

THE JOURNAL OF ABNORMAL PSYCHOLOGY

VOL. XIII

APRIL, 1918

NUMBER 1

ORIGINAL ARTICLES

A REPORT ON TWO CASES OF SYNESTHESIA

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THE curious variation of normal mental processes, synesthesia, has scarcely received the attention it deserves, in view of its frequency and its possible importance in throwing light on mental activity in general. One finds many articles dealing with it, but a majority are merely superficial reports of individual cases. I have found only one contribution reporting the results of a detailed study of cases made in a psychological laboratory. (1)

The studies of the cases here reported were not extensive and are considered worthy of publication only because they seem to throw some light on one or two doubtful points.

It is not necessary to discuss synesthesia in detail in this article because a very good conception of it can be obtained from a recent article in this Journal (2); it may be well, however, to enumerate a few facts that are more or less basic for the investigations made on these two cases.

Synesthesia is evidently of common occurrence, although it is difficult to estimate even approximately its frequency, because the figures of different observers and even those of the same observer on different material vary within such wide limits. Galton (3) gives the percentage of occurrence as 3.3 of the general population, while Mercante (4) estimates that it exists in 80 per cent. of all grade school children. Calkins (5) found it present in 6.6 per cent. of certain classes of Wellesley College in 1891, and in 15.7 in 1892. Some reason for the difference in these

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figures is to be found in the fact that the condition has been described under a number of different names,—color-audition, psychochromesthesia, photisms, etc., some of which include many more manifestations than others, and again in the fact that it is not possible definitely to separate synesthesia from visions, and the so-called “forms” and “personifications.” Accepting the lowest estimates as correct, however, it remains that synesthesia is a common phenomenon.

A clear idea of synesthesia is probably best obtained from a hypothetical example. In one form a spoken word or other sound is followed in the synesthete not only by the usual sound perception but also by a perception of color which may not differ greatly from the color-percept produced by a colored object, and which takes place coincident with or even before the sound-percept. If in a synesthete the color-association of the name John be red, he is able to name the color as quickly and as definitely as he can repeat the word itself. It is to him as natural that “John” should have a certain color as that it should have a certain sound.

The above example of the association of colors with sounds, the so-called color-audition, is only one type of synesthesia, although apparently the most common one. In a similar manner colors may be associated with vision, taste, smell, touch, pain, temperature, and even with thoughts. Further, the secondary or associated sensation need not be a color; it may be a sound, taste, tactile or any other type of sensation, and indeed may be a feeling of pleasantness or unpleasantness not ordinarily considered as a sensation. Again, secondary sensations may be multiple and involve more than one sense. In fact the types and extent of the associations are almost limitless. For example, when the individual studied by Ulrich heard the letter “a,” he perceived in addition to the sound the color green, a taste insipid and unpleasant, a coldness and a surface smooth like a pane of glass. For him the color association of water varied with the temperature, being at 50° deep red, at 40° clear red, at 35° rose and green and at 25° clear red. Each musical instrument had its particular color upon which were engrafted the colors of the different notes or airs. (6) In some persons only a few words or sounds may have associations, while in others like Dr. D. Fraser Harris, all words and even ideas are colored. (2)

The so-called “forms” and “personifications” and visions often are found in the subject with synesthesia and in a sense

are similar to it. The most common type of "forms" is "number forms" which Dr. Peabody of Harvard has recently estimated to occur in 25% of children. (7) When a subject with a number form attempts any sort of mathematical calculation, he always thinks of numbers as arranged in a certain constant form and conducts his calculations by reading off, so to speak, the results from this form. Sir Francis Galton found that several mathematical prodigies were enabled to perform their remarkable calculations by means of these forms. (3)

In subjects having "personifications" numbers, letters, the months, etc., may arouse feelings that ordinarily are felt in reference to persons. For example one says: "T's are generally cruel ungenerous creatures; U is a soulless thing. I dislike 11, 13 and 17. My feeling for 11 is almost one of pity." (5) Another says: "All the little a's have their eyes turned to the right." (3)

The types of visions are almost as numerous as the subjects having visions. Number forms may be regarded as one variety of visions. Another is that represented by the woman described by Raines, who in idle moments amused herself by recalling the vision of a castle of ancient architecture situated in beautiful grounds, the details of which were invariable and perfectly distinct (8). Still another type is the epileptic aura. (9) (10). Visions probably reach their fullest development in the psychic medium or at least that type of medium who makes her prophecies by interpreting the constant stream of visions and hallucinations of all the senses that pass through her mind under the proper conditions. (11)

Some characteristics of synesthesia stated by Sir Francis Galton in his interesting and illuminating book published in 1883, and since found to be generally applicable are as follows:

- (1) That synesthesiae are remarkably persistent;
- (2) Synesthetes are minute in their descriptions of the colors, thus showing that the colors are distinct;
- (3) Two people hardly ever agree as to the associated color;
- (4) The tendency to synesthesia is very hereditary.

Almost all writers agree that synesthesia generally first becomes manifest in early childhood and that often it is well developed before the subject has learned to read and write. Without doubt it gradually disappears as the subject approaches adulthood unless preserved by training; but a little attention

often will result in its reappearance and practice may serve to increase its scope.

The secondary sensations are remarkably constant. In the case of Dr. Harris himself they have remained practically unaltered since childhood. (12) Professor Holden found very few changes in those of his daughter when he examined her at the ages of 7, 8, $10\frac{1}{2}$, 13, $14\frac{1}{2}$, and $17\frac{1}{2}$ years respectively. (13) Apparently in rare instances associations may change spontaneously, but they cannot be altered by voluntary effort.

There is seldom any great degrees of agreement as to associated sensations among synesthetes, even when they are related. It is said that the oft-mentioned Nussbaumer brothers agreed more often than they differed and Harris and his brother had similar associations in 50% of the words. (12) Usually the percentage of agreement is much smaller than in these examples. It is not a practice conducive to accuracy, therefore, to resort to associated sensations in describing primary sensations as Bor-ing did in his paper on the physiology of tactile, pain and temperature sensibility. (14)

When colors are the secondary sensations they are usually definite and distinct as well as delicate. Several adjectives and various comparisons may be used in describing them. Undoubtedly some associations have been wrongly thought to have changed owing to the fact that in attempting to describe color-mixtures different terms have been used at the later trials for the same tint. Given water colors or paints the subjects are able to match their associations.

Not infrequently synesthesia is found in several members of a family. The cases studied by Smith consisted of a man and his five children (15). Laignel-Lavastine was able to establish its presence in 10 of 11 individuals representing three generations of a family (16). Saurez de Mendoza makes the point that only the tendency to synesthesia is inherited and whether secondary sensations appear or not depends on suggestion to a considerable extent. (17)

Beaumis and Binet investigated the reaction time of associated sensations and found it about the same as that of the primary. (18)

The utility of synesthesia is established by the evidence of many investigators. Harris states that it is never an impediment (19) but Thorp was forced to give up his music on account of the disturbing effects of the secondary sensations. (20) One

synesthete asks:—"How could anyone tell whether a name is pretty or not except by its color?" Another states that words incorrectly spelled have the wrong color. A writer was aided in composing rhymes by his color associations. Mr. Spencer found his of service in learning a foreign language. (21) Scriabin, the Russian composer of operas, judges his harmonies by the colors associated therewith. He has the ambition to see some of his musical creations given with color and odor accompaniments so selected that all three sensations will blend in one great harmony. (22) Blanchard saw an attempt, and to judge from the amount of applause, a successful one, to produce a color-sound harmony in a London music hall. (23) Grafe has suggested that synesthesia may be utilized to make the blind see and the deaf hear. (24)

It is definitely established that synesthesia is not a mental abnormality. That it has been found associated with the psychoneuroses and epilepsy does not controvert this statement. A large majority of the subjects are normal, healthy-minded persons. Indeed it has been frequently stated that their intelligence is above the average. Dr. David Starr Jordan (21), Henry Head (2), and many other noted men have synesthesia. Harris believes synesthesia a manifestation of genius. (19)

It is stated that synesthetes are prone to have certain mental peculiarities. They are apt to be imaginative, introspective, shy and sensitive. As a result of the sensitiveness they may conceal their faculty from a false notion that it is abnormal. Again they frequently have talents along musical and artistic lines. In a surprisingly large number of the reports of cases one finds it stated that the subject is very intelligent.

The present study was undertaken chiefly to establish the degree of correspondence of associated sensations in the two subjects. As they were twins of the same sex and therefore presumably much alike mentally both by nature and training, it seemed that the extent of such correspondence would throw some light on the factors that determine the form of secondary sensations indicating whether these sensations are accidental, *i. e.*, dependent on conditions that it is impossible to determine, a result of some peculiarity of mental make-up, or are determined by suggestion. The cases at first promised to be unique because before the study was begun the subjects themselves believed that their associations were always the same.

The circumstances under which it was discovered that

synesthesia was present in these subjects are interesting and perhaps important. After an intimate acquaintance of several years during which synesthesia was not mentioned, the remark was dropped casually by one of them in my presence that when they were children the names of persons were colored. After a few further remarks the topic of conversation was changed and the incident was forgotten for several weeks. Then I came across the article by Blanchard (23) and recognized that the phenomenon he described was the same as that present in them. Before the study was undertaken all available literature consisting of about sixty articles, was gone over.

The subjects are young men 27 years of age and are very intelligent. In school they were brilliant students. They completed the high school and college courses each in one year less than the usual time, and in both stood near the heads of their classes. On several occasions they accomplished mental feats quite beyond the usual student. Wishing once to enter an advanced class in German, they covered the prescribed work for two years in about 12 lessons taken during a period of six weeks so well that at the end of the following year they were among the very best of the third year class. Again they were able to commit to memory for the purpose of recitation a German poem of several hundred lines merely by reading it over a few times. They surpassed perhaps in literature and languages but also made excellent grades in scientific courses. They are very fond of poetry and offhand are able to repeat dozens of verses from the classical authors, which apparently have been retained from their school days without especial effort. They are fond of and well informed in architecture, music and painting.

Temperamentally they are emotional, sympathetic, sensitive, shy and modest, almost to a fault. Their lack of self-assertiveness has been a great handicap but nevertheless they have been quite successful in their work. They are to some extent introspective and seclusive, and conceal their real feelings and thoughts on many matters. Still they are very agreeable companions and have many close friends. They are perhaps somewhat morbid in their liking for the problems fabricated by writers of the Shaw, Ibsen and Browning types. Their likes and dislikes are similar.

They are described together because they are very similar mentally as well as physically. Their differences are almost too

subtle to analyze. One consistently made grades a few points higher than the other and also takes toward the other the protective attitude of an elder brother.

In the study both at first acquiesced and co-operated enthusiastically. Later, however, as a result of some remark of a meddler a concealed unwillingness to proceed further was detected in one more particularly, and the work as originally planned had to be given up. With one of the subjects an examination on some words of the list and also a second examination after an interval was not possible. This situation accounts for the different sizes of the groups of words used in the comparisons.

A list of 150 names, chiefly Christian names, was made, and then, usually with nobody else present besides the examiner and subject, although on a few occasions both subjects were present, the names were read off and the responses jotted down. Sometimes the subject would glance at the list and give the answer before there was time to read off the name. Usually the answers were given without a moment's hesitation, but with some names there was a period of hesitation, the subject explaining that the color was indistinct or difficult to describe, or that several colors were perceived and it was hard to select the dominant one. When the examination lasted longer than half an hour, the subject showed signs of fatigue and stated that such an array of colors was constantly present as to obscure that of the name. Although both subjects believed that their synesthesiae had disappeared some years before, these immediately appeared when the examination was begun. The second trial was made 3 months after the first, during which interval synesthesia was mentioned only a few times.

Before the examination the subjects believed that their associations were limited to Christian names, but during the tests it became evident that the names of a few cities, some letters and figures and those of the days and months were also colored. Further it was found that the converse association was present, thoughts of colors serving to recall names. With the months there was an interesting experience: When first asked concerning them one subject denied associations. A few days later, however, he said: "Oh the colors of the months suddenly came to me the other day." As it was with figures, letters, and the months, so it is the impression it would have been with many other words had the tests been continued. In his experience

Whipple found that associations were present in categories unsuspected by the subject. (1) It is the impression further that an exhaustive examination by a psychologist would reveal in synesthetes peculiarities in mental activity comparable to synesthesia, in many fields.

It is not desirable for reasons of brevity to give the entire list of words with the responses. It was found that of 80 words with which satisfactory responses were obtained from both subjects, there was at least approximate agreement, with 54.

In the subject who was twice tested, with only two words were distinctly different colors given on the second trial, 3 months later. On the first trial there were, however, 7 words for which no association existed, and on the second 19 different words, to leave out of all consideration the words for which there was no association on either test, and those in which it was not possible to decide whether there was the same association or not. The following tests give some idea of the difficulty of deciding this question, and also of the nature of the responses:

Subject I

Test name	Association 1st trial	Association 3 mo. later
George	red	pink, I think
John	yellow-brown	yellow
Henry	dark blue	dark
Alma	sort of white	yellow, I think
Nellie	pale yellow	pink, I think
Adolph	muddy, I hate it	red or brown-yellow
Adam	brown	dull red
Abraham	brown	red
Arnold	sort of yellow	red-brown
Thomas	pale blue	dark blue
Will	no association	kind of black (after an interval)
Smith	pale blue, I think	no association
Raphael	starry	white
Max	dark (after an interval)	no association
Ottillie	no association	red I think
Alonzo	yellow	brown or yellow- brown

Alexander	yellow	yellow-red
Gertrude	pale pink	several colors
Sarah	dull	blue
D.	sort of light	no association
L.	white	pale yellow

These names are the two on which there was a decided difference of association at the second trial:

Amy	very yellow	red
Jones	red	yellow

This list of names and responses gives the associations of both subjects:

Subject I		Subject II	
	1st trial	2nd trial	
John	yellow brown	yellow	red
Helen	light blue	pale blue	white
Ruth	red	red	rose, I think
Grace	yellow	yellow	very light buff
Mary	black	black	dark red
James	brown	brown	tan
Annie	pale	pale or white	pale blue
Homer	blue	blue or white	white
Cliff	real blue	real blue	kind of blue
Alexander	yellow	yellow	red
Kate	yellow	yellow or yellow brown	tan

Reversing the order of the test and giving the color as the stimulus word, gave the following results in subject I:

	1st trial	3 mos. later
Red	Alice, Adele, Ethel, Esther, Edwin, Edward	Alice, Ethel, Edwin, Ruth, Edgar, Allen
Green	Agnes, Verne, Fern	Agnes, Verne, Fern
Yellow	Charles, Catherine	Catherine, Marguerite, Charles, John
Orange	Julius, Julia	No association
Blue	Hildegard, Hugh, Sue, Howard and Lucy	Sue, Hildegard, Lucy, Hugh, Howard and Leland
Violet	No association	No association
Rose	Many names given to test word red	Same
Pink		

When names of members of the family and very common names were used in the comparison, the percentage of agreement was no higher than was the case with the entire list.

It is stated by both that the colors are as distinct as any could be from a colored object. They are not projected but are "seen in the mind." Besides some replies in the above list other evidence of personifications was obtained. Subject I likes 2, 3, 4, 6, 8, M, U, Q, X and Z; dislikes 7, R, S, T, and hates J. Poetry also has color associations in this subject. The colors of poetry seem to be determined more by the sense than by the individual words or letters. It may be that the facility with which both commit verse to memory is somehow a result of these associations.

No reason for the colors of many names can be worked out. A and E color many words red even when not forming the initial letter. So also U and H color some names blue and C some white. The associated color of Brown is brown. It is possible to venture an explanation for these associations: Sue, blue; Flora, red; Fern and Verne, green; Monday, blue. Indeed both subjects state that they believe Monday is blue because of the expression, "blue Monday."

No definite tests were made on other members of the family, but superficial inquiry gave no evidence of synesthesia in them.

Although the percentage of agreement in these subjects (67%) is the highest that has yet been found between two subjects, it would be dangerous to affirm that either suggestion or similarity of mental make-up play any great part in determining the colors. In the first place it seems likely that if more exact determinations of the associations were made, the proportion of agreement would be much lower. Again, considering the small number of colors given as associations, it is evident that the opportunity for difference is much smaller than if the number of colors were greater. With the proportion of identical factors of suggestion with which these subjects, being all their lives closely associated, must have come in contact and with the resemblance as to their mental constitutions, it would seem that responses should agree in a greater proportion of instances, if mental make-up and suggestion play any great part in determining associations.

It would seem that an intensive study of cases of synesthesia, for which the psychologist or perhaps the Freudian is probably best fitted, should throw light on many forms of mental activity. It is doubtful that such a study would repay the psychiatrist or

neurologist for synesthesia seems to be a manifestation of the normal mind. It is possible, however, that the spectra and scotomata of migraine may be in part synesthetic phenomena.

SUMMARY

In this paper first an attempt is made to give a brief resumé of the principal facts of synesthesia. Then are reported the results of a study of color-audition in twin brothers, whose mental characteristics are very similar. It is found that there was apparent agreement in the secondary sensations of the subjects with 67 per cent. of the test words, but it seems doubtful that the percentage would be so high if more accurate methods were used. It is concluded, therefore, that mental make-up and suggestion are not particularly important in determining the colors in associated sensations. Finally it is suggested that a study of synesthetes by the psychologist or psychoanalyst might reveal interesting peculiarities in other fields of mental activity.

REFERENCES

- (1) Whipple, Two cases of synesthesia, *American Journal of Psychology*, 1899-1900, XI, 377.
- (2) Harris, Colored thinking, this journal, 1908, III, 97.
- (3) Galton, *Inquiries into Human Faculty and its Development*, London, 1883.
- (4) Mercante, quoted by Pierce, Synesthesia, *Psychological Bulletin*, 1912, IX, 179.
- (5) Calkins, A statistical study of pseudo-chromesthesia and of mental forms, *American Journal of Psychology*, 1892-93, V, 439.
- (6) Ulrich, quoted by Laures, *Les Synesthesies*, Paris, 1908.
- (7) Peabody, Certain further experiments in synaesthesia, *American Anthropologist*, 1915, XVII, 143.
- (8) Raines, Report of a case of psycho-chromesthesia, this journal, 1909-10, IV, 249.
- (9) Alford, A Consideration of the auras of epilepsy and migraine. *Southard Memorial*, (unpublished).
- (10) Southard, On the mechanism of gliosis in acquired epilepsy, *American Journal of Insanity* 1907-8, LXIV, 607.
- (11) Prince, An experimental study of visions, *Brain*, 1898, XXI, 528.
- (12) Harris, On psycho-chromesthesia and certain synesthesiae, *Edinburgh Medical Journal*, 1905, n. s. XVIII, 529.
- (13) Holden, Colour associations with numerals, etc., *Nature*, 1891, XLIV, 223.
- (14) Boring, Cutaneous sensation after nerve-division, *Quarterly Journal of Experimental Physiology*, 1916, X, I.
- (15) Smith, Synesthesia, *John Hopkins Hospital Bulletin*, 1905, XVI, 258.
- (16) Laignel-Lavastine, Audition colorée familiale, *Revue neurologique*, 1901, IX, 1152.
- (17) Saurez de Mendoza, L'Audition Colorée, *La Salpêtrière*, 1899.
- (18) Quoted by Krohn, Pseudo-chromesthesia or the association of colors with words, letters and sounds, *American Journal of Psychology*, 1892-93, V, 20.
- (19) Harris, Colored thinking and allied conditions, *Science Progress in 20th Century*, 1914-15, IX, 135.
- (20) Thorp, Colour audition and its relation to the voice, *Edinburgh Medical Journal*, 1894-95, XI, 21.
- (21) Jordan, The colors of letters, *Popular Science Monthly*, 1891, XXXIX, 367.
- (22) Myers, Two cases of synesthesia, *British Journal of Psychology*, 1914-15, VII, 112.
- (23) Blanchard, De l'encéphalopsie chromatique, *Bulletin de l'Académie de Médecine*, 1916, LXXV, 615.
- (24) Grafe, Note sur un nouveau cas d'audition colorée, *Revue de Médecine*, 1897, XVII, 192.