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On the Color-Vocabulary of Children

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II. — *On the Color-Vocabulary of Children.*

By HARRY K. WOLFE.

THE very interesting investigations and discussions on the development of the color-sense in man, during historical times, have indirectly shown the deficiency of ancient languages in words for simple sensations. Even if the validity of the inference drawn by the original investigators is more than doubtful, their labor has not been in vain. In seeking evidence for the recent evolution of the sense of color, Gladstone, Geiger, and others have shown that few words denoting color are used in the earliest literature of several nations. Furthermore, most of the color-words found denote shades of red, orange, or yellow. Violet is never named, blue very seldom, and green much less frequently than we might expect from its occurrence in nature. Quite similar results have been obtained from examination of the vocabularies of modern uncivilized peoples.[1] Although most tribes have names for the principal colors of the spectrum, the terms denoting red or yellow are far more numerous and much more definite than the others.

The inference from these facts has been that primitive peoples are deficient, not merely in words for color, but also in color-perception. In making the perception depend on the name, the fact was overlooked that the conception must precede the name. Moreover, the latter is not invented until the desire arises to communicate the conception to others.

It is not my purpose at present, however, to show that this

[1] Dr. Hugo Magnus: *Untersuchung über den Farbensinn der Naturvölker*, S. 43 *et seq.*

conclusion is a *non sequitur.* It is now generally believed that other conditions than lack of discriminative power have caused the paucity of color-words in the languages of early peoples.

No exhaustive investigation into the science of names has ever come to my notice. When the science of onomatology shall have been more completely developed, it will show, not merely the philological origin of our name-words, but also why these were coined and why others were not coined. Philology may show whence a word comes; why it comes at all must be determined by another science.

An imperfect generalization may be formulated from a few simple examples. Among our immediate friends a name is required for each individual; but in the social world the family name is often sufficiently definite. In dealing with large bodies of men, as in military affairs, the group of one hundred or even of a thousand may be highly enough specialized. Generally the company or regiment is known only by its official title, or by the name of its chief officer. In these cases no one suspects the cause of class-names to be weak discriminative power in man. We are able to discriminate the individuals of these aggregates, but we do not need to designate them. Among the lower animals it is only those individuals with which we come in frequent contact that receive special names. Few men know a dozen individual dogs by name, or half as many cats, or even a single bird. It is only some peculiar circumstance that assigns names to plants, such as the 'Charter Oak,' the 'Oak of Dodona.' Garden plants are usually designated by means of their particular location, by reference to the source from which they were obtained, or by some peculiarity of the plant itself. The awkwardness of their names indicates that the necessity for individual designation is not commonly recognized. It seems quite ridiculous to say we do not have a separate name for each house-fly, because we are unable to distinguish one from another. If there were no other reason, this would doubtless be sufficient, yet no one thinks this circumstance

of the slightest importance. Our interest in the house-fly is not of such a nature as to require more than specific distinction, and this the word 'house-fly' gives us. An example of the superior interest which multiplies names is found in the herdsmen, who often distinguish and specially designate many of their cattle and horses. Long association with herds, convenience, and lack of other mental employment doubtless contribute to this result. Inanimate objects receive individual names only when uncommon circumstances distinguish them from their kind. Such circumstances may consist in the unusual nature of the object, or in its exceptional relation to ourselves.

The languages of races peculiarly situated with regard to animals, plants, or physical phenomena exhibit extraordinary specialization of words denoting such relations. Thus the Arabs are said to have at least one hundred names for lion and fifty for locust. The language of the Marianne Islanders has twenty appellations for the different stages in the growth of the cocoanut.[1] The Chinese have many words for familiar objects, as cow, rice, etc. Among warlike people the variety of military terms is remarkable. On passing from material objects to mental phenomena it will be observed that comparatively few simple sensations have names. In this respect, however, the modern languages are far superior to the ancient. Locke noticed and deemed it worth while to record this peculiarity of language.[2] He furthermore remarks concerning the indefinite character of names that "men generally content themselves with some few obvious qualities," and adds that "in organized bodies it is usually the *shape*, and in other bodies the *color*, that serves as a distinguishing mark."[3]

In temperature, 'hot,' 'warm,' 'tepid,' 'cold,' and 'cool' are the chief terms used. For the muscular sense we employ 'heavy,' 'light,' and 'elastic.' For touch there exist the terms

[1] Farrar: "On the Growth of Language," *Journal of Philology*, II. 13 *et seq.*

[2] *Essay concerning Human Understanding*, Bk. II. Chap. 3, § 2.

[3] *Ibid.* Bk. III. Chap. 6, § 29.

'rough,' 'smooth,' 'slimy,' 'greasy,' 'granular,' 'hard,' 'soft,' and 'sharp,' besides many words taken from materials, as 'velvety,' 'silky,' 'gummy,' and 'furry.' 'Sour,' 'bitter,' and 'sweet' are the most important designations of tastes. Comparison with the taste of better known substances is the chief expedient adopted to increase the definiteness of these descriptions. Odors are described in terms quite analogous to those employed for tastes. Sounds are 'high,' 'loud,' 'low,' 'shrill,' 'deep.'

It will have been noted that the words for sensations given above are, without exception, adjectives. Nearly all the corresponding abstract nouns are used; but very few concrete nouns for these sensations exist. In sound, however, we have such concrete words as 'tone,' 'noise,' 'roar,' and 'splash,' besides many participial nouns, as 'rumbling,' and 'singing.' If a high degree of accuracy is not required, the combination of adjectives with substantives, or of adverbs with adjectives, takes the place of new names. In this case there is, of course, a comparison with definite names, as 'a dark pink,' 'less bitter than gall.'

Color is the most elementary mark of distinction between objects. It seems to require less energy for its apprehension than any other quality of bodies. When used in connection with form it affords the most common means of describing any object in nature. If to these, size be added, we probably have the complete method employed by the larger part of the race to describe any unfamiliar object. We are again reminded of Locke's generalization. Although color is so universal and so constantly used in description, it is, nevertheless, very indefinite. In describing any object to one unacquainted with it, we involuntarily attempt to give its color: and we nearly always find difficulty in doing so. It is recognized as a powerful means of vividly bringing the object before the mind of a listener; yet unless it is a common object, or unless we have decided on the name of the color while it was before our eyes, we are unable to name it satisfactorily. Our own idea of it is indefinite. We experience

no such difficulty in stating approximately the size or shape of the object. The cause of uncertainty doubtless lies in the nature of our *memory* for color.[1] It is probable that the reproductions of color-sensations do not correspond exactly, even in *quality*, to the original impressions.

The sense of sight, perhaps, has developed a larger vocabulary than any other sense. Its words, too, have advanced farthest on the way from adjectives to substantives. The number of color-terms in modern languages is surprisingly large. French is said to have more than six hundred. Günther Wagner advertises about two hundred pigments in water colors, most of which have individual names (German). Including technical terms, the English language doubtless contains more than three hundred words denoting color; though the dictionaries do not contain half that number. Thirteen members of the senior class (1889) of the University of Nebraska wrote an average of twenty-six color names in *five minutes* without previous thought on the subject.[2] In these lists, written on the spur of the moment, there appeared *ninety* different names, about half of which are in common use. Most of the remainder were names of pigments. It may be confidently stated, I think, that an educated person possesses a color-vocabulary of at least twenty-five terms.[3]

There seems little doubt that the practice of naming sensations or objects tends to increase the power of discrimination. It must not be inferred from this, however, that paucity of names indicates more than an indistinctness of perception in regard to the finer differences. One would not conclude that a person is unable to distinguish geometrical figures, because he is ignorant of their names. It is also evident that delicacy of discrimination is not the only cause of the multiplication of

[1] As far as I am aware, no experiments on memory for colors have been described. If I am enabled to continue such a series already begun, a contribution to this question will soon be offered.

[2] Neither colors nor names had received even incidental attention at our meetings, and until the test began none knew what was required.

[3] It will not be understood that these terms usually represent as many clear ideas of color-differences.

names. Not only are comparatively few sensations provided with names, but the distribution of these names is not in proportion to the delicacy of sense-discrimination. The sense of tone is, perhaps, even finer than that of color, yet it has not nearly as many terms in common use. The relation between the vocabularies of sight and hearing is peculiar. In sound there are few words for absolute pitch or intensity; but there is an exact method of comparing and determining sensations with very slight variations. Though the nomenclature of music is technical, it is extensive and definite. More names for color than for sound are in general use; yet these are not so well determined, and to different people represent different ideas. Even the methods of science are insufficient to determine with satisfactory accuracy a criterion and scale in color. Sounds differ in intensity, purity, and quality; and colors have no other modes of variations. Sound forms a continuous scale in all these particulars; and color has precisely the same characteristics. The distinctness of the one and the vagueness of the other are, nevertheless, clear to all observers. This may depend upon the predominating influence of the rate of vibration which, in sound, is perhaps more directly apprehended, as well as objectively more easily determined. The larger number of common names for color than for sound may be owing to the *demand;* the greater accuracy of the terms denoting sounds may depend upon the relative simplicity of auditory sensations.

In the growth of vocabularies there appears to be a tendency to unite individual names into groups designated by class-words, and these into still higher groups. In these larger divisions there is a tendency to specialize by limiting the class-words. If the first names denoted individuals, it is evident that the generalizing tendency began very early. This progress towards the more general was accompanied by a process of degeneralization approaching individualization, which was carried forward not merely by means of new words, but also by limiting the extension of the general term.

If we seek the conditions fixing the extent and accuracy of

any special vocabulary, they will be found in the *delicacy of the discriminative power* and *the need for expressing small degrees of difference.* The truth of this generalization is most clearly seen in the color-vocabulary, to which the remainder of this article is devoted. The eye is most sensitive at the red end of the spectrum. Here also we find the greatest need for color-names, and by far the largest number of terms in use.

Few investigations on the knowledge and use of words among very young children have come to my notice. The ease with which special information of this nature might be collected renders it probable that such will soon be forthcoming. The early development of the sense of color in the individual is clearly indicated in Preyer's observations on his own child.[1] During the first few days after birth, the child probably distinguished only light and dark, and these very imperfectly. On the eleventh day a burning candle seemed to give it pleasure, and even before this time the mild sunlight from the window attracted its notice and caused it to turn its head in that direction. The first object which, on account of its color, seemed to attract the attention of the child was a pink curtain brightly illuminated by the sun, and about a foot from its face. This was first observed on the twenty-third day.

When Preyer began systematic experiments in the eighty-fifth week, no trace of ability to associate names with colors could be detected. There was, however, undoubtedly a perception of color apart from light and dark, as the pleasure in bright colors clearly indicated. Repeated attempts to have the child associate the name with the color were in vain, even when only red and green were used. On the 758th day the number of correct answers so constantly exceeded the incorrect ones that a beginning of correct association could be detected. On the 763rd day almost complete association was established and afterwards maintained for these two colors in the absence of others. Yellow was added and un-

[1] *Die Seele des Kindes*, 2te Aufl., S. 7–16.

certainty in the first two naturally followed. Yellow was easily mastered and soon was more surely named than the others. As new colors were added, association became more difficult. The development of the child's mind as shown in mastering these associations was remarkably rapid.

Until the thirty-fourth month the colors used and the per cent of correct answers were as follows: yellow 96.7, brown 90.8, red 86.7, violet 85.3, black 84.8, pink 72.4, orange 67.1, gray 51.5, green 45, blue 28.8. Preyer evidently believes from the above results and from other observations that green and blue are not as early distinguished as yellow and red. The accuracy with which violet was named would seem to render this conclusion doubtful.

The child had practice first in red and green, and then in the other colors in the following order: yellow, blue, violet, gray, brown, pink, black, orange. If we consider this fact, it will change to some degree the apparent relative ease in associating the name with the color. It is evident that after the child has had practice with certain color-words, it will be much better fitted to take up new ones. Had green and blue been introduced later, they would probably have occupied a higher relative rank. On the other hand, if yellow and red had first been used later, they would have occupied a still higher position in the scale. The other colors would evidently have fallen into a lower relative position had they been introduced earlier. It must be added that many of the later experiments were conducted in a different manner from the earlier ones. At first the child was required to select the color called for by the father. Later, the child both selected and named the colors. Blue was the hardest to distinguish. In the twilight it was often called gray when its true nature was quite apparent to adults. Preyer's observations prove conclusively that it is possible for children two or three years old not merely to distinguish colors, but to apply to them their proper designations. It is probable that ordinarily children do not learn so early to associate colors and their names, though Preyer intimates that at three or four

years of age they often do name colors with accuracy, even when not specially instructed. He mentions the case of a boy four years old who, uninstructed in colors, recognized and named red, yellow, green, and blue in the rainbow.

Professor Holden has given an interesting account of investigations made to determine the vocabulary of children.[1] He emphasizes the fact that the results show a much larger number of words used by the young than is generally supposed. His first case is that of a girl (M. H.). During her twenty-fourth month she used 483 words. In all cases Professor Holden excluded words not used with evident understanding of meaning, and all nursery rhymes, etc., learned by rote. An examination of these 483 words shows not *one* referring to color. Another girl (M. M. H.) used 399 words, none of which indicate color. A boy (B. K.) used 173 words, among which occur black and white, but none other referring to color. It certainly is very remarkable that in none of the cases described by Professor Holden was there a real color-term employed, and in only one case was even black or white used.

Grant Allen's conclusions, based on experiments which he does not describe, coincide with the above. "A child two years old (or a little more) knows very well the names of grapes, strawberries, and oranges; but for purple, crimson, and orange as colors it has as yet no appropriate verbal symbols."[2]

Professor Holden intimates that the acquisition of words about the beginning of the third year is very rapid; hence it is not improbable that Preyer's conclusion may have a quite general application. On the other hand, it is possible that children may know and use the names of colors without a clear perception of their differences. They may learn from the conversation of adults that certain objects have particular colors. They would then be able to apply these words

[1] Trans. Am. Philol. Assoc., 1877, p. 58 *et seq*, "On the Vocabularies of Children under Two Years of Age."

[2] *The Color-Sense: Its Origin and Development*, p. 250.

correctly in many instances even though no distinct perceptions of color were present. Whether the name precedes or follows, the sharp discrimination in sensation doubtless depends on the environment and education of the child. We must carefully distinguish the ability to recognize color-differences from the habitual exercise of the ability. The average child will seldom make comparisons of colors unless stimulated by others. And it is only by means of comparison that the active recognition of a color's individuality is awakened. If left to themselves most children will have in mind more color-names than clear ideas of color. They also will be able, perhaps, to apply these names better to natural objects than to artificially prepared surfaces. This of course indicates that the child has associated the *name* of the color with the object, rather than with the peculiarity of the color.

A few years ago while investigating the color-sense of the children of the public schools of Lincoln, Nebraska, it occurred to me that with little additional labor a test of ability to name colors might also be made. The results of such test are described in the following pages.

The colors used were oil pigments on card-board previously treated with a coating of common glue. Each card was five and one-half centimetres square. The children were examined separately out of the hearing of their fellows. The cards were placed one at a time, and always in the same order, before each child. As soon as one answer was given, another card was placed upon the first in order to prevent comparison as far as possible. The question was, "What color is that?" Only in a few cases was there a desire expressed on the part of the child to change his verdict after seeing other colors. Generally, after a card was covered by another, he seemed to forget the former and to give his whole attention to the one in view. In all cases only the first name is given in the tables unless the change was desired before another color was seen. In this instance the child was allowed time to select one name. The time given to each pupil varied

from one to five minutes; yet it seldom exceeded three minutes. Slow or backward children were given time to think; and all appearance of haste was avoided. While the child was finding one answer, I made a record of the answer preceding.

Although many children five years old may be superior in every way to their classmates several years older, it yet seemed better to make age the basis of comparison rather than the artificial classification of the schools. Children ten years old and naturally bright are often classed temporarily with those five or six years old, because they have been deprived of book instruction. Their sense-perceptions may be as keen and as fully developed, and their vocabulary of terms as large, as that of children equal in age but several years in advance of them in the school course.

It ought to be said that no systematic instruction about color had ever been given in these schools. A few teachers occasionally gave lessons on the "primary" and "secondary" colors. Some first-grade teachers also used colored paper and sticks for aids in drawing, designing, and numbers, without more than incidental attention to the colors. Comparison of the city schools with a few country schools in which colors had never been used failed to reveal the slightest influence of the "color-teaching" in the city.

As before stated, the investigation was undertaken primarily with a view to determine the accuracy of the color-sense in the young.[1] I have, therefore, excluded the answers of those found to be deficient in the sense of color, and shall tabulate them separately for comparison with the answers of normal children. For the purpose of comparison with the results given by Preyer and Holden, the ratio of correct answers by children five, six, and seven years old is given separately for each age. The results obtained from the older pupils are given in groups of three years each. It was not deemed necessary to employ more than the very common colors with the younger pupils. Even pink was omitted from

[1] The results obtained will soon be published.

TABLE I.

AGE	5		6		7		8-10		11-13		14-16		17+	
SEX	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. EXAMINED.	28	20	71	77	101	85	367	335	274	303	181	177	27	46
White.	964	950	986	1000	980	1000	1000	997	1000	997	983	1000	1000	1000
Black.	1000	950	958	961	960	988	997	994	982	983	989	983	1000	935
Red.	821	1000	901	987	970	988	984	988	985	993	995	989	926	935
Blue.	679	950	859	961	911	977	943	964	978	980	989	983	1000	978
Yellow.	571	750	761	832	782	918	924	970	956	977	983	989	963	957
Green.	679	900	817	858	881	988	896	964	942	980	961	1000	963	1000
Pink.	208	733	500	655	406	770	526	889	683	928	795	954	778	935
Orange.	0	50	56	52	20	94	98	212	186	317	149	249	222	328
Violet.	0	0	28	0	0	12	8	9	26	23	17	34	148	22

the list used in several first-grade rooms. The preceding table exhibits the number of correct answers in a thousand for the more common colors by children of different ages. M indicates males, and F females.

Careful study of this table yields some unexpected results. It will be remembered that Preyer's child learned to recognize and to name colors in the following order: yellow, brown, red, violet, black, pink, orange, gray, green, blue. These children name them in an entirely different order. White, black, and red were nearly always correctly named. Blue clearly occupies the fourth place. During the first few years even green precedes yellow, though on the whole this order is reversed. Pink uniformly falls seventh, orange eighth, and violet last. It is not strange that the position of orange and violet should be very different in the two cases. Preyer's child had been specially drilled in color-names, and these children had, perhaps, seldom heard of orange or violet. The remarkable change in the absolute and relative positions of yellow and blue cannot be so easily accounted for. Yellow was most easily recognized and named by the instructed child. Uninstructed children, a few years older, name four other colors more accurately. Blue was by far the most difficult of ten colors to Preyer's child. In my experiments it was scarcely the most difficult of four colors, being almost as surely named as red or black.

The most constant progress during the first three years is to be observed in connection with yellow and green. It is found among both boys and girls. The table also shows that the improvement in yellow exceeds that in green. On the whole, the girls appear to name green more correctly than yellow, while the reverse is true of the boys. Whether this fact in any way depends upon the greater frequency of color-blindness among the boys, cannot be decided without further investigation. It ought to be said, however, that many writers on color-blindness have acquired the habit of referring to it as an absolute instead of a relative defect. There are, doubtless, degrees of color-perception as well as

of vision in general. It is not improbable, therefore, that the difference between boys and girls in naming these colors is due to the relative distinctness with which the sexes perceive green. The exceptions to this rule in the first few years may be the result of indefinite nomenclature, together with a larger number of terms having some resemblance to yellow.

The relative accuracy with which these children named the colors employed is, therefore, as follows: white, black, red, blue, yellow, green, pink, orange, violet. The younger pupils found green easier to designate than yellow. There is also a greater difference between blue and green in the answers of the younger pupils. I think the variation in these two instances is, perhaps, greater than the difference in familiarity with the colors would require; yet greater uniformity is to be expected among older subjects. It is not desirable to make the ability to name colors a test of individual development or of scholarship; but the improvement during the early years of childhood is worth noting. We should expect girls to name colors much more accurately than boys of equal age. Not only are the sexes very unequally endowed by nature, but the opportunity for developing this sense is afforded to woman in much the more attractive form. I doubt if we should expect, from general knowledge, that girls eight years old will, on the average, name the above nine colors better than boys sixteen years of age. The greatest improvement is in pink, and of course is made by the boys. At five years of age they give the correct answer once in four times. At sixteen about eight-ninths of their answers are correct.

Orange seems to require special instruction for general recognition. Its situation is peculiarly unfortunate. If the child decides that it is not red, he is pretty sure to say it is yellow. If yellow occurs to him first, he makes up his mind that 'it isn't exactly yellow,' hence calls it red. This wavering between red and yellow was a very interesting experience during the investigation, and will be referred to again when I come to treat of the nature of the incorrect answers.

Violet was very seldom correctly named. Indeed, it is very rarely properly conceived by more experienced people. It is doubtless true that the common idea of violet would place it among the reds, whereas a moment's thought would convince most persons that it more nearly resembles the blues. The name seems to be comparatively unused, and almost never employed in every-day life to denote the real color. The very interesting results of the incorrect answers in this color will be considered presently. It will be noticed that the ignorance respecting violet and orange offers convincing proof of the absence of color-instruction in the schools. In my opinion this circumstance adds not a little to the interest of these results.

Among the additional colors first employed with children ten years old, brown was by far the most readily named, and indeed ranks with green and yellow. Owing to the smaller number of individuals examined I shall merely compare the results with those already given, and refer the reader to the final tables containing the right and wrong answers of each separate color. Drab was correctly named by about one-third of the children. There was less difference between the accuracy of boys and girls in drab and also in purple (which was less surely named) than in pink and orange. Gray was named correctly nearly as often as purple; while lilac, crimson, and scarlet were reduced to the rank of violet. That gray and drab were named scarcely more correctly than purple, and much less so than brown can be accounted for only by their great resemblance, and by the numerous words used for tints closely allied to them.

It may be interesting to give the proportion of correct answers to the nine chief colors, for each year and sex. This table will show the rate and time of improvement.

The girls make very little progress after the eleventh year. The greatest gain of the boys also occurs before this age, yet they are still quite inferior to the girls. The boys continue advancing, until at seventeen there is less difference between the sexes than at any previous period.

TABLE II.

SEX.	M.	F.	SEX.	M.	F.
AGE.			AGE.		
5	554	698	12	760	787
6	655	701	13	743	806
7	671	747	14	761	806
8	702	768	15	762	792
9	711	778	16	767	795
10	712	783	17+	778	800
11	746	802			

The following tables exhibit in detail the number of correct answers and the character of those which were incorrect for each color used. The numbers are absolute, as it did not seem advisable to reduce these results to a uniform scale. The most common false answers are indicated separately; the less common are grouped together under "*Other.*" If no name was given, the case was recorded under "*Blank.*" Three boys were unable to name white. Four boys and three girls gave other names to this color, such as red, green, slate, blue, etc. Two boys and three girls could not give any name to black. Seven boys and six girls called it green. One boy and seven girls thought it was brown. Five boys and two girls assigned to it other names, as blue, red, *white.*

From the adduced examples the method of using the tables will be recognized. It is believed that these complete tables offer material of more value than the random selection of odd instances. The reader may select queer cases, and surprise himself as taste dictates.

TABLE III.

Age		5-7		8-10		11-13		14-16		17+	
Sex		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. Examined		200	182	367	335	274	303	181	177	27	46
Red.	Red.	185	180	361	331	270	301	180	175	25	43
	Blue.	4	1	...	1	2	...	...	...	...	...
	Yellow.	1	...	2	...	...	...	...	...	...	...
	Green.	1	...	...	...	...	...	...	...	...	...
	Brown.	2	...	...	1	1	...	...	...	...	...
	Blank.	4	1	4	1	...	...	...	...	...	...
	Other.	3	...	...	1	1	2	1	2	2	3
Blue.	Blue.	172	176	346	323	268	297	179	174	27	45
	Green.	10	2	10	3	4	1	2	1	...	...
	Red.	3	3	1	2	1	...	...	...	...	...
	Indigo.	...	...	1	...	...	...	...	2	...	...
	Purple.	2	...	6	6	...	5	...	...	...	...
	Blank.	9	1	3	1	...	...	...	...	...	...
	Other.	4	...	...	...	1	...	...	...	...	1
Yellow.	Yellow.	149	157	339	325	262	296	178	175	26	44
	Green.	19	8	14	4	6	1	1	...	...	...
	Blue.	7	9	1	1	2	...	...	...	...	...
	Pink.	5	3	3	...	1	...	...	...	...	...
	Orange.	...	...	2	2	1	6	2	1	...	1
	Blank.	15	3	4	1	2	...	...	...	...	...
	Other.	5	2	4	2	...	...	...	1	1	1
Green.	Green.	166	168	329	323	258	297	174	177	26	46
	Blue.	18	9	31	6	14	6	5	...	...	...
	Red.	2	...	1	2	...	...	1	...	...	...
	Yellow.	3	2	3	2	...	...	...	...	...	...
	Pink.	2	...	2	...	...	...	...	...	...	...
	Blank.	8	3	...	2	1	...	1	...	1	...
	Other.	1	...	1	...	1	...	...	...	...	...

TABLE III. — *Continued.*

Age		5-7		8-10		11-13		14-16		17+	
Sex		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. Examined		200	182	367	335	274	303	181	177	27	46
Orange.	Orange.	6	13	36	71	51	96	27	44	6	15
	Red.	80	62	139	105	99	79	77	51	12	9
	Yellow.	39	41	59	82	39	44	12	12	2	3
	Pink.	18	9	27	6	14	10	6	3	2	1
	Brick.	...	...	...	3	2	8	2	18	...	5
	Green.	...	6	3	1	...	...	...	...	...	...
	Brown.	4	3	12	8	13	14	13	8	2	1
	Purple.	1	2	4	2	1	1	1	...	...	...
	Salmon.	...	1	1	2	...	3	...	2	...	2
	Drab.	...	...	2	...	1	...	4	...	1	...
	Blank.	46	41	79	51	50	45	35	26	1	2
	Other.	6	4	5	4	4	3	4	13	1	8
Violet.	Violet.	2	1	3	3	7	7	3	6	4	1
	Blue.	91	88	196	136	132	104	107	56	15	13
	Purple.	28	47	71	156	69	174	49	105	7	30
	Pink.	3	2	21	8	12	...	1	...	...	1
	Brown.	5	4	5	1	4	1	...	...	...	...
	Red.	3	5	7	...	...	...	1	...	...	...
	Drab.	...	...	2	6	2	1	1	1	...	...
	Green.	4	1	2	2	6	1	...	...	...	...
	Yellow.	2	4	3	...	1	...	...	...	...	...
	Lavender.	...	...	...	3	1	1	1	...	1	...
	Blank.	56	28	51	16	36	9	16	5	...	1
	Other.	6	2	6	4	4	5	2	4	...	...
Black.	Black.	193	177	366	333	269	298	179	174	27	43
	Green.	2	1	1	1	2	2	2	...	...	2
	Brown.	...	1	...	1	1	2	...	2	...	1
	Blank.	2	2	...	...	...	1	...	...	...	...
	Other.	3	1	...	...	2	...	...	1	...	...

TABLE III. — *Continued.*

Age		5-7		8-10		11-13		14-16		17+	
Sex		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. Examined		200	182	367	335	274	303	181	177	27	46
White.	White.	196	181	367	334	274	302	178	177	27	46
	Blank.	2	...	...	...	...	...	1	...	...	...
	Other.	2	1	...	1	...	1	2	...	...	...
No. Examined		145	143	289	262	255	279	180	175	27	46
Pink.	Pink.	60	103	152	233	174	259	143	167	21	43
	Red.	33	17	52	12	19	4	8	4	...	...
	Blue.	6	4	3	...	...	...	1	...	...	...
	Yellow.	12	8	16	7	11	1	7	...	...	1
	Purple.	4	3	17	4	16	3	6	1	5	...
	White.	1	...	1	...	1	...	1	...	...	...
	Green.	4	...	1	...	...	...	...	...	...	...
	Blank.	24	8	40	5	30	10	12	1	...	...
	Other.	1	...	7	1	4	2	2	2	2	2
No. Examined		...		19	9	116	151	155	159	27	45
Drab.	Drab.	...	...	4	4	37	70	50	81	8	33
	Green.	...	...	1	...	2	2	3	1	...	...
	Blue.	...	...	2	...	13	10	9	8	4	...
	Gray.	...	...	6	4	27	36	23	36	4	4
	Slate.	...	...	2	...	8	17	29	14	3	3
	Lead.	...	...	...	...	3	2	9	3	2	2
	Brown.	...	...	...	...	7	3	6	2	1	1
	Black.	...	...	1	...	1	1	1	...	...	...
	Lavender.	...	...	1	...	1	1	3	1	2	1
	Blank.	...	...	1	1	12	5	15	6	2	...
	Other.	...	...	1	...	5	4	7	7	1	1

TABLE III. — *Continued.*

Age		5-7		8-10		11-13		14-16		17+	
Sex		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. Examined		...		19	9	116	151	155	159	27	45
Gray.	Gray.	...	...	9	5	29	41	25	38	6	5
	Green.	...	...	1	...	4	...	4	1	...	...
	Blue.	...	...	2	1	12	9	10	6	6	3
	Drab.	...	...	1	3	32	64	52	77	7	31
	Lavender.	...	...	1	...	2	4	...	2	1	...
	White.	...	...	2	...	2	1	1	...	...	...
	Lead.	...	...	...	...	5	4	12	4	3	3
	Slate.	...	...	...	...	5	14	21	14	4	5
	Brown.	...	...	...	...	4	4	7	5	...	1
	Blank.	...	...	3	...	15	17	15	8	1	...
	Other.	...	...	...	...	6	3	8	4	2	...
Scarlet.	Scarlet.	...	...	...	...	2	4	1	3	...	2
	Red.	...	...	19	9	113	146	149	153	26	41
	Vermilion.	...	...	...	...	...	...	3	1	...	1
	Blank.	...	...	...	...	1	...	...	...	...	...
	Other.	...	...	...	...	...	1	2	2	1	1
Lilac.	Lilac.	...	...	...	...	...	6	2	7	...	4
	Pink.	...	...	3	3	40	53	37	34	8	8
	Purple.	...	...	12	1	36	43	46	50	3	15
	Blue.	...	...	2	2	8	4	7	1	...	1
	Lavender.	...	...	...	1	4	14	8	32	...	6
	Drab.	...	...	1	...	3	...	3	2	2	...
	Violet.	...	...	...	...	2	1	3	4	4	2
	Red.	...	...	...	...	...	3	1	...	2	...
	Blank.	...	...	1	2	20	24	39	25	4	5
	Other.	...	...	...	...	3	3	9	4	4	4

TABLE III. — *Continued.*

Age		5-7		8-10		11-13		14-16		17+	
Sex		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
No. Examined		...		19	9	116	151	155	159	27	45
Purple.	Purple.	...	...	9	4	24	37	49	45	7	7
	Red.	...	...	1	2	21	46	17	33	6	9
	Wine.	...	...	1	1	2	10	1	13	2	6
	Blue.	...	...	2	...	3	2	1	1	...	...
	Brown.	...	...	...	1	14	3	22	6	6	3
	Drab.	...	...	1	...	7	...	4	1	2	...
	Plum.	...	...	...	...	...	7	...	14	...	5
	Pink.	...	...	...	...	6	1	7	5	...	...
	Blank.	...	...	5	1	34	37	49	28	4	7
	Other.	...	...	...	...	5	8	5	13	...	8
Crimson.	Crimson.	...	...	1	...	1	4	5	6	2	2
	Red.	...	...	18	8	100	121	129	122	23	35
	Wine.	...	...	...	1	1	15	8	12	1	4
	Cherry.	...	...	...	...	1	2	1	3	...	1
	Cardinal.	...	...	...	...	2	4	...	6	...	1
	Pink.	...	...	...	...	1	...	3	...	...	...
	Garnet.	...	...	...	...	1	1	...	3	1	...
	Blank.	...	...	...	...	3	2	1	...	...	...
	Other.	...	...	...	...	6	2	8	7	...	2
Brown.	Brown.	...	...	16	6	106	135	137	148	25	42
	Red.	...	...	...	3	4	11	6	6	1	1
	Plum.	...	...	...	...	...	2	...	...	...	...
	Wine.	...	...	...	...	...	3	...	4	...	...
	Purple.	...	...	...	...	2	...	...	...	...	...
	Blank.	...	...	3	...	3	...	8	...	1	...
	Other.	...	...	...	...	1	...	4	1	...	2

It will doubtless be inferred that the mistakes in naming such common colors as black and white are the results of inattention. It seems almost incredible that children with sufficiently good eyesight to attend the public schools should be unable to recognize white and black. Scarcely less surprising is it that children could be found, who, though able to read, are incapable of associating the words white and black with the corresponding surfaces. In this connection several things are to be remembered if we would avoid false conclusions. This paper has nothing to do with the color-perception of the children examined. The answers of those found deficient in the sense of color are excluded from the tables. I do not believe it even possible that any child represented in the tables would have hesitated an instant if black and green, for example, had been placed before him at the same time with the request that black be pointed out. The fault does not lie in the ability to discriminate present sensations. It exists rather in the process of association. The bond of association between sensation and name is so weak that the former fails to call up the latter. Hence also the false name fails to recall *its* corresponding sensation; thus the only opportunity of correction is wanting. If we seek a remoter cause of these results, it would doubtless be found in the nature of color-impressions. An approximate idea of what I mean may be gained by trying to determine from memory the difference between lilac and lavender. Unless specially experienced in colors and their names, we should find our conception of this difference quite vague. It is a vagueness in reproduced sensations that causes so great uncertainty in naming. This, in turn, is caused by the indistinctness of accustomed perceptions; the whole depending, of course, upon the habitual want of attention to sensations. The habit of indifference to simple sensations during early life, I believe, tends toward the formation of indefinite ideas on more complex subjects. It would be an interesting question for future investigation to determine whether all ideas of school children are as indistinct. The question might

profitably engage the attention of those interested in the improvement of methods and means of elementary education. If children's conceptions of such simple sensations as color are so unsatisfactory, what is to be inferred regarding their mental pictures of more complex objects, as bird or tree; saying nothing of abstractions like goodness, or humanity?

A vagueness of perception is observed in the answers to all colors; though in the less common ones there are other elements of uncertainty, which partly conceal the lack of clearness. The practical effect of these results is to give emphasis to the advice of those educators who urge the training of the senses in our public schools. The attention needs stimulation, and no other means is so well adapted to this end.

The character of the incorrect answers to red deserves some attention. Why do so few of the assigned colors in any degree resemble red? It may be thought that they are merely chance names that happened to come into the minds of puzzled children. There must have been some determining cause as to what words should be used. Why should green be substituted so often for yellow and blue, and scarcely at all for red? It also will be noticed that green is seldom given for pink, scarlet, crimson, or purple. Yellow is very rarely assigned to blue, or any color containing blue. In neither of these cases is the converse true. Hence we cannot conclude anything regarding the substitution of colors nearly complementary. A few of the "other" names given to red were specific, as scarlet and cardinal.

The results in blue clearly contradict the popular impression that "many persons do not know the difference between blue and green." Only thirty-three among more than two thousand called blue green. This belief in the indefiniteness of the two colors is owing to their proximity and intermingling. If the pigments nearly approach the types, few children will mistake one for the other. If seen together, no one with normal eyes would think them more closely related than red and orange. In this case the names also would be interchanged much less frequently than if the colors were

brought successively into view. It will be noticed that green is much oftener called blue than blue is called green. Theoretically, we might expect yellow and green to be very often confused, lying as they do adjacent in the spectrum. Practically, however, we can only be surprised that these two colors are ever confounded. Fifty-three children called yellow green. The difficulty in naming yellow is certainly unexpected, and to me is inexplicable.

Orange offers some curious results. Nearly four hundred children were wise enough not to attempt to designate it. Not quite as many gave the correct name. As might be expected, more than half the answers belong to red and yellow, — red receiving about twice as many as yellow. The preference for red seems much stronger among the boys than among the girls. Pink and brown receive a large share of these guesses. Among the "other" names given to orange are blue, gray, scarlet, crimson, cream, wine, terra-cotta, plum, white, pumpkin, crab, tomato, strawberry, copper, vermilion, and several compound names, as reddish pink, yellowish red, etc. In all there were thirty-four distinct names given to orange. At least 150 answers are absurd, viz.: all pinks, greens, purples, drabs, and one-half those marked "other." If we attempt the analysis of this matter, a curious state of affairs is revealed. In the first place, these children have no clear ideas either of orange or of the colors whose names were given to orange. They probably have never learned the word 'orange' as the name of a color. (This is doubtless true also of far the larger number of the pupils examined.) Yet they all clearly perceived this color and, while looking at it, called it pink, green, purple, drab, cream, blue, or crimson. If their conceptions of these colors had been clear and closely associated with the terms, the thought of the word would have recalled the character of the color, and the absurdity would have been evident. Another result of studying the orange table is, that the pupils seem loath to confess their ignorance. Four-fifths of them attempted to name orange, and only one-fifth knew what it was. This

impulse in the child to do the best he can (*i.e.* to guess when he does not know), whether natural or cultivated, is worth investigating, both as to its causes and effects. I suspect our schools favor its development, and should like to know how and why they do so.

The results in violet very greatly resemble those in orange. Few correct answers were expected. The names of the adjacent colors, blue and purple, are most frequently employed to designate it. The boys prefer blue, and the girls purple. This is easily explained by the fact that the finer discrimination of the girls distinguishes violet from the more common blue. The boys seize upon the resemblance without attention to the difference. Again, boys very seldom use the word purple, and girls are, perhaps, accustomed to associate this term with a tint more nearly resembling violet than the real purple. Both these causes are doubtless active, and that they tend in the direction indicated may be seen by observing that the older and hence more discriminating the girls are, the greater the proportion of purples to blues. There were also many irrelevant terms applied to violet; *e.g.* pink, green, yellow, scarlet, black, and white. Fewer children gave no name to violet than to orange.

The number of correct answers in pink is larger than one might look for. The distribution of the incorrect replies is also unexpected. Among the younger children (boys especially) we should have anticipated as many reds as pinks. Instead of this being the case, there are comparatively few reds. Indeed, they are almost equalled by the sum of the yellows and purples. The superiority of the girls is, perhaps, more clearly seen in pink than in any other color. This is also the best general test for color-blindness. Among the other terms applied to pink are cream (five times), drab (seven times), green (seven times), besides orange, white, brown, gray, and blue several times each.

The remaining colors were not given to the pupils of the lower grades. It would be interesting to know in what way young children would designate gray, brown, and lilac.

Crimson and scarlet are, of course, red to nearly all observers. It is nevertheless strange that with the real red preceding these it occurred to so few children to assign other names. Nearly all the terms used for these two tints denote varieties of red. It is possible that more words were employed for crimson because scarlet always preceded it, and the children may have attempted to avoid a repetition of red by seeking other expressions. I am, however, inclined to think that this circumstance had very little influence, for red preceded scarlet, and many more terms were used for red than for scarlet. The variety of names for crimson most probably depends upon the peculiar nature of the color. Scarlet is a bright red; whereas the crimson used was dark, much less positive, and hence permitted the application of less definite names.

Brown was surprisingly well named. Further than this it offers little interest. Brown being rather a neutral color was often used by children with weak eyes or little discrimination for stronger shades, and especially for orange and violet.

Lilac was correctly responded to by only nineteen children, only two of whom were boys. Pink and purple claim the larger share of the false answers. There seems to be no apology possible for so many pinks. Indefinite ideas of pink, together with poor discriminative power, must have been the causes. The common idea of purple would allow lilac to be called a light purple, and a sharper discrimination would have brought more answers under this head. The incorrect terms are quite numerous, and nearly all of them have some foundation. A remarkable exception, however, must be noticed in the case of lavender. More than fifty girls deceived themselves regarding the nature of this color, being at the same time ignorant of the name or nature of lilac, else of both these.

The replies to purple are pretty evenly divided between purple and red; wine and brown also receiving a good share. The blue element may be considered as represented by the few answers under that head. The frequent occurrence of drab, and especially of brown, indicates very weak discrimi-

native power. Plum is not out of place, but this is scarcely true of pink. It is strange that fewer children should have given no answer to lilac than to purple.

The very general distribution of answers to the four colors, orange, violet, lilac, and purple, as also to gray and drab, yet to be considered, offers material of considerable interest. It shows in the first place how great a variety of words occurs to young minds for the same sensation. Not less than twenty children — not the same ones in each case — gave the name brown to each of the colors, orange, violet, purple, gray, and drab. No less than a dozen pupils in each case gave the name purple to lilac, blue, orange, pink, and violet. The number of colors often called blue is also large, while red appears among the answers to nearly all the test colors, gray and drab only excepted.

Drab and gray were very similar in appearance. The former was slightly darker, and contained a little blue. The latter was a mere mixture of black and white pigments. If seen side by side, no one would say they were the same color. Drab was correctly named oftener than gray, and also oftener than gray was called drab; yet gray was called drab more frequently than it was correctly designated. Though drab contained an appreciable quantity of blue, this fact is only slightly indicated in the tables. Nearly as many eyes saw blue in the gray as in the drab. Another slight recognition of the blue is the greater number of slate answers in drab. These tables show that children over eight years of age have many ways of designating the simple shades gray and drab. In all, gray received sixteen different appellations. Drab received all these and eight additional ones.

In general, red appears most frequently in the answers. Blue and green were each given to thirteen different colors. Yellow was comparatively rarely used. Purple occurs very often, yet is seldom applied with discrimination. Altogether for my sixteen tests the children found seventy-three distinct names; viz. red, orange, yellow, green, blue, violet, black, white, pink, brown, lilac, gray, scarlet, crimson, purple.

drab, salmon, plum, cream, wine, pumpkin, ornish, indigo, navy-blue, lemon, Indian-red, pearl, slate, lavender, ink (violet), blue-pearl, crab, tomato, brick, vermilion, cherry, lead, carmine, maroon, grape, crushed strawberry, cardinal, rose-madder, garnet, olive, yankee brown, dove, steel, mouse, flesh color, terra cotta, orbid, house trimming, strawberry, dark, burnt Sienna, copper, mauve, gold, blood, wood, clay, pansy, indigo-blue, sky-blue, magenta, buff, heliotrope, scarlet-lake, chrome yellow, cadmium, crushed raspberry, rose, solferino. I have admitted to the list two types (ornish and orbid) of many answers that were evidently results of imperfect attempts to reproduce words heard, but never understood.

Besides the above list there were sixty-six modifications or compounds of these elements; as, reddish yellow, pinkish drab, grayish blue. Some of the combinations display great originality. I have seldom been more amused than when sober-faced children, wishing to be very exact, called out, after thorough deliberation 'light-white.' It seemed impossible that anything should exceed the luminosity of this description of gray; but its ludicrousness was certainly excelled by the pupil who gravely replied '*dark-white.*' Only one step remained, and it was soon taken. The colored children, for some unknown reason, frequently employed the adjective dark as a substantive.[1] There are, of course, shades of dark. Several bright pupils, therefore, independently invented the expression '*light-dark.*' Among the other combinations are reddish blue, reddish pink, drabbish red, pinkish drab.

The total number of questions propounded to boys was 11,508; to girls, 11,797. The boys answered more than sixty-two per cent correctly, and the girls more than sixty-seven per cent. No answer was attempted by the boys to nearly seven per cent, and by the girls to nearly four per cent.

[1] Black was probably intended. This may be a method of designating their own complexion. Its relation to the popular expression for "colored person" is unknown to me.

TABLE IV.

	RED.	BLUE.	GREEN.	YELLOW.	ORANGE.	WHITE.	PINK.	BROWN.	DRAB.	GRAY.	PURPLE.	BLANK.	OTHER.	TOTAL.
Red.	**65**	2	4	1	....	....	....	....	....	....	....	1	1	74
Blue.	1	**67**	4	....	....	....	....	....	....	....	1	1	....	74
Green.	1	3	**56**	....	....	....	1	2	1	2	....	6	1	74
Yellow.	1	5	5	**58**	1	1	2	....	....	....	....	1	....	74
Orange.	33	1	5	14	**3**	....	3	4	....	1	1	9	....	74
Violet.	2	40	4	....	....	....	3	1	2	....	10	11	1	74
Pink.	11	5	3	5	....	4	**25**	....	....	1	3	8	1	66
Brown.	5	....	1	....	....	....	....	**19**	....	....	....	5	....	30
Crimson.	26	....	....	....	....	....	....	1	....	....	1	1	1	30
Scarlet.	30	....	....	....	....	....	....	....	....	....	....	....	....	30
Drab.	....	5	1	1	....	2	....	1	**6**	4	....	4	6	30
Gray.	....	....	7	....	....	3	....	2	8	**5**	....	1	4	30
Lilac.	1	4	....	1	....	....	12	....	2	....	2	6	2	30
Purple.	7	3	1	....	....	....	....	6	2	....	**3**	6	2	30

The answers of the seventy-four pupils who were found to be more or less deficient in color-discrimination have been excluded from the preceding tables. For the purpose of comparison these results are given at length in Table IV. No mistakes were made in black or white; hence they are omitted from the table.

It has long been held that name tests are of little value in the investigation of color-blindness; but, as far as I know, this table contains the only statistics on the manner of designating the common types actually employed by those deficient in the sense of color. It is evident from the table, that by this method the detection of defects would be very difficult. Boys with normal eyes named correctly nearly sixty-two per cent of the tests. Boys more or less color-blind named correctly about forty-four per cent. Curiously enough, even this small difference is not particularly prominent in the colors for which the color-blind eyes are especially defective. Nearly all were deficient in red, or green, or both; very few in blue or yellow; yet red was named nearly as well as blue, and green nearly as well as yellow. Defective vision is, perhaps, most clearly shown in naming pink. Much lighter than the red, it doubtless escaped recognition by many. This is especially noticeable in the four white and one gray answers; scarcely less so in the thirteen answers falling to blue, green, and yellow, and in the eight blanks. Gray was called green by seven children, and green was called by some red, pink, brown, or drab. On the whole, the blanks are only slightly more numerous than with normal children; yet green, pink, brown, and drab occur much more frequently in the answers of those with abnormal vision.

This table indicates in a measure the difficulty of detecting defects in the color-sense. It also shows the possibility of those who are color-blind learning to associate names with well-saturated, typical colors. Of course this last fact explains why so few ever recognize a defect in their sense of color.