

VISUAL MASKING AS A FUNCTION OF PERSONALITY

BY R. J. McLAUGHLIN* AND H. J. EYSENCK

Institute of Psychiatry, University of London

Visual masking was related to the personality dimensions of introversion-extraversion and neuroticism. It was predicted and found that extraverts have a higher masking threshold than introverts. The function of reticulo-cortical arousal and inhibition mechanisms is discussed in relation to extraversion-introversion as a possible source for an explanation of this phenomenon.

Visual masking, meta-contrast, or the suppression of the primary visual stimulus, are terms which have been applied to a phenomenon in which one visual stimulus (S_1) is applied for a brief period (10-30 msec) and followed by another brief visual stimulus (S_2) after a variable inter-stimulus interval (ISI). With ISI of 40 msec or less only S_2 is seen, and S_1 is suppressed or 'masked'; with ISI of 100 msec or more, both stimuli are seen. For most subjects there is an intermediate value of the ISI (masking threshold) at which S_1 ceases to be suppressed, and is seen. This threshold can be established with considerable accuracy (Holland, 1963; Pollack, 1965) and forced-choice methods do not seem to have any advantage over conventional procedures (Heckenmueller & Dember, 1965). Other phenomena of a similar kind, such as the Bidwell effect (Eysenck & Aiba, 1957; Aiba, 1963) appear to obey similar laws, and visually evoked potentials have been shown to correlate with the psychological events of visual masking (Donchin & Lindsley, 1965).

Since S_2 appears to *inhibit* the perception of S_1 , it has been argued (Eysenck, 1957) that personality differences in inhibitory potential should be relevant to this phenomenon, as should c.n.s. stimulant and depressant drugs. In terms of physiological arousal theory, introverts are postulated to be in a state of higher cortical arousal than extraverts (Eysenck, 1963, 1964) and should thus be able to maintain the discrimination between S_1 and S_2 more efficiently than extraverts. Similarly, stimulant drugs, by increasing cortical arousal, should increase discrimination, while depressant drugs, by decreasing arousal, should have the opposite effect. It was predicted therefore that introverts (and persons given stimulant drugs) would have lower masking thresholds than extraverts (and persons given depressant drugs). The drug prediction has been verified several times (Eysenck, 1957; Aiba, 1963; Holland, 1963): the purpose of the present investigation was to test the personality prediction.

METHOD

Subjects

Sixty-four paid volunteers were tested on the Eysenck Personality Inventory (EPI) (Eysenck & Eysenck, 1964) and put into four groups: neurotic extraverts (NE); stable extraverts (SE); neurotic introverts (NI) and stable introverts. Eight subjects were eliminated from further testing because they obtained scores from 11 to 13 on the E-I scale (mean = 12.0) and were thus not easily classifiable as either introverted or extraverted. One other subject was eliminated at this point because his 'lie scale' score was too high ($L = 6$) for his personality score to be accepted as valid.

* Now at Saint Louis University, Saint Louis, Missouri.

Seven subjects were eliminated during the experiment, five for having an error rate above 10 %, indicating that they were reporting the test stimulus when it was not being presented, and a further two subjects for not reporting the presence of the test stimulus below an ISI of 130 msec, which might be an indication that the subject did not have normal visual acuity.

The remaining forty-eight subjects, eleven females and thirty-seven males, were equally divided, twelve in each of the four personality groups. The mean age of subjects was 25.71 years (s.d. = 8.29) and all reported that they had normal or corrected-to-normal visual acuity.

Apparatus

The instrument, previously described by Holland (1963, pp. 72-5), was an electronic Dodge-type tachistoscope with variable exposure and interval between exposures. The exposed fields were illuminated at 0.155 log. *L* by four 9 in. 6 W fluorescent tubes arranged around a rectangle and shaded to illuminate a 7 in. square. The stimuli presented were a 20 mm black disk (visual angle 0.46°) and a black annulus with inner and outer diameters of 20 mm and 58 mm (visual angle 1.26°) both presented on a white ground. The disk was viewed binocularly through, and the annulus reflected from, a half-silvered mirror placed at 45° to the line of regard. The sequence of stimulus presentations was: (1) test figure 15 msec; (2) ISI, variable; (3) masking figure, 15 msec. The darkened fields between the trials contained a pin-point source of red light superimposed on the centre where the disk and annulus appeared. This point served as a focusing stimulus when the subject was told that the lights were to be flashed.

The tachistoscope was modified to carry two display wheels which could easily be rotated into position and held by a spring-loaded ball-bearing and dimple giving very accurate positioning. Hence it was easy to select between a present or absent test stimulus and a present or absent masking stimulus within a matter of 2 or 3 sec.

Procedure

Each subject was tested individually. The procedure followed that reported by Holland (1963) with sometimes two exceptions. First, a measurement of the subject's responses was made on trials in which the annulus was shown but the disk was not (to establish error rate). Secondly, subjects were required to rate on a three-point scale (1 = 'positive'; 2 = 'fairly certain'; 3 = 'not sure') their confidence in having seen the disk on those trials in which they reported its appearance. An ascending method of limits was used proceeding from an ISI of 40 msec and increasing in steps of 5 msec until the subject responded correctly on two consecutive trials that he was positive (saying '1') that he had seen the test stimulus. It was necessary to limit the range of ISI tested and only to test in a series of ascending limits to maximize the reliability of the measure, because of the limited availability of subjects and the problems of fatigue that would be expected if the session exceeded 45 min. After five consecutive threshold measurements the subject was given a rest period of approximately 5 min before a final series of five further threshold measurements was made.

RESULTS

The masking threshold was computed for each subject by averaging the ISI of the first response, for each of the ten trials, for which the subject correctly reported that he was positive the disk appeared. Table 1 summarizes the masking thresholds for the four personality groups. A 2 × 2 analysis of variance was applied to the thresholds,

Table 1. *Mean masking thresholds (and s.d.) for each of the four personality groups (n = 12); for all four groups combined, mean threshold = 71.11 (s.d. = 12.26, n = 48)*

	Stable		Neurotic	
	Mean	s.d.	Mean	s.d.
Extraverts	74.33	12.73	75.04	13.19
Introverts	68.83	10.68	66.25	11.50

comparing extraversion-introversion with high and low levels of neuroticism. The comparison of introversion with extraversion yielded the only significant effect ($F = 4.21$; D.F. 1, 44; $P < 0.05$) with extraverts having a higher threshold than introverts. Bartlett's test showed no significant heterogeneity of variance.

The correlation between the threshold for the first five trials and the second five was 0.96 for all subjects, showing high intra-subject reliability of the masking threshold measurements.

DISCUSSION

A possible explanation of masking phenomena may be found in Granit's (1955) concept of pre-excitatory inhibition (Eysenck, 1957); it seems likely that higher centres play an important part in this activity (Aiba, 1963). Donchin & Lindsley (1965), who have studied averaged evoked cortical potentials to pairs of flash stimuli and who found that physiological masking occurred with short ISI, have raised the question of the localization of the stage in the visual system at which the neural effect produced by S_2 interferes with the effect elicited by S_1 ; they consider four possibilities: (1) retina (receptor cell layer to ganglion cell layer), (2) lateral geniculate body (relay and other functions), (3) cortical structures (primary and secondary), and (4) non-specific sensory system (reticular and thalamic). Eysenck (1963, 1964) has argued for the relevance of the reticular system in connexion with personality differences along the extraversion-introversion axis, and data from experiments with drugs are in good agreement with this hypothesis (Killam, 1962).

The work of Shagass & Schwartz (1963*a*, *b*) appears to be relevant. They administered pairs of stimuli and recorded the evoked potentials, thus making it possible to plot the cycle of recovery of responsiveness. They found that the early portion of the recovery cycle for the primary somatosensory response tended to be biphasic in form. The first phase of recovery occurs very early, the amplitude of the second response equalling that of the first, or exceeding it before 20 msec. There is then a phase of diminished responsiveness, followed by a longer phase of full recovery, usually reaching a peak at about 100–130 msec. Dysthymics (introverted neurotics) were found to have higher recovery ratios than psychopaths (personality disorders—neurotic extraverts), i.e. they recovered more quickly. These data are in good agreement with those reported here, and suggest that the processes involved are essentially similar.

Another phenomenon which appears closely relevant is critical flicker fusion (Eysenck, 1957). There is evidence that introverts have higher C.F.F. thresholds (i.e. discriminate better between flashes at high frequencies) than extraverts, and that stimulant drugs improve discrimination, while depressant drugs have an opposite effect (Eysenck, 1967). Aiba (1963) has compared C.F.F. with masking and has drawn attention to some of the similarities, and to the possibilities of accounting for both along similar theoretical lines. It cannot be said that any particular theory in this field is at present clearly indicated as more correct than any of the others; indeed, it seems likely that these phenomena represent the confluence of neural impulses originating from several different points. Nevertheless, there is increasing evidence (*a*) that reticulo-cortico arousal and inhibition mechanisms play a part in

the causation of the phenomena themselves, and (b) that personality differences along the extraversion-introversion axis are meaningfully related to masking and to C.F.F. effects through the mediation of the reticular system.

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