

RORSCHACH VALIDATION. III: AN EXAMINATION OF THE
ROLE OF COLOUR AS A DETERMINANT IN THE RORSCHACH
TEST.

By J. D. KEEHN,

London University Postgraduate Scholar, Institute of Psychiatry,
Maudsley Hospital.

INTRODUCTION.

THE importance and relevance of reaction to colour in the interpretation of Rorschach protocols has been so often and so vigorously stressed by proponents of the test that few psychologists can have remained unaffected by their views. It is the purpose of this paper to examine the validity of these views. Already the evidence pertinent to the hypothesis that certain reactions to the blots depend upon the indirect effect of colour, the so-called "colour-shock" signs, has been examined (Keehn, 14). Beyond repeating the general conclusion that such signs seem not to be dependent upon presence or absence of colour this topic will not be discussed, so restricting this paper solely to a consideration of the validity of the hypotheses concerning the direct reaction to colour on the cards. No better or succinct and documented statement of these hypotheses can be made than that of Hertz and Baker (10), who, after summarising numerous studies relating to the topic, conclude that—

"There is general agreement that colour factors give a measure of the stability of the emotional life. They show the externally directed or expressed emotionality of an individual. FC represents emotional stability and adaptability, CF, emotional lability, excitability and lack of control, and C, lack of restraint and impulsiveness."

Essentially there are two main problems to be considered. Firstly, we must examine the validity of the proposition that those responses said to be determined wholly or partly by colour are correlated with emotional stability in the manner hypothesized, and secondly, whether the responses said to be determined by colour really do depend upon colour, and if so, in which way and to what extent.

Investigations tackling the first of these problems all concern themselves with correlating Rorschach colour scores with other hypothesized indices of emotion. These studies fall into three main groups according to the type of external criterion employed. Firstly there are those studies where the Rorschach colour scores are correlated with indices of emotion obtained from other personality tests or ratings; secondly come a few experiments where the effect of artificially produced emotions upon the Rorschach protocols are examined; and finally there are those laboratory studies using physiological correlates as their external criterion of emotion.

Using the first method Clark (5) found a significant correlation between the M.M.P.I. scale of hypochondriasis and high sum C scores on the Rorschach, and Hertz (9) reported a correlation of .86 between the Brush modification of

the Allport A.S. test with the Rorschach introversive-extravertive types. As Holtzman (11) has more recently identified the introversive-extravertive dimension with one of shyness-gregariousness as rated by friends, and Thornton and Guilford (30) have seen fit to correlate the various indices of this typology with the Nebraska Inventory of introversion-extraversion and neither of these studies yielded significant correlations, it is impossible to reach any definite conclusions other than that there is a deplorable lack of terminological agreement between different investigators. Also in view of the unreliability of the tests used as criteria, it is doubtful if the added refinement in observation compensates for the loss of information incurred by departing from the original data of observed emotional behaviour. Where Holtzman (12) used ratings by other members of a group as a criterion of impulsiveness he did find that pure colour was the most important single indicator of this trait.

In experiments using artificially induced emotion (Williams (33), Baker and Harris (3) and Eichler (6)) no reliable and significant correlations between colour and emotionality have been reported. This is hardly surprising if one remembers that such investigations are still hampered by problems of methodology, although that used by Baker and Harris does seem likely to produce acceptable results.

Similar failure to confirm the colour-emotionality hypothesis comes from the physiological studies. Goodman (8) taking P.G.R. readings during the administration of the Rorschach could find no consistent differences in affective value between the cards, and Levy (19) found no more than a slight tendency for card VIII to rate higher than the others. Hughes, Epstein and Jost (13) used such measures as respiration, heart-rate and blood pressure as well as P.G.R. readings, and found no correspondence between colour responses and these physiological measures. However, Plesch (23), in comparing protocols from 50 patients suffering from rosacea and excessive blushing with a control group of 50 normal subjects, did find that the ratio $FC : (CF + C)$ was very much lower for the patients than for the controls. The observed co-existence, then, of colour determined responses in Rorschach protocols and signs of emotionality in patients or subjects producing such responses, whilst finding little support from experimental studies has by no means been disproven.

Turning now to the second problem two main lines of attack are open. Firstly the plates may be presented with the colour removed to see if such removal in any way affects the responses, and secondly, experiments may be carried out to see if any correspondence exists between the production of colour responses on the Rorschach and the use of colour in other tests and situations.

Several studies involving the use of achromatic cards have been reported such as those by Lazarus (17), (18), Buker and Williams (4), Allen *et al.* (1) (2), but they have been mainly concerned with the effect of removing colour on the supposed indirect reactions to colour. To test its effect upon the direct use of colour would involve a comparison of the content of responses produced to the same cards, both coloured and uncoloured.

Although correspondences between Rorschach colour responses and the use of colour in other situations such as in drawings (Ruesch and Finesinger (25)) and Kohs block productions (Sarson and Potter (26)) have been examined,

such investigations do not lend themselves easily to experimental rigour and objective measurement. These objections do not apply to the tachistoscopic and colour-form sorting type tests as first used by Külpe (16) and by Kuhlman (15) in 1904. Although Oeser (22) reported a correlation between colour types as determined by a tachistoscopic test and Rorschach colour responses, Vernon (32) in summarizing the results of a number of such experiments concluded that "there is not an identity of tachistoscopic form and colour measures with the Rorschachian form and colour scores." However, tests used to establish the so-called colour-form typology were not restricted to the tachistoscopic exposure of ambiguous figures. Various sorting techniques were used, and Lindberg (20) presented evidence in favour of his Ring test as a test of this nature. This test consisted of two cards containing designs differing in colour and various formal details. The subject was shown the cards and asked to name the differences. Those subjects whose first two responses included the colour difference were designated colour types, and the remainder, form types. Schwarz (29) has shown that colour responses on this test are correlated with colour responses on the Rorschach.

However, Eysenck (7) giving the Ring test and two other colour-form tests of his own devising to a group of subjects found the average intercorrelation between the tests to be quite low. This led to the speculation that either such tests were all measuring specific abilities or traits, so rendering conclusions obtained from one test incomparable with those obtained from others, or that there was a general factor running through all these tests and the particular ones used were rather poor measures of it.

It was to examine the latter hypothesis that the present investigation was undertaken. The underlying strategy behind the experimental design was as follows: Some evidence had been obtained indicating that colour responses on the Rorschach had something in common with certain other tests involving responses determined by reaction to colour. These tests themselves had little in common, and so showed themselves to be unsatisfactory criteria taken individually. Therefore a better procedure might be to use a number of such tests in order to see if a better, composite criterion could be obtained. In factorial terms this amounts to using a number of tests to establish a factor and seeing if the Rorschach scores could be interpreted as measures of this factor.

SELECTING THE TESTS.

In arriving at a suitable battery of colour non-colour tests, preliminary experiments were carried out on over 150 subjects, most of whom were University students. The need for such an extensive exploratory period arose from both psychological and statistical considerations. In the first place the design of the investigation suggested the use of the "either-or" type of test. This was not strictly essential and not all the tests were of this nature, but earlier tests of a quantifiable nature, such as Eysenck's polygon ranking (7) and Schmidt's ratio test (28), tended to be rather lengthy, both in administration and in subsequent scoring. This, together with the apparent success of Lindberg's Ring test (20), and the necessity of constructing tests which would

not be too trying for unstable patients, led to a search for tests which could be easily and quickly administered. As it was also considered desirable that the battery should be portable, so that testing could be effected in various diverse localities, the introduction of heavy and complicated apparatus for detecting fine scoring differences was precluded. The further necessity of giving as many tests as possible within the optimum testing period prompted the introduction of the short single response test.

To construct *a priori* a test of this nature is by no means difficult, and many such tests, mostly of a sorting nature, have already been used. However, what cannot be determined on an *a priori* basis are the respective difficulties of each of the alternatives, for although the examiner may consider each aspect of his test equally obvious, his subjects may not. In fact, if the experimenter is, for instance, highly colour-dominant, then to construct an apparently neutral test he will naturally give excess emphasis to the non-colour alternative, and vice versa. Consequently when a test is first constructed it is impossible to have any but the most general idea as to how it is going to behave. This problem has not always been squarely met, and has resulted in the publication of meaningless percentages of colour and form types in various populations.

The problem is not to discover just what percentage of the subjects react in any particular manner, but how the test should be constructed so that a predetermined cutting point should be met. Defining the cutting point is simple enough. If we hypothesize that the trait is distributed in normal fashion, then we should expect about half the subjects to react to one alternative and half to the other. As also the "either-or" type of test necessitates the subsequent use of tetrachoric correlations (which are most stable and reliable for medial cuts), this psychological criterion has statistical support. Hence the extensive exploratory period was required in order that the tests could be adjusted so as to approximate as closely as possible to this criterion.

On the whole, tests were examined after every fifty subjects, and those giving extreme cuts were amended in the necessary direction. In this way, most tests were adjusted to fall within the 70-30 per cent. cutting region, although some had to be rejected altogether on the grounds of unsuitability. Appended is a description of the tests finally retained for the experiment proper, and the rationale behind their inclusion. The number at the side of each test is the code number to which it will be referred hereafter, and designates the serial position it occupied in the battery. Except where otherwise stated the figures were of coloured paper stuck on to the appropriate background. Examples of the exact colours employed corresponding to the names used in this description together with detailed administrative instructions may be obtained from the author.

ADMINISTRATION.

These tests were given to 200 normal subjects comprising 174 soldiers and 26 extra-mural students whose ages ranged from 19 to 39 years with a mean of about 24 years. The subjects were split into higher and lower intelligence groups on the basis of their scores on either the Mill Hill Matrices (1938 version) test or on the Army Dominoes test. Where tests gave continuous scores they

were dichotomized in this manner, the cutting period being chosen near to the mean. Thus score 17a, that of after-image duration, was designated as colour for times longer than 10 seconds, and as F for shorter times. Score 17b depended upon whether or not colour was mentioned in describing the after-image, and it was scored colour in the former case. Colour was scored for test 20 if more colours than shapes were recalled, and for tests 21 and 23 if the second time exceeded the first by more than 5 seconds and by more than 9 seconds respectively. Two scores were obtained from test 25. The first, 25a, was scored colour if the total of the reaction times to the form stimuli exceeded that of the colour ones. The second, 25b, depended solely upon which of the alternative reactions was made. Test 26 was scored by giving 5 points for the first error mentioned, 4 for the next, and so on down to 1 for the fifth. The test was scored colour only if the number of points gained from indicating colour errors exceeded 5. In the T-test, No. 18, it was unusual for the subjects to be consistent throughout the whole five trials, thus the designation of a colour or form score was determined by which was used the more often. In the rare cases when a particular colour and a particular proportion appeared equally often a second choice had to be obtained. This introduced a certain amount of subjectivity, but as it occurred in only 5 cases out of 200 it can hardly have affected the over-all result.

A colour score was given to any Rorschach protocol where C or CF responses were present. However, another method of treating the Rorschach score was devised in order to bring it more into line with the other tests in the battery. As well as using the score obtained from the test as a whole, cards VIII, IX and X were each treated as separate individual colour-form tests. This is not unreasonable unless one argues that the production of a colour response on one card precludes such a response on one or both of the others, and as similar reasoning could be applied to all the other tests, the whole experimental design would become pointless. For these individual cards colour was scored if either the first or second response was determined by colour in any way at all. This would then make them strictly comparable to all the other tests and more particularly with Lindberg's ring test, which, too, was scored colour if the colour difference was mentioned in one of the first two responses. Following Lindberg (20) only explicit colour differences were so scored, Schwarz's (29) "teaser" response (where the cards were designated by their colour for reference only) was scored form. Another score taken from the Rorschach, the whole percent, was dichotomized at the 38 per cent. level. However, as this percentage was, in many cases, based upon only a few responses it is not viewed with much confidence, for as the number of whole responses is more limited than the number of detail responses it follows that W per cent. must fall for highly productive subjects. This score, together with test 6 and test 7a, the whole-part score of test 7, was included to test the value of Lindberg's (21) hypothesis that colour-form and whole-part dimensions might be identical.

RESULTS AND DISCUSSION.

In Table I the percentage of colour reactions to each test are shown. Table II shows the correlation matrix obtained by correlating each test with all the

TABLE I.*

| Test. | %C. | Test. | %C. | Test. | %C. |
|-------|------|-------|------|-----------------|------|
| 1 | 41.5 | 12 | 60 | 23 | 45.5 |
| 2 | 61.5 | 13 | 35 | 24a | 54 |
| 3 | 61 | 14 | 21.5 | 24b | 38 |
| 4 | 32 | 15 | 45.5 | 25a | 51.5 |
| 5 | 33 | 16 | 75 | 25b | 49.5 |
| 6 | 33 | 17a | 52.5 | 26 | 49 |
| 7 | 46 | 17b | 63.5 | R ₈ | 31.5 |
| 7a | 47 | 18 | 55 | R ₉ | 33 |
| 8 | 42.5 | 19 | 24 | R ₁₀ | 25.5 |
| 9 | 61.5 | 20 | 44 | R _w | 44.5 |
| 10 | 38 | 21 | 40 | g | 57 |
| 11 | 43 | 22 | 45.5 | | |

* Beside each test is the percentage of subjects giving the colour-determined response to that test.

others. Those tests designed to measure whole-part rather than colour-form attitudes were scored as though the whole response were the same as a colour one. Similarly, in correlating intelligence with the other tests, higher intelligence was equated with colour reaction. As tests 7, 16, 18, 23, 25a and 25b clearly contributed almost nothing to the total variance they were not included in the factor analysis. Examination of Table III, the correlations of 1, R₈, R₉ and R₁₀ with the other tests, shows that fairly similar patterns run through 1 and R₉ which differ from R₈ and R₁₀, which are also similar. Thus only scores 1 and R₈ were used in the factor analysis. Similarly, instead of including both scores 24a and 24b, scores on similar tests, only the latter was included.

The remaining matrix was analysed using Thurstone's centroid method. Only two factors were extracted, partly because the remaining residuals were nearly all insignificant, but mainly because any further factors could contribute very little to the common variance. Table IV shows these first two factor loadings. These loadings are represented graphically in Fig. 1, where I and II are the original axes. New axes I' and II' have been drawn representing, roughly, a 50° rotation from the original solution. The first axis, I', passes through a group of tests, 10, 12, 13 and 19, all concerned with colour-form sorting, whilst all the other tests clustered about it are of a similar nature. The only score out of place is R_w and the note has already been made that this score was not reliable. There is ample evidence, then, for regarding this factor as depicting the traditional colour-form dimension. The composite, conventional Rorschach score, 1, has zero saturation as this factor, so there is little doubt that colour as normally scored on the Rorschach has little in common with this use of colour. Even card VIII, which had been deliberately scored to make it as similar as possible to the sorting tests, although showing some saturation on this factor, still has much more of its variance dependent upon the second factor.

Although it would be unsafe and unwise to attempt any dogmatic interpretation of the second factor in view of the heterogeneity of the tests defining it, certain indications suggest that it may be one of whole as against part attitude. Tests 6 and 7a, for instance, were designed specifically as tests of this dimension, and Lindberg (21) has already indicated that his ring test,

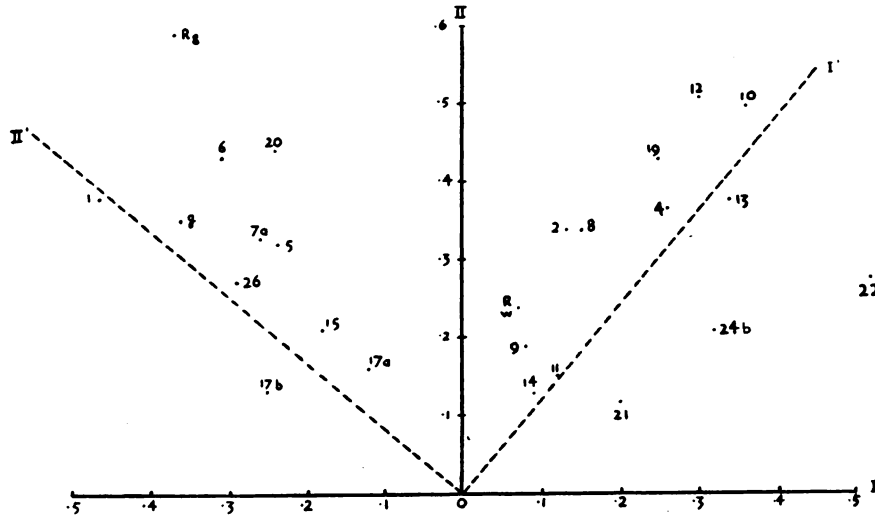


FIG. 1.—Geometrical representation of the factor saturations shown in Table IV. Rotation of the original axes through 50° brings them to the position shown by the dotted lines. Examination of the tests clustered about these axes suggests that I' is a factor of colour-form and II' is a factor of whole-part attitude. The tendency for all the tests to lie just within the quadrant I'O II' indicates that these factors are probably correlated slightly.

No. 5, gives very similar results to those obtained from test 6. This led Lindberg to suggest that the colour and synthetic attitudes coincided, whereas it now appears that his Ring test is really a test of the latter rather than of the former attitude. Instead of being coincident, it seems that the two attitudes

TABLE II.—Tetrachoric Correlations Matrix obtained by

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 7a. | 8. | 9. | 10. | 11. | 12. | 13. | 14. |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 2 | .12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 3 | .20 | .24 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 4 | -.05 | .29 | .10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 5 | .06 | -.02 | .17 | .10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 6 | .16 | .02 | -.08 | -.16 | .47 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 7 | -.15 | .15 | .03 | .12 | .12 | .06 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 7a | .22 | .14 | .19 | .17 | .37 | .21 | .48 | .. | .. | .. | .. | .. | .. | .. | .. |
| 8 | .07 | -.18 | -.06 | .03 | .10 | .35 | .00 | .00 | .. | .. | .. | .. | .. | .. | .. |
| 9 | -.08 | .05 | .03 | .17 | .08 | .12 | .05 | -.03 | .10 | .. | .. | .. | .. | .. | .. |
| 10 | -.08 | .18 | .17 | .42 | .14 | .28 | .22 | .17 | .42 | .12 | .. | .. | .. | .. | .. |
| 11 | -.07 | .00 | .18 | -.09 | .12 | .12 | -.14 | -.11 | .12 | .33 | .08 | .. | .. | .. | .. |
| 12 | .13 | .14 | .26 | .20 | .02 | .05 | -.04 | -.11 | .30 | .14 | .26 | .34 | .. | .. | .. |
| 13 | .01 | .18 | .15 | .10 | .10 | -.07 | .00 | .04 | .11 | -.10 | .33 | -.04 | .32 | .. | .. |
| 14 | .06 | .26 | -.10 | .10 | -.20 | .04 | .00 | .07 | -.11 | .04 | .07 | -.15 | -.16 | .09 | .. |
| 15 | .21 | -.06 | .12 | .10 | .00 | .00 | -.18 | -.06 | .26 | .04 | .02 | .12 | .05 | .10 | -.09 |
| 16 | .04 | .05 | .00 | .14 | -.13 | -.08 | .02 | .00 | -.04 | -.04 | -.10 | -.08 | -.05 | .16 | .00 |
| 17a | .10 | .00 | -.11 | .20 | .06 | .02 | -.12 | .03 | .06 | .10 | -.02 | .01 | -.01 | -.08 | .11 |
| 17b | .20 | .00 | .05 | .08 | -.18 | .11 | .05 | .08 | -.06 | .00 | -.22 | -.05 | .09 | -.12 | .03 |
| 18 | .26 | .04 | -.03 | .06 | .13 | .03 | .07 | .14 | -.08 | -.08 | -.23 | -.16 | -.23 | -.05 | -.07 |
| 19 | .05 | -.02 | .07 | .03 | .26 | .05 | .08 | .17 | .34 | -.06 | .36 | -.07 | .40 | .37 | .26 |
| 20 | .32 | .19 | .05 | .20 | .06 | .28 | .11 | .12 | .02 | -.04 | .08 | .04 | .10 | .00 | .14 |
| 21 | -.13 | .03 | .07 | .05 | -.01 | -.08 | -.19 | -.02 | .04 | .00 | .09 | .02 | .10 | .17 | -.05 |
| 22 | -.05 | .36 | -.08 | .44 | -.18 | -.10 | .06 | -.12 | .14 | .00 | .22 | .00 | .34 | .27 | .06 |
| 23 | .31 | .06 | .14 | .00 | .04 | -.07 | .05 | .07 | -.17 | .06 | -.24 | .04 | .04 | .08 | -.06 |
| 24a | .04 | -.18 | .07 | .20 | .15 | .. | .14 | .. | .02 | -.02 | -.06 | -.24 | .00 | .28 | -.14 |
| 24b | -.07 | .15 | .12 | .24 | -.08 | .00 | .04 | .04 | .12 | .12 | .00 | .01 | .12 | .33 | .16 |
| 25a | -.07 | .21 | .13 | .05 | .15 | .04 | .20 | -.02 | .02 | .01 | .04 | -.03 | -.07 | .01 | .13 |
| 25b | .12 | -.09 | -.11 | .05 | -.02 | -.06 | -.30 | -.12 | .10 | -.08 | -.13 | .02 | -.21 | -.05 | .01 |
| 26 | .16 | -.01 | .01 | .13 | .09 | .30 | -.13 | .09 | -.08 | .03 | .09 | -.16 | .17 | .06 | .00 |
| Rw | .15 | .00 | -.01 | -.07 | .14 | .21 | -.17 | .15 | .03 | -.23 | .22 | .10 | .14 | .14 | .00 |
| g | .13 | .13 | .14 | -.22 | .22 | .36 | -.11 | .11 | .08 | .29 | .09 | .16 | .18 | -.06 | .03 |
| R _g | .58 | .18 | .27 | .01 | .21 | .31 | .09 | .36 | .10 | -.04 | .20 | -.17 | .25 | .27 | .13 |

TABLE III.—The Cells in this Table show the Correlation between the Rorschach Scores I, R₈, R₉ and R₁₀ with the Other Tests.

| | | | | | | | | | | | | | | | | |
|-----------------|------|------|-----|------|-----|------|------|------|------|------|------|-----------------|-----|-----------------|-----------------|------------------|
| I | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. |
| R ₈ | .58 | .18 | .27 | .01 | .21 | .31 | .09 | .36 | .10 | -.04 | -.17 | .25 | .27 | .13 | .27 | -.01 |
| R ₉ | .79 | .27 | .14 | .07 | .08 | .16 | -.01 | .10 | -.04 | .05 | -.09 | -.02 | .00 | .04 | .17 | -.12 |
| R ₁₀ | .56 | .09 | .02 | .00 | .06 | .22 | .00 | .07 | .11 | .24 | .02 | .20 | .23 | .16 | .16 | .25 |
| I | 17a. | 17b. | 18. | 19. | 20. | 21. | 22. | 23. | 24b. | 25a. | 26. | R _{w.} | g. | R _{8.} | R _{9.} | R _{10.} |
| R ₈ | .10 | .20 | .26 | .05 | .32 | -.13 | -.05 | .31 | -.07 | -.07 | .12 | .15 | .13 | .58 | .79 | .56 |
| R ₉ | -.06 | .06 | .10 | .22 | .27 | -.06 | .03 | .06 | -.06 | -.04 | .01 | .20 | .29 | .33 | .38 | .44 |
| R ₁₀ | .22 | .15 | .31 | -.04 | .28 | .06 | -.04 | .10 | .14 | -.07 | .29 | .09 | .24 | .38 | .38 | .30 |
| | -.01 | .02 | .06 | .24 | .16 | .00 | -.03 | -.07 | -.04 | .13 | .24 | .22 | .47 | .44 | .30 | .30 |

TABLE IV.—First and Second Unrotated Factor Loadings obtained from a Centroid Analysis of the Correlation Matrix shown in Table II.

| | | | | | | | | | | | | | | | | | |
|----------|-----------|-------|------|------|------|------|------|------|-----|------|------|-----------------|------|-----------------|--|--|--|
| Factor I | Factor II | Test. | | | | | | | | | | | | | | | |
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7a. | 8. | 9. | 10. | 11. | 12. | 13. | | | |
| | | .38 | .34 | .30 | .37 | .32 | .43 | .33 | .34 | .19 | .50 | .15 | .51 | .38 | | | |
| | | -.46 | .13 | -.04 | .26 | -.24 | -.31 | -.26 | .15 | .08 | .36 | .12 | .30 | .34 | | | |
| Factor I | Factor II | Test. | | | | | | | | | | | | | | | |
| | | 14. | 15. | 17a. | 17b. | 19. | 20. | 21. | 22. | 24b. | 26. | R _{w.} | g. | R _{8.} | | | |
| | | .13 | .21 | .16 | .13 | .43 | .44 | .12 | .28 | .21 | .27 | .24 | .35 | .59 | | | |
| | | .09 | -.18 | -.12 | -.25 | .25 | -.24 | .20 | .52 | .32 | -.29 | .07 | -.36 | .37 | | | |

placed upon certain responses may, in fact, be correct, the rationale behind such interpretations has been shown to be highly questionable.

The "whole-part hypothesis," it must be emphasized, is only *suggested* by this study; it is certainly not confirmed nor proven. To do this a new, similar investigation must be carried out using tests to establish the newly hypothesized relevant factor more definitely.

Some confirmation, at least, can be obtained by a re-examination in the light of the new hypothesis of the data already collected. The unreliability of the W per cent. in its usual form has already been indicated, but if we limit the number of responses to each card to only one or two then this effect of productivity can be discounted. In the same way as it was earlier pointed out that cards VIII, IX and X can be regarded as individual colour-form type tests, so it can be argued that cards I to VII constitute separate whole-part tests. With this in mind the subjects' Rorschach protocols were re-examined, and for each card a score of W was recorded if either the first or second response was one normally so scored, otherwise a D was allotted. As a number of losses were incurred due to the elimination of all records involving refusals this part of the investigation involved only 100 subjects. On cards I and V over 80 per cent. of the initial responses were W's, and as tetrachoric correlations obtained from such extreme cuts are highly unreliable these cards were excluded from further analysis. Tetrachoric correlations were calculated between all the other cards and the colour-form scores on cards VIII, IX and X separately as well as with tests 5, 6, 7a and g from the previous analysis. Table V shows

TABLE V.*

| | R ₂ | R ₃ | R ₄ | R ₆ | R ₇ | R ₈ | R ₉ | R ₁₀ | 5. | 6. | 7a. |
|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|----|----|-----|
| R ₂ | . 37 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| R ₄ | . 21 | 05 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| R ₆ | . 24 | 28 | 18 | .. | .. | .. | .. | .. | .. | .. | .. |
| R ₇ | . 40 | 52 | 31 | 10 | .. | .. | .. | .. | .. | .. | .. |
| R ₈ | . 11 | 24 | 43 | -05 | 20 | .. | .. | .. | .. | .. | .. |
| R ₉ | . 00 | 21 | -08 | 18 | 32 | 38 | .. | .. | .. | .. | .. |
| R ₁₀ | . 18 | 04 | 44 | 37 | 04 | 44 | 30 | .. | .. | .. | .. |
| 5 | . 05 | -04 | 30 | 22 | 00 | 21 | 08 | 06 | .. | .. | .. |
| 6 | . 06 | -16 | 26 | 16 | -07 | 31 | 16 | 22 | 47 | .. | .. |
| 7a | . 17 | -18 | 11 | 20 | 06 | 36 | 10 | 07 | 37 | 21 | .. |
| g | . 06 | 26 | -07 | -16 | 14 | 33 | -02 | 16 | 22 | 36 | 11 |

* Tetrachoric correlations obtained by intercorrelating the scores from 100 subjects in the whole-part tests, R₂, R₃, etc., represent the individual Rorschach cards II, III, etc. respectively. Tests 5, 6, 7a and g are those used in the original analysis; the inter-correlation between these tests was calculated on scores from the whole 200 subjects.

the inter-correlation matrix so obtained. This table was factor analysed by the Thurstone centroid method. As the principle axis of this battery was hypothesized to be the rotated axis II' from the initial battery, and as the aims of the analysis were to examine—

- (i) the validity of the interpretation of this as a whole part factor by the inclusion of further whole-part tests, and
- (ii) saturations of the colour scores to cards VIII, IX and X on this factor,

there was no point in going beyond a one-factor solution.

Table VI shows the unrotated factor saturations obtained from this analysis. Comparison with Table VII, which gives the rotated saturation on this factor

TABLE VI.—*First Factor Loadings Obtained from a Centroid Analysis of the Correlation Matrix shown in Table V.*

| | Test. | | | | | | | | | | | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------------|-----|-----|-----|-----|
| | R ₂ . | R ₃ . | R ₄ . | R ₆ . | R ₇ . | R ₈ . | R ₉ . | R ₁₀ . | 5. | 6. | 7a. | g. |
| S | .43 | .37 | .49 | .39 | .47 | .67 | .37 | .53 | .45 | .46 | .37 | .33 |

TABLE VII.—*Whole-part Factor Saturations Calculated Graphically from the Rotated Axis O II' shown in Fig. 1.*

| | Test. | | | | |
|-----|------------------|-----|-----|-----|-----|
| | R ₈ . | 5. | 6. | 7a. | g. |
| II' | .67 | .39 | .52 | .41 | .50 |

from the first analysis (computed graphically), shows close agreement between the two sets of saturations for the common tests. In view of the fallibility of the second set of correlations due to the relative smallness of the sample it is not unreasonable to suppose that the two factors are identical. It may, then, tentatively be concluded that this factor is one of whole-part reaction, whilst bearing in mind that none of the saturations are terribly high. As the colour cards, and especially cards VIII and X, measure this factor at least as well as the tests used to define the factor, the earlier interpretation of their effect in terms of this rather than the colour factor is supported.

SUMMARY.

The purpose of this paper was to examine the validity of the role attributed to colour in the Rorschach test. This was shown to involve two separate problems:

- (i) the validity of the hypothesis connecting response to colour with emotionality, and
- (ii) the validity of the view that colour-determined Rorschach responses depend upon colour *per se*.

Concerning the first problem, a number of experiments were reviewed showing that although experimental evidence provides no striking support for the hypothesis, it by no means disproves it.

Some experiments pertinent to the second problem were reviewed, leading to the suggestion that a composite criterion consisting of a battery of other tests involving colour response as a scorable item would be preferable to the more usual single test criterion.

A battery of such tests was constructed and given to a reasonably heterogeneous group of 200 subjects. A Thurstone centroid factor analysis was carried out on the matrix of test inter-correlations. The analysis was stopped after two factors had been extracted, and a rotation of the original axes through 50° led to the identification of two factors. The first, a colour-form factor, indicated that some of the tests in the battery did measure along one

dimension depending upon reaction or non-reaction to colour. The Rorschach colour score had no saturation on this factor. The second factor was tentatively identified as one of whole-part reaction as it passed through a cluster of tests designed to measure just this attitude. The Rorschach score had a saturation of about .6 on this factor. On this evidence the hypothesis was suggested that Rorschach colour responses depend not upon colour reaction *per se* but upon reaction to the stimulus as a whole rather than to any particular part of it. A re-analysis of part of the data in the light of this hypothesis added further support for it.

APPENDIX.

Description of Tests.

(1) *Rorschach.*

The normal cards.

(2) *Tossing.*

This consisted of a cardboard disc of diameter 5 cm. coloured red on one face and green on the other. Centrally placed on the green face was a yellow disc of diameter 2.5 cm. On the red face was a yellow square of side 2.5 cm. also centrally placed. The point of this test is to see whether the subject designates the faces by their colours or their shapes when guessing which side will face upwards after being spun like a coin.

(3) *E.S.P.*

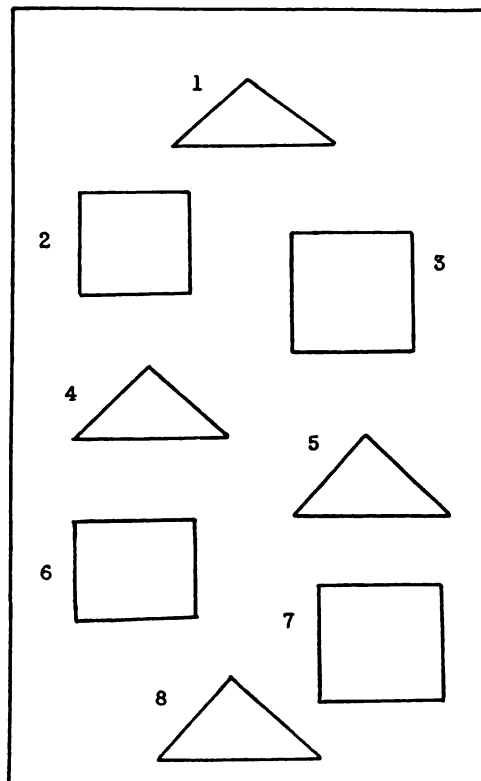
Regarded by the subjects rather as a test of extra-sensory perception, this test consisted of a dark grey rectangular piece of cardboard 8 cm. by 13 cm. acting as a background for four squares of side 2 cm. and four isosceles triangles of base 3 cm. and height 1.5 cm. placed as shown in the diagram. Numbers 1 and 6 were white, 2 and 5 sea green, 3 and 8 rose, and 4 and 7 were light grey. When the subject was asked to select the one he thought the examiner was thinking about it was assumed that "colour dominant" subjects would choose a coloured symbol and "form dominant" subjects a non-coloured one.

(4) *Memory.*

On the assumption that in a fairly short learning period the degree of learning would be incomplete, cards were prepared so that the subjects had to learn to associate a given letter with a given coloured shape. On testing some ten minutes later, the same shapes and colours were used but with different pairing, so that the subject could give either the letter associated with the previous colour or with the previous shape. In this way it could be determined whether the original learning depended mainly upon the shape or mainly upon the colour of the symbol.

The material consisted of four white rectangular cards 7.5 cm. by 11.5 cm. On one was a royal blue square of side 1.5 cm. placed medially with its base 4 cm. from the top of the card. Four centimetres below it, printed in black, was the letter F .5 cm. high. The three other cards contained respec-

tively a green equilateral triangle with apex pointing down, and of side 2 cm., a red right-angled triangle of base 1 cm. and height 2.5 cm., with apex pointing upwards and the right angle to the left, and a light grey trapezium of height 1.5 cm. and parallel sides 2 cm. \times 1 cm. long respectively, with the longer side as the base. All three figures were placed medially on the cards with their lowest points 4 cm. from the top edge of the card. Below the figures were the



Test No. 3.

letters R, L and T respectively, in the same relative positions and of the same size as the F on the first card described.

The four test cards were of the same size as the originals and contained the same four shapes and colours in the same positions on the cards except that this time the equilateral triangle was royal blue, the right-angled triangle light grey, the square red, and the trapezium green. This time there were no letters on the cards.

(5) *Ring Test.*

This test was devised by Lindberg (20) and printed copies of his test were used. This description of the test is taken from his original monograph.

“ The principle of my main test is to let the subject compare two simple figures, which differ from each other in many respects, one of them being

a difference in colour. . . . The figures to be compared are drawn on two separate pieces of paper, both 15.5×10.4 cm. in size, one paper being entirely white, the other ordinary squared arithmetic paper; the figures on the white sheet are blue and on the squared paper red. Each sheet of paper has a ring and a rectangle upon it. The blue ring has a thin outer margin and a thick inner one, the two margins being separated by a narrow crescent; in the red ring the conditions are the reverse. Each of the rings has an arrow, which is placed differently in both rings and point in different directions. The head of the red arrow is at a few millimetres' distance from the shaft, while the head of the blue arrow is fitted tightly on to the shaft. The location of the rings on the paper differs also. They are also at unequal distances from the rectangles. These rectangles are equal in size but differ in having a diagonal line drawn in different directions and in having sides of unequal thickness. Only the principle differences are mentioned here, several other particulars which differ in the two plates can of course be found."

(6) *Text Test.*

This test, too, was devised by Lindberg and supplied in printed form. The description hereunder is taken from Lindberg (21):

"The subject is given a paper containing versions of a well known proverb. One version reads: 'A bird in the hand is worth two in the bush.' The other reads; 'A fowl in hand is worth three in the bush.' The first version is typewritten, and the second is handwritten in the same block colour below."

This test is one of analytic-synthetic attitude, to see if the subject reacted to the stimulus as a whole, or whether it was analysed into its component parts first.

The reason for including it was to check upon Lindberg's observation that colour reactors also tended to be synthetic reactors.

(7) *Cards.*

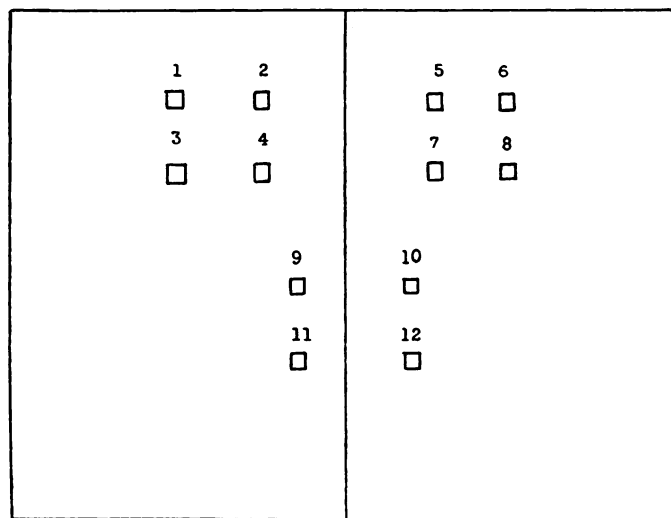
Although from test 6 it was possible to see if colour reactors were also whole, as against part, reactors, it was not possible to assess the influence of colour upon the whole reaction. There was, for instance, no opposition of colour and wholeness, so that it was not possible to say that because the colour response and the whole response happened to coincide on a particular test, and that subjects giving this particular response also gave a whole response on another test, then the original response was determined by its wholeness and not by its colour characteristics. The colour may or may not have contributed to the determination of the response. Had, in fact, the colour been irrelevant we should have expected to find a number of background differences (in the Ring test the designs appeared one on plain and the other on squared backgrounds) reported. This was not so, suggesting that the colour really did influence the result. For this reason a test was constructed to give four possible major

differences, where colour and shape and part and whole differences could appear in all possible combinations.

The apparatus consisted of two rectangular cards, one pale green and 8.5 cm. by 14 cm., and the other turquoise and 8.5 cm. by 7.5 cm., each containing three figures. In the top left-hand corner of each card 1 cm. in and 1 cm. down was a rose square. This figure was meant to be common in shape and colour to both cards, but as a simultaneous contrast effect with the different backgrounds induced a slight apparent colour difference between the squares, that on the green card was made slightly larger to introduce a compensating form difference. The square on the pale green card was of side 2.1 cm., the other one having a side of 1.9 cm. In similar positions in the right-hand top corners were a circle of diameter 1.8 cm. on the pale green card, and a rectangle 2 cm. by 1 cm. with the longer side horizontal on the turquoise one. Both these figures were orange. An equilateral triangle of side 2 cm. was placed symmetrically about the medial line of both cards and 1 cm. from the bottom. The triangle on the pale green card was royal blue, and that on the turquoise card was purple.

(8) *Grouping.*

Based upon Gestalt grouping principles, this test consisted of twelve coloured squares set out in three groups of four, each as shown in the diagram. The background was made up of two plain white rectangular cards 13 cm. × 20



Test No. 8.

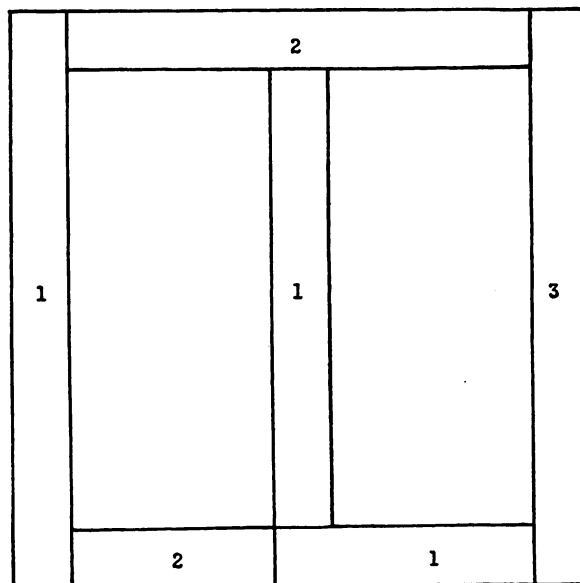
cm., joined together so as to fold over in the manner of the cover of a book. Six of the coloured squares of side 1 cm. were on each card, the upper groups of four being set at the corners of a square of outer side 5.5 cm., 3 cm. from the top of the page and 3 cm. from the medial line, whilst the remaining pair on each card made up a similar square 3 cm. below the others and bisected by the

medial line. Squares numbered 1, 3, 9 and 11 in the diagram were sea green, 6, 8, 10 and 12 were orange and 2, 4 5 and 7 were purple so that the squares could be grouped either according to their formal properties or according to colour.

The following nine tests, numbered 9 to 17, all consisted of coloured symbols and designs placed centrally upon white rectangular cards 13 cm. by 20 cm. in size. The cards were punched and placed in a loose-leaf file so that progress from one test to the next consisted in simply turning over the page. Between successive tests plain white cards were inserted so that the page could be turned immediately a response was made without exposing the next test before the appropriate instructions had been given.

(9) *Hidden Letter.*

The simple design shown in the diagram was constructed so that it contained, right-way-up, a fairly well proportioned letter T, made up of two colours, rose and sea green, and a less well proportioned letter L appearing wholly in rose. It was hypothesized that a person reacting primarily to colour would spot the



Test No. 9.

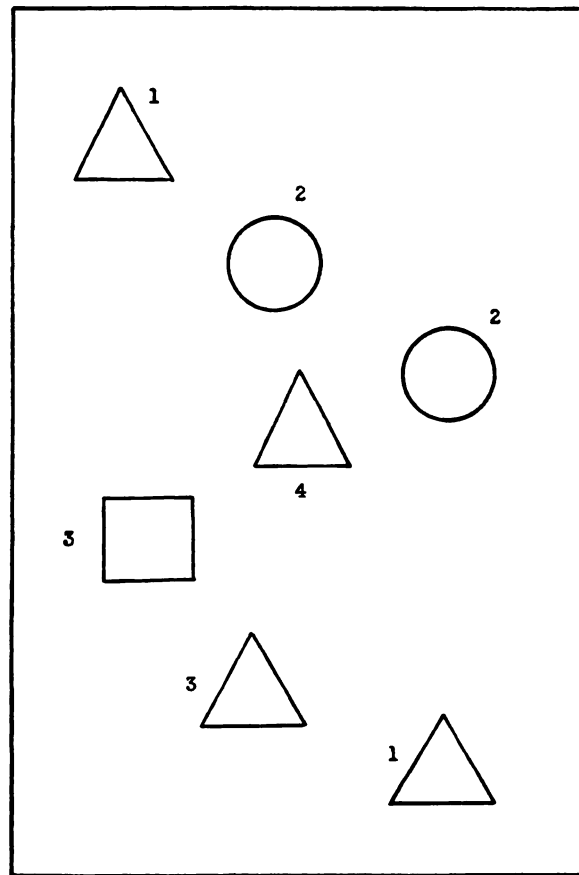
L when asked to look for a letter hidden in the figure, but that without the colour attraction the letter proportioned T would be more likely to attract attention. Preliminary studies indicated that best results obtained when the L was divided by a faint line continuing its horizontal across its vertical member. In this way the common member more naturally belonged structurally to the T, and could only be associated with the remainder of the L on a like-colour basis.

The outer side of the square was 10 cm. and all the lines were 1 cm. thick. Thus the T had equal arms of 8 cm. each, which the horizontal-vertical illusion

tended to improve, and the L had arms of 8 cm. and 3.5 cm. (inner dimensions), which were phenomenologically "elongated" by this illusion. The parts marked 1, 2 and 3 in the diagram were rose, sea-green and yellow respectively.

(10) *Odd One Out.*

Essentially only a variant of the older sorting techniques, this test consisted of seven figures scattered on the page approximately in the relative positions shown in the accompanying diagram. The figures were shaped and coloured



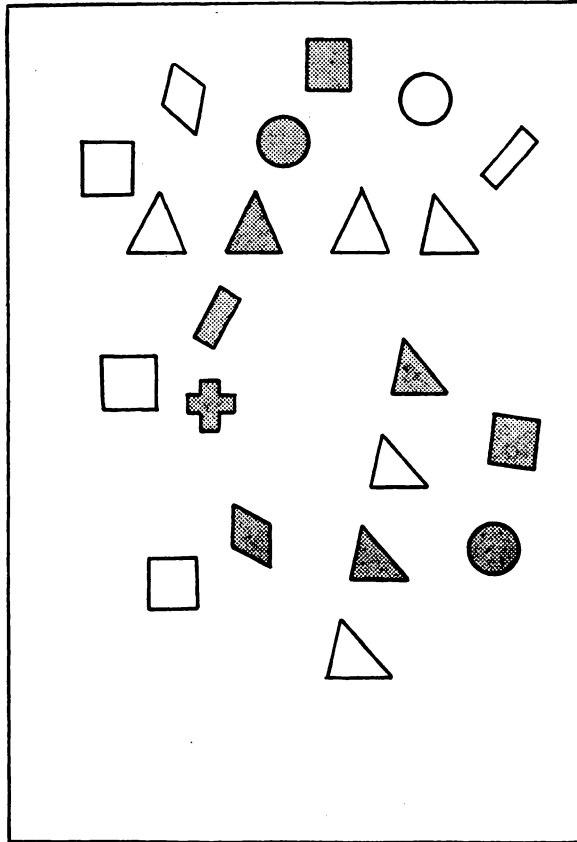
Test No. 10.

so as to allow two possible groupings into three sets of pairs with one figure left over. The figures consisted of two turquoise circles of diameter 1.5 cm. which always made up one group, two purple isosceles triangles of base 1.5 cm. and height 1.5 cm., making another stable pair and three other figures. The remaining figures were two isosceles triangles of the same size as the others but coloured orange and green respectively, and an orange square of side 1.3 cm. Thus the third pair could either consist of a pair of triangles, so excluding

the only square, or a pair of orange figures, leaving the single green as the odd figure. The figures marked 1, 2, 3 and 4 were purple, turquoise, orange and green respectively.

(II) *Hidden Number.*

Consisting of a number of diversely shaped, sized and coloured figures, this test is impossible to describe verbally except in its major elements. The accompanying diagram shows the general disposition of the figures on the card. The figures were so arranged that eight isosceles triangles of base 1.2 cm. and



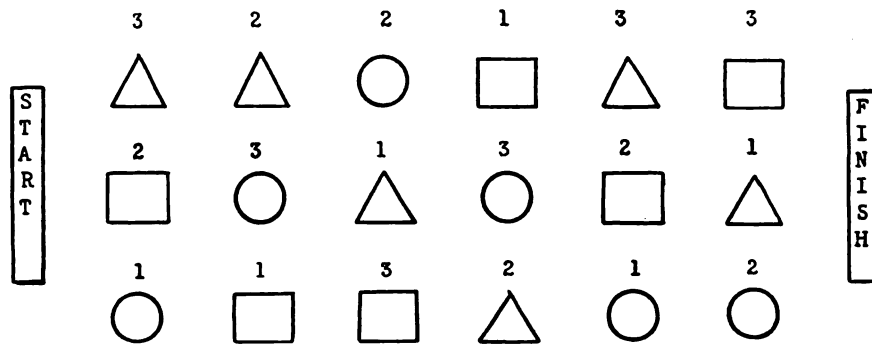
Test No. 11.

height 1.2 cm. and of various colours made up the shape of the figure 7. Intwined with this a series of variously shaped royal blue figures whose sizes were of the order of those of the triangles were set out in the form of the figure 6. Several other odd-coloured shapes were added to disguise these figures. When the subjects were asked to find the number hidden in the pattern, the expectation was that those reacting to colour would find the 6, whilst those whose reactions were more determined by shapes would be more likely to find the 7.

(12) *Stepping Stones.*

This is another test of the sorting variety, and requires the subject to pick his way across a set of coloured figures as though he were crossing a river on stepping-stones. In the example card the correct path consisted of figures which were alike in both colour and shape—turquoise triangles. From this the subject obtained his clue as to the relevant “steps” to use in the test proper. On the second card no path of exactly similar figures appeared, but two equal parts, one of common colour, pale green, and the other of common shape, circle, were available. According to which clue, colour or shape the subject had placed most emphasis in the example trial, so it was expected he would choose in the test proper.

On both cards the sides of the triangle, diameter of the circles, and sides of the squares were all about 1.3 cm. Each maze, excluding the starting and



Test No. 12 (Test card).

finishing boxes, was included within a rectangle 12 cm. by 6 cm. The starting and finishing boxes were made to extend the whole width of the mazes (as shown in the diagram) so as not to bias the subject into believing that the figure in the centre line should be used for starting and finishing. The figures marked 1, 2 and 3 were rose, turquoise and pale green, respectively.

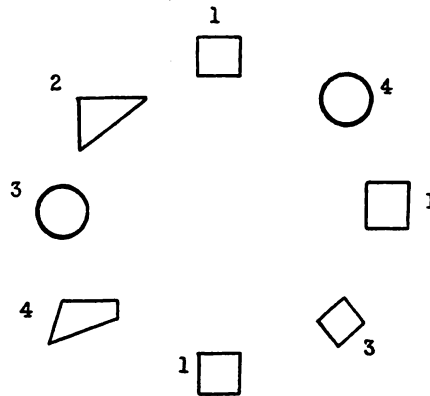
(13) *Common Elements.*

A variant of one originally devised by Eysenck (7), this test is another version of the sorting type. Eight coloured figures, equally spaced around the circumference of a circle, were presented from which three had to be selected as being similar.

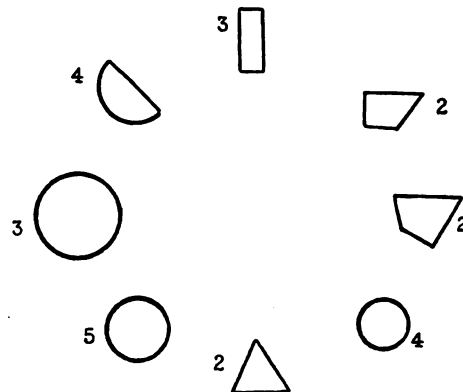
An example card was presented first where the similar figures were of the same colour and shape. In this card, as on the test card, the diameter of the circle circumscribed by the figures was 5.7 cm. The common figures, appearing at 12, 3 and 6 o'clock respectively, were purple squares of side 1.5 cm. The remaining figures were of comparable size, and disposed as shown in the diagram. On the test cards two alternative sets of “similar” figures appeared. Here were three circles of diameters 1.5 cm., 1.2 cm. and 1.8 cm., coloured rose,

turquoise, and yellow, appearing at 5, 7 and 9 o'clock respectively. The common colour was sea green and appeared on two irregular quadrilaterals at 1 and 2 o'clock respectively, and an equilateral triangle of side 1.7 cm. placed at 6 o'clock. The remaining figures were as shown in the diagram. Colours 1, 2, 3, 4 and 5 were purple, sea-green, yellow, rose and turquoise respectively.

EXAMPLE



TEST

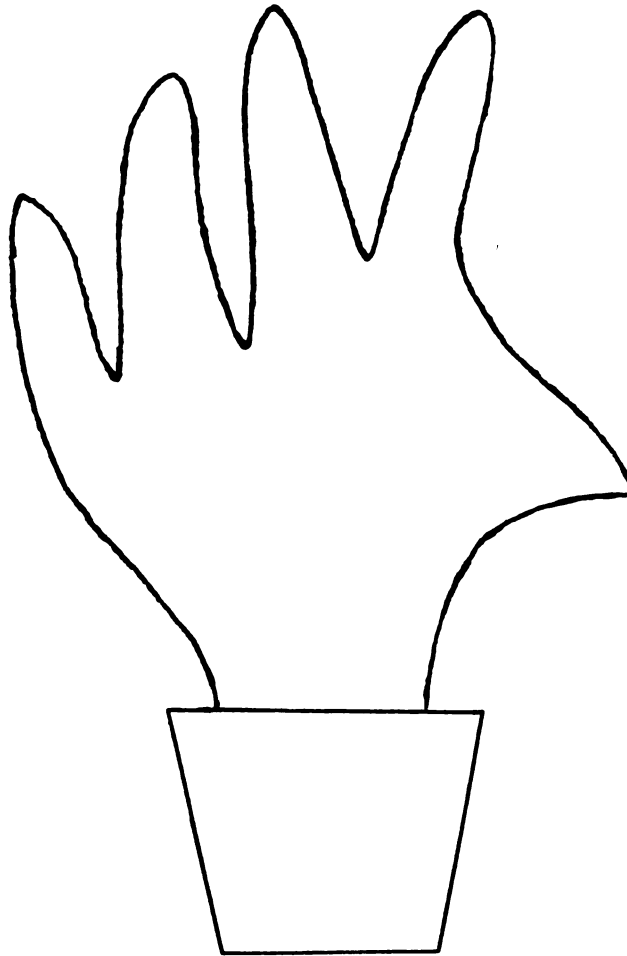


Test No. 13.

(14) *Poppinga*.

This ingenious test, called here after the name of its author, Poppinga (24), consisted of a figure shaped somewhat like a hand emerging from the cuff of a sleeve. By colouring the hand green and the cuff a reddish-brown, it was made to appear also like a cactus type plant in a pot. Thus, subjects sensitive to the colour rather than the formal aspects of the figure might be expected to give the latter rather than the former interpretation. Construction of this test proved rather difficult, for it was found to be very sensitive to small changes

in colour and design. The figure as finally used stood about 14 cm. high, of which 3.5 cm. was taken up by the "cuff" which was coloured rose. At its base the "cuff" was 3.5 cm. wide, and the widest part portion of the hand, taken from the thumb tip (AB in the diagram), was about 8 cm. The general shape of the figure is shown in the diagram. The hand was coloured green.



Test No. 14.

(15) *Words.*

By arranging a letter square so that words could be read both downwards and across, it was hypothesized that by making the vertical arrays of like colours, subjects reacting to colour be made to read the words downwards rather than the words across as would be customary. The letters in the vertical array CAT were coloured red, OXO were green and PET were royal blue. The letters were about 1.5 cm. high with 2 cm. spaces between. Greatest discrimination was obtained in the pre-tests when the words across made an angle of about 15° with the horizontal.

(16) *Hidden Tumbler.*

Verbal description of this test, too, is impossible. It consisted of a jig-saw-like arrangement of lines and colours such that two tumbler shapes were hidden in it. One tumbler was made up entirely in red with no black definite lined edges, whilst the other had a line edge but with several colours running through it, tending to break it up. Thus a colour reactor might be expected to pick out the red tumbler and a form reactor the outlined one. Both tumblers were centrally placed and partly overlapped, the "form" tumbler being above and to the left of centre, and the other below and to the right of it. The whole figure was 12 cm. square and each tumbler stood about 4 cm. high. Owing to its complexity this test could not be constructed satisfactorily with coloured papers and was made with coloured crayons, and so the colours cannot be specified exactly.

(17) *After Image.*

Included because it was thought that colour reactors might have longer after-image duration than non-colour reactors, this test consisted simply of a royal blue rectangle 3.5 cm. by 7.5 cm. centrally placed upon the white background. During the preliminary testing periods it was found that when describing the after-image some subjects mentioned its colour, whilst others did not. It was decided, therefore, to include this presence or absence of colour designation as a second score obtainable from this test.

(18) *T-Test.*

Rather than rely entirely upon what might be called reception type tests requiring a more or less passive attitude on the part of the subject, it was decided to include one or more performance tests. The polygon ranking test of Eysenck, although ideal in its original form, was discarded as being too lengthy and laborious in both administration and scoring, but its principle was utilized in constructing a test which, while theoretically less neat and precise more nearly fitted in with practical requirements. This was done by giving the subject a set of sticks of various colours and lengths which had to be fitted together to make (for him) the nicest looking letter T. By repeating this five times it could be determined whether the subject retained the same proportions between the members of the T from trial to trial or whether a fixed colour combination was preferred.

The five cross-pieces for the respective trials were all 10.2 cm. long, 2.5 cm. wide and coloured green. Each piece had a recess cut out into which the vertical members making up the T were to be fitted. These cut-outs were made of different shapes, as shown in the diagram, to facilitate the sorting out of the various vertical members should they become mixed. In each case the recess occupied a length of 2.5 cm. (the width of the vertical members) and was 1.2 cm. deep. Five vertical members were provided for each cross-piece, their overall lengths being 12.5, 11.5, 10.2, 9.0 and 7.5 cm. respectively. Calling the cross pieces A B C D E in order of presentation and the vertical members 1 2 3 4 5 in order of decreasing length, each individual vertical member becomes identifiable by a letter and a number. Thus A1 is the longest vertical member

in the first set and E₅ is the shortest one in the last set. A₁, B₄, C₃, D₂ and E₅ were coloured red, A₂, B₅, C₄, D₃ and E₁ were light grey, A₃, B₁, C₅, D₄ and E₂ were royal blue, A₄, B₂, C₁, D₅ and E₃ were green, and A₅, B₃, C₂, D₁ and E₄ were yellow.

The pieces were cut from fibre-board 3 mm. thick and were quite rigid. As for all the other tests, the colouring was done by sticking on coloured paper, but in this case, in order to prevent spoiling by excessive handling, a layer of transparent sticky paper (scotch tape) was put on top. This gave the colours a shiny appearance not present in the other tests.

(19) *Weigl Sorting.*

A variant of the Weigl colour-form sorting test, this test consisted of nine wooden blocks, three squares of side 3.3 cm., three circles of diameter 3.3 cm., and three equilateral triangles of side 3.3 cm. All the blocks were 9 mm. thick and coloured on all surfaces. One of each shape was yellow, one red, and one green. As it was obviously impractical to use papers to colour these blocks they were painted to match, as far as was possible, the colours shown on the colour chart.

(20) *Immediate Memory.*

This test was taken from Thurstone (31) and modified slightly.

On each of seven plain white rectangular cards 10 cm. by 7.5 cm. in size were four coloured symbols set one in each quarter of each card. The subject's task was to recount the contents of each card immediately after a short exposure of it. An example card was first presented to acquaint the subject with the task. He was also shown a set of the symbols used, drawn in black indian ink, to ascertain that he could name them all before the test proper. The designs on the cards, starting at the top left-hand corner and reading clockwise, were, in their order of presentation :

- a* (Example) : Pale green X, yellow square, red triangle, blue heart.
1. Blue star, red crescent, red arrow, yellow triangle.
 2. Pale green arrow, pale green ring, blue heart, red square.
 3. Red arrow, yellow lines, pale green diamond, blue cross.
 4. Yellow heart, blue X, red star, red circle.
 5. Blue lines, pale green crescent, red X, yellow ring.
 6. Yellow square, pale green heart, blue crescent, pale green cross.

Thurstone, in the original version, used 10 cards and differentiated between the X and the cross and the ring and the circle. In this case, as well as the reduction in the number of cards, these form distractions were eliminated to simplify the task for the subjects. The exposure time was 1 second. According to the predominance of colour or form correct answers to the subject was designated a colour or form reactor.

(21) *Stroop Ratio.*

This test, too, was taken from Thurstone (31), who acknowledged in turn his indebtedness to Stroop. As used in this battery only two cards were neces-

sary, one containing lines of uncoloured printed colour names, and the other the same names but coloured. Both names and colours were the same as those reported by Thurstone, and were determined randomly originally. The actual order is shown on p. 434 with the colour shown underneath in brackets.

The cards were made by photographing a type sheet and then printing so that the words appeared white on a black ground. The cards were enlarged to 15 cm. by 20 cm. One card was left this way, whilst a second print was coloured by painting over each word with the appropriate photographic tint. These colours were applied so as to match the colours on the colour chart as nearly as possible. The time taken by the subject to read the uncoloured card was recorded and subtracted from the time taken to read the coloured one. This difference was reckoned to be a measure of the distraction caused by the colour on the second reading. Hence subjects little affected by the colour in the second case would obtain a low score, whilst those who were strongly attracted by the colour would obtain a high one. Errors were not included in the scoring as they were usually rectified with consequent loss of time anyway.

(22) *Card Sorting.*

An old favourite with researches into colour-form attitudes, this sort of test has obvious and unfortunate drawbacks in its usual form. Normally a set of cards have to be matched one at a time with a number (usually four) of master cards arranged so that the matching is possible either by colour or contour similarities. By a count at the end the experimenter determines the number of matches made by colour and the number on the basis of form comparisons. Unfortunately this ambiguity quickly becomes obvious to the subject with unpredictable results. The examiner is often pestered with questions as to the principle of sorting to be followed, and the subsequent behaviour of the subject is conditioned largely by his interpretation of the test situation and the examiner's non-committal replies. This has led many experimenters to comment upon the unreliability of such tests.

To overcome this difficulty the cards to be sorted were made so as to match the master cards in both colour or form in all but four cases, and only the placing of these four cards was scored. In order further to disguise the intent of the test, the subject was made to learn the positions of the four master cards. They were then removed and the pack had to be sorted from memory. By making the subject work under pressure of time, and by placing the ambiguous cards near the end of the series, almost all subjects completed the test unaware of the alternatives.

The four master cards were 6.5 by 7.5 cm., white and rectangular, containing a rose circle of diameter 1.8 cm., a pale green cross of side 1.8 cm., a yellow equilateral triangle of side 1.8 cm., and a blue square of side 1.8 cm. from left to right respectively as seen by the subject. The figures were medially placed and 1.5 cm. from the top of the cards. The cards to be sorted were of the same size as the master cards and were to be placed in four slits, 75 cm. by 1 cm. in the top of a box 23 cm. by 36.5 cm. by 7.5 cm. placed about a foot in front of the subject. Thus the subject was unable to see any card after he had placed it.

| | | | | | | | | | |
|------------------|-------------------|-------------------|-------------------|-------------------|--------------------|------------------|--------------------|-------------------|-------------------|
| RED (blue) | GREEN (red) | BLUE (yellow) | GREEN (blue) | RED (green) | YELLOW (red) | BLUE (yellow) | YELLOW (green) | BLUE (red) | GREEN (yellow) |
| YELLOW (blue) | RED (green) | BLUE (red) | YELLOW (blue) | GREEN (yellow) | RED (green) | BLUE (yellow) | RED (blue) | BLUE (yellow) | YELLOW (red) |
| GREEN (green) | BLUE (blue) | BLUE (green) | YELLOW (red) | YELLOW (green) | YELLOW (yellow) | RED (blue) | RED (red) | YELLOW (green) | GREEN (yellow) |
| BLUE (blue) | YELLOW (red) | YELLOW (blue) | BLUE (green) | RED (red) | BLUE (yellow) | YELLOW (red) | YELLOW (blue) | GREEN (green) | RED (yellow) |
| RED (red) | GREEN (yellow) | GREEN (red) | GREEN (blue) | RED (green) | GREEN (blue) | GREEN (green) | YELLOW (yellow) | RED (blue) | GREEN (yellow) |
| YELLOW (red) | RED (blue) | GREEN (yellow) | YELLOW (red) | BLUE (green) | GREEN (blue) | RED (yellow) | GREEN (red) | GREEN (blue) | BLUE (yellow) |
| BLUE (green) | GREEN (red) | RED (yellow) | RED (blue) | GREEN (yellow) | RED (green) | GREEN (red) | BLUE (yellow) | YELLOW (green) | YELLOW (blue) |
| RED (green) | YELLOW (blue) | YELLOW (red) | RED (yellow) | BLUE (green) | YELLOW (red) | BLUE (green) | YELLOW (blue) | GREEN (red) | GREEN (yellow) |
| YELLOW (blue) | BLUE (yellow) | RED (green) | BLUE (yellow) | GREEN (blue) | GREEN (red) | YELLOW (blue) | BLUE (green) | BLUE (red) | RED (blue) |
| GREEN (red) | RED (blue) | YELLOW (green) | BLUE (red) | YELLOW (blue) | BLUE (green) | RED (yellow) | GREEN (red) | RED (green) | BLUE (yellow) |
| BLUE (green) | RED (yellow) | BLUE (green) | GREEN (yellow) | RED (blue) | YELLOW (red) | BLUE (yellow) | BLUE (green) | YELLOW (red) | RED (blue) |

Test No. 21.

There were 28 cards in all to be sorted and were always in the order as numbered. Numbers 1, 5, 9, 19, 21 and 24 had yellow triangles on them; 2, 6, 7, 14, 15, and 26 had blue squares; 3, 4, 10, 11, 20 and 22 had rose circles; and 8, 12, 13, 16, 18 and 27 had pale green crosses. Number 17 was a red triangle, 23 a pale green square, 25 a blue cross and 28 a yellow circle. The latter were the four crucial cards and their placing according to colour or form provided the scorable response.

(23) *Playing-cards.*

This test was based upon the possible disrupting effect of colour upon instructions to sort on the basis of form. In order to obtain an index of the subject's facility in sorting playing-cards he was given part of a pack to sort into its component suits as rapidly as possible. This performance was timed to the nearest second. The same cards, but this time differently coloured, again had to be sorted at speed. Whereas originally both colour and shape could be used as a basis of sorting, in the second series shape only was available, the use of colour being actually detrimental. Thus, it was hypothesized that colour reactors would take relatively longer over the second series than those paying but little attention to the colours.

Both sets of cards were made by painting the figures on to plain white visiting cards 9.2 cm. by 6 cm. Stencils were made for the shapes to ensure the greatest possible uniformity, and the outlines were filled in with coloured inks. The cards were always given in the same order; the first series were 2C, 5D, 4D, 1D, 3D, 1C, 3S, 2S, 4C, 3C, 6S, 5C, 6D, 1H, 5S, 5H, 4H, 2H, 2D, 1S, 4S, 6H, 3H, 6C. In the second series the cards were not in their correct colours; thus the first letter indicates the colour used, Y being yellow, G green, BK black, R red, and B blue. The cards were in the order: Y5S, G4D, BK5D, BK2C, R5H, BK3H, B1H, G1C, Y6H, B4H, B6D, Y4S, Y6C, G1D, BK1S, B2S, G6S, R5C, G2H, B3C, R4C, R3D, Y2D, R3S.

(24) *Tachistoscope.*

Another well-tried colour-form test is the simultaneous tachistoscopic exposure of a number of figures, from which one has to be chosen as similar to a main figure, presented to the subject. Usually there are figures similar in shape and figures similar in colour alone but none which match the main figure exactly. The location of the figure chosen by the subject indicates whether he noticed the colour or form during the short exposure.

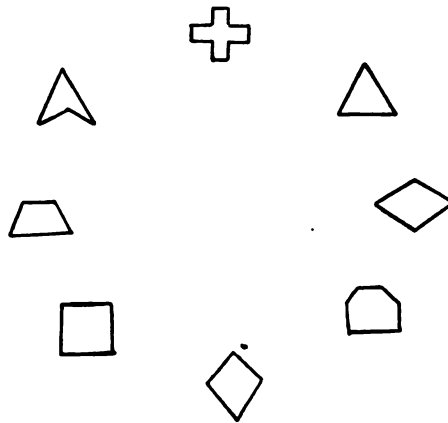
In this instance the subject was seated 3 ft. before an ordinary dropping shutter tachistoscope with an exposure time of about .1 sec. The aperture was 9.5 cm. across and 8 cm. deep containing 8 figures circumscribing a circle of diameter 3.5 cm. Starting at 12 o'clock and proceeding clockwise the figures were: a purple cross, a pale green equilateral triangle, a purple diamond, an orange square, a turquoise trapezium, and a sea-green equilateral triangle with a piece cut from its base, turning it into a symmetrical quadrilateral. The major dimension of each figure was of the order of 1.7 cm. The main figures were, on the first exposure, a pale green triangle with a piece cut out, making

it exactly like the figure in the top left-hand corner of the exposure card, and a rose square with the corners cut off, corresponding to the figure in the bottom right-hand corner of the exposure figure.

Thus the colour and form responses for the first exposure were top right and top left respectively, and for the second exposure bottom left and bottom right respectively. By including the two versions of this test it was possible to obtain a quick and easy estimate of its reliability.



MAIN FIGURES



EXPOSED CARD

Test No. 24.

(25) *Reaction Time.*

The reasoning behind this test was quite simple and straightforward. The subject was presented with a number of symbols to which differential reactions were required, according to the colour or shape of the symbol. This presented to the subject the ordinary choice reaction time test. The point was to see whether coloured or shaped stimuli evoked the faster reaction. A second score was obtained by making one of the symbols a sufficient condition for either of the alternative reactions. The stimuli were presented visually to the subject by opening a circular aperture of diameter 4 cm. in a screen of size 23 cm. by 36.5 cm. The screen was 4 ft. in front of the subject. The relevant stimulus

conditions were blueness and triangularity. Thus, if the presented figure were blue, the subject pressed one of two keys before him, whilst if he saw a triangle he was to press the other. The stimulus figures in the order of presentation were: blue square, blue circle, yellow triangle, blue square, blue circle, blue triangle. Hence, there were five blue and five triangular figures in random sequence prior to the ambiguous blue triangle. The sides of the squares were 2 cm., the circles were 2.5 cm. in diameter, and the triangles, which were equilateral, had sides of 2.8 cm. each.

The mechanics of the apparatus were such that when the aperture was opened an electrical circuit was closed, so starting an electrically controlled stop-watch. When the subject pressed his key, this circuit was broken and the watch stopped. Rather than zero the watch after each operation, a score sheet was devised whereby the raw data could be manipulated with the greatest economy by inserting the reading on the watch after each operation.

Alteration of the stimulus figure was effected by rotating a circular disc on to which they were pasted so that the appropriate one would appear in the aperture. The whole apparatus was fitted into a filing box 23 cm. by 36.5 cm. by 7.5 cm.

(26) *Inaccurate Picture.*

By presenting an inaccurate picture of a fairly common scene to the subjects, and asking them to name the inaccuracies, some of which were in colour and some in shape, a measure of their relative attitudes to colours and forms was expected. The picture, a water colour, measured 50 cm. by 33 cm. and depicted a scene of a seaside town. The errors were distributed systematically about the picture, one appearing in each decant. The mistakes were a blue sun, a lamp-post with part of its stem missing, a purple postbox, a Belisha beacon with a cube instead of a sphere at the top, a blue tree, a barrow with a square wheel, a red Belisha beacon, a jagged edge on the pavement, a red and pink stem to the first Belisha beacon, and a policeman with an elongated hat surmounted by an arrow.

BIBLIOGRAPHY.

- (1) ALLEN, R. M., MANNE, S. H., and STIFF, N., "The Role of Color in Rorschach's Test: a Preliminary Normative Report on a College Student Population," *J. proj. Tech.*, 1951, **15**, 235-242.
- (2) *Idem*, "The Influence of Color on the Consistency of Responses in the Rorschach Test," *J. clin. Psychol.*, 1952, **8**, 97-98.
- (3) BAKER, L. M., and HARRIS, J. S., "The Validation of Rorschach Test Results against Laboratory Behavior," *ibid.*, 1949, **5**, 161-164.
- (4) BUKER, L., and WILLIAMS, M., "Colour as a Determinant of Responsiveness to Rorschach Cards in Schizophrenia," *J. consult. Psychol.*, 1951, **15**, 196-202.
- (5) CLARK, J. H., "Some MMPI Correlates of Color Responses in the Group Rorschach," *ibid.*, 1948, **12**, 384-386.
- (6) EICHLER, R. M., "Experimental Stress and Alleged Rorschach Indices of Anxiety," *J. Abnorm. and Soc. Psychol.*, 1951, **46**, 344-355.
- (7) EYSENCK, H. J., *Dimensions of Personality*, 1947. London: Kegan Paul.
- (8) GOODMAN, H. W., "An Experimental Investigation of the Affective Value of Color on the Rorschach Test," *Amer. Psychol.*, 1950, **5**, 321-322.
- (9) HERTZ, M. R., "The Rorschach Ink-blot Test: Historical Summary," *Psychol. Bull.*, 1935, **32**, 33-66.
- (10) *Idem* and BAKER, E., "Personality Patterns in Adolescence as Portrayed by the Rorschach Ink-blot Method. II: The Colour Factor," *J. gen. Psychol.*, 1943, **28**, 3-61.

- (11) HOLTZMAN, W. H., "Validation Studies of the Rorschach Test: Shyness and Gregariousness in the Normal Superior Adult," *J. clin. Psychol.*, 1950, **6**, 343-347.
- (12) *Idem*, "Validation Studies of the Rorschach Test: Impulsiveness in the Normal Superior Adult," *ibid.*, 1950, **6**, 348-351.
- (13) HUGHES, H., EPSTEIN, L. J., and JOST, H., "The Relationship between Certain Measurable Functions of Autonomic Nervous System Activity and Color Responses on the Rorschach Test," *ibid.*, 1951, **7**, 244-249.
- (14) KEEHN, J. D., "Rorschach Validation. II: The Validity of Colour Shock in the Diagnosis of Neuroticism," *J. ment. Sci.*, 1953, **99**.
- (15) KUHLMANN, F., "Experimental Studies in Mental Deficiency: Three Cases of Imbecility (Mongolian) and Six Cases of Feeble-mindedness," *Amer. J. Psychol.* 1904, **15**, 391.
- (16) KULPE, O., "Versuche über Abstraktion. Ber. über d. 1," *Kongr. f. exp. Psychol., Leipzig*, 1904, 56.
- (17) LAZARUS, R. S., "An Experimental Analysis of the Influence of Color on the Protocol of the Rorschach Test," *J. Person.*, 1948, **17**, 182-185.
- (18) *Idem*, "The Influence of Colour on the Protocol of the Rorschach Test," *J. Abnorm. Soc. Psychol.*, 1949, **44**, 506-516.
- (19) LEVY, J. R., "Changes in the Galvanic Skin Response accompanying the Rorschach Test," *J. consult. Psychol.*, 1950, **14**, 128-133.
- (20) LINDBERG, B. J., "Experimental Studies of Colour and Non-colour Attitude in School Children and Adults," *Acta psychiat. et neurol.*, 1938, Suppl. xvi.
- (21) *Idem*, "Different Mixtures of Syntonic and Asthenic Personality Traits," *ibid.*, 1950, **25**, 225-235.
- (22) OESER, O. A., "Some Experiments on the Abstraction of Form and Colour," *Brit. J. Psychol.*, 1932, **22**, 200-215, 287-323.
- (23) PLESCH, E., "A Rorschach Study of Rosacea and Morbid Blushing," *Brit. J. Med. Psychol.*, 1951, **24**, 202-205.
- (24) POPPINGA, O., "Die teilinhaltliche Beachtung von Form und Farbe bei Erwachsenen in ihrer Beziehung zur strukturpsychologischen Typenlehre," *Zsch. J. Psychol.*, 1931, **121**, 137-177.
- (25) RUESCH, J., and FINESINGER, J., "The Relation of the Rorschach Color Response to the Use of Color in Drawings," *Psychosom. Med.*, 1941, **3**, 370-388.
- (26) SARASON, S. B., and POTTER, E. H., "Colour in the Rorschach and Kohs Block Designs," *J. consult. Psychol.*, 1947, **11**, 202-206.
- (27) SCHACHTEL, E. G., "On Colour and Affect. Contributions to an Understanding of Rorschach's Test: II," *Psychiatry*, 1943, **6**, 393-409.
- (28) SCHMIDT, B., "Reflectorische Reaktion auf Form und Farbe und ihre typologische Bedeutung," *Zeitschr. f. Psychol.*, 1936, **137**, 245.
- (29) SCHWARTZ, W., "Correlation between the Rorschach Test and the Lindberg Ring Test in Demonstrating Personality Psychograms," *Acta Psychiat. and Neur. Scandinavica*, 1941, **26**, 199-211.
- (30) THORNTON, G. R., and GUILFORD, J. P., "The Reliability and Meaning of Erlebnistypus Scores in the Rorschach Test," *J. Abnorm. Soc. Psychol.*, 1936, **31**, 324-330.
- (31) THURSTONE, L. L., *A Factorial Study of Perception*, 1944. Chicago: U. of Chicago Press.
- (32) VERNON, P. E., "The Rorschach Ink-blot Test," *Brit. J. Med. Psychol.*, 1933, **13**, 89-118, 179-200, 271-291.
- (33) WILLIAMS, M., "An Experimental Study of Intellectual Control under Stress and Associated Rorschach Factors," *J. consult. Psychol.*, 1947, **11**, 21-29.