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MENTAL IMAGES.

BY E. A. KIRKPATRICK, WINONA, MINN.

SPENCER, in his "Philosophy of Style," decides in favor of the English custom of placing the adjective before the noun because when the word "horse," for example, is pronounced, there tends to arise in the mind a mental image of a horse, probably of a brown color, since that is most common, and when the adjective "black" follows, as in French, this image must be changed, producing hindrance. While listening to a recitation upon this well-known passage, in a high school, the question came to me: "Do people form distinct mental images when words are spoken?" I immediately obtained permission to test the matter there and later in the grammar school and in a college in the same town.

The following ten words were selected and pronounced, one at a time, the pupils being requested to write down just what came into their minds when the words were spoken: "church," "book," "drum," "tree," "horse," "dog," "chair," "stove," "man," "lamp." They were told to give the size and color, if it were visual, and if it was something heard or felt to state that fact.

The answers were various, and of all grades of distinctness and vagueness, so that the task of classifying them was very difficult. This standard was finally adopted. If the writer mentioned the size and color of the object, or named an individual or species of the general class indicated by the word, his mental image was counted as a distinct mental image, otherwise it was not. Three classes of visual images were found: (1) distinct, including all that conformed to the standard given above; (2) particular, including those of the above that were of particular or individual things; (3) indistinct images, or none. The auditory and tactile images, which were very few in number, were classified separately.

The general results for the different grades of pupils and classes of students, and the sexes are shown in table I.

It will be seen from the general average that for those persons and those words distinct visual images were found in about three-fourths of the cases. The conditions were much more favorable, however, for forming mental images than are present in ordinary reading or listening. More time was allowed between the words. A tendency to form mental images was excited by the preliminary remarks, and the fact that they were to write something tended to make them form more distinct men-

TABLE I.

	Grammar School				High School				College Students				Gen. Aver.													
	7th G.	8th G.	Average.	9th G.	10th G.	11th G.	12th G.	Average.	Fresh.	Junior.	Senior.	Average.														
F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.													
No. of Persons,	12	12	13	18	25	30	22	22	21	22	9	7	8	3	60	54	14	32	13	21	16	21	43	74	128	158
Distinct Im'g's,	8.51	7.08	7.61	7.72	8.04	7.46	9.13	8.18	8.23	7.36	8.00	7.71	9.12	4.66	8.65	7.64	7.42	6.96	6.30	6.75	6.06	5.90	6.58	6.74	7.83	7.19
Particular,	2.75	2.91	3.07	4.50	2.92	3.66	2.40	3.00	4.00	4.27	3.00	4.14	3.00	2.66	3.11	3.68	2.85	2.77	1.77	3.75	3.75	2.23	2.86	2.90	2.21	3.36
Indistinct or None,	.91	.25	.207	.216	1.52	2.20	.76	1.68	1.66	2.50	1.99	2.00	.87	5.33	1.25	2.29	2.28	2.68	3.15	2.35	3.56	3.57	3.02	2.85	2.21	3.36

tal images. In a subsequent experiment upon about two hundred normal students, when more care was taken not to make the preliminary explanations suggestive, the number of distinct mental images was about ten per cent less, and in the case of four hundred school children considerably less than that, but in this latter case many did not understand what was wanted. When particular things are thought of the descriptions may have been given from memory, in some cases, without any distinct mental image being present, but the general term was, at any rate, translated into a particular thing which represented the class. These results do not prove that in reading three-fourths of the names call up distinct mental images, but they indicate that in a large proportion of cases there is a strong tendency to form such images, which is probably often effective in slow, careful reading.

It will be seen that the females show a stronger tendency to form mental images than the males. This is especially evident when the particular images, which are less surely distinct, are not counted. The numbers in each grade or class are so few and the ages of the members in each so different that not much importance can be attached to the differences shown in the table. It is significant, however, that among the college students, where, all being adults, age is a less important factor, and where each year they take up more abstract subjects, the tendency to form distinct mental images decreases from the lower to the higher classes. Galton, in his study of mental imagery, found that some eminent men who had spent many years in abstract studies, were utterly unable to form distinct mental images. On the other hand those who deal much with objects sometimes form mental images as distinct and vivid as the original, as, for example, the painter mentioned by Taine, who looked at his subjects when sketching the general outline, then filled in the details from the mental image he had formed.

The results classified according to the age of the subjects are given in table II:

TABLE II.

No. of Persons, (Females),	-	3	5	14	21	24	9	14	6	3	2	9	8	7		
Age,	-	-	-	12	13	14	15	16	17	18	19	20	21	22	23	24
Distinct Images,	-	-	7	8	8.71	8.66	7.33	8.77	7.83	7.83	8.33	4.50	6.44	5.12	6.00	
No. of Persons, (Males),	-	-	4	8	20	16	16	7	11	18	18	7	7	5	8	
Distinct Images,	-	-	8.25	8.75	6.75	9.05	7.47	5.00	8.00	6.88	7.00	6.85	6.40	6.83	4.37	

In the case of boys of fourteen and seventeen years the average is cut down by the fact that there were several who formed no distinct mental images, though it would have been low anyway, and in several other cases the numbers are so small that only slight importance can be attached to the figures. The very high average for boys of fifteen is quite suggestive. The average for girls of fourteen is also high. It is well known that great changes take place during the period of adolescence, especially in the boy. It has been shown that it is a period of rapid growth and good health, and that it is preceded and followed by short periods of slow growth and poor health. Recent experiments have also shown that at this period there is a rapid increase in the rate of voluntary motions. These figures suggested that perhaps the same law holds for the formation of mental images as for growth, health and motion. I accordingly repeated the experiment upon about four hundred more school children. The results for boys from thirteen to seventeen were as follows:

	13	14	15	16	17
and for boys:	3 7-12	3 4 10-29	3 9-29	2 3-11	
and for girls:	4 8-33	3 3 1-2	3 7-23	3	

I arranged in marking the papers so that I should not know the age of the subject whose answers I was classifying, hence my judgment could not have been influenced by my theory. The large number of distinct images formed by boys of fifteen compared with those of other ages, especially fourteen and seventeen, is again very marked. There is considerable probability that the law of change in the tendency to form mental images is somewhat like this. The tendency to form mental images decreases just before the period of adolescence, increases very rapidly early in that period, decreases at its close, then increases or decreases according as the occupations and studies favor or oppose the tendency. More extensive experiments and more exact methods will be required to demonstrate the law.

The words used were not all equally effective in calling up mental images, but the difference is not very marked.

Table III shows the per cents for the different words with the high school pupils:

"Church," being the least general term in the list, produces the most distinct images, but a large proportion of them are particular, usually of the one the writer attends. The following are typical answers: *School Children*—"Methodist church front door," "Congregational church with a large crowd singing," "A country church with a steeple," "A large white church with people going in and out," "Word 'church' printed," "A little white church on a hill in Ovid." *College Students*—"A gothic building with spire," "A generalized type of a church building," "Pictures of the exterior color somewhat dull," "Interior of the church I have attended the later years of my life, the people gathered," "A religious organization," (none of the school children gave this answer) "Sermon or religious service," "The image of several churches in succession, the Congregational first,"

"A white church with a spire in the corner," "First an edifice capped with a spire, then a preacher standing before his audience," "Congregational as seen from the library this morning," "Congregational views from the N. E.," "White building longer than wide, with green shutters and a spire." "A common country church building," "Image of a light stone church situated on a hill."

Book ranks next to *church* in the number of distinct and particular images called up. The particular image most frequently suggested was of the book from which the pupil was to recite next.

School Children.—"Leaves of a reader," "Circuit Rider," "Study," "A real good novel" (how suggestive this answer), "Longfellow," "Small colored white and brown," "Daniel Webster's dictionary" (!), "Bible," "See a large red book full of poems on the table," "Large, with gold edges," "Scottish Chiefs," "A large dictionary on a rack," "The knowledge one would have if he could tell all the important events in history." *College Students*—"Reading

school," "The ordinary book form," "Food for the mind," "General idea of a book," "The thoughts of some person," "Picture of a book closed," "An object which contains

Word.	Church.	Book.	Drum.	Tree.	Horse.	Dog.	Chair.	Stove.	Man.	Lamp.
Sex, -	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.	F. M.
Distinct Images, -	89.5 86.6	73.0 82.7	79.0 80.0	87.0 70.0	82.0 76.6	79.0 77.3	73.5 66.6	82.0 66.6	80.5 70.0	81.0 72.4
Particular, -	76.2 76.6	58.0 66.6	29.0 46.6	26.5 43.3	24.0 30.0	18.0 36.6	18.6 33.3	16.0 36.6	40.0 60.0	16.0 36.6
Indistinct or None,	10.5 13.3	27.0 17.2	16.0 13.3	13.1 30.0	18.0 23.3	20.5 26.6	26.5 33.3	16.0 33.3	19.4 30.1	19.0 27.4

The numbers indicate per cent.

TABLE III.

printed matter," "Indefinite, stiff cover, open," "A 12mo. bound in cloth, black in color," "Indistinct form of a book," "Hawthorne's *House of Seven Gables*," "A small black book."

The word drum called forth remarkably few auditory images. The Salvation Army drum which had been carried through the streets every evening for some time was most commonly thought of, the image usually being visual. Drums in certain bands were next most common. *School Children*.—"Circus parade," "Large base drum with sticks on it," "Small, with a very pretty girl playing," "Small drum with silver bands," "An army," "Ear drum," "A little drummer boy in a crowd and fifers." *College Students*.—"A large noisy instrument with a man or boy attachment," "My little brother using his drum," "Picture in mind of a drum, size medium, red trimmings, stretched skin across the top, cord on the sides" (evidently this image became distinct as the writer wrote the description), "My little cousin and his drum, auditory as well as visual," "A big base drum with a man pounding on it," "A band walking the street," "Drum of my native city with name of town in black letters," "An old drum I had in my childhood," "Noise and Fourth of July procession," "Form [?] and their sound," "Image of a child's drum with red ornaments."

The word tree called forth images of nearly every kind of tree growing in that region and some that do not. The maple was most frequently mentioned by the school children, probably because they were specially interested in it at that time of year. The particular trees were usually of the school grounds, the college campus, or the yard at home. Although the trees were bare at that time, many of the images were of trees in full leaf.

School Children.—"Maple tree tapped, with a sap can," "The cherry tree that George Washington cut down," "Tree of life," "A maple tree tall and straight, but leaves withered," "I fancy I am sitting under it in summer time eating apples," "A tall tree with spreading branches," "An apple tree in blossom," "A tree without leaves, maple, I think," "Big trees in California." *College Students*.—"A representation of vegetable life, something growing," "Green leaves and shade," "That of a dream I had last night," "A particular tree which, when I began drawing lessons, I pictured," "Hear the rustle of the leaves moved by the wind," "Mass of foliage," "A symmetrical body," "Leafless trees, bare branches," "A large stately oak."

The word horse called up images of horses of all sizes, ages and colors, the particular horse thought of usually being that belonging to the family.

School Children.—"Axtell" (the noted Iowa trotter), "A bay horse attached to a red-wheeled buggy," "A horse with wings," "Geo. H. trying to hold a runaway horse," "Maud S," "Black horse in a red barn," "A black horse going at full speed," "The horse I draw pictures of," "Team I saw this morning." *College Students*.—"A black horse in a pasture," "Picture of a horse with a fine-shaped head and curly mane," "One which I saw loose on the street yesterday," "A horse travelling very fast," "Visual image of the word horse," "A large bay horse; I used to work with such a one," "A span of gray horses, not particular," "Pony with a saddle," "A vague image of a horse trotting down the road," "Horses struggling with a heavy load."

The answers given above are typical of the kind of answers given for the other words.

The question of what determines what one of the many possible mental images shall be called up at any particular time by a word is a very interesting one. One would naturally think, as Spencer suggests, that the image of the object most often seen would be the one called up and used to represent the class. In many cases this is true. The particular images, however, are often of objects recently seen. Again, the effect of early association is prominent, e. g., a college senior thought of the

high chair he used to occupy. In other cases intensity of the impression produced by its novelty, oddity, or some emotional accompaniment, seems to be the principal cause.

It may be asked, Is it not entirely uncertain what kind of a mental image an individual will form when a word is spoken? May it not be of one kind at one time and of another the next hour or day? Galton tested himself several times under entirely different circumstances and was astonished to find in what a large proportion of cases the same thing was called up by the same word. In order to test this matter I repeated the experiment upon the senior class after an interval of a month, during which there had been a ten days' vacation. Twenty-three papers were obtained of those who had been tested before, and the answers were classified. The results were very much the same as in the first test. In the case of distinct images, not particular, the results were almost identical, thirty-five such images being called up in the mind of the boys the first time and thirty-three the second, and twenty-four both times in the minds of the girls. Upon comparing the two sets of papers individually, I found that forty per cent of the answers were identical and ten per cent were nearly so. The greatest variation was in the case of particular images, especially where recency was the principal factor in producing them. Yet I found that where one formed particular images in one case he did in the other, though often of a different thing. Those who formed distinct images in the first case did in the second, and those who formed none, or vague ones, in the first case, did the same the second time. I was surprised at this result and my confidence in my experiments very much strengthened by it. It shows that the mind works according to fixed laws, and justifies one in believing that the kind of mental images one forms are just as characteristic of his mental organization as his features and gestures are of his bodily. Were we accurate observers of mental phenomena we could recognize the language and thought of a friend as readily as we can his handwriting.

The individual differences in the tendency to visualize vary greatly and form an interesting study. They play an important part in the mental processes of some, while others do not use them at all. For convenience, we may divide people into two classes—the non-visualizers and the visualizers. So far as could be determined there is no more reason to expect one to be intelligent than the other. The following answers from two seniors illustrate two types of the first class. The first is from a rather dull student who forms concepts instead of images, the second from one of the keenest reasoners in the class—a “relational” thinker who thinks not of the thing named, but of some related thing:

Church, a religious organization.

Book, an object which contains printed matter.

Drum, a large musical instrument (round).

Tree —

Horse, a large quadruped.

Dog, a very friendly animal.

Chair, an object generally composed of wood, used for comfort.

Stove, an iron—

Man, a being made in the image of God.

Lamp, a glass object containing a wick and oil, which is used in giving light.

Church, pews, pulpit.

Book, leaves, intelligence.

Drum, a noise.

Tree, a symmetrical body.

Horse, a beast of burden.

Dog, household pet, fights the cat.

Chair, a comfortable lounging place.

Stove, a cooking apparatus.

Man, the crown of creation, the complement of woman.

Lamp, gives light unto all that are in the house.

Of the visualizers some nearly always form distinct visual images, either general or particular, others do not always do so spontaneously when a general term is heard, but can at will. The following answers show that the writer thinks in visual images, but the images are not generally very distinct.

“Church—A particular building in another town where a certain event took place. Book—General image. Drum—An image of a drum. Tree—The image of a general tree, not any particular one. Horse—An image of a former horse of my own. Dog—Image of the general form of a dog. Chair—Image of the general form of a chair. Stove—An image of a hard-coal burner with a fire. Man—General image.”

The following are the answers of a young lady who always thinks in visual terms and who generally uses the same images for the same notion.

“Church—White wooden building with spire rising from the front. Book—Image of a book, always of a dark gray color. Drum—Probably image of the first one I ever saw. Tree—Very similar to the toy tree that came with Noah's Ark. Horse—A white or dappled gray horse, always prancing. Dog—A black Newfoundland. Chair—Common cane-seated oak chair. Stove—Image not well defined. Man—Not particular, idea. Lamp—Greasy little lamp with glass globe.”

The extent to which visual images predominate in most minds is quite surprising. Only about three per cent of the distinct images called up by the ten words in the list were other than visual. In a subsequent experiment upon 227 normal students 2.4 per cent of the images were auditory and 1.2 per cent tactile and motor. This does not mean that 96 per cent of these people are eye-minded to such an extent that they cannot form anything but visual images, but it shows the proportionate strength of the tendency to represent everything in visual terms.

The power to visualize (not the spontaneous tendency to do so) and the power to form auditory images were studied in another way. The normal students mentioned above were asked to think of the breakfast table at which they had sat that morning, then they answered questions as follows: (1) Have you a distinct image of it? Yes, 211; No, 10. (2) Is each object well defined? Yes, 183; No, 20; Part, 15. Do they appear in their true color and brightness? Yes, 167; No, 36; Part, 13. (4) Do they seem at a definite distance? Yes, 173; No, 43; Part, 3. (5) Can you mentally hear the voices of your companions as distinctly as you can see their faces? Yes, 84; No, 108; Part or almost, 22. These answers are very interesting, but too much importance must not be attached to them, especially the first. Paradoxical as it may seem, a person is a very poor judge as to the distinctness of his own mental images. I am convinced that persons who usually form very distinct images are as likely to say of any particular image that it is not distinct as one who has the power to form only the vaguest images. Each answers according to his own experience and standard of judgment, and the “vague image” of one may really be much more definite and vivid than the “distinct” image of another. An objective test and standard of judgment applied by some one else will give more accurate comparative results.

The relation of mental images to all psychical processes and to pedagogical problems is very interesting and important. Their relation to memory is peculiarly close, and a number of experiments to determine it were made but cannot be reported in this article.