THE AMERICAN
JOURNAL OF PSYCHOLOGY

Founded in 1887 by G. STANLEY HALL

Vol. LXXII DECEMBER, 1959 No. 4

A SYSTEM OF COLOR-PREFERENCES

By J. P. GUILFORD, University of Southern California, and PATRICIA C. SMITH, Cornell University

Some years ago the authors were engaged in a rather systematic and comprehensive study of preference for color, in which more than 300 different color specimens were used. Data from this source have been utilized for different purposes in publications since that time, but a unified report has not been made.[1]

Among other reasons for publication, the authors believe that the results, systematically and fully presented, can provide a kind of basis for norms with regard to the color-preferences of young, adult men and women in North American culture. The authors fully recognize the limitations of the data, which were obtained from individuals originating mostly from one state (Nebraska) in a limited time of about two years. The results cannot, therefore, be proposed as representative of the general population. The authors had hoped to extend the sampling to other parts of the country and to other times, but the opportunities for doing so have not arisen and seem unlikely to arise in the foreseeable future.

The results presented, then, may serve as starting points or as a frame of reference for future studies of color-preferences. One thing that can be said of the results is that they possess a very high degree of internal consistency, and hence of reliability, for the population that they do represent. In addition to whatever norm-value they possess, they demonstrate a high degree of predictability of preference-values from knowledge of the attributes of color, they bring out some general principles of color-preferences, and they incidentally indicate some systematic sex-differences.

* Received for publication January 6, 1959.

[1] J. P. Guilford, A study in psychodynamics, *Psychometrika*, 4, 1939, 1023; There is system in color preferences, *J. opt. Soc. Amer.*, 30, 1940, 355-359; System in color preferences, *J. Soc. Motion Pic. Eng.*, 52, 1949, 197-210.

Background. Prior to this investigation, it had been recognized that studies of color-preferences had been severely limited and were generally not reproducible. The chief source of limitation was the very small number of color-specimens used. Interest was confined to perhaps a half-dozen colors, usually of relatively high saturation. There had been no attempt to sample more extensively from the whole range of discriminable colors. Experiments were not reproducible because there was no specification of color-stimuli in terms that would enable other investigators to use the same colors.

The first step in the direction of a larger sampling of colors and in the direction of color-specification was taken by the senior author.[2] Using 40 color-specimens, each calibrated for hue, brightness, and saturation, he found that the average affective value of a color could be predicted to a large extent from knowledge of its position on these three dimensions. Affective value was apparently a periodic function of hue and was positively correlated with both brightness and saturation. Not much more could be said regarding the functional relationships because of the inadequate number of color-samples. Hence, a new study involving a much more liberal sampling was initiated.

Materials and Procedure

Color-samples. It is commonly known that the number of discriminable colors is enormous. Of all the systems that pretend to represent the whole range of color-variations, that of the *Munsell Book of Color* offers the best opportunities for quantitative specifications along the lines of the attributes familiar to psychologists.[3] The authors chose to use specifications of colors in terms of their phenomenology rather than in terms of stimulus-variables for two reasons. One is the assumption that it is the appearance of the color that is the determiner of affective reaction, although the psychophysical problem admittedly deserves attention. The other reason is that colors between the hues of violet and red in the color-circle are more readily specified in phenomenal terms.

The abridged edition of the *Munsell Book of Color* contains more than 600 different colors. It was the authors' objective to obtain a fully representative sampling of colors from this set.[4] Of the 20 pages, each representing a different hue, alternate pages were selected, except in the region of green and blue, where colors of intermediate hues were also chosen. The reason for this exception was that in the senior author's previous study it had been found that affective value changed as a function of hue in that region. On each chosen page of the *Book of Color* we selected specimens nearest to brightness-levels (B) 2, 4, 6, and 8 (Munsell value). All levels of saturation (Munsell chroma) were included. Most of the color-specimens that we could find among the available materials actually departed slightly from the Munsell levels just indicated, but they were nevertheless fairly representative of the color solid. From earlier results during the collection of data, it became apparent that a

[2] Guilford, The affective value of color as a function of hue, tint, and chroma, *J. exp. Psychol.*, 17, 1934, 342-370.

[3] *Munsell Book of Color,* Baltimore: Munsell Color Company, 1929.

[4] Except for a very few colors that were purchased from the Munsell Color Company, the sources of color were the Milton-Bradley series, the All-Color Company series, and the Bauman color-series obtained from Paul A. Struck, 415 Lexington Ave., New York).

very intensive sampling was needed in the series of achromatic colors, hence 21 samples of zero saturation were used. With the 295 chromatic specimens, the total number came to 316.

For use in the experiments on affective-judgment, the colored papers were cut into 2-in. squares and glued to the centers of 4-in. squares of heavy cardboard, the surface of which was gray with a Munsell value of 5. The Munsell specifications of all the color stimuli were determined by averaging the judgments of 20 *O*s who compared them with samples in the Munsell book. These observations were made under conditions of background and of illumination identical with those under which affective judgments were given later.

Affective judgments. The color-stimuli were exposed to the *O*s within an enclosure, the entire inner surface of which was lined with the same gray cardboard on which the color-samples appeared. The enclosure was constructed on a table, of dimensions 30 × 48 in., and was 24 in. high. One end had an opening at which the *O* sat, his head being adjusted in position by means of a headrest. At the center of the other end was an opening just less than 4 in. square, within which each color-stimulus was exposed by resting its card in a convenient slot.

The illumination within the enclosure consisted of the direct, diffused light from four 60-w. frosted bluish Mazda bulbs, which were placed two on either side of *O*'s opening in the enclosure and shielded from his view. Each color-stimulus was exposed for 5 sec. after a preliminary 'Ready' signal.

Instructions. The essential part of the instructions reads:

You are to judge the pleasantness of the color presented, being careful to judge it as a color. Do not think of it in connection with any object in particular, but rather take it just as a sensation. Try to make the judgment before the color is taken away. Your report of pleasant (*P*) or unpleasant (*U*) is to be given in terms of the following scale (the two extremes, 0 and 10, will in all probability not be used in this series):

0 = most unpleasant imaginable
1 = extremely unpleasant
2 = very unpleasant
3 = moderately unpleasant
4 = mildly unpleasant
5 = indifferent; neither *P* nor *U*
6 = slightly pleasant
7 = moderately pleasant
8 = very pleasant
9 = extremely pleasant
10 = most pleasant imaginable

(The two most extreme categories were included as anchors. They were used on very rare occasions.

O judged about 100 colors on each day of observations, with rest-pauses after sets of 25. The order of presentation was partly random and partly planned. The planned aspect consisted of avoiding both extreme and minimal changes in hue, brightness, or saturation, also contrasts in probable affective value insofar as this could be guessed in advance. Every *O* judged the colors two times, on different days, the order on the second occasion being the complete reversal of that during the first. We thus had the opportunity for determining the degree of personal stability of ratings as well as inter-rater correlations for the purpose of estimating reliability of judgments.

It was planned to have the judgments of affective value (*A-V*) of all the color-stimuli made by 20 men and 20 women from among students volunteering to serve.

Things did not, however, work out that way. Actually, the study was started with 211 color-stimulus, including eight achromatic colors.[5] After completing the preliminary experiments, it was realized that there were serious gaps in the data, which would make difficult the establishment of quantitative functional relationships. An additional set of 114 chromatic colors was therefore selected to fill the gaps and observations were obtained from new groups of *O*s.[6] Ten color-stimuli were common to the two sets, to provide some information as to comparability of the judges in the two series of observations. After 10 men had judged the second set of stimuli, it was realized that additional samples of achromatic colors at the lower region of the brightness-scale were also needed in order to explore that section more intensively, hence 13 new achromatic stimuli were added.

It should be stated that all *O*s were tested for normality of color-vision before being accepted.

RESULTS

Reliability of the judgments. Several estimates were made of reliability of ratings of *A-V*. Correlations between first- and second-trial ratings of single *O*s ranged from 0.62 to 0.81 for the men and from 0.53 to 0.84 for the women. Raising these values by applying the Spearman-Brown formula to estimate what reliabilities should be expected for averages of 20 *O*s yields coefficients of 0.97 to 0.99. Averages of ratings were obtained by computing medians because of some irregularities in the form of distributions. Correlating the median *A-V*s from two randomly chosen sets of *O*s and applying the Spearman-Brown formula, we find reliabilities of 0.94 for the men and 0.93 for the women. For the 10 color-stimuli common to the early and late observations, the correlations between the two sets of median values were 0.86 and 0.91, for the men and women, respectively. Indirect evidence that the results from the early and late observations were generally comparable comes from two sources. One is that the general levels of ratings in the two sets were similar and the other is that the two sets of data seem to fit the same derived functional relationships.

Affective values of achromatic colors. The relation of *A-V* to degree of brightness of color in the achromatic series is of considerable importance, primarily because this series represents the points of zero saturation for colors of all hues and all levels of brightness. The *A-V*s of the achromatic colors thus had an important bearing upon determination of

[5] For assistance in obtaining these early observations we are very much indebted to Mrs. Ada P. Jorgensen. These data were obtained during the autumn and winter of 1936-37.

[6] These later observations were obtained by the junior author, who also collaborated in the computation of results. The ratings were obtained during the spring and fall of 1938.

the functions relating *A-V* to saturation and indirectly upon determination of other relationships as well, as will be clear when we describe the process of fitting curves to the data.

In the prior study referred to, it was concluded that there is a positive relationship between *A-V* and brightness of colors in general.[7] In that study, however, it was not determined either that this applied to the achromatic series or that the relationship is a linear one. In the early results from this investigation, it was concluded that the relation of *A-V* to brightness of achromatic colors is curvilinear, with *A-V* increasing

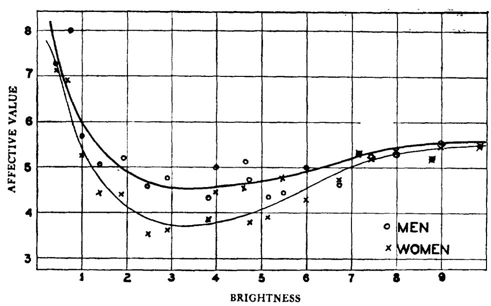


FIG. 1. AVERAGE AFFECTIVE VALUES RELATED TO BRIGHTNESS OF ACHROMATIC COLORS, AND THEIR CURVILINEAR REGRESSIONS

with negative acceleration toward the white end of the scale.[8] There was a slight indication of an upturn at the lower end of the scale, but with only eight stimulus-values involved, the idea of a reversal in trend could not be accepted.

With a much greater sampling of achromatic stimuli, which involved 21 brightness-values, the shape of the regression is much more clearly determined, as shown in Fig. 1. The curves were drawn entirely from inspection of the points. The goodness of fit of the data to the curves is indicated by correlations of 0.87 for the men and 0.94 for the women between the 21 observed and expeced values.

First to be noted is the fact that most of the achromatic colors, from Munsell values 2 through 8, are rated slightly on the unpleasant side.[9]

[7] Guilford, *op. cit.,* 1934, 360.
[8] Guilford, *op. cit.,* 1939, 13.
[9] In connection with Fig. 1, and all subsequent figures, it should be noted that the indifference-level is at 5.5. The reason is that a rating of 5 was arbitrarily assumed to occupy the range 5.0 through 5.99 on the numerical scale, with other rating categories defined accordingly.

It should be remembered that the ratings were obtained in a larger setting that involved the rating of numerous chromatic colors. This should be a desirable condition, for under these circumstances the adaptation-level established would probably be as unbiased as it could be. If *O*s had rated achromatic stimuli only, they might have given a larger proportion of judgments on the pleasant side.

The second noteworthy fact is that colors in the region of black were rated more pleasant than those in the region of white. This conclusion is largely determined by the ratings for two color-stimuli, which were somewhat unusual in one respect, *i.e.* texture. All other samples were of colored paper of similar texture. The blackest black was actually a sample of velvet cloth and the one next to it was a paper with a slightly velvety texture. One would expect an upturn of the functional relationship from the trends of the points for other samples. Whether it is, however, as extreme as indicated by the reactions to the two unusual specimens is hard to say. There is apparent consistency in the shape of the regressions in the region of dark grays and blacks. Perhaps, after all, differences in texture were not so very clear to *O* when seen at a distance of 4 ft.

The third noteworthy fact is that although the two curves, for men and for women, are similar in shape throughout, women have a general tendency toward lower ratings, a difference that is most pronounced in the region of lowest *A-V*s for both sexes. The smaller variance in the average ratings by men may mean that they were less sensitive in their affective reactions to changes in brightness. From their generally higher *A-V*s, one might also conclude that men are more tolerant of achromatic colors, but they showed a similar bias toward higher ratings of chromatic colors as well.

Affective value and hue. There has always been greatest interest in *A-V*s in relation to hue. In the current setting, the question concerning the functional relationship of *A-V* to hue must be restricted to instances in which brightness and saturation are held constant. We must recognize, however, that the function may change due to interactions of hue with the other two attributes of color. It is necessary to ask the question, therefore, for all combinations of brightness and saturation.

In Fig. 2 are shown the relationships that were concluded to exist between *A-V* and hue when saturation is held constant at a Munsell rating of 6 and when the *O*s are women. A functional relationship is presented for *B* 3 through 8 on the Munsell scale. The hues on the base line are spaced in accordance with the Munsell scaling. Points representing actual medians of ratings of *A-V* are not shown in Fig. 2, in order to present a cleaner and more simplified picture.

Some explanation is in order as to how the smoothed curves in Fig. 2 were obtained. Especially to be accounted for are the curves at B 3, 5, and 7, for which, as it was stated earlier, no color-samples had been selected for use in the investigation. The smoothing process was not confined to plots relating *A-V* to hue. There were also plots relating *A-V* to brightness, with hue and saturation held constant, and to saturation, with hue and brightness held constant. Examples of such smoothings may be seen in Figs. 3 and 4. The most important step, however, was to ensure consistency of relationship of *A-V* to all three attributes simultaneously, so that on any one plot a color having a given hue combined with a given brightness and a given saturation would have the same *A-V*. This meant considerable going back and forth from one plot to another and a number of iterations was needed. With the continuities

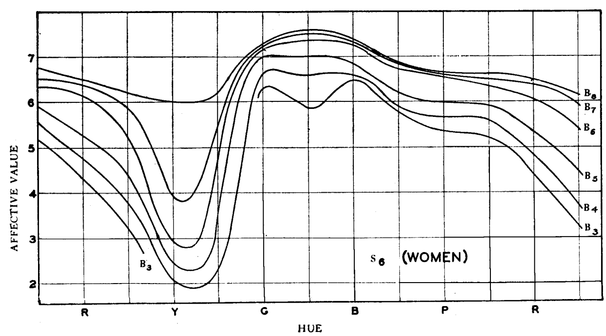


FIG. 2. CURVILINEAR REGRESSION-LINES RELATING AFFECTIVE VALUE TO HUE (Saturation constant at Munsell level S6; brightness at several selected levels.)

thus achieved, it was possible to draw the interpolated functions seen in Fig. 2, as well as those in Figs. 3 and 4.

The curves in Fig. 2 are essentially similar in form to those obtained in the earlier investigation.[10] The maximal *A-V* comes in the region of green to blue, with a slight dip between those two hues, but only at lower levels of brightness. The minimal *A-V* comes on the green side of yellow and there is a slight secondary dip in the region of purple. The general levels of the curves are in direct proportion to the brightness-levels of the colors, with no inversions in this particular chart. There are a few inversions elsewhere among such curves.

It is of some interest to ask whether these relationships of *A-V* to hue can be described, as in the earlier investigation, in terms of periodic

[10] Guilford, *op. cit.*, 1934, 356.

algebraic functions involving strong first and third components. Using some of our data, Stamm has found that the first and *second* harmonics account for most of the covariations with hue.[11] The difference between his finding and the earlier one is probably accounted for by the fact that the earlier study utilized Troland's *jnd*-scaling of hue, whereas Stamm used the Munsell scaling. The two scalings are not the same.

Affective value in relation to brightness and saturation. Fig. 3 is shown as a sample of the smoothed relationships of *A-V* to brightness for men's judgments. At different levels of saturation (S), the regressions are very

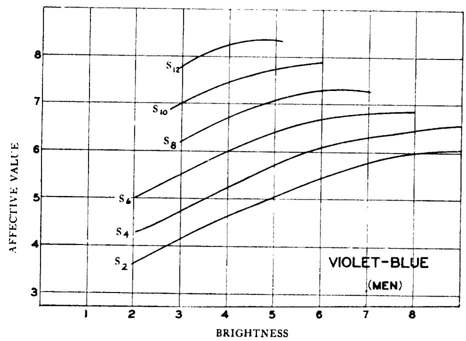


FIG. 3. CURVILINEAR REGRESSION-LINES RELATING AFFECTIVE VALUE TO BRIGHTNESS OF COLORS
(Hue constant at violet-blue; saturation levels varying from S2 to S 12.)

similar. They are usually monotonic, and the greater the saturation, the higher is the level of the curve.

In general, there is a positive relationship between brightness and *A-V*, but in no case is it linear. For the so-called cool colors, like that represented in Fig. 3, the curves tend to be concave downward. They rise with negative acceleration and in some instances there is a slight drop at the upper levels. For the so-called warm colors, particularly in the region of yellow, there is positive acceleration. Taking these two kinds of regressions together, we may state the principle that colors tend to be liked most at levels of brightness at which they can be most saturated.

Fig. 4 shows an example of a family of curves for the relation of *A-V* to saturation for various levels of brightness (B), the hue being held constant. Most noteworthy is the fact that at the lower levels of brightness there is a reversal in *A-V* as a function of sautration. The principle is

[11] J. S. Stamm, Fourier analyses for curves of affective value of color as functions of hue, this JOURNAL, 68, 1955, 124-132.

that at lower levels of brightness a saturation of zero is preferred to saturations of 2 or even of 4. The charts in Figs. 5-14 will show that the minimum *A-Vs* are usually at neither the lowest level of saturation nor at the lowest level of brightness and that this rule holds for both sexes and at most hues.

Isohedonic charts. In Figs. 5-14 inclusive are shown what have become known as isohedonic charts, and isohedon being a line (or locus) of uniform *A-V*.[12] Each chart represents a hue at one page of the *Munsell Book of Color;* 10 (alternate) pages being represented. In each chart, the vertical axis represents the variable of brightness and the horizontal axis represents

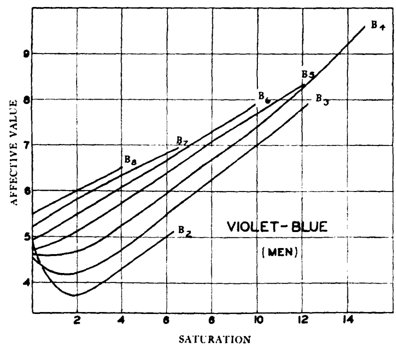
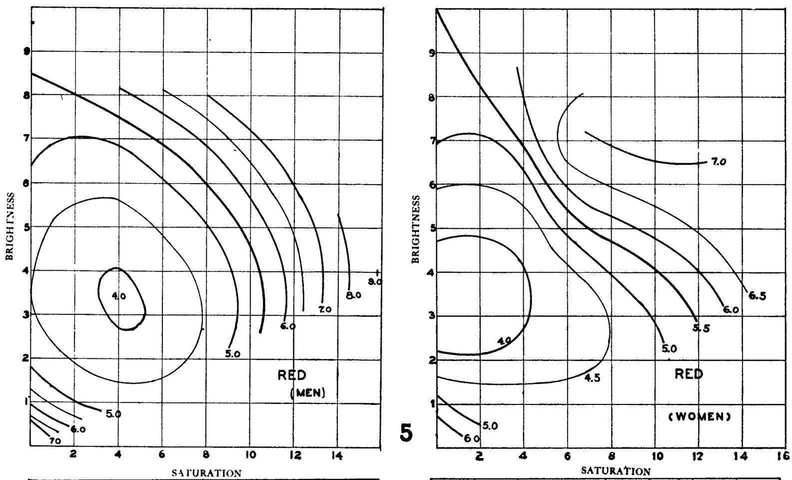


FIG. 4. CURVILINEAR REGRESSION-LINES RELATING AFFECTIVE VALUE TO SATURATION
(Hue constant at violet-blue and brightness at several levels varying from B2 to B8.)

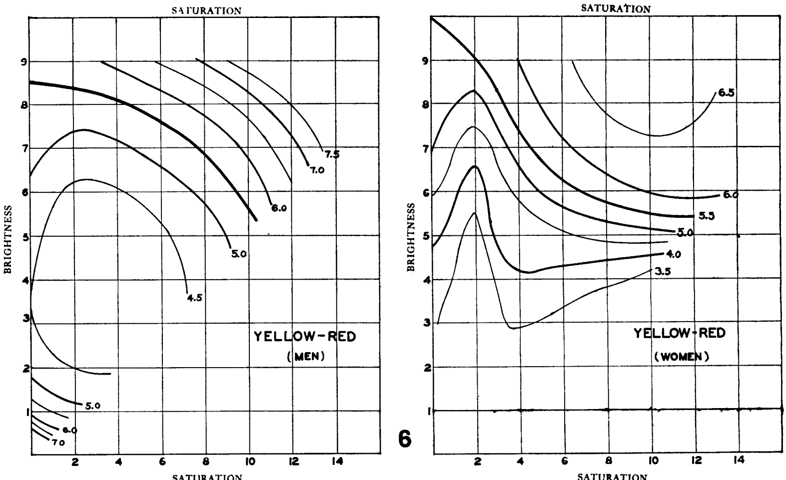
the variable of saturation. Any point in a plane represents a particular hue, brightness, and saturation. Obviously, not all points on a plane represent actual colors, since the color-solid is a double pyramid (or cone) and not a cubical affair. The curved lines (isohedons) in a chart extend roughly within the limits of the known, experienced colors.

The construction of an isohedonic chart proceeded roughly as follows. In preparation of one of the charts in Fig. 5, for example, the smoothed curves such as those in Figs. 2-4, wherever the hue red was in any way involved, were inspected, also the appropriate curve in Fig. 1. Examination of the plotted curves where red was concerned showed what combinations of brightness and saturation would yield predicted average *A-Vs* of exactly 4, 5, 6, etc., and of values midway between them.

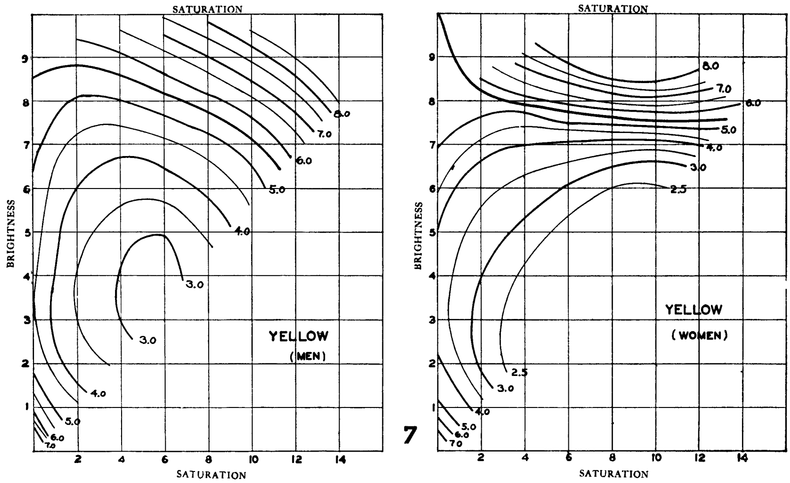
[12] Such charts were proposed by the senior author (*op. cit.,* 1939, 19.) and have also been applied to *A-V* as related to sounds (see Guilford, System in the relationship of affective value to frequency and intensity of auditory stimuli, this JOURNAL, 67, 1954, 691-695).



5

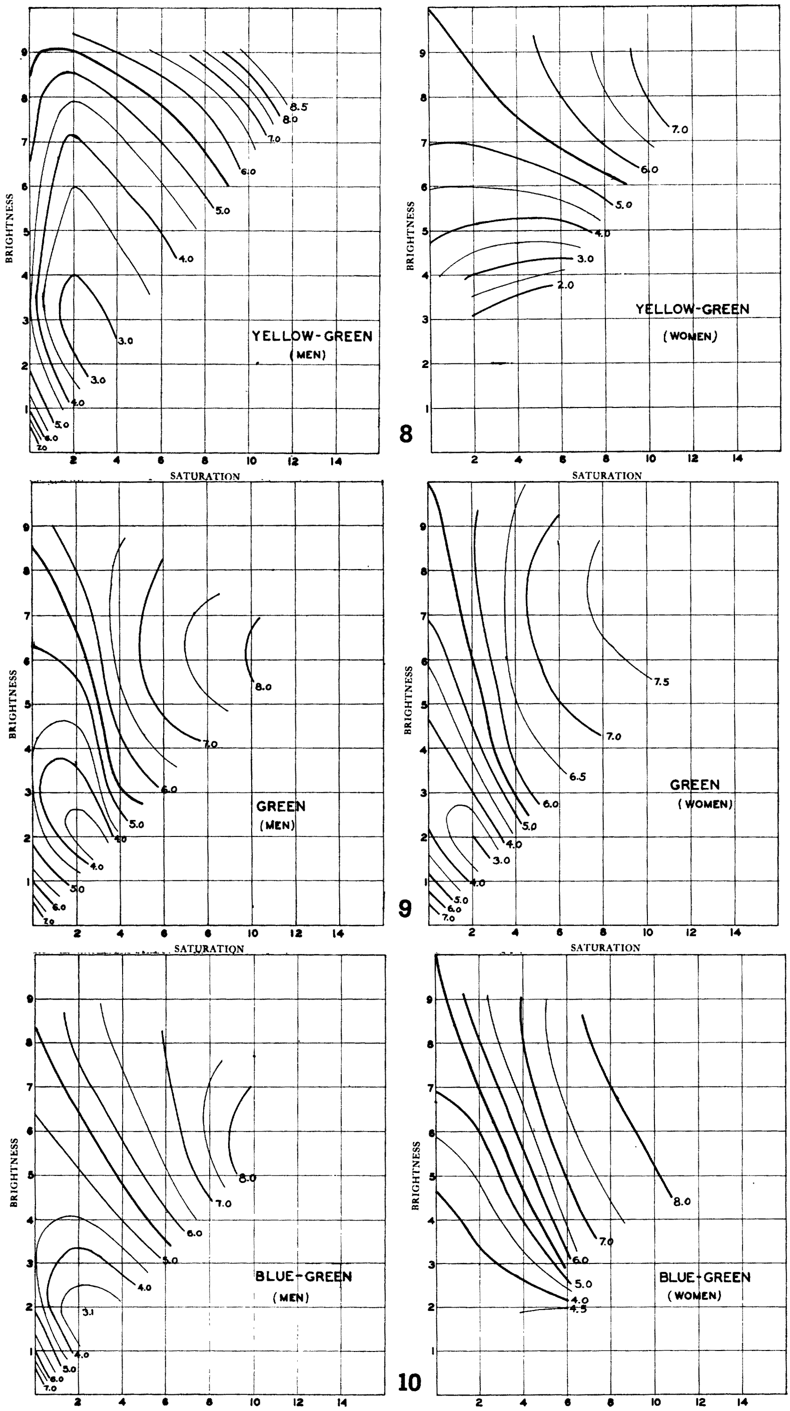


6

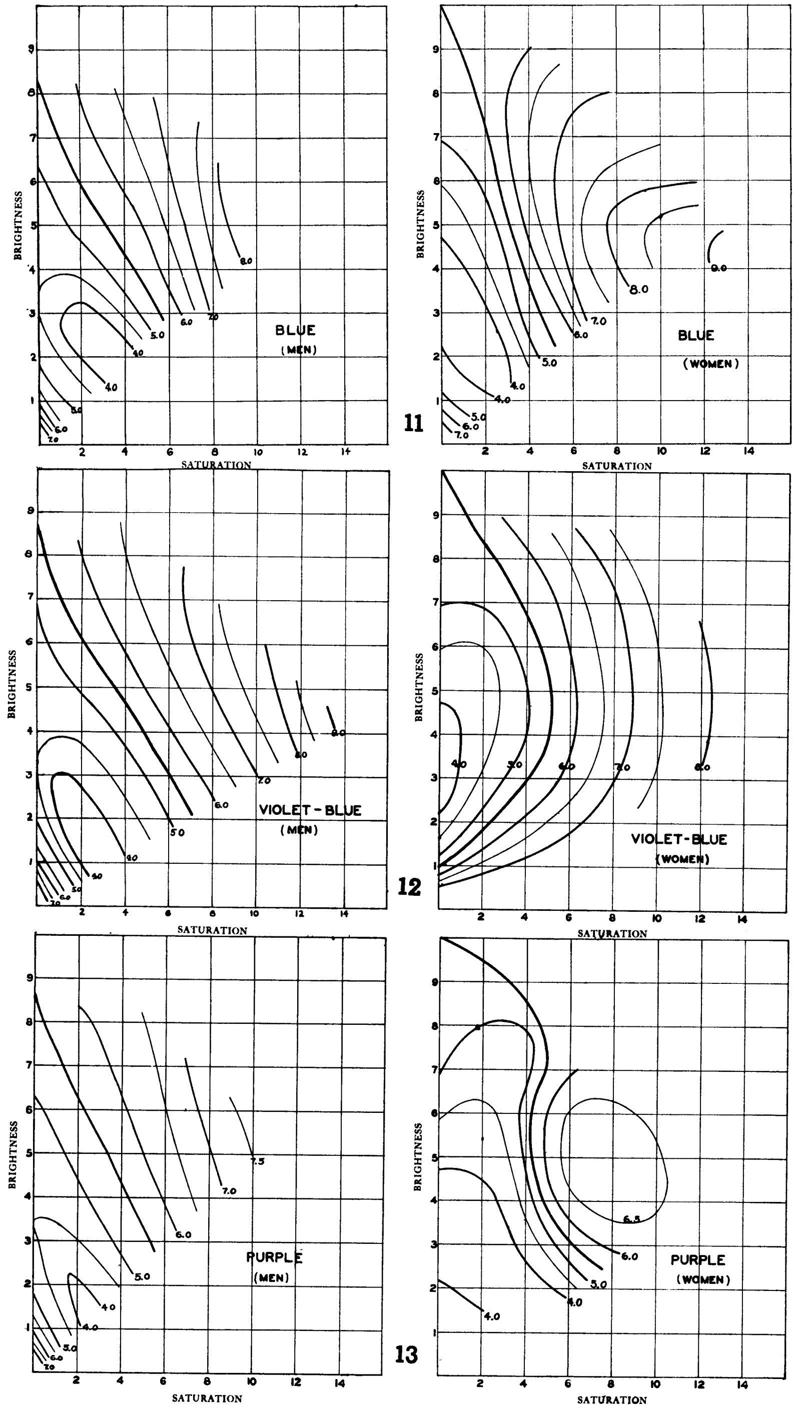


7

FIGS. 5-7. ISOHEDONIC CHARTS FOR B, YB, AND Y



FIGS. 8-10. ISOHEDONIC CHARTS FOR YG, G, AND BG



FIGS. 11-13. ISOHEDONIC CHARTS FOR B, VB, AND P

The isohedonic lines were drawn accordingly. The line at an A-V of 5.5 has been drawn very heavy, since that value is at the point of indifference. For the men's chart in Fig. 5, colors above and to the right of this isohedon are expected to be rated pleasant to some degree. To the left and below this line the A-V decreases, down to the level of about 4, but beyond this the A-V again increasing and rising quite rapidly. For the corresponding women's chart, the general trends are similar, with minor variations.

Prediction of affective values. Perhaps the chief value of the isohedonic charts is the basis that they provide for the prediction of the most probable A-V from knowledge of the quantitative Munsell designations of

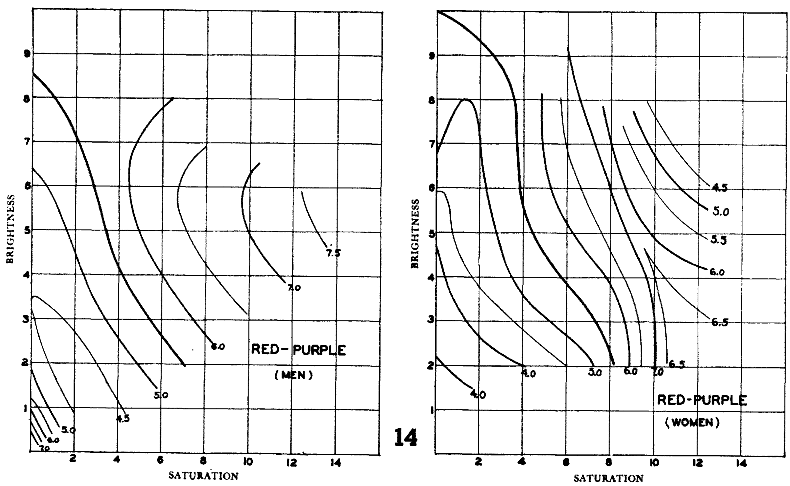


FIG. 14. ISOHEDONIC CHART FOR RP

hue, brightness, and saturation. For example, a red Munsell value (brightness–B) 7 and chroma (saturation–S) 10 would have an expected A-V of 6.8 for men and about 7.2 for women. A red of Munsell value B3 and chroma S12 would be expected to have an A-V of 6.2 for men and 5.5 for women.

The goodness of such predictions for the sample of *O*s from whom the judgments were obtained can be indicated by the correlations between expected and obtained A-Vs. For each color-stimulus used in the study, an estimate of its expected A-V was found from the isohedonic charts. The correlations between obtained and exepcted A-Vs are given in Table I, for each of the 10 hues separately and for each sex, as well as for all hues together. Somewhat smaller correlations should be expected in a cross-validation sample, of course.

From the given correlations, it will be seen that the best predictions can be made in the region from green to purple-blue and that the poorest predictions occur for purple, green-yellow, and yellow-red. In general, where predictions are better for men, they are also better for women. For all hues combined, the correlations between predicted and obtained *A-V*s are 0.93 for the men and 0.88 for the women. Coupled with this lower predictability for the women is the fact that their isohedonic charts are somewhat less regular and simple. Perhaps this is because women are more color-conscious and their tastes for color are more changeable and

TABLE I

CORRELATIONS AMONG OBSERVED AND PREDICTED AFFECTIVE VALUES FOR HUES AND BETWEEN MEN AND WOMEN

(R=red, Y=yellow; G=green, B=blue; P=purple)

Hue

Ss	R	YR	Y	GY	G	BG	B	PB	P	RP	All hues
Men	.96	.83	.97	.86	.97	.93	.95	.94	.81	.87	.93
Women	.93	.80	.90	.79	.92	.92	.96	.91	.77	.90	.88
M vs. W	.88	.67	.94	.92	.93	.96	.95	.91	.70	.27	.84

diverse. There is supporting evidence for the conclusion regarding lower stability and consistency of women's judgments of *A-V* of colors in a study that indicated that over a period of 14 yr., inter-year correlations averaged higher for men (0.80) than for women (0.68).[13] In the same study, however, agreement, within the same year, was about the same among women as among men—the average correlations being 0.88 for men and 0.90 for women.

Also shown in Table I are intercorrelations of obtained *A-V*s of men and women for the different hues and for them all combined. There was very poor agreement for colors with the hue of red-purple (RP), the correlation being 0.27. It is noteworthy that for this hue the women liked the most saturated colors less than they did most colors of moderate saturation. This is the only instance in which a reversal in *A-V* occurred in going from moderate to high saturation. This systematic shift in pattern was responsible for the low correlation between the sexes at the hue of red-purple. The next lowest inter-sex correlation was 0.67 for the hue yellow-red (YR). The correlations were above 0.90 in the hue region

[13] W. E. Walton, R. B. Guilford, and J. P. Guilford, Color preferences of 1279 university students, this JOURNAL, 45, 1933, 322-328.

from yellow through purple-blue. The average inter-sex correlation was 0.84 (all colors included). Had the one hue of red-purple been excluded, the agreement might have been of the order of the intra-sex correlations.

Correlations do not, however, tell the whole story regarding sex-differences in ratings. In general, men's ratings average higher than women's. This is true for the earlier observations as well as the later observations, with different *O*s involved in the two cases. It is also true for both achromatic and chromatic colors. It is true at every hue except one. The over-all average difference is about a half unit on the rating scale. Although this difference is small, it represents a condition that cannot be ignored in predicting *A-V*s of colors.

Discussion

Limitations in predicting affective value. It has been proposed that the isohedonic charts be used in predicting the *A-V*s of colors for average men and women. Within the sample of judges used in this study, and within the experimental conditions employed, it is evident that a very large proportion of the variance in the *A-V* can be accounted for on the basis of the known Munsell specifications of color. Use of such predictions in practical situations would, of course, be subject to many risks. It is not without reason, however, that we should expect some degree of relationship between such predictions and the satisfactions to be derived from colors in everyday experience. Improvement of predictions of such satisfactions would depend upon our having other pertinent information.

Greater generality of prediction could be achieved by further basic research that brought into the picture some variations of additional conditions. The size of the color-sample should be varied over a reasonable range, including many stimuli larger than were utilized in this study. The brightness-level of the background should be varied over a wide range. Surfaces other than that of paper could be utilized, also variations in texture, gloss, and shape. From a theoretical point of view, aperture colors could be used, also bulky colors. From a more practical point of view, each color could be applied to commercial objects such as gowns, neckties, houses, and motor cars. In all such studies involving the combination of color- and non-color variables, it will be important to watch for interaction-effects of one kind or another. For example, there may be strongly preferred (or unpreferred) combinations of colors and forms, the affective values of which cannot be well predicted from the affective values of their color and form components alone. Beyond all these areas of needed investigation there exists the whole area of affective reactions to color-combinations, a problem that has as yet been scarcely touched.[14]

SUMMARY

This report pertains to a systematic and relatively exhaustive study of the affective values of 316 different color specimens, each of which had been calibrated in terms of color-specifications of the *Munsell Book of Color.* The color-stimuli were in the form of 2-in. squares of paper on a neutral gray background. Each was rated by 20 men and 20 women students on two different occasions. Smoothed graphic adjustments of the data were made to curvilinear functional relationships, from which isohedonic charts were constructed showing the loci of equal preference-values applying to all colors in the color-solid.

Considerable consistency in ratings of affective values of colors was found from day to day for the same *O*s, from one set of *O*s to another within the same sex, and even between *O*s of different sex. Men rated colors generally a little higher than did women. Agreement as to relative affective values was better for colors of certain hues than for others, both within and between sexes. Preferences were highest in the region of green to blue and lowest in the region of yellow and yellow-green, when brightness and saturation are held constant. With few exceptions, affective value is positively related to brightness and to saturation, all relationships being curvilinear. Predictions of affective values from the specified hue, brightness, and saturation of colors were generally excellent within the sample of *O*s who rated the colors. Predictions of a more general scope will depend upon information concerning other populations, other variables of color-stimuli, other viewing-conditions, and particular uses of colors. Considerable gain in accuracy of prediction should be possible from further basic research of the kind reported here.

[14] A study by E. C. Allen and J. P. Guilford (Factors determining the affective values of color combinations, this JOURNAL, 48, 1936, 643-648) is practically alone in the area of this problem.