Table 2. 'k' AND 'z' INTRUSIONS (% OF OPPORTUNITIES FOR ERROR)

| Type of intrusion | Terminal phonemes | | | | | |
|---|---|---|---|---|---|---|
| | SV | LV | SV+k | LV+k | SV+z | LV+z |
| 'k' | 2·3 | 3·2 | 2·6 | 3·1 | 2·7 | 3·5 |
| 'z' | 2·7 | 1·4 | 2·2 | 3·3 | 2·5 | 1·6 |

overall difference between conditions with and without a terminal consonant was significant at well beyond the 0·001 level.

One possible explanation of the foregoing result might be that in the lists with terminal consonants the terminal 'k' or 'z' keeps 'popping into mind' during recall of the initial consonants and greatly increases the frequency of 'k' or 'z' intrusions in 'k' or 'z' lists, respectively. Table 2 shows that this is definitely not the case. The tiny increase in the rate of 'k' and 'z' intrusions from SV and LV to SV+k, LV+k, SV+z, and LV+z amounts to about 0·8 per cent, whereas the total error rate increases by about 5·2 per cent. Furthermore, the increase in 'k' and 'z' intrusions is not specific to 'k' and 'z' conditions, respectively. There is no significant difference in the 'k' or the 'z' intrusion rate between 'k' and 'z' conditions. It is clear that the stimulus interference of the terminal consonant is not reflected primarily in intrusions of that consonant.

Even though subjects know they are to ignore the terminal consonant, they cannot do so completely. The terminal consonant may weaken the memory traces for the initial consonants, or it may establish its own memory trace which competes with the traces for the initial consonants at the time of recall, or both. It is not possible to decide between these possibilities at the present time. However, it is clear that it is the presence of an extra consonant phoneme, not its temporal duration, that produces the interference.

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## Perception of Pattern and Colour in the Stabilized Retinal Image

OBSERVATIONS of coloured areas using the stabilized retinal image (an image which remains stationary on the retina despite eye movements) have produced reports of gradual desaturation of colours[1], or of colour fusion if bipartite coloured fields are used[2]. When black and white geometrical shapes are examined, a marked loss of contrast occurs, with ultimate failure of perception over parts or the whole of the visual field[3]. The examination of targets in which colour gradations and major pattern variations occur simultaneously has, however, not been reported; and it is not easy to predict the phenomena which might be expected to occur in these conditions.

Plates of the Ishihara test for colour blindness have been used as targets for this investigation. They were photographed as colour transparencies and viewed through two types of stabilizing apparatus; either that described by Pritchard[4], in which a miniature collimator is mounted directly on the contact lens, or through the equipment described by Clowes[5]. In this the target is viewed using a complex optical system, which, although cumbersome, permits rather more versatility in the manipulation of the target material.

In normal usage at the recommended viewing distance, Ishihara charts subtend a minimum angle of 6·5°; when viewed through the collimator they subtend 10° on a homogeneous buff background extending to 35°, and through the optical system they subtend 2° on a 10° background. In stabilized vision the targets were symmetrically disposed about the fovea and were in sharp focus. Ishihara charts provide only a crude test of colour vision, suitable for rapid screening of major defects; but they are ideally suited for the purposes of this experiment, which is to explore the gross changes of form and colour perception in stabilized vision.

Eight subjects, all of whom had previously observed black and white targets in stabilized vision, reported their subjective experiences when viewing the Ishihara charts. The following observations were made reliably and repeatedly by all subjects.

(1) In normal vision no abnormalities of colour perception were detected in any of the subjects.

(2) Fade-out of perception seemed less marked, and was certainly slower in occurring than with simple black and white material.

(3) The coloured numerals or convoluted lines desaturated and ultimately vanished as patterns, merging with a neutral-coloured background. The apparent colour of the residual image varied somewhat with the target used, and ranged from grey to dull brown or green.

(4) The background detail itself, that is, the series of tiny circles of which the target is composed, was highly stable and rarely faded out. Desaturation of colour was always more prevalent than loss of contour and the Ishihara plates often appeared as a set of uniformly bright monochromatic circles.

(5) Interruption of the light source for periods as short as 0·5 sec produced regeneration of the colours, though these quickly seemed to fade out again.

The following observations were made repeatedly by two subjects, who were the only ones to experience the experimental conditions described.

(6) Continuously flickered illumination in the frequency range 4–8 c/s (which has previously been shown to be beneficial in maintaining the visibility of a stabilized retinal image) did not prevent the colour desaturation effects described here except in the case of red lines on a grey background in which good visibility of the target and freedom from colour fusion were obtained over extended viewing periods.

(7) Side-to-side oscillation of the target through 2 min arc at frequencies in the range 4–8 c/s prevented colour fusion in targets having orange lines on a blue ground but otherwise produced no major effects.

The results of these experiments indicate that hue discrimination and form perception are mediated by separate mechanisms, for in these tests the two types of perception fail independently; disappearance of the form of the background circles was never observed to occur before colour desaturation had taken place, however.

It should be noted that failure of colour perception always produced characteristic effects which could not be confused with dichromatic vision, such as might be engendered by precise foveal fixation.

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