INDIVIDUAL DIFFERENCES IN THE IMAGINATION OF CHILDREN.¹

BY WM. H. BURNHAM.

Since Kant it has been customary to distinguish between the reproductive and the productive imagination. The former merely reproduces ideally sense-impressions; the latter recombines original impressions to make new wholes. Briefly, the one is the imagination of any Gradgrind; the other the imagination of the poet and the painter. Leaving out metaphysical considerations we may say, then, that the work of imagination is either the reproduction of images or their combination. The reproductive imagination must furnish all the raw material. The productive imagination may combine this material in endless variety, but is at the same time limited by it. Differences of imagination are both of degree and of quality. Differences in reproductive imagination are largely qualitative differences. Differences in productive imagination are differences of degree. It is the purpose of this paper to illustrate these differences.

I. *Differences in Reproductive Imagination.*

The primary meaning of the word *image* is, of course, a visual picture; but the usual psychological meaning is rather a copy of any sensation. An image, as Taine puts it,² is a spontaneously recurring sensation, which in general is less vivid and less precise than the sensation properly so

¹ QUEYRAT, F., *L'Imagination et ses Variétés chez l'Enfant*, Paris, 1893.

BINET, A., *Jacques Inaudi*, *Revue des Deux Mondes*, June 15; translated in the *Pop. Sci. Mo.*, Nov., also in the *Chautauquan*, Sept., 1892.

BEAUNIS et BINET, *Questionnaire de Psychologie Adressé aux Peintres*, *Revue Scientifique*, Sept. 10, 1892.

BINET, *Mental Imagery*, *Fortnightly Review*, July, 1892.

RIBOT, *Une Enquête sur les Variétés des Concepts*, *Revue Scientifique*, Sept. 3, 1892.

JAMES, *Psychology*, Chap. on Imagination.

² On Intelligence, p. 36.

called. Under present conditions of education imagination's content is made up chiefly of elements from four different sources, namely, the senses of sight, hearing, the muscle sense, and the dermal senses. Four different types of mind have been distinguished according as images from one or another of these four senses predominate in imagination.

1. *The Tactiles.* Those who reproduce in imagination chiefly impressions from the dermal senses—the so-called tactiles of French writers—are, I believe, very rare. The best if not the only examples of this type are found among the blind. Blind deaf-mutes like Laura Bridgman and Helen Keller must, obviously, belong either to this or to the motor type, or to an evenly balanced tactile-motor type. All of us, however, can with more or less vividness reproduce images of touch; and with some they play a much more important part than with others.

2. *Visual Type.* The majority of people, perhaps, belong to this class; visual images predominate in their thinking, and consequently the eye is usually most highly prized of the senses. The popular opinion is admirably expressed by Thoreau:

"The eye does the least drudgery of any of the senses. It oftenest escapes to a higher employment. The rest serve and escort and defend it. I attach some superiority, even priority, to this sense. It is the oldest servant in the soul's household; it images what it imagines, it ideates what it idealizes. Through it idolatry crept in, which is a kind of religion. If any joy or grief is to be expressed, the eye is the swift runner that carries the news. In circumspection, double; in fidelity, single, it serves truth always, and carries no false news. Of five castes, it is the Brahmin. It converses with the heavens. How man serves this sense more than any other! When he builds a house, he does not forget to put a window in the wall. We see truth. We are the children of light. Our destiny is dark. No other sense has so much to do with the future. The body of science will not be complete till every sense has thus ruled our thought and language and action in its turn."¹

There are, of course, among their class great individual differences, varying from the visualizing power of the ordinary individual who can learn a series of figures or a list of words easier by seeing them than by hearing them, to that of the painters who can visualize a subject after one sitting, or of the mathematical prodigies, like Bidder, who, it is said, could see, "as if photographed on his retina, the exact figures

¹Thoreau, *Autumn*, pp. 56-57.

whether arithmetical or geometrical, with which he was occupied."¹

Fechner was perhaps the first to call attention to individual differences in visualizing power; and the results of Galton's² important investigations are well known. While the latter found men of science usually deficient in visualizing power, people in general society furnished him with numerous instances of remarkable visualizing power. Some persons read their speeches from mentally seen manuscripts; others have number-forms in which figures always arrange themselves. "Some few persons," says Galton, "see mentally in print every word that is uttered; they attend to the visual equivalent and not to the sound of the words, and they read off, usually as from a long imaginary strip of paper, such as is unwound from telegraphic instruments."³ Mr. Petrie habitually works out sums by aid of an imaginary sliding rule, which he sets in the desired way and reads off mentally. "The power of visualizing is higher in the female sex than in the male," says Galton, "and is somewhat, but not much, higher in public school boys than in men." And of the visualizing power in children he says: "There is reason to believe that it is very high in some young children, who seem to spend years of difficulty in distinguishing between the subjective and objective world. Language and book-learning certainly tend to dull it."

Many cases of good visualizing power among children might be cited. George Sand seems to have been a good visualizer and to have retained her power in later life. "I never look at certain mosses in my herbarium," she says, "without finding myself again under the oaks of Frascati. A little stone makes me see again all the mountain from which I brought it, and recall the same with all its minutest details from top to bottom. The odor of the *liseron-vrille* makes a terrible Spanish landscape appear before me, of which I know neither the name nor the location, but which I passed by with my mother at the age of four." A more remarkable case is that of the painter Doré. When a youth he reproduced Raphaels from memory. He objected to the study of models except in the swimming school, and said: "My mind is my model for everything."⁴

Some of the cases of extreme visualizing power among adults are the best illustrations of this type. For a single example, take the frequently cited case reported by Charcot. The visual-

¹ Scripture, *Amer. Journal of Psychology*, IV. 1, p. 57.

² See *Inquiries into Human Faculty*. New York, 1883.

³ *Op. cit.* p. 96.

⁴ Macchetta, *Life of Doré*, p. 99.

izing power of one his patients is described as follows : He no sooner thought of persons or things, but features, forms, and colors rose with the same clearness, sharpness and accuracy as if the subjects stood before him. When he tried to recall a fact or a figure in his voluminous polyglot correspondence, the letters themselves appeared before him with their entire content, irregularities, erasures and all. At school he recited from a mentally seen page, which he read off line by line and letter by letter. In making computations, he ran his mental eye down imaginary columns of figures, and performed in this way the most varied operations of arithmetic. He could never think of a passage in a play without the entire scene, stage, actors, and audience appearing before him. After business troubles, loss of sleep, and so on, a great change occurred in this man. Everything now seemed new and strange. He had lost all memory of forms and colors. Every time he returned to A., from which place business often called him, he seemed to himself as if entering a strange city. His memory gradually returned, however, or rather he could use it in a different way. In short he had lost his visual memory and become ear-minded. In his condition after this change he will serve as an illustration of the third class.

3. *The Auditory Type.* He can no longer draw. Asked, for example, to draw an arcade, he says, "I remember that it contains semi-circular arches, and that two of them meeting at an angle make a vault, but how it *looks* I am unable to imagine." He cannot remember his wife's and children's faces. He knows that his wife's hair is black, but he cannot recall its color. "Now when he seeks something in his correspondence, he must rummage among the letters like other men, until he meets the passage. He can recall only the first few verses of the Iliad, and must *grobe* to read Homer, Virgil, and Horace. Figures which he adds he must now whisper to himself. He realizes clearly that he must help his memory out with auditory images, which he does with effort. *The words and expressions which he recalls seem now to echo in his ear, an altogether novel sensation for him.* If he wishes to learn anything by heart, a series of phrases for example, he must *read them several times aloud*, so as to impress his ear. When later he repeats the thing in question, the sensation of inward hearing which precedes articulation rises up in his mind. This feeling was formerly unknown to him..... He dreams no more in visual terms, but only in words, usually Spanish words."¹

Such is the auditory type. This class probably is not nearly as common as the visual type; but still there are

¹James, Psychology, Vol. II. pp. 58-60.

many poor visualizers who seem to have unusually good auditory memories. The difference between the two types is illustrated by an example given by M. Bernard.¹ "When I write a scene," said Legouvé to Scribe, I *hear*, but you *see*. At each phrase that I write, the voice of the person that speaks strikes my ear. Your actors walk about, they gesticulate before your eyes. I am a *listener*, you a *spectator*." "Nothing is more true," said Scribe. "Do you know where I am when I write a piece? In the middle of the parterre."

There are no sufficient data to show how common this type may be among children; but some interesting cases have been reported. Many singers belong to this type. The case of Mozart is usually cited. At the age of fourteen, after hearing Allegri's *Miseréré* for a single time,² as he was forbidden by the popes to copy it, he reproduced the entire work from memory. This power of auditory memory is frequently found at a very early age. A case is cited of a child who at the age of nine months could repeat accurately notes played on the piano. Stumpf's child could follow the scale in singing at the age of fourteen months; and it is said that the son of the composer Dvorak, at the age of a year and a half, could sing his father's melodies while the latter accompanied him on the piano.³ Mozart composed at the age of six years, and other famous musicians have shown their power at an early age.

Another example of the auditory type seems to be furnished by Inaudi, the mathematical prodigy. A Piedmontese shepherd in early life, he first manifested his passion for figures at the age of 6, and at the age of 7 he could multiply numbers of five figures. He used no material aids, such as counting upon the fingers, pebbles, and so on, like some other famous calculators; but the operations with him were entirely mental, and he used only words. He could not read, but his brother taught him the names of numbers up to 100, and by these names he represented numbers to himself in his calculations. In 1880, at the age of 13, he came to Paris, and has since learned to read and write, and is skillful in playing cards and billiards. He performs operations in addition, subtraction, multiplication, division, extraction of roots, and arithmetical problems corresponding to equations of the first degree. These are all mental calculations, without any reading, writing or mnemonic device. As an example of his work he was asked the number of seconds in 18 years, 7

¹ De l'Aphasie, p. 50. Cited by Queyrat, op. cit. p. 66.

² Taine says *twice*, op. cit. p. 41.

³ Queyrat, op. cit. p. 63.

months, 21 days and 3 hours. He gave his answer in 13 seconds. But he knew beforehand the number of seconds in a year, month and day. The basis of his calculations is multiplication. In multiplying he begins at the left, as is usual with mathematical prodigies; and he decomposes a complex problem in multiplication into a series of simple ones. Many of the arithmetical prodigies have performed such examples by visualization. Bidder said that he always depended upon visual images in his calculations and could conceive of no other possible way of doing mental arithmetic. But Inaudi does not visualize.

"When a problem is given to him orally," says Binet, "he repeats it to himself, articulating distinctly, as if he were stamping it upon his mind; if he does not understand it he asks to have it repeated. Problems can be given him in writing, but he prefers to receive them by means of the voice; if he accepts them in a written form he always reads them in an audible tone. When he has grasped the question, he says, 'I am ready,' and begins to whisper low and very rapidly; in this indistinct murmur a listener can occasionally catch the names of figures. Nothing can distract his mind from its quest, he carries on the most complex operations in the midst of the tumult of public exhibitions. More than this, he can talk with others while performing this mental work; he responds correctly to questions, will even sustain a regular conversation, without disturbing his mathematical work; the only difference to be observed under these circumstances is that the result is not reached so rapidly. During the solution he occasionally puts his hand to his forehead, or shuts his fists, or traces imaginary lines with the index finger of his right upon the palm of his left hand. Then, always at the end of a very short time he announces, 'I have it,' and gives the solution, and, for his personal satisfaction, proves it." When closely questioned by a commission of the French Academy, "he affirmed without hesitation," says Binet, "that he had no visual representation of the figures whatever." "I hear the figures," he said emphatically, "and it is my ear which retains them; I hear them resounding after I have repeated them, and this interior sensation remains for a long time." Some time later in replying to a new question put by Charcot, he renewed his assertion. "Sight serves me nothing; I have much more difficulty in remembering numbers when they are given to me in writing than when they are repeated. In the former case I am put under a great restraint. Neither do I like any better to write the figures myself; the writing does not help me at all to recall them." When he begins his solution, he turns his eyes away from the

written figures, the sight of them serving to embarrass his calculation. Regarding this he recently made a pertinent remark. "You ask me," he said, "if I see the figures. It is scarcely four years that I have known their written form, and long before that time I was making my calculations."

Hence Binet concludes that Inaudi's mind is of the auditory type; but it is evident that he depends largely upon motor images also, for he whispers the figures as he calculates. When Binet asked him to sing in one tone as he worked, four or five times as long was required for the calculation, and even then his voice betrayed the fact that he was articulating.

4. *The Motor Type.* In the intellectual operation of persons of this type, images of movement predominate. There are no data to show how numerous this class may be. All of us depend largely upon motor images, for they are necessary to the execution of movements, as is shown by pathology. When the images of a certain class of movements are destroyed—as in motor aphasia, agraphia, and the like—the patient is no longer able to execute these movements. Probably the blind depend very largely upon motor images. Blind deaf-mutes would seem especially likely to belong to the motor type, although, of course, they may be tactiles. I watched Helen Keller while she was engaged in thought, and she kept her fingers busy spelling her thoughts in the finger alphabet. Berthier, a deaf-mute, said of himself: "Although my fingers and my hands are immovable, I feel, when I think, that they are in activity. I see internally the image that they produce. I feel that my thought exercises itself and identifies itself with these movements which the external eyes do not see."¹

Prof. Stricker has described his own imagination very fully²; and his case, if not the most remarkable on record, is probably the one that has been most carefully studied. His recollections both of his own movements and those of objects are accompanied invariably by distinct muscular feelings in those parts of his body which would naturally be used in effecting or in following the movement. In thinking of a soldier marching, for example, it is as if he were helping the image to march by marching himself in his rear. And if he suppresses this sympathetic feeling in his own legs, and concentrates all his attention on the imagined soldier, the latter becomes, as it were, paralyzed. In general his im-

¹ Queyrat, op. cit. p. 86.

² Studien über die Sprachvorstellungen, 1880, and Studien über die Bewegungsvorstellungen. I cite the résumé given by Prof. James, Psych. II. p. 63.

aged movements, of whatsoever objects, seem paralyzed the moment no feelings of movement either in his own eyes or in his own limbs accompany them. The movements of articulate speech play a predominant part in his mental life. "When after my experimental work I proceed to its description," he writes, "as a rule I reproduce in the first instance only words, which I had already associated with the perception of the various details of the observation while the latter was going on. For speech plays in all my observing so important a part that I ordinarily clothe phenomena in words as fast as I observe them."

That children depend largely upon motor images, especially those of articulation, is clear from the common habit of whispering the words as they read. But whether images of articulation or of hearing predominate in the minds of such children it is hard to say. That these two kinds of images may be divorced is evident in the case of deaf mutes who learn to talk. But the vocal organs have been intimately associated with the ear in all the experience of the race; and further observation may show that an articulatory-auditory type is far more common than either by itself. Inaudi, as has been said, depends upon the images of articulation as well as upon those of hearing; and Stricker, on the other hand, has very good auditory memory.

There are then four types of the reproductive imagination—the tactile, the visual, the auditory, and the motor. A fifth type is distinguished by French writers, where imagination's content is made up of images from these different sources in equal proportion, and, of course, there are infinite individual variations according to the varying proportions in which images from the different sources are present. In this so-called normal type the reproduced images are sometimes visual, sometimes auditory, and again sometimes motor or tactile. The way in which one of this type remembers depends largely upon the method by which anything was learned. The visual memory retains what has been learned by reading, the motor memory what has been committed by recitation, the auditory memory what has been acquired by hearing. Queyrat gives an illustration from his own experience. While in memory he *sees* one literary quotation, and *articulates* others, the martial strophes of the *Marseillaise* resound in his ears.¹ The distinction between these different memories is well shown in methods of learning foreign languages. Some understand and can speak a language which they are entirely incapable of reading, and *vice versa*.

¹ Op. cit. p. 122.

As everybody knows, reading a language is a very different thing from speaking it. Ballet gives a case in point. One of his friends has both visual and auditory memory for English. He reads and understands it when spoken with equal facility, since he acquired it first by conversation, then by reading. It is quite different with German, which he has heard spoken a great deal, but has read but little. With German he has difficulty when he limits himself to mental reading; but he understands well when he can read the piece aloud.

II. DIFFERENCES IN PRODUCTIVE IMAGINATION.

Popular speech divides the world into two classes—the imaginative and the unimaginative. But all children, unless they be idiots, probably have productive or creative imagination in some measure; and among them the differences in degree are much greater and more important than is usually supposed. The child with deficient imagination may be sluggish and stupid or too constantly engaged in concrete activities in the real world. But in either case reality satisfies him. Examples of unimaginative children are familiar, but it is not as easy to find illustrations of this class in literature as of the imaginative; for the child of deficient imagination is likely to be uninteresting, if not actually stupid. Imaginative children, however, have been observed again and again, and illustrations of their ability in combining the raw material of thought will show by contrast the individual differences in productive imagination.

Pres. Hall (PED. SEM. I. 2, p. 213) and others in the study of children have shown the manifoldness of their imaginations' content, and called attention to that ideal world that lies very near about us in our childhood. The same thing has been impressed upon me by reading some of Mr. Russell's records under the rubric *Phantasy*. The imaginative child often seems to live half his life in a world of poetry and make-believe. Such imaginative children not only have imaginary playmates, and personate animals and men, sometimes doing grotesque or outlandish things for the sake of playing their rôles, but they almost reconstruct ideally the world in which they live. Beasts, birds, and their food and furniture talk with them. When the dew is on the grass, "the grass is crying;" when the stars come out, they are candles or street-lamps lighted by little boys, or, perhaps, cinders from God's stove; butterflies are pansies flying; icicles are Christmas candy. They have play-brothers and sisters, and dear friends with whom they talk. Sometimes God talks with them, even in a way that may seem sacrile-

gious to an on-looker. Even the prosiest things are vivified. The tracks of dirty feet on the floor are flowers; a creaking chair talks; the shoemaker's nails are children, and he drives them to school; a tin-peddler is Santa Claus. Generally some object—a piece of wood or cloth or a stone—is required as an *Anknüpfungspunkt*, yet some children are so idealistic that they need no such objective aids. To them dolls and the like are stupid, cold and unreal substitutes for the warm creatures of their imaginary world. It is not entirely a world of joy. Shadows become wild beasts; a statue may seem alive and terrify them; any object once associated with fright is a constant source of alarm; and sometimes the phantoms of their own creation become unmanageable like the delusions of the insane. Much of this imagining centres about their own personalities, and consists in ideals for the future. The material for it comes largely from their reading.

Those who have such remarkable productive imagination live in a mental world as unlike that of the ordinary prosaic person as the world of a deaf mute is unlike that of a person with all his senses. The differences in degree are so great that they have become differences in kind. To such poetic persons imagination is at once their inspiration and temptation in health, their comfort and torment in illness. Numerous illustrations from literature might be given—Savonarola, Swedenborg, Rousseau, Shelley. For a single concrete illustration of the imaginative child, I know of none better than that furnished by George Sand in her autobiography. I borrow from Sully's interesting study of her childhood.¹

She appeared strange and deficient in childish traits to the commonplace observer; yet "the untamed and untamable 'oddities' were, after all, only certain common childish impulses and tendencies exalted," or exaggerated. She was possessed of such a vivid imagination that she suffered terrors from her interpretation of the real world, but found supreme delight in an ideal world of fiction. She could concentrate her whole consciousness in this imaginary world and forget her actual surroundings. The echo of her own voice made her think she was double, that another was round about her, whom she could not see, but who always saw her. Combining this with the ocular spectra caused by looking at the golden globe of a church she formed the theory that everything has its double. Her mother's voice reading to her in the evening threw her into a stupor of day-dreaming. Images formed and settled on the green screen before the fire. "They were woods, meadows, rivers, towers of a grotesque

¹ Longman's Magazine, Dec. 1889, and May, 1890.

and gigantic architecture, as I have often seen them in dreams, enchanted palaces with gardens like nothing that exists, with thousands of birds of azure, gold and purple, which sprang on the flowers and let themselves be caught. There were roses, green, black, violet and especially blue."

Most remarkable of all, perhaps, was her religious experience. "From her mother, ardent, imaginative and of a 'simple and confiding faith,' she had caught some of the glow of a fervent piety. Then she suddenly passed into the chilling air of Nohant and the grandmother, a disciple of Voltaire, and equalling her master in cynical contempt of the revered mysteries." Her conflicting religious experiences led her to invent the idea of a new religion "with which nobody else should meddle," and she formed her own private cult with a new divinity, with sacred songs, and ritual, and temple. The name of her divinity was Corambé; and she describes his attributes as follows: "He was pure and charitable as Jesus, radiant and beautiful as Gabriel; but it was needful to add a little of the grace of the nymphs and of the poetry of Orpheus. Accordingly he had a less austere form than the God of the Christian, and a more spiritual feeling than those of Homer. And then I was obliged to complete him by investing him on occasion with the guise of a woman, for that which I had up to this time loved the best, and understood the best, was a woman—my mother. And so it was often under the semblance of a woman that he appeared to me. In short, he had no sex, and assumed all sorts of aspects. Corambé should have all the attributes of physical and moral beauty, the gift of eloquence, the omnipotent charm of the arts; above all, the magic of musical improvisation. I wished to love him as a friend, as a sister, while revering him as a God. I would not be afraid of him, and to this end I desired that he should have some of our errors and weaknesses. I sought that one which could be reconciled with his perfection, and I found it in an excess of indulgence and kindness."

The history of Corambé's existence was developed in a series of sacred books. She composed perhaps a thousand such songs without writing down a line of them. She lived in communion with her deity. While her companions were chattering around her, she could lose herself in her world of religious romance. A thicket of trees and undergrowth formed the temple for this divinity, and she erected an altar, ornamenting it with shells and flowers. Here she enjoyed "delicious reveries," and began to find the pure feeling of a religion according to her heart, until a playmate discovered the temple, when its sacred charm was immediately destroyed.

"From the instant that other feet than mine had trodden his sanctuary, Corambé ceased to dwell in it. The dryads and the cherubim deserted it, and it seemed to me as if my ceremonies and my sacrifices were from this time only childishness, that I had not, in truth, been in earnest. I destroyed the temple with as much care as I had built it; I dug a hole at the foot of the tree, where I buried the garlands, the shells, and all the rustic ornaments, under the ruins of the altar."

III. EDUCATIONAL ASPECTS OF THE SUBJECT.

It has been shown that there are great individual differences in respect to the modality of mental images as well as in the ability to combine the raw material of thought. With reference to reproductive imagination five typical classes have been described—the tactiles, the motiles, the visual type, the auditory type, and the normal or mixed type. Of productive imagination there are all degrees from that of the stupidly prosaic child to that of the idealist who lives half the time in a world of make-believe. Some of the writers upon this subject may perhaps have made too much of their classification. The cases cited in illustration are often the extreme and unusual cases; for these show more clearly the types. But however this may be, there are clearly great individual differences both in productive and in reproductive imagination, and these differences are of the utmost importance in education.

In view of the differences in the modality of mental images a number of pedagogical questions arise. Is one of these types of mind better than another? Is one kind of images genetically the primary one, and should the others be subordinated to it? Should the teacher conform his methods to the child's type of mind, using pictures, diagrams, and the like, for the eye-minded; kindergarten occupations, manual training, oral exercises, and the like, for the motiles? Or should the aim be to supply deficiencies and to check any tendency to specialize in one kind of mental images? If the evenly mixed type should be striven for, should we appeal to the different senses simultaneously or successively? In teaching the alphabet, for example, should we, as one writer maintains, first accustom a child's ear to the sounds, then teach pronunciation, and, finally, the forms of the letters; or is the customary way better, where all three operations are carried on at once? Do our present educational methods furnish imagination with the right content and tend to develop the best type of mind? Such questions cannot be answered *a priori*; and there is no sufficient collection of empirical data that would enable us to settle them. A few pedagogical

considerations, some of them suggested by Queyrat, are, however, pretty obvious.

The first desideratum is a set of as definite tests as possible for determining to which of these classes a given individual belongs. Prof. Jastrow¹ has suggested a number of tests, among others the following: The number of nonsense words that can be repeated after a single hearing as compared with the number that can be repeated after a single reading; the number of repetitions required to commit a passage when it is read compared with the number required when it is heard; take two passages of equal difficulty, while the subject reads one let the other be read aloud to him, and note what portion of each he can recall. To determine one's dependence on the motor images of articulation Stricker has suggested this test:² Imagine, with partly opened mouth, any word containing labials or dentals, as "bubble," "toddle." With most persons the image is then indistinct; and clearness requires incipient articulation. Of 100 persons questioned Stricker found only one who had no feeling in his lips when thinking of the letters M, P, B.

Beaunis and Binet³ have prepared an elaborate list of questions to be submitted to painters, with hope of determining the role of images of different modality in their mental life. The list is as follows:

DISTINCTION OF VISUAL, VERBAL AND MOTOR MEMORIES.

(1) Can you easily and clearly represent an ordinary object to yourself, your easel, a flower, a statue, a table, a landscape, the face of a friend? (2) When you try to represent to yourself in memory these common and well-known objects, do they appear to you in a visible form, do you have a mental vision of them? If you try to represent to yourself a forget-me-not, have you clearly in mind the form of the petals and the shade of blue? (3) Or do you recall more clearly the movements of the hand and crayon which are necessary for drawing the form of the flower? Is the representation of a profile, for example, which you call up in memory, a memory of the hand which traced it, and during your act of memory do you make mechanical movements with the hand for drawing the object of which you are thinking? (4) Or again, do you repeat mentally in words the details of an object in memory? For example, suppose you are thinking of the Venus of Milo and that you wish to represent to yourself more particularly the form of the forehead, do you pronounce mentally the word *forehead* to characterize the form of it, or do you see that form directly in your memory? Another example; think of a color—how do you represent it to yourself? Is it a name, a stain, or a figure? A third example; when you think of a word (your own name) does it appear to you written, printed, or do you hear it in your ear, or do you murmur it to yourself in a low voice? A final example; if you add mentally three

¹ Pop. Sci. Mo. Vol. 33, p. 597.

² Cited by James, op. cit. II, pp. 63, 64.

³ Revue Scientifique, 10 Sep., 1892.

or four figures (38+436), do you see the figures, or do you hear them, or do you repeat them mentally?

Kinds of Visual Memory.

(5) Supposing you represent in memory common objects under the form of things seen, please give some details in regard to the nature and character of your mental vision. (6) Do you see mentally everything together or only in details? Can you represent at once a vast scene with many persons, or do you see only a little of a thing at a time? (7) Has this internal vision clearness and stability? Is it comparable to the visual sensation given by objects present? (8) Does the vividness of your image vary according as your eyes are open or shut, or as your look rests on a clear or obscure background? (9) Try to describe exactly what occurs in your mind when you draw or paint from memory. Do you project outside of yourself the image which serves as a model, two metres, for example, or into a corner of the room? Or does this memory remain in your mind? Or, again, do you project it on your paper, do you see it on your canvas, or do you incorporate it into your drawing? Do you have a different process from any of those enumerated? (10) When you desire to recall a drawing, do you attend to it part by part, or do you apply yourself to it as a whole?

Distinction between Memory of Forms and Memory of Colors.

(11) Do you represent to yourself form or color better? When you recall an object, are you more sure of its contour than of its exact shade, or the reverse? Or do you recall the two things with equal exactness? When you imagine any scene, do you see it simply drawn or colored? (12) In a memory which is beginning to fade, is it the color which disappears first or the form? (13) In that which concerns color, do you recall better the color or the intensity? In a whole scene which you recall, the general tone or color of each object? Do you recall more easily exact shades or their relations? Can you represent and draw from memory a common object in profile, front view, and so on?

Fidelity of Visual Memory.

(14) Can you draw or paint complex objects from memory, a portrait for example? Do you know any remarkable examples of this kind of reproduction? (15) Do you recall certain objects better than others—the face, for example, better than a landscape? (16) Certain painters make yellow, violet, brown or gray colors predominate (Ziem, Corot, etc.). Is this due to a prejudice, or to special delicacy of perception for these colors, or to an illusion of memory, or to a particular investigation of the external conditions in which the preferred colors dominate? (17) Do you think there is any relation between the vividness of the images in your memory and their veracity?

The Rôle of Visual Memory in the Arts.

(18) Can you recognize in studying the work of a painter whether he has visual memory developed or not? Is the faculty of painting or drawing from memory more developed generally among certain kinds of painters than among others (landscape, historical, portrait, etc.)? (19) Is it developed among persons who work with special knack? What is the particular gift which these latter persons possess? (20) Do those painters whose works bear a personal mark work especially from a model or from memory?

(21) Is it an advantage to this that, at school, painters pursue exercises on the memory of colors and forms to perfect the education of the eye? We call the attention of artists to the pedagogical interest of this question. (22) Does visual memory in general appear to you a necessary faculty for the artist?

Various Peculiarities.

(23) Have you noticed a great development of visual memory in other members of your family? (24) Have you perfected your own by exercise? (25) Have you had hallucinations of sight? (26) Have you a good musical memory? (27) Have you a memory for places? Do you orientate yourself easily? Can you make the plan of an apartment, a museum, a garden, a village which you have passed through rapidly? (28) Have you good sight? Are you near-sighted? Far-sighted? Are you color-blind? (29) Do you see certain sounds or certain letters colored? (colored-hearing.) (30) Please describe any peculiarities of visual memory which have not been mentioned in this list of questions.

Some of these questions, or similar ones of simpler nature, could be used with older children, and they would serve as a valuable addition to such tests as those proposed by Dr Jastrow.

Queyrat also suggests certain ways of testing the child's type of mind—its behavior in the presence of different objects, its ability in retaining words, dates, figures, colors, sounds, movements, and so on; and its taste for different studies. He quotes¹ the Spanish philosopher Balmès, who would have the remarkable products of human industry and intelligence placed before the child, maintaining that nature will indicate innate aptitudes which the most attentive study would never be able to discover. An ingenious mechanism, for example, attracts the attention of a group of children. The majority admire it for a moment and pass on. A single one stops and seems to forget himself for a long time. His curiosity, questions and rapid comprehension of the mechanism are signs of his talent. Correggio crying out before Raphael's St. Cecilia, "And I, too, am a painter!" is a case in point. Finally, one may question children in regard to the way in which they remember a page which they have learned, whether they recall the printed words or retain rather their sound; how they perform an operation in mental arithmetic, and so on.

The difference in the modality of their mental images is one reason why many children surrounded by the same conditions of education make such different progress. With any given method, for example, some of the pupils in a class must be handicapped. In a language method like that of Gouin's², which

¹Op. cit. p. 103.

²Cf. "How to Learn a Language in Six Months," Review of Reviews, July, 1892.

appeals primarily to the auditory and motor imagination, but which also puts so much stress upon mental visualization, some children (as Mr. Stead's boy has done¹) may show remarkable progress; but it must not be expected that children with less power of visual and motor imagination will succeed as well. The peculiar form of a child's imagination is sometimes a sign of his fitness for a certain calling in life. In many of the arts, sciences and professions, the power of visualization seems necessary; other studies and callings, like music, require auditory memory; still others, like instrumental music and oratory, demand a talent for retaining motor images; while linguistic studies, especially the acquisition of skill in speaking, require both auditory and motor imagination. The educator's task is to recognize the kind of images which predominate in a child's mind and to adapt his work to the child's talents. There are plenty of cases on record that seem to be illustrations of the wisdom of doing this. Balmès cites the following. Vaucanson and Watt became prodigies in mechanics. They would doubtless have remained mediocre in the fine arts or in poetry. La Fontaine has become immortal by his fables, but his incapacity in affairs is well known.²

Certain dangers are connected with the extreme development of images of a given modality. In the case of auditory images, for example, every one has had the experience of being haunted for hours by the persisting memory of some intolerable refrain. Queyrat cites the case of a composer³ who had unusual auditory imagination. As he sat by his fire and recalled the song of a linnet that he had heard during a walk in the field, he heard a complete symphony — Beethoven's *Pastorale*. Nothing was lacking, although at times the voices of nature mingled with the orchestra. But his marvelous imagination had exasperating caprices. Often for entire days some vulgar refrain of a hand-organ would keep repeating itself. There was no means of escaping from this obsession. Even sleep did not avail; and the more he exerted himself to shake it off, the more it clung to him. The mental image sometimes, instead of persisting thus temporarily, assumes the character of an auditory hallucination. Examples from history are the demon of Socrates, the celestial messenger of Mahomet, the voices of Joan of Arc and Luther's devil. Perhaps the predominance of images of a given modality causes a corresponding species of deliri-

¹Of. Review of Reviews, Nov., 1892.

²Queyrat, Op. cit., footnote, p. 101.

³Op. cit. p. 111.

um. Thus Binet thinks that in the delirium of persecution the patients are usually of the auditory type; for their hallucinations are generally those of hearing—the persecutors are not seen, but heard. Extreme development of visual images exposes to similar dangers. Wigan's painter, whose case has so frequently been cited, after a time became unable to distinguish his imaginary subject from a real one, and was finally sent to an asylum, where he remained for 30 years.¹

The advantages of the normal type, according to Queyrat, are the diminished danger of hallucinations, and the advantage of not having one's eggs all in one basket in case of cerebral lesion. For example, if visual images are destroyed, as in Charcot's patient, auditory images may take their place. Again, while one of this type may not hope to be a genius of the highest rank in some study requiring specialization in memory of a given kind, he is compensated for this inferiority by the variety of means at his disposal. Queyrat cites some of the distinguished scholars of the renaissance as examples of this type,—Alberti, who was theologian, poet, mathematician, architect, painter, sculptor, etc.; Verrochio, who, while having a preference for sculpture, was at the same time goldsmith, engraver, painter and musician; Léonard de Vinci, who was not only a painter, sculptor, architect, but also skilled in mathematics, mechanics, hydrostatics, music and poetry, was an accomplished fencer, rider and dancer, and a scholar in anatomy, philosophy and literature; also Benvenuto Cellini, who was an excellent draughtsman, goldsmith, enameller, sculptor and a Jack at several other trades. He made his own fire-arms and his own gunpowder, and could hit a bird at 200 paces. He was also an excellent player on the flute and cornet, although he disliked this exercise and applied himself to it only to satisfy his father. The advantages that accrue to those of the normal type are largely the advantages that come from symmetrical development; and the dangers that beset the other classes are the dangers of specialization. One who depends chiefly upon images of a single kind is not only limited in his mental life, but more liable to fall into error, as he lacks the important correctives that come from images of several modalities.

The kind of mental images that shall predominate can be determined largely by education. This has been shown by cases of disease where images of one modality have been destroyed and dependence upon images of a different modality has brought them into prominence in the mental life. A case like that of Charcot's patient shows this. More familiar

¹Cited by Queyrat, *Op. cit.* p. 115.

illustrations are the cases of those who have lost one or more of their senses in early life. In the case of the blind, those who have lost their eyesight before the age of 5 to 7 years, according to the investigations of Professor Jastrow, seem to lose their visual imagination. That their education gives unusual prominence to images from the other senses in their thinking is obvious. In the mental activity of a girl like Helen Keller, motor images and images from the dermal senses must play a role which an ordinary person can hardly conceive.

Of course, making certain allowances for hereditary aptitude, that kind of mental images predominates which has been most frequently before the mind. Hence the cultivation of a given sense develops the corresponding form of imagination. It would be interesting to study the effect of prevalent methods in developing one or another type of imagination. Most of the methods now in vogue tend perhaps unduly, as Professor Patrick thinks,¹ to develop visual imagination. Many of them, however, associate visual, auditory and motor images; and some appeal especially to the auditory imagination. Methods of the past made the ear relatively more important than it is to-day. Professor Patrick has shown² how this was among the Greeks. "They were a conversing people; we are a writing and reading people. With them poetry was sung or recited; with us it is read. They conducted politics in the agora; we in the newspapers. With them music (including poetry) was the most prominent branch in popular education, with us it is least so." The Jesuits too, with their customs of oral repetition and disputation, have appealed to the auditory and motor imagination.

In modern schools certain methods of teaching language make the ear the special channel of instruction. In teaching the mother-tongue in the schools, the prevailing methods appeal especially to the eye. The special devices—reading machines, reading tablets, cards and the like—serve to give vivid visual impressions. And the general dependence upon books in language-study is well known. But the usual methods are sometimes modified in a way that gives the ear a larger share in the work. A lesson in language described by Dr. Klemm³ will serve as an example. One of his former teachers "practices analysis and synthesis by placing three bright boys in front of the class, charging one to say *m* (the sound *m*, not the letter *em*) when called upon; the next one *a*;

¹Cf. "The Rivalry of the Higher Senses," Pop. Sci. Mo. Oct. 1891.

²Loc. cit.

³Educational Topics of the Day, pp. 245, 246; also European Schools, pp. 7, 8.

and the third *n*. Then by placing them close to each other, so that their shoulders would touch, she makes them sound the word *man* rapidly. The same is done with other words. Now she separates the boys, the middle one remaining in his place, while the others recede toward the right and left, and every time they make a step the word is pronounced over again, thus separating the sounds farther and farther." After this synthesis follows, the boys returning step by step to their former positions and pronouncing the sounds as before.

It is not the purpose of this article to estimate the value of different methods; but the general effect of certain kinds of study upon imagination is obvious. Drawing, writing, manual training, gymnastic exercises, active sports and games, and exercises in elocution develop the motor imagination, while the ordinary book-work in the school appeals more or less to visual imagination. In the subjects of drawing and sketching special exercises can be given to develop visual imagination. Boishaudran¹ had his pupils draw models from memory; after four months they testified that their visual images were much more distinct and that they could recall them almost at will.

For cultivating the sense of hearing and the auditory imagination the means are also simple. Children should be taught to listen; they should be trained to perceive different shades of sound, to hear distinctly. Instruction in music is of course one of the best means of giving this training.

But without attempting to judge the merits of methods that appeal to the different senses, it may be safely said that in education we should use as many avenues to the mind as possible—eyes, ears, hands, vocal organs, etc. There is a strong feeling also that our education neglects the motor side. It has been passive rather than active. Manual training and physical education, not to mention the forms of active education upon a higher plane, are not merely useful as means for preserving health and the like, but they are means for developing a distinct type of mind, one in which motor images play a greater part.

Beyond pointing out certain dangers that may beset those whose dependence upon images of one modality is extreme, and beyond stating certain obvious advantages of the normal type, little can be said of the relative merits of the different kinds of reproductive imagination. But it cannot be doubted that the differences in reproductive imagination are of fundamental importance in the mental life. Even one's temperament and character may be affected by the kind of images

¹Cf. Queyrat, op. cit. pp. 147, 148.

that predominate in his thinking. Mr. Fraser's studies have suggested that even one's philosophy may be profoundly influenced by the modality of his imagination. And Ribot has attempted to extend this study to concepts and general ideas, and to determine whether there be not individual differences in the way that different persons represent concepts, and if these differences be not reducible to certain fundamental types. Tests of more than a hundred persons have shown striking individual differences, and indicate that the type of one's reproductive imagination may determine the form of his abstract thinking.

It is equally important to differentiate instruction in view of the individual differences in productive imagination. With some children it may be necessary to check imagination. With others the effort should be to develop it. And it is well to remember that most children have sufficient imagination to vivify what is dull, prosaic and dead to us. What you tell a child of wolves and bears, of tramps and robbers, of the dark forest and the all-devouring sea, of giants, ogres, angels, devils and future punishment is not apperceived in the dull prosaic way in which you tell it; but it grows appalling in that vivid ideal world in which it finds lodgment. The whole subject of religious education especially, should be studied in relation to the child's productive imagination. The religion of George Sand or of Waldo in the African Farm is but an exaggerated description of the religious experience of many children. The plays of children also should be studied in their relation to the development of imagination. Simple plays and toys are often the best; for they give scope to the imagination, and the importance of play is conditioned largely by the share of imagination in it. Jean Paul has put this well in a brilliant passage.

"In the first place," he says, "the child plays with things, consequently with himself. A doll is to him a nation, or a company of players, and he is the theatrical poet and director. Every bit of wood is a gilded flower-rod, on which fancy can bud hundred-leaved roses. For not merely to grown-up people but also to children, the plaything itself becomes indifferent if a happy imagination alone is permitted to decide; whether it be with regard to imperial or laurel crowns, shepherds' crooks, or marshals' staves, the flails of war or of agriculture. In the eyes of wonder-working fancy every Aaron's rod blossoms. As the Elysian fields of the ancients near Naples were grounded (according to Maccard) on nothing more than a bush in a cave, so, for children, is every bush a forest; and they possess that heaven which Luther in his table-talk promises the saints, where the bugs

are sweet scented, the serpents playful, the dogs gold-skinned and Luther a lamb. I mean to say that in the heaven of childhood the father is God the Father, the mother the mother of God, the nurse a Titaness, the old servant an angel of the communion, the turkey a cherub of Eden, and Eden itself is restored." "Never forget that the games of children with inanimate playthings are so important because for them there are only living things; a doll is as much a human being to a child as a baby is to a woman; and also because to them every word is a reality. In beasts the body alone plays; in children the mind."¹

Here in a child's imaginings is a vast fund of spontaneous interest. How to utilize it; how to check imagination when extreme without wasting this spontaneous interest; how to develop imagination when deficient—in a word, how to adapt education to individual differences in productive imagination—such are the teacher's problems. These questions have not been satisfactorily answered, and only by the patient study of many children and of the effects of various methods of education can a satisfactory answer be obtained. But modern education has recognized one fact: God has made men different. It is the merest platitude of every-day philosophy that there is infinite variety in the talents and in the deficiencies of human beings. Teachers must study the individual differences in their pupils. But the present problem is, should education aim to remedy nature's defects or to develop innate talents? This alternative meets us everywhere. The questions of general culture vs. specialization, of the elective system in the colleges, of the differentiation of the courses of study in the lower schools, generally come to this when reduced to their lowest terms.

Psychology has rightly confined its study hitherto chiefly to the primary and universal in mental phenomena and has neglected individual variations, but educational psychology must make special study also of the individual. While general psychology is fundamental, and while no one can succeed in teaching a class unless he can appeal to what is common and universal in child-nature, it is likewise of the greatest practical importance to lay stress upon individual differences; for we are apt to suppose the mental operations of other people precisely like our own. The visions, number-forms and the like found by Galton are almost incredible to those who do not have them. "The number-forms of different persons are mutually unintelligible." But the seers are like the color-blind. They think everybody

¹ Richter's *Levana*, p. 85.

else has the same way of regarding things as themselves. So educators find one method that suits minds of their own type perhaps, and forthwith they announce it as *the* method. Careful study of the effect of different methods might show that no method has ever been employed that had not some good in it for some individual; but it would also show that no method (except in its general principles) is of universal application.