SYNAESTHESIS: 'PRESSURY' COLD

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Last semester during the routine experiments, in the qualitative laboratory, on the temperature spots, one of the students (Miss Alexandra Hobart) made the very interesting observation that "some of the cold spots are felt in my teeth;" that is, besides the primary cold sensations localized upon the forearm where the stimuli were applied, she experienced at times secondary sensations of indefinite character localized in and around the teeth and cheeks.

Questions regarding these experiences brought out that we were probably dealing with a type of synaesthesis as yet undescribed, *i.e.* 'pressury' cold;[1] we learned also, that *O*'s mother (Mrs. M. F. McClure Hobart), a student in this laboratory 27 years ago, had a complicated form of synaesthesis—studied and described in detail by Whipple.[2] Because we apparently had here a type of synaesthesis that was new, and one that might also cast some light upon the hereditary theory of synaesthesis, it seemed worth while to make a further study of this case.

I. DESCRIPTION OF EXPERIMENTS AND RESULTS

Experiments. The routine laboratory experiments for cold were repeated.[3]

Experiments were first performed upon the area that gave anomalous results—the radial side of the left forearm, 16.5 cm. above the carpal folds. When the casual observations of the class experiments were verified, the experiments were extended to an area located symmetrically upon the right forearm; to areas on the external parts of the right and left upper arms, 20 cm. from the elbow; and to areas on the right and left legs, 8 cm. above the patella. These parts of the body were shaved, so as to avoid the possible distractions of tickle from the hair, and a map, 2 cm. sq., bearing cross-section lines 2 mm. apart, was stamped on the skin. The areas were explored with temperature cylinders[4] cooled by cracked ice. The

[1]The literature on synaesthesis is very extensive. Cf. the reviews and bibliographies of F. Suarez de Mendoza, *L'Audition colorée*, 1890, 1-139; W. O. Krohn, Pseudo-chromaesthesia, or the association of color with words, letters and sounds, this JOURNAL, 5, 1893, 20-41; F. Wehofer, 'Farbenhören' (chromatische Phonopsien) bei Musik, *Zsch. f. angew. Psychol.*, 7, 1913, 1-54; and R. H. Wheeler, The synaesthesia of a blind subject, *Univ. of Oregon Pub.*, 1, 1920, No. 5, 1-61.

[2]G. M. Whipple, Two cases of synaesthesia, this JOURNAL, 11, 1900, 377-404.

[3]Miss Hobart's laboratory partner, Miss Harriet W. Leaf, acted as *E* in all the experiments reported here.

[4]For a description of the apparatus see E. B. Titchener, *Experimental Psychology, Student's Qualitative Manual*, 1900, 54.

cylinders came to a point 1 mm. in diam. Stimulation was punctiform, and proceeded at the rate of one a second. Every square millimeter of the areas was worked over.

O was blindfolded and instructed to give a complete report of her experience, but to pay particular attention to the experiences of cold and to the concomitant experiences in the teeth and cheeks. When either an 'ordinary' cold or a 'toothy' cold spot—for thus did *O* designate the spots that gave the concomitant experiences—was discovered its position was marked upon a duplicate map by dots and crosses respectively. When the 'toothy' spots were reported, *O* attempted, by pointing and by verbal description, to localize the concomitant experience. When an area had thus been worked over and mapped, *O* gave a description of the concomitant experiences. Twenty four hours later, before the map had faded from *O*'s arm, the area was worked over in the same manner and a second map obtained.

Results. The results of these experiments corroborate the casual observation of the laboratory exercises. *O*'s cold spots were of two kinds: (1) those that gave only the "bright, flashing, lancing" cold experiences with which we are familiar; and (2) those that yielded additional experiences, localized in the teeth and cheeks. The average number of these two kinds of spots per sq. cm. found in the areas investigated is shown in Table I. No great significance is to be attached to the absolute frequencies, for the procedure was rough, and both *O* and *E* were relatively inexperienced. The significance of the data, however, lies in the fact that 'toothy' spots were discovered in both mappings, in all six of the areas explored. The relative frequency of the two kinds of spots varied greatly from area to area; on an average, however, there was 1 'toothy' to 2 'ordinary' spots. A surprisingly large number of spots were re-obtained in the second mapping. The data in Table I show that of the total number discovered 69% of the 'ordinary' and 81% of the 'toothy' colds were verified.

TABLE I

Showing the number of 'cold' and 'toothy' spots obtained per sq. cm. from the right and left forearms, upper arms, and legs; and the number and percent verified at the second mapping

AREA	Obtained in first mapping		Verified in second mapping		Percent of verification	
	cold	toothy	cold	toothy	cold	toothy
left forearm	7½	3½	5½	2½	73	71
right forearm	4½	5	3	4¼	66	85
left upper arm	5½	1¼	4	1¼	72	100
right upper arm	2¾	½	1½	¼	54	50
left leg	4¼	½	3	¼	71	50
right leg	2¾	1½	1¾	1½	58	100
TOTAL	27¼	12¼	18¾	10	69	81

In the first series of experiments—those upon the left forearm—all the secondary experiences were localized to the left of

the mesial plane. The experiments on the right arm and leg were undertaken to see whether this bilateral relation would persist. It did without a single exception; the concomitant experiences were always localized on the side of the body to which the stimulus was applied.

Within this limit, the secondary experiences were variously described and localized by *O*. At times the experiences were reported as 'cold' and localized in a specific tooth. Examples are:

"Cold in right upper front tooth" (right forearm stimulated);
"Cold sensation in tooth on right side lower row" (right upper arm).

For the most part, however, they were described as "pressury feels" and indefinitely localized in the teeth and cheeks, and occasionally in the eyes, ears, temples, head and neck. Examples are:

"That spot gave a reaction in the teeth. Began with a feeling in front tooth, spread to the left and disappeared" (left forearm);
"With that spot I experienced a flash in the cheek and neck" (left forearm);
"Vague sensation in left ear" (left upper arm);
"Pressury feel around left ear" (left leg);
"Pressury flash besides the left eye" (left leg);
"Pressury feel in right temple" (right leg);
"Ache in head much like that caused by eating ice cream" (right leg);
"Sensation in right eye ball" (right leg).

Movement in the secondary experiences was frequently reported. Examples are:

"Began with a feeling in front upper tooth, spread to the left and disappeared" (left forearm);
"The pressury experience begins most often in front teeth above the enamel line, that is it starts there and spreads out to one side or the other depending upon the side stimulated. It is not, however, always definitely localized" (introspection given at conclusion of the experiments).

The secondary experiences were usually concomitant with the primary. On a few occasions, however, a temporal disjunction was reported. Examples are:

"After a very cold spot, I had a sensation in the left front tooth" (left leg);
"Developed into tooth sensation. Seemed as though the stimulus had been held on the spot" (right forearm).

In order to determine whether cold was the necessary stimulus, an attempt was made to stimulate a few of the 'toothy' spots by pressure, but to no avail. Cold seemed to be the only adequate stimulus.

The examination of this case reveals that we have here phenomena that are synaesthetic in type. They are intermediate in complexity between colored hearing, colored tastes, odors, etc.—phenomena that involve the higher senses; and the 'thrills' and 'goose-flesh' occasioned by the hearing of the rasp

of a file, the scrape of the finger nails, or the squeak of chalk upon the blackboard,[5] etc.—experiences which involve the lower senses and which are more or less common to all mankind.[6]

II. Discussion

The importance of this case lies not only in the fact that we have here a new type of synaesthesis, but also in the fact that it may throw some light upon the hereditary hypothesis first advanced by Cornaz[7] in 1848, and since then both denied and re-affirmed by many investigators. The evidence against the hereditary theory of synaesthesis and in favor of the associative theory lies chiefly in the fact that case histories and questionary results do not show that the trait has been transmitted from one generation to the next. But questionaries are notoriously inaccurate, and case histories are adequate only where the parents or children of the synaesthetic subjects are personally interviewed and examined. To ask a synaesthetic subject about the peculiarities of his parents' or children's experiences is the questionary over again, but at one step removed, with the chance of error and inaccuracy greatly increased.

We know the facts about our *O*. Though her mother has synaesthetic images with noises, tones, tastes, and smells, and also a few personifications, our *O* has, besides the pressury colds just discovered, no other form of synaesthesis. Had she been asked previously to this experiment if she had any synaesthetic images, she would have replied in the negative. If our *O*'s mother had been asked whether her daughter experienced any such phenomena her reply would likewise have been in the negative. A questionary or the ordinary case history would have failed to reveal the facts in this case.

An hereditary theory does not necessarily imply that the same kind of synaesthetic images should be experienced by parent and offspring. Nothing more is hypothesized than that the offspring—or some of them, for synaesthesis, like color blindness, may prove to be sex linked—inherit a peculiarity of nervous

[5]The ice-cream pain variously localized in the head, though of extremely common experience, are not included here, for it is very doubtful whether they are of synaesthetic origin. Until more is known about them they must be regarded simply as referred pains (Cf. E. G. Boring, Sensations of the alimentary canal, this Journal, 26, 1915, 25, 35 ff.) originating in the stimulation of the esophageal and gastric branches of the vagus, or due to the faulty localizations of the sensations aroused in the esophagus.

[6]Whether they are common to all mankind is undetermined, since no reports, so far as I have been able to discover, have been made concerning the experiences of shrill sounds by aborigines.

[7]C. A. Cornaz, *Des abnormités congénitales de jeux et de leurs annexes*, 1848.

constitution—unusual anastomoses or abnormal crossing and uniting of afferent fibers—which will be evinced in some one or more of the many types of synaesthesis.[8] There is no *a priori* reason, however, why the peculiarity of nervous structure should, in different generations and different individuals, be equal in extent or identical in location. One generation may show one type of synaesthesis, the next another. Or, as in the present instance, the mother may have photisms with tones, noises, smells, and tastes, and the daughter 'pressury' colds; yet a common hereditary trait may be responsible for both.

In giving the case history of *O*'s mother, Whipple reports that, "no trace of colored hearing can be found in the other members of the family."[9] Whether colored hearing specifically existed is unimportant, what is important is whether either of the parents had synaesthetic images of any kind. Furthermore, Whipple does not tell us whether he based his statement upon an examination of his subject's family. The presumption is that he did not, that he relied, as so many investigators before and since him have done, upon his subject's knowledge and report. This, particularly when it is negative, has but little value; one individual's knowledge of another's—even a parent's—mental peculiarities may be practically nil. A parent may have a pronounced case of synaesthesis; yet the children may know nothing of it. Even questions put to the individual concerned may fail to bring out the fact, either because the questions are too specific and do not cover the particular variety involved, or, as in the case of our *O*, because the individual himself may be totally unaware that he has synaesthetic images. It is only when the peculiar conditions necessary for their arousal are present that they may make themselves known.

The fact that synaesthetic images appear suddenly and are sometimes unnoticed until comparatively late in life, as in the case of our *O*, is brought in evidence against the hereditary theory. Whipple reports that *O*'s mother at the age of 16 suddenly experienced colored hearing, and remarks that "the hypothesis of heredity seems to be refuted by the fact that the first instance of the phenomenon was quite sudden and hallucinatory in character, and of late origin."[10] Suddenness and lateness of appearance is, however, no argument either for the associative theory or against the hereditary. They are merely facts that need explaining, and indeed when it comes to that they are more difficult to explain by the associative theory than by the hereditary. As a *post hoc* explanation, the associative theory may be

[8]Wheeler lists 34 varieties, *op. cit.*, 32 f.

[9]Whipple, *op. cit.*, 378.

[10]*Ibid.*

stretched to explain the various phenomena experienced afterwards, but it is totally unable to account for the first appearance. Both of these points, however, may be accounted for upon the hereditary hypothesis by assuming that the inherited neurological condition was there, but that the essential objective conditions for the appearance of synaesthetic images were not previously present. This seems certainly to be the explanation of the suddenness and lateness of the appearance of the 'pressury' colds experienced by our *O*, for until she came to the laboratory experiments on cold the objective conditions had never been so favorable. It was only when the cold spots were stimulated separately and she was free from distractions, in the objective attitude, and set for a description of experience, that she suddenly became aware of the synaesthetic images.

Now that these images have been focalized, they may of course be experienced under other and less favorable conditions; but this does not mean that the first sudden experience established an associative mechanism which is responsible for their later appearance. What factors, one might well ask, were responsible for the association in the first instance; and, in view of our results, why was the associative mechanism established only in the case of some of the cold spots—about one-third of them—and not for others.

Suddenness and lateness of occurrence, moreover, do not necessarily imply that the concomitant phenomena had never before been experienced. Doubtlessly, they had been previously experienced; but since they had no meaning and played no functional part in mental life, the subject ignored them, brushed them aside, without ever becoming fully aware of them. We do not for a moment believe that our *O* never before had 'pressury' colds, but only that never before had she become distinctly aware of the pressure component. The case is similar with the positive and negative after-images of vision and with many other mental phenomena that come to most students of psychology as 'new,' as something never before experienced. The lecture demonstration is not the first time that these phenomena have been aroused; it is merely the first time that they have been consciously present. A single demonstration is all that is needed to set the students observing their after-images under other conditions. Knowledge that such phenomena occur is all that is necessary. The case, we feel, is similar with synaesthesis. A particular subject may be unaware that he has synaesthetic images until conditions arise in which they are so clear, so intense, so insistent that he is forced to attend to them. They will of course be described as coming suddenly, and—if this collocation of conditions occurs comparatively late in life—as late. Once attended to, the synaesthetic images may recur in

experience; but, as with the after-images, this merely shows the importance of 'knowledge about;' it is no argument against the hereditary hypothesis.

SUMMARY

The findings of this study may be summarized as follows:

(1) A type of synaesthesis—'pressury' cold—hitherto undescribed has been reported.

(2) *O*'s cold spots were of two kinds: the 'ordinary' spots that gave the usual experiences, and 'toothy' spots that gave also secondary experiences localized in and around the teeth and cheeks.

(3) The 'toothy' cold-spots occur on all the parts of the body experimented upon—the right and left forearms, upper arms, and legs—though with varying frequency.

(4) The secondary experiences aroused by stimulation of the 'toothy' spots were always localized upon the side of the body stimulated.

(5) A second mapping, made 24 hours after the first, verified 69% of the 'ordinary' colds and 81% of the 'toothy' colds.

(6) The secondary experiences were described as light, transient, and pressury in quality.

(7) The results of this case, in view of the fact that *O* has a synaesthetic inheritance, appear as evidence of the hereditary theory of synaesthesis.