the 4 chromosomes shows clear secondary constrictions at the tip of its longer arm. Among the shorter chromosomes, 2 sets are distinctly subtelocentric, and the remaining sets are submetacentric to metacentric. The chromosomes of each set compare closely with corresponding chromosomes of the diploid($2n = 24$) *Hyla arborea japonica* (*5*), and *Hyla andersonii* (Fig. 2), a tree toad found in sandy pine barrens from New Jersey to South Carolina.

Although I have not sampled individuals of *H. versicolor* from other populations, individuals examined from a population of this species at Bastrop, Bastrop County, Texas, are also tetraploid (*6*). It therefore appears likely that there are several tetraploid populations of this species or that the species is entirely tetraploid.

If the sibling species, *H. chrysoscelis*, is indeed diploid, it would account for the high degree of incompatibility demonstrated in hybridization tests between *H. chrysoscelis* and *H. versicolor* (*7*), as well as the difference in trill rate between the two forms (*4*).

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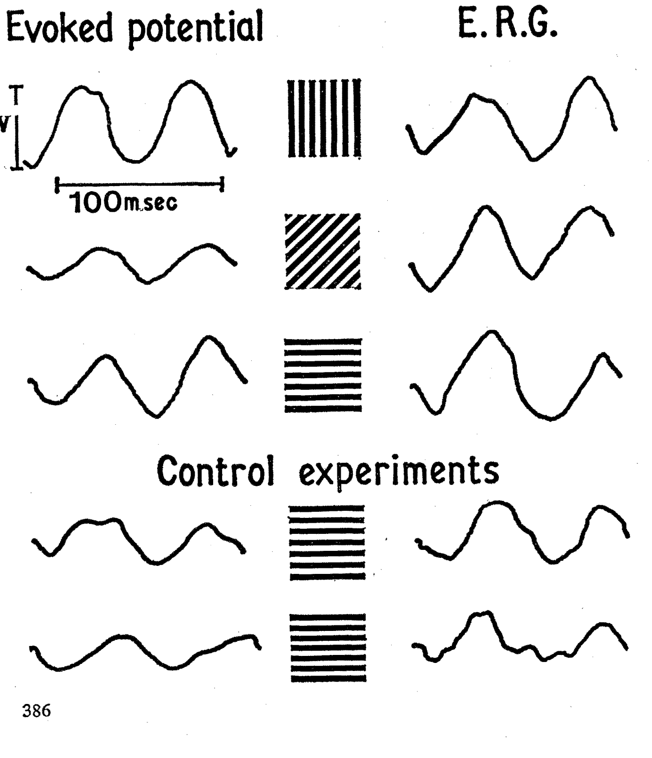
Neurophysiological Localization of the Vertical and Horizontal Visual Coordinates in Man

Abstract. *The amplitude of the potential evoked by a moving grating, recorded from the occipital scalp, is less when it is oblique compared with vertical and horizontal. This inequality is not found by recording the electroretinogram. Thus, orientational effects must arise between the site of origin of the electroretinogram and the evoked cortical response.*

The resolving power of the human visual system is better in the vertical and horizontal orientation than in the two oblique orientations (*1*). Many explanations have been advanced to account for this observation, and certain of these have been eliminated. For example, it is now quite certain that the effect is not caused by the optics of the eye (*2*).

The remaining hypotheses range from pure psychological explanations to detailed neurophysiological mechanisms. For example, our ability to see better in the vertical and horizontal orientations may be because our visual environment is largely composed of verticals and horizontals and that we have "learned" to use these orientations better. On the other hand, the anatomical finding of Colonnier (*3*), who found in the visual cortex of the cat that the stellate cells have specifically oriented dendritic fields, supports a structural explanation, provided that the human visual cortex is similarly organized. Studies in the cat and monkey of cortical cells selectively sensitive to the orientation of a moving bar or edge show that all orientations are equally well represented and that there is nothing peculiar about the oblique orientations (*4*). However, studies of the cat show that a higher proportion of cells selectively sensitive to orientation are present in the vertical and horizontal orientations (*5*). This new finding may be due to these authors' having investigated the properties of simple cells with receptive fields lying very close to the visual axis.

We attempt to establish in man where this orientational effect arises. The technique used is to view a grating pattern generated on the face of an oscilloscope. This pattern is then shifted in phase through 180° at a



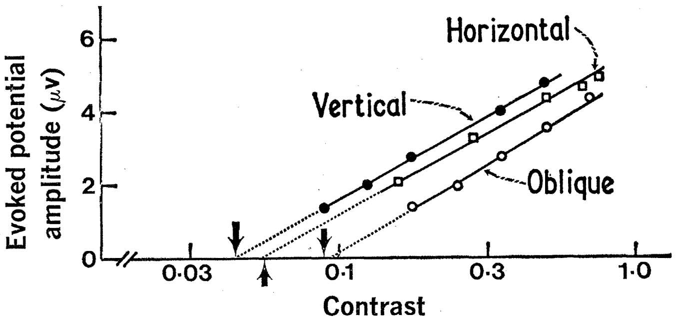


Fig. 1 (left). Evoked responses recorded from occipital area (left) and from the eyeball (right). The orientation of the grating is as indicated. The upper six records were obtained with a grating contrast 1.3 log units (× 20) above the psychophysical threshold. The lower set of four records (control experiments) were obtained with lower contrast levels; the first and second rows were obtained with a grating 1.15 log units (× 14) and 1.0 log unit (× 10) above the psychophysical threshold, respectively. Fig. 2 (above). The amplitude of the evoked potential from the scalp is plotted in microvolts against the contrast of the grating used as a stimulus. Lines indicate the calculated regression lines. The dotted portions are extrapolations to the zero amplitude positions. The arrows indicate the psychophysically determined thresholds.

temporal frequency of 8 cycle/sec. In this manner, apparent movement is achieved without there being any temporal modulation of the light flux entering the eye. Such a moving pattern readily evokes potentials that may be recorded both from the occipital area of the scalp and from the eyeball with an electrode in the conjunctival sac.

The resulting responses (Fig. 1) have a simple waveform whose amplitude may be readily measured. The evoked potential from the cortex is the average of 1500 phase shifts, and the electroretinogram is the average of 3000. The screen subtended 4° by 5°, and the spatial frequency of the sinusoidal grating was 10 cycle/deg. Its contrast was 0.5; contrast is defined as the maximum luminance minus the minimum luminance, divided by twice the mean luminance of the grating.

It can be seen that the amplitude and waveform of the results obtained when the grating was oriented vertically and horizontally were very similar. However, when the grating was presented obliquely, the amplitude of the resulting cortical evoked potential decreased.

In order to understand better the relation between the change in psychophysical threshold at different orientations with the change in the amplitude of the evoked potential, we measured the evoked potential with gratings set at a number of contrast levels. The results are shown in Fig. 2, where the amplitude of the evoked potential is plotted as a function of the log contrast level of the stimulus grating. The three orientations are shown. The results for the horizontal and vertical gratings are similar. However, the results obtained with the oblique grating are displaced to the right by 0.3 log unit on the contrast axis. The regression coefficients of the three sets of results are not significantly different. These findings agree well with the change in psychophysical threshold (indicated by the arrows in Fig. 2), for the oblique grating has a threshold about 0.3 log unit higher than the other orientations.

This linear relation between the amplitude of the evoked cortical potential and the log stimulus contrast has been found to hold over a wide range of spatial frequencies. It has also been found that when the regression line is extrapolated to the zero amplitude value it intersects the contrast abscissa at, or very close to, the threshold determined psychophysically. We elaborate elsewhere how this experimental approach can lead to an objective confirmation of psychophysical data (*6*). Evoked responses obtained at very high contrast levels sometimes show saturation.

Using the same stimulus and recording technique, we now measure the evoked potential arising from the retina. The responses are shown in Fig. 1 for a vertical, a horizontal, and an oblique grating. It is clear that there is no difference in the amplitude or waveform of the results obtained at these three orientations.

Now it could be argued that, at the contrast level used to obtain the results in Fig. 1, the signals which we record are saturated and therefore any effect due to a small change in contrast sensitivity might be missed. This possibility was excluded by decreasing the contrast of a horizontal grating by 0.15 and 0.3 log unit and using these as the stimuli. The results obtained for the evoked potentials from the cortex and eyeball are shown as control experiments in the lower portion of Fig. 1. Thus, a small decrease in the contrast of the stimulus grating produces a measurable decrease in the amplitude of the recorded signals.

These findings lead us to conclude that there is an electrophysiological correlate of the psychophysical observation that the visual resolving power in oblique orientations is less than in the vertical and horizontal, and that the mechanism of this phenomenon arises between the site of origin of the electroretinogram and the evoked potential from the visual cortex. These conclusions are in agreement with the finding in the cat that, for simple cells subserving central vision, there is a greater proportion of orientationally selective units in the vertical and horizontal coordinates (*5*). The histological observations of Colonnier (*3*) give further anatomical support for the existence of such a mechanism.

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Senescence in Detached Betel Leaves: Role of the Petiole

Abstract. *Removal of the petiole from detached betel leaves delays onset of leaf senescence; the delay is nearly proportional to the extent of depetiolation. An agar diffusate from intact midrib or excised petioles induces normal senescence in depetiolated leaves.*

The chewing of green betel leaf (*Piper betle*) spiced with arecanut (*Areca catechu*) and lime, and similar flavorings, is a common practice in the Orient. Betel leaf is harvested with the petiole, which is about 3 cm long, smooth, and cylindrical (terete). The removal of petiole during handling of this leaf, though commonly practiced, seems to have neither definite aim nor scientific basis. These aspects are dealt with in this report.

Senescence of betel leaves involves disappearance of chlorophyll and subsequent browning which begins at the petiolar end and progresses distally along the midrib (Fig. 1). Leaves were considered senescent when browning reached halfway along the midrib (HMS state).

Depetiolation brought about a

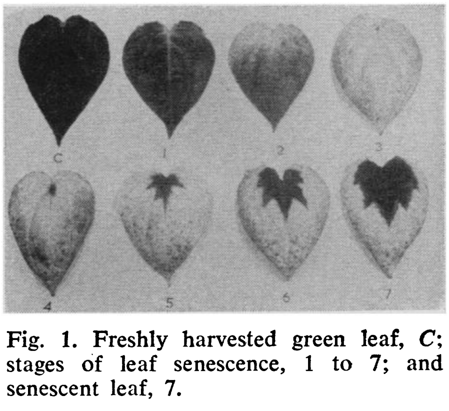

Fig. 1. Freshly harvested green leaf, *C*; stages of leaf senescence, 1 to 7; and senescent leaf, 7.