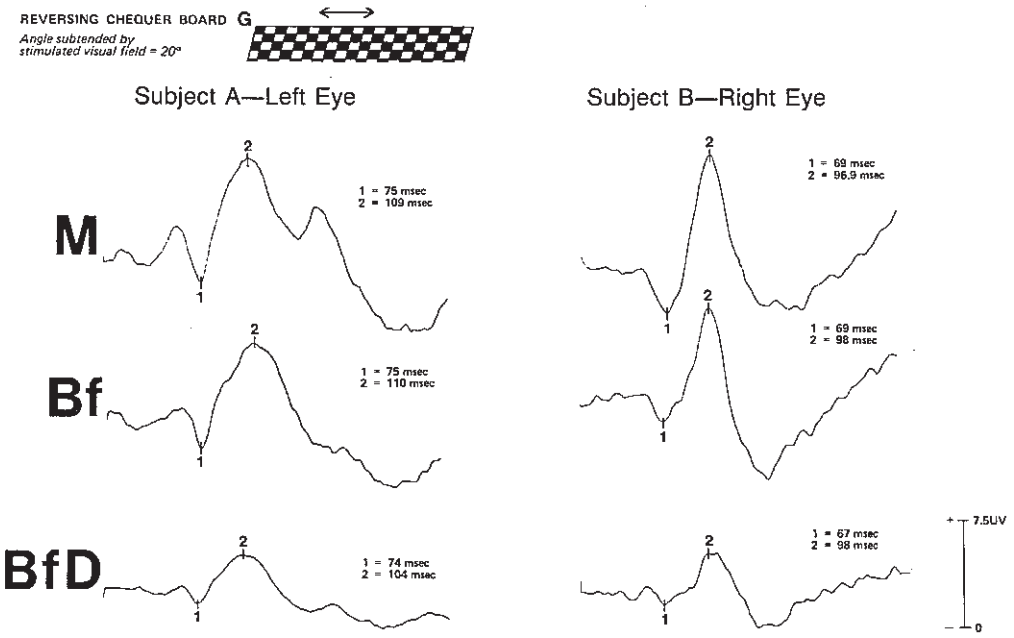


*Figure 2:* Sample recordings. Calibration refers to all traces.

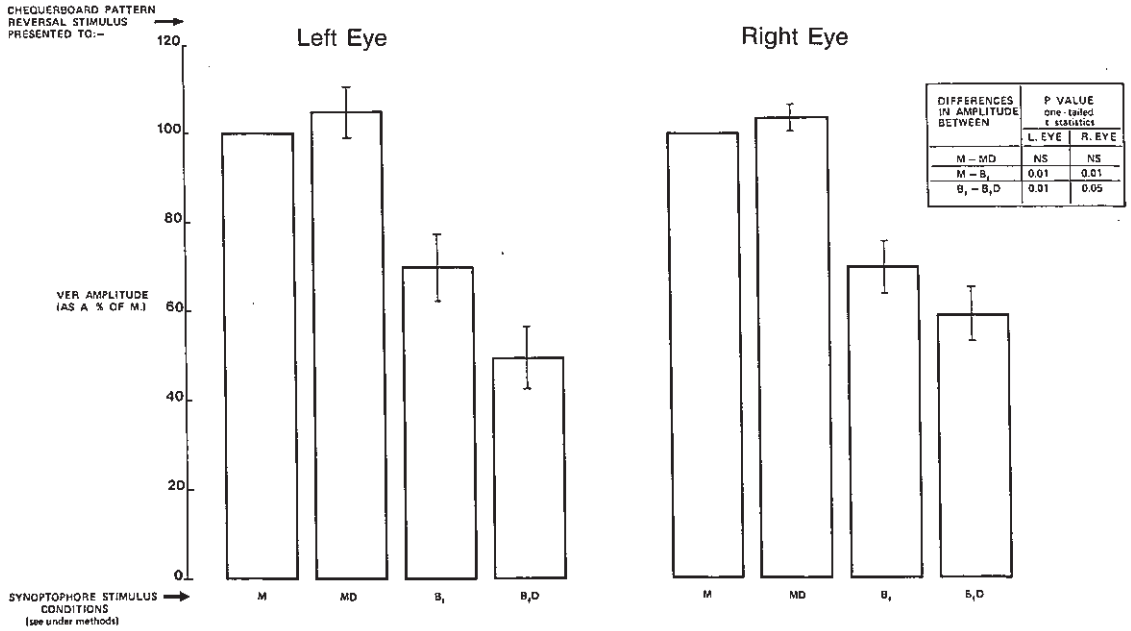


*Figure 3:* Pooled data ($n = 8$) to show changes in peak to peak amplitude of the VER from the left and right eye under different stimulating conditions listed below. All values are expressed as a percentage of the M (monocular) value for the same eye. The bars indicate standard errors.

and synoptophore fusion slides, which subtended 3°. As well, the convex lenses were removed from their usual position to position C and D (Fig. 1). These lenses could be exchanged to enable an increase in the lens power by 2DS in order to defocus the synoptophore slide, without affecting the checkerboard image clarity. Two adjustable diaphragms were positioned at E and F (Fig. 1), either to enable control of the size of the field of stimulation by the checkerboard to 20° or to occlude one eye to enable monocular tests to be carried out.

The patient was set up for VER assessment with the response to each checkerboard reversal being collected and accumulated, with the end result being determined following the averaging of 128 stimulation-responses.

Separate monocular VERs were recorded from left and right eye under each of the following conditions:

M. (monocular) Slide presented to the stimulated eye only, the other eye being covered.

M.D. (monocular, defocussed) As for M except that the synoptophore image was defocussed by increasing the strength of the lens (C, D) by 2 spherical dioptres.

$B_f$ (binocular, fused) The slides (A and B) were presented to each eye and synoptophore barrels adjusted until the subject was able to fuse the images.

$B_fD$ (binocular, fused, defocussed) As for $B_f$ except that the image to the stimulated eye only was defocussed at C or D.

(See Fig. 2.)

RESULTS

From Fig. 3 it may be observed that:

1. The monocular (m) VER amplitude was greatly reduced by presentation of a synoptophore image to the other eye. (The difference between M and $B_f$ was significant at the 0.01% level).

2. VER amplitudes from the 2 eyes were approximately symmetrical during viewing of the fused synoptophore images ($B_f$).
3. Defocussing of one of a pair of fused images reduced the amplitude of the VER from the defocussed eye (*t* values showed BfD to be significantly different to $B_f$ at the 0.01% level for the left eyes and at the 0.05% level for the right eyes).
4. Defocussing the synoptophore image when it was viewed monocularly, could not be seen to have an effect on the VER response.

As a further control under conditions where fusion was prevented by vertical displacement of one of the images the suppression effect was not evident.

## CONCLUSION

We conclude that approximately symmetrical responses may be obtained from the eyes of normal subjects under binocular viewing conditions. However, normal subjects also possess the ability to suppress the input from one eye when it is presented with a poorly focussed image in binocular circumstances and this is associated with attenuation of the VER from the suppressed eye. Further this effect is dependent on the fusion of images, one of which is superior in clarity to the other.

This form of suppression is likely to contribute to maximising the binocular visual acuity of patients with unilateral refractive errors under similar conditions but cannot be related to the suppression associated with strabismus where patients are unable to fuse.

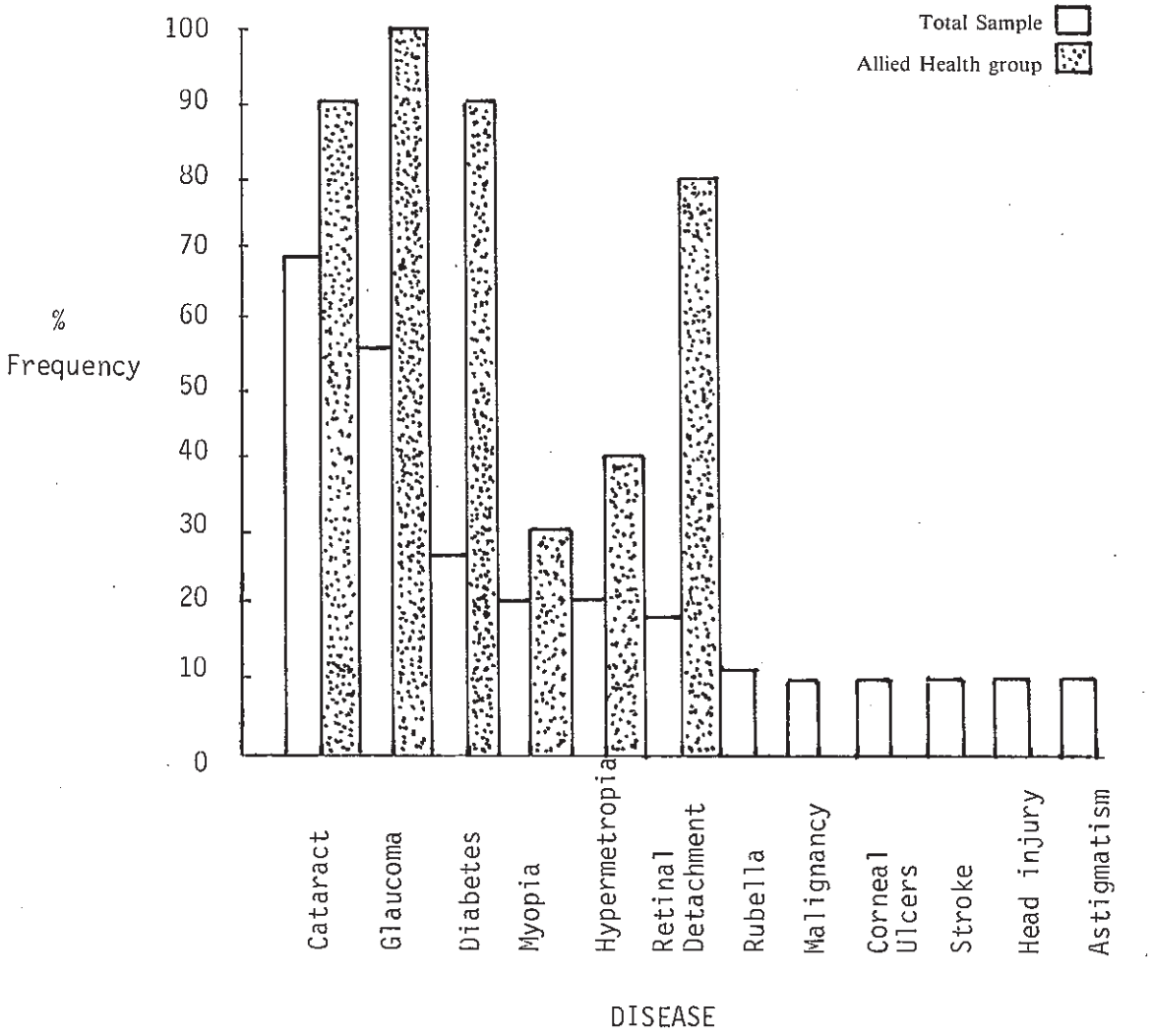


*Figure 1:* Frequency distribution (percentages) for the ten most frequently mentioned diseases.

Reduced vision is seen to be due, principally, to refractive errors and not to possible medical conditions. Only 44.5% of 45 to 64 year olds seek a medical investigation of their eyes, and it is seen that 46% of those over 64 years of age see non-medical professionals for vision problems.

The above data, the number of legally blind elderly persons being referred to an eye clinic from nursing homes, and the generally held attitude "that vision failure is a normal function of ageing and is to be accepted" prompted the author to investigate commonly held knowledge about vision and eye care in the community at large.

## METHOD

A self administered questionnaire containing forced-choice and open-ended questions was administered to 264 persons.

The ages of the sample employed in this study ranged from 25 years of age up, with a mean of 40.1 years. There were 50 persons in this sample who could be classified as health or health-related workers.