MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY.

I.—STATISTICS OF MENTAL IMAGERY.

An outline is given in the following memoir of some of the earlier results of an inquiry which I am still prosecuting, and a comparatively new statistical process will be used in it for the first time in dealing with psychological data. It is that which I described under the title of "Statistics by Intercomparison" in the *Philosophical Magazine* of Jany., 1875.

The larger object of my inquiry is to elicit facts that shall define the natural varieties of mental disposition in the two sexes and in different races, and afford trustworthy data as to the relative frequency with which different faculties are inherited in different degrees. The particular branch of the inquiry to which this memoir refers, is Mental Imagery; that is to say, I desire to define the different degrees of vividness with which different persons have the faculty of recalling familiar scenes under the form of mental pictures, and the peculiarities of the mental visions of different persons. The first questions that I put referred to the illumination, definition and colouring of the mental image, and they were framed as follows (I quote from my second and revised schedule of questions):—

"Before addressing yourself to any of the Questions on the opposite page, think of some definite object—suppose it is your breakfast-table as you sat down to it this morning—and consider carefully the picture that rises before your mind's eye.

1. *Illumination.*—Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene?

2. *Definition.*—Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?

3. *Colouring.*—Are the colours of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?"

There were many other questions besides these, of which I defer mention for the moment.

The first results of my inquiry amazed me. I had begun by questioning friends in the scientific world, as they were the most likely class of men to give accurate answers concerning this faculty of visualising, to which novelists and poets continually allude, which has left an abiding mark on the vocabularies of every language, and which supplies the material out of which dreams and the well-known hallucinations of sick people are built up.

To my astonishment, I found that the great majority of the men of science to whom I first applied, protested that mental imagery was unknown to them, and they looked on me as fanciful and fantastic in supposing that the words 'mental imagery' really expressed what I believed everybody supposed them to mean. They had no more notion of its true nature than a colour-blind man who has not discerned his defect has of the nature of colour. They had a mental deficiency of which they were unaware, and naturally enough supposed that those who were normally endowed, were romancing. To illustrate their mental attitude it will be sufficient to quote a few lines from the letter of one of my correspondents, who writes:—

"These questions presuppose assent to some sort of a proposition regarding the 'mind's eye' and the 'images' which it sees. . . . . This points to some initial fallacy. . . . . It is only by a figure of speech that I can describe my recollection of a scene as a 'mental image' which I can 'see' with my 'mind's eye'. . . . . I do not see it . . . any more than a man sees the thousand lines of Sophocles which under due pressure he is ready to repeat. The memory possesses it, &c."

Much the same result followed some inquiries made for me by a friend among members of the French Institute.

On the other hand, when I spoke to persons whom I met in general society, I found an entirely different disposition to prevail. Many men and a yet larger number of women, and many boys and girls, declared that they habitually saw mental imagery, and that it was perfectly distinct to them and full of colour.

The more I pressed and cross-questioned them, professing myself to be incredulous, the more obvious was the truth of their first assertions. They described their imagery in minute detail, and they spoke in a tone of surprise at my apparent hesitation in accepting what they said. I felt that I myself should have spoken exactly as they did if I had been describing a scene that lay before my eyes, in broad daylight, to a blind man who persisted in doubting the reality of vision. Reassured by this, I recommenced to inquire among scientific men, and soon found scattered instances of what I sought, though in by no means the same abundance as elsewhere. I then circulated my questions more generally among my friends, and so obtained the replies that are the main subject of this memoir. The replies were from persons of both sexes and of various ages, but I shall confine my remarks in this necessarily brief memoir to the experiences derived from the male sex alone.

I have also received batches of answers from various educational establishments, and shall here make use of those sent by the Science Master of the Charterhouse, Mr. W. H. Poole, which he obtained from all the boys who attended his classes, after fully explaining the meaning of the questions, and interesting the boys in them. They have the merit of returns derived from a general census, which my other data lack, because I cannot for a moment suppose that the writers of them are a haphazard proportion of those to whom they were sent. Indeed, I know some men who, disavowing all possession of the power, cared to send no returns at all, and many more who possessed it in too faint a degree to enable them to express what their experiences really were, in a manner satisfactory to themselves. Considerable similarity in the general style of the replies will however be observed between the two sets of returns, and I may add that they accord in this respect with the oral information I have elsewhere obtained. The conformity of replies from so many different sources, the fact of their apparent trustworthiness being on the whole much increased by cross-examination (though I could give one or two amusing instances of break-down), and the evident effort made to give accurate answers, have convinced me that it is a much easier matter than I had anticipated to obtain trustworthy replies to psychological questions. Many persons, especially women and intelligent children, take pleasure in introspection, and strive their very best to explain their mental processes. I think that a delight in self-dissection must be a strong ingredient in the pleasure that many are said to take in confessing themselves to priests.

Here then are two rather notable results: the one is the proved facility of obtaining statistical insight into the processes of other

persons' minds; and the other is that scientific men as a class have feeble powers of visual representation. There is no doubt whatever on the latter point, however it may be accounted for. My own conclusion is, that an over-readiness to perceive clear mental pictures is antagonistic to the acquirement of habits of highly generalised and abstract thought, and that if the faculty of producing them was ever possessed by men who think hard, it is very apt to be lost by disuse. The highest minds are probably those in which it is not lost, but subordinated, and is ready for use on suitable occasions. I am however bound to say, that the missing faculty seems to be replaced so serviceably by other modes of conception, chiefly I believe connected with the motor sense, that men who declare themselves entirely deficient in the power of seeing mental pictures can nevertheless give life-like descriptions of what they have seen, and can otherwise express themselves as if they were gifted with a vivid visual imagination. They can also become painters of the rank of Royal Academicians.

The facts I am now about to relate, are obtained from the returns of 100 adult men, of whom 19 are Fellows of the Royal Society, mostly of very high repute, and at least twice, and I think I may say three times, as many more are persons of distinction in various kinds of intellectual work. As already remarked, these returns taken by themselves, do not profess to be of service in a *general* statistical sense, but they are of much importance in showing how men of exceptional accuracy express themselves when they are speaking of mental imagery. They also testify to the variety of experiences to be met with in a moderately large circle. I will begin by giving a few cases of the highest, of the medium, and of the lowest order of the faculty of visualising. The hundred returns were first classified according to the order of the faculty, as judged from the whole of what was said in them, and all I knew from other sources of the writers; and the number prefixed to each quotation shows its place in the class-list.

Vividness of Mental Imagery.

(From returns furnished by 100 men, at least half of whom are distinguished in science or in other fields of intellectual work.)

Cases where the faculty is very high.

1. Brilliant, distinct, never blotchy.

2. Quite comparable to the real object. I feel as though I was dazzled, *e.g.*, when recalling the sun to my mental vision.

3. In some instances quite as bright as an actual scene.

4. Brightness as in the actual scene.

5. Thinking of the breakfast table this morning, all the objects in my mental picture are as bright as the actual scene.

6. The image once seen is perfectly clear and bright.

7. Brightness at first quite comparable to actual scene.

8. The mental image appears to correspond in all respects with reality. I think it is as clear as the actual scene.

9. The brightness is perfectly comparable to that of the real scene.

10. I think the illumination of the imaginary image is nearly equal to that of the real one.

11. All clear and bright; all the objects seem to me well defined at the same time.

12. I can see my breakfast table or any equally familiar thing with my mind's eye, quite as well in all particulars as I can do if the reality is before me.

Cases where the faculty is mediocre.

46. Fairly clear and not incomparable in illumination with that of the real scene, especially when I first catch it. Apt to become fainter when more particularly attended to.

47. Fairly clear, not quite comparable to that of the actual scene. Some objects are more sharply defined than others, the more familiar objects coming more distinctly in my mind.

48. Fairly clear as a general image; details rather misty.

49. Fairly clear, but not equal to the scene. Defined, but not sharply; not all seen with equal clearness.

50. Fairly clear. Brightness probably at least one-half to two-thirds of original. [The writer is a physiologist.] Definition varies very much, one or two objects being much more distinct than the others, but the latter come out clearly if attention be paid to them.

51. Image of my breakfast table fairly clear, but not quite so bright as the reality. Altogether it is pretty well defined; the part where I sit and its surroundings are pretty well so.

52. Fairly clear, but brightness not comparable to that of the actual scene. The objects are sharply defined; some of them are salient, and others insignificant and dim, but by separate efforts I can take a visualised inventory of the whole table.

53. Details of breakfast table *when the scene is reflected on*, are fairly defined and complete, but I have had a familiarity of many years with my own breakfast table, and the above would not be the case with a table seen casually unless there were some striking peculiarity in it.

54. I can recall any single object or group of objects, but not the whole table at once. The things recalled are generally clearly defined. Our table is a long one; I can in my mind pass my eyes all down the table and see the different things distinctly, but not the whole table at once.

Cases where the faculty is at the lowest.

89. Dim and indistinct, yet I can give an account of this morning's breakfast table;—split herrings, broiled chickens, bacon, rolls, rather light coloured marmalade, faint green plates with stiff pink flowers, the girls' dresses, &c., &c. I can also tell where all the dishes were, and where the people sat (I was on a visit). But my imagination is seldom pictorial except between sleeping and waking, when I sometimes see rather vivid forms.

90. Dim and not comparable in brightness to the real scene. Badly defined with blotches of light; very incomplete.

91. Dim, poor definition; could not sketch from it. I have a difficulty in seeing two images together.

92. Usually very dim. I cannot speak of its brightness, but only of its faintness. Not well defined and very incomplete.

93. Dim, imperfect.

94. I am very rarely able to recall any object whatever with any sort of distinctness. Very occasionally an object or image will recall itself, but even then it is more like a generalised image than an individual image. I seem to be almost destitute of visualising power, as under control.

95. No power of visualising. Between sleeping and waking, in illness and in health, with eyes closed, some remarkable scenes have occasionally presented themselves, but I cannot recall them when awake with eyes open, and by daylight, or under any circumstances whatever when a copy could be made of them on paper. I have drawn both men and places many days or weeks after seeing them, but it was by an effort of memory acting on study at the time, and assisted by trial and error on the paper or canvas, whether in black, yellow or colour, afterwards.

96. It is only as a figure of speech that I can describe my recollection of a scene as a 'mental image' which I can 'see' with my 'mind's eye.' . . The memory possesses it, and the mind can at will roam over the whole, or study minutely any part.

97. No individual objects, only a general idea of a very uncertain kind.

98. No. My memory is not of the nature of a spontaneous vision, though I remember well where a word occurs in a page, how furniture looks in a room, &c. The ideas are not felt to be mental pictures, but rather the symbols of facts.

99. Extremely dim. The impressions are in all respects so dim, vague and transient, that I doubt whether they can reasonably be called images. They are incomparably less than those of dreams.

100. My powers are zero. To my consciousness there is almost no association of memory with objective visual impressions. I recollect the breakfast table, but do not see it.

These quotations clearly show the great variety of natural powers of visual representation. I will proceed to examine the subject more closely, and to compare the returns from the 100 men with those from the Charterhouse boys, on the principle of my "Statistics by Intercomparison," which I must first explain at sufficient length.

There are many who deny to statistics the title of a science, and say that it is a mere collection of facts. For my part I think that there is such a thing as a science of statistics, though its field is narrowed almost to a point. Its object is to *discover methods* of epitomising a great, even an infinite, amount of variation in a compact form. To fix the ideas, it is well to take as an example the heights of men, in which case the science of statistics enables us to specify, by means of a very few figures, the conditions of stature that characterise the whole of the adult male inhabitants, say of the British Isles. These figures will suffice to inform us that there are so many per cent. between such and such heights, and so many between such other heights, giving us material whence we can answer any such question as this:— Out of 1000 men how many are we likely to find between 5 feet and 6 feet in height? If the figures do not give the answer directly, we can find it by interpolation and easy calculation from them. So again, if we wish to compare the heights of

Englishmen and Frenchmen, statistics show how to obtain the average height of the two races, and the two averages may be readily compared, which goes a considerable way towards answering the question; or, if we wish it, we may compare very much more in detail, all the facts that are needed for the purpose being contained in the few figures of which I spoke.

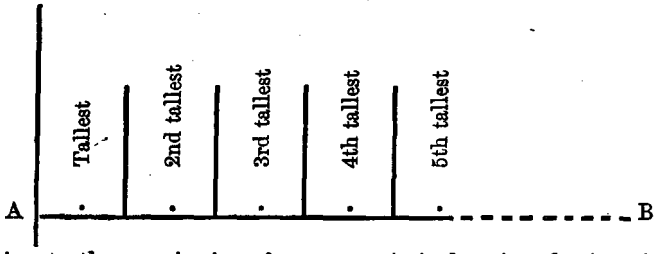
But all these operations require the use of an *external standard*. The men must be separately measured by a foot-rule before their measurements can be classified, and the same need of an external standard of measurement is felt in every case with which the ordinary methods of statistics profess to deal. The standard of measurement may be that of time, weight, length, price, temperature, &c., but without the almanack or watch, the scales, the foot-rule, the coin, the thermometer, &c., statistics of the ordinary form to which I refer, cannot be made.

In my process, there is no necessity for an external standard. It clearly comes to the same thing whether I take eleven men and, measuring them one against another, range them in order, beginning with the highest and ending with the lowest, or if I measure them separately with a foot-measure, and range them in the order of the magnitude of the measurements recorded in my note-book. In each case the tallest man will stand first, the next tallest second, and so on to the last. In each case the same man will occupy the sixth or *middlemost* place, and will therefore represent the *medium* height of the whole of them. I do not wish to imply that 'medium' is identical with 'mean' or 'average,' for it is not necessarily so. But I do say that the word medium may be strictly defined, and therefore if we wish to compare the heights of Englishmen with Frenchmen, we shall proceed just as scientifically if we compare their medium heights as if we compare their average heights. Now it will be observed that we have got the medium heights without a foot-rule or any external standard; we have done so altogether by the method of intercomparison. In the particular question with which we are dealing I have classified the answers according to the degree of vividness of mental imagery to which they depose, and I pick out the middlemost answer and say that the description given in it describes the medium vividness of mental imagery in the group under discussion. If I want to compare two such groups I compare their respective middlemost answers, and judge which of the two implies the higher faculty.

Thus much is a great gain, yet I claim to effect more; but in order to explain what that is I must return to the illustration of heights of men. Suppose them as before to be all arranged in order of their stature, at equal distances apart on a long line A B, with their backs turned towards us. If there

be a thousand men, we must suppose A B to be divided into 1000 equal parts, and a man to be set in the middle of each part. The tallest man will have A close to his left, and the shortest man will have B close to his right. They will form a series as shewn in Fig. I., where the subdivisions of A B are indicated by the vertical lines, and the positions where the men are standing are shown by the dots half-way between those lines.

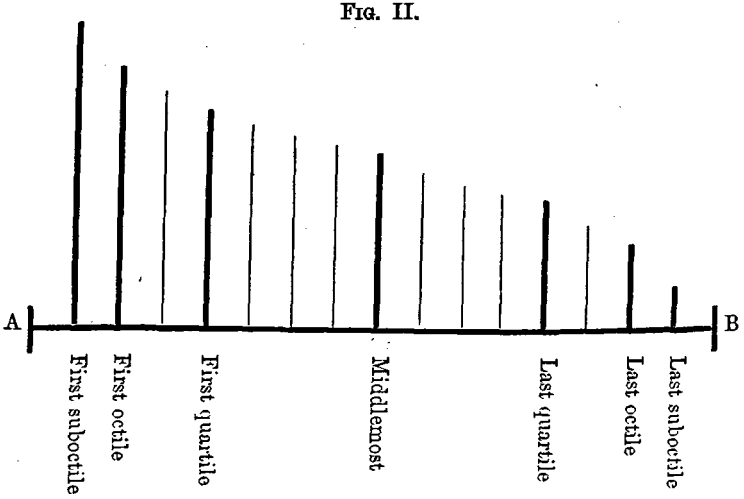
FIG. I.



Owing to the continuity of every statistical series, the imaginary line drawn along the tops of the heads of the men will form a regular curve, and if we can record this curve we shall be furnished with data whereby to ascertain the height of every man in the whole series. Drawing such a curve for Englishmen and another for Frenchmen, and superimposing the two, we should be able to compare the statures of the two nations in the minutest particulars.

A curve is recorded by measuring its ordinates. If we divide A B by a sufficient number of equi-distant subdivisions and measure the ordinates at each of them as has been done in Fig.

FIG. II.



II. (where the ordinates only are shewn, and not the curve), we can at any time plot them to scale, and by tracing a free line touching their tops, we can with more or less precision, reproduce the curve. It happens, however, from the peculiar character of all statistical curves, that ordinates at equal distances apart are by no means the most suitable. The mediocre cases are always so numerous that the curve flows in a steady and almost straight line about its middle, and it becomes a waste of effort to take many measurements thereabouts. On the other hand its shape varies rapidly at either end, and there the observations ought to be numerous. The most suitable stations are those which correspond to ordinates that differ in height by *equal degrees*, and these places admit of being discovered by *à priori* considerations on certain general suppositions.[1]

We shall however do well to ignore those minutiæ on which I laid much stress in the Memoir, and adopt the simpler plan of successive subdivisions of A B, and of measuring the ordinates shown by darkened lines in Fig. II., and severally named there as 'middlemost,' first and last 'quartile,' first and last 'octile,' and first and last 'suboctile'. This is far enough for our present wants, though the system admits of indefinite extension. By measuring the 'ordinate,' I mean measuring the 'man' whose place in the series is nearest to the true position of that ordinate. Absolute coincidence is not needed in such rude work as this; thus in a series of 100 men either the 50th or the 51st will do duty for the middlemost. The places I have actually taken in the series of 100 men for the several stations, are, the 6th and 94th for the first and last suboctiles, the 12th and 88th for the octiles, the 25th and 75th for the quartiles, and the 50th for the middlemost.

Seven men thus become the efficient representatives of a very large class. It will be found as a general rule that these seven selected representatives will differ each from the next by approximately *equal intervals*, the difference between the suboctile and the octile being usually about the same as that between the octile and quartile, and between the quartile and the middlemost.

[1] These are discussed in the Memoir already referred to, "Statistics by Intercomparison," by myself, in *Phil. Mag.*, Jan., 1875, but there are some errors, and also some appearances of error owing to faults of expression, in that article, which were first pointed out to me by Mr. J. W. L. Glaisher. There is a full mathematical discussion bearing on the matter in a memoir by Mr. D. McAlister in the *Proceedings of the Royal Society*, 1879, on the "Law of the Geometric Mean," to which and to the immediately preceding paper by myself on the "Geometric Mean," I would refer the mathematical reader. Mr. J. W. L. Glaisher has also taken the subject in hand and calculated tables, and I trust that his memoir thereon may before long be published.

As a matter of interest, and for the chance of finding very exceptional cases, I also record the highest and the lowest of the series, but it must be clearly understood that these have no solid value for purposes of comparison. In the first place, their position as ordinates is uncertain unless the number of the group of cases is given, for when the number is large the position of the highest and lowest will be nearer to A and B respectively than when it is small. In the second place, the highest and lowest being outside cases, they are more liable to be of an exceptional character than any of those which stand between neighbours, one on either hand of it.

The comparison of any two groups is made by collating their seven representatives each to each, the first suboctile of the one with the first suboctile of the other, the first octile with the first octile, the first quartile with the first quartile, and so on. I also collate the highest of each, and again the lowest of each, as a mere matter of interest, but not as an accurate statistical operation, for the reasons already given.

It is possible that I may be thought to have somewhat loosely expressed myself under the necessity of foregoing the use of technical terms, but the mathematical reader who demands precision of statement will understand me, while it would require a treatise and much study to make the mathematical substratum of my method perfectly intelligible to a person who was not familiar with the laws of 'Probabilities' and 'Frequency of Error'.

In the following comparison between the 100 Adult Englishmen and the 172 Charterhouse boys, I have divided the latter into two groups, to serve as a check upon one another. Group A includes boys of the four upper classes in the school, group B those of the five lower classes. I have combined their replies as to Illumination and Definition under the single head of 'Vividness,' and have taken no editorial liberties whatever except of the most pardonable description. It is wonderful how well and graphically the boys write, and how much individual character is shown in their answers.

Vividness of Imagery.

HIGHEST.

Adult Males.—Brilliant, distinct, never blotchy.

Charterhouse A.—The image is perfectly clear. I can see every feature in every one's face and everything on the table with great clearness. The light is quite as bright as reality.

Charterhouse B.—The image that arises in my mind is perfectly clear. The brightness is decidedly comparable to that of the real scene, for I can see in my mind's eye just as well as if I was beholding the scene with my real eye.

FIRST SUBOCTILE.

Adult Males.—The image once seen is perfectly clear and bright.

Charterhouse A.—It is very clear and is as bright as it actually was. Everything occurs most distinctly. I can imagine everything at once, but can think a great deal more clearly by thinking more on a particular object.

Charterhouse B.—I see it exactly as it was, all clearly defined just as it was.

FIRST OCTILE.

Adult Males.—I can see my breakfast table or any equally familiar thing with my mind's eye quite as well in all particulars as I can do if the reality is before me.

Charterhouse A.—To me the picture seems quite clear and the brightness equal to the real scene. I cannot see the whole scene at the same instant, but I see one thing at once and can turn my eye mentally to another object very quickly, so that I soon get the whole scene before my mind.

Charterhouse B.—Fairly clear. I cannot see everything at the same time, but what I do see seems almost real.

FIRST QUARTILE.

Adult Males.—Fairly clear; illumination of actual scene is fairly represented. Well defined. Parts do not obtrude themselves, but attention has to be directed to different points in succession to call up the whole.

Charterhouse A.—The image is fairly clear, but its brightness is dimmer than the actual. The objects are mostly defined clearly and at the same time.

Charterhouse B.—Fairly clear, the objects are pretty well defined at the same time.

MIDDLEMOST.

Adult Males.—Fairly clear. Brightness probably at least from one-half to two-thirds of the original. Definition varies very much, one or two objects being much more distinct than the others, but the latter come out clearly if attention be paid to them.

Charterhouse A.—The image is fairly clear, but its brightness is not comparable to that of the actual scene. The objects are pretty well defined at the same time.

Charterhouse B.—The image is pretty clear, but not so clear as the actual thing. I cannot take in the whole table at once, and I cannot see more than three plates at once, and when I try to see both ends of the table I cannot see anything of the middle. I can see nothing beyond the table, but the table itself seems to stand out from the distance beyond.

LAST QUARTILE.

Adult Males.—Dim, certainly not comparable to the actual scene. I have to think separately of the several things on the table to bring them clearly before the mind's eye, and when I think of some things the others fade away in confusion.

Charterhouse A.—The image is fairly clear. I cannot see everything at once, but as I think of them they come clearly before me. The objects are not all defined at the same time, and the place of sharpest definition is more contracted than in real scene.

Charterhouse B.—If I think of any particular thing without the others, it seems clear; all at once, are not clear.

LAST OCTILE.

Adult Males.—Dim and not comparable in brightness to the real scene.

Badly defined with blotches of light; very incomplete; very little of one object is seen at one time.

Charterhouse A.—I can call up to my mind the picture of the breakfast table in every detail, but seem to see everything through a darkened pane of glass. I see just the same number of people, plates, &c., the whole time, provided of course that I do not change my idea of the scene to any great degree.

Charterhouse B.—Rather dim; the objects are pretty well defined.

LAST SUBOCTILE.

Adult Males.—I am very rarely able to recall any object whatever with any sort of distinctness. Very occasionally an object or image will recall itself, but even then it is more like a generalised image than an individual one. I seem to be almost destitute of visualising power as under control.

Charterhouse A.—The image is dim, dark, and smaller than the actual scene, and the objects nearest to me show most distinctly. The whole picture is more or less of a dark green tint.

Charterhouse B.—Dim. The place of sharpest definition is more contracted than in a real scene.

LOWEST.

Adult Males.—My powers are zero. To my consciousness there is almost no association of memory with objective visual impressions. I recollect the table, but do not see it.

Charterhouse A.—Image dim, the brightness much less than in the real scene. Only one object is very clearly visible at the same time.

Charterhouse B.—Very dim. I can only see one part at a time.

I gather from the foregoing paragraphs that the A and B boys are alike in mental imagery, and that the adult males are not very dissimilar to them; but the latter do not seem to form so regular a series as the boys. They are avowedly not members of a true statistical group, being an aggregate of one class of persons who replied because they had remarkable powers of imagery and had much to say, of another class of persons, the scientific, who on the whole are very deficient in that gift, and of a third class who may justly be considered as fair samples of adult males.

I next proceed to colour, and annex the returns to the third of the above questions, which I have classified on the same principle as before.

Colour Representation.

HIGHEST.

Adult Males.—Perfectly distinct, bright, and natural.

Charterhouse A.—Yes, *perfectly* distinct and natural.

Charterhouse B.—The colours look more clear than they really are.

FIRST SUBOCTILE.

Adult Males.—White cloth, blue china, argand coffee pot, buff stand with sienna drawing, toast,—all clear.

Charterhouse A.—I see the colours just as if they were before me, and perfectly natural.

Charterhouse B.—The colours are especially distinct in every case.

FIRST OCTILE.
Adult Males.—All details seen perfectly.
Charterhouse A.—Quite distinct and natural.
Charterhouse B.—All colours are perfectly distinct to me in my mind's eye, in whatever scene or shape they appear to me.

FIRST QUARTILE.
Adult Males.—Colours distinct and natural till I begin to puzzle over them.
Charterhouse A.—Quite distinct and natural.
Charterhouse B.—The colours of the china, &c., are quite distinct and natural.

MIDDLEMOST.
Adult Males.—Fairly distinct, though not certain that they are accurately recalled.
Charterhouse A.—They are all distinct after a little thought, and are natural.
Charterhouse B.—Yes, quite distinct and natural.

LAST QUARTILE.
Adult Males.—Natural, but very indistinct.
Charterhouse A.—The colours of the most pronounced things on the table are distinct, as the white tablecloth and yellow mustard.
Charterhouse B.—Some are; china, mustard, toast,—the others are not.

LAST OCTILE.
Adult Males.—Faint, can only recall colours by a special effort for each.
Charterhouse A.—Colours not very distinct.
Charterhouse B.—They are natural, but not very distinct.

LAST SUBOCTILE.
Adult Males.—(Power is nil.)
Charterhouse A.—The colours are very dim.
Charterhouse B.—The colours seem to be more like shades, but they have some colour in them.

LOWEST.
Adult Males.—(Power is nil.)
Charterhouse A.—(Power is nil.)
Charterhouse B.—(Power is nil.)

The same general remarks may be made about the distribution of the faculty of colour representation as about that of the vividness of imagery. It seems that on the whole, colour is more easily recalled than form, and especially so by the young. As the faculty of visual representation is being dropped by disuse, colour disappears earlier than form. This I may remark, was the case with the often quoted hallucinations of Nicolai, which, in his progress to recovery, faded in colour before they faded in outline.

One of my correspondents, an eminent engineer, who has a highly developed power of recalling form, but who described himself as deficient in the power of recalling colour, tells me that since receiving and answering my questions he has prac-

tised himself in visualising colours and has succeeded perfectly in doing so. It now gives him great pleasure to recall them.

It will be of interest to extract the few instances from the returns of the Adult Males in which peculiarities were noticed in connexion with colour representation, other than in its degree of vividness. Each sentence is taken from a different return.

Light colours quite distinct, darker ones less so.
Patchy.
Generally hueless, unless excited.
Mostly neutral.
Brown colour, *e.g.* of the gravy, is difficult to visualise.

Another question that I put was as follows :—

"*Extent of field of view.*—Call up the image of some panoramic view (the walls of your room might suffice); can you force yourself to see mentally a wider range of it than could be taken in by any single glance of the eyes? Can you mentally see more than three faces of a die, or more than one hemisphere of a globe at the same instant of time?"

It would have been possible to classify the Charterhouse returns, but the answers were not so generally good as to make it advisable to spend pains upon them. I therefore content myself with the replies of the Adult Males, but shall subsequently add a few facts taken from those of the boys, in a separate paragraph.

Extent of Field of Mental View.

Highest.—My mental field of vision is larger than the normal one. In the former I appear to see everything from some commanding point of view, which at once embraces every object and all sides of every object.

First Suboctile.—A wider range. A faint perception *I think* of more than three sides of a room. Rather more *I think* than one hemisphere, but am not quite sure about this.

First Octile.—Field of view corresponding to reality.

First Quartile.—Field of view corresponding to reality.

Middlemost.—Field of view corresponding to reality.

Last Quartile.—I think the field of view is distinctly smaller than the reality. The object I picture starts out distinct with a hazy outline.

Last Octile.—Much smaller than the real. I seem only to see what is straight in front as it were.

Last Suboctile. } No field of view at all.
Lowest. }

It may seem strange to some that the field of mental vision should occasionally be wider than reality, but I have sufficient

testimony to the fact from correspondents of unquestionable accuracy. Here are cases from the returns:—

I seem to see the whole room as though my eye was everywhere. I can see all around objects that I have handled.

I can see three walls of a room easily, and with an effort the fourth. I can see all the faces of a die and the whole globe, but die and globe seem transparent.

[An eminent mineralogist told me that familiarity with crystals gave him the power, of mentally seeing all their facets simultaneously.]

This subject is of interest to myself on account of a weird nightmare by which I am occasionally plagued. In my dream, a small ball appears inside my eye. I speak in the singular, because the two eyes then seem fused into a single organ of vision, and I see by a kind of touch-sight all round the ball at once. Then the ball grows, and still my vision embraces the whole of it; it continues growing to an enormous size, and at the instant when the brain is ready to burst, I awake in a fright. Now, what I see in an occasional nightmare, others may be able to represent to themselves when awake and in health.

From the foregoing statistical record it will be seen that in one quarter of the cases, that is to say, in the last quartile and in all below, the field of mental view is decidedly contracted. The Charterhouse returns (A and B combined) give a higher ratio. They show that in at least 74 out of the 172 cases, or in 43 per cent. of them, it is so; indeed, the ratio may be much larger, as I hardly know what to say about 51 cases, owing to insufficient description. I am inclined to believe that habits of thought render the mental field of view more *comprehensive* in the man than in the boy, though at the same time it causes the images contained in it to become fainter.

A few of the boys' answers are much to the point. I append some of them:—

The part I look at is much smaller than reality, with a haze of black all round it. It is like a small picture.

I have to fix my eyes on one spot in my imagination, and that alone is fairly defined.

I cannot see anything unless I look specially at it, which is not the case with my real eyes.

I have to move my mental eyes a good deal about. The objects are not defined at the same time, but I think of them one at a time; also, if I am thinking of anything, as a map for instance, I can only imagine one name at a time.

The next question that I put referred to the apparent position of the image. It was as follows:—

"*Distance of images.*—Where do mental images appear to be situated? within the head, within the eye-ball, just in front of

the eyes, or at a distance corresponding to reality? Can you project an image upon a piece of paper?"

Unfortunately this question was not included among those that I first issued, and I have not a sufficient number of answers to it from adult males to justify a statistical dependence on them even on that ground alone. It is better in this case to rely on the Charterhouse boys, of whom only twelve failed to answer the question. Reducing to percentages, I find:—

POSITION OF MENTAL IMAGES.

	Per Cent.
Further than the real scene	9
Corresponding to reality	39
Just in front of the eyes	22
In eye-ball	6
In head	15
Partly at one distance, partly at another	9
	100

The more closely the image resembles in its vividness the result of actual vision the more nearly should we expect its distance to appear to coincide with that of the real object, and this as a matter of fact I find to be the case. The meaning of the word *reflection* is bending backwards, and those who reflect have the sense of a turning back from without to within the head. When a mental scene arises vividly and without any effort, the position of the vision is more frequently external, as it is in an hallucination.

I will next give the results of the latter part of the question, about the ability to project images on paper.

For the same reason as in the last case the returns from the adult males are insufficient. I have five clear cases only among them of an affirmative answer, out of which I will quote the following:—

ABILITY TO PROJECT AN IMAGE.

Holding a blank piece of paper in my hand, I can imagine on it a photograph or any object that it will hold.

The Charterhouse boys in at least 18 cases, or in ten per cent. of them, appear to have this power. The following are a few of their answers:—

I can think things to be upon a blank piece of paper.

I can place a mental image wherever I like, outside the head, either in the air or upon any substance.

After looking at a blank wall for some time, I can imagine what I am thinking of.

I can half project an image upon paper, but could not draw round it, it being too indistinct. I see the effect, but not the details of it.

I find it very hard to project an image on a piece of paper, but if I think for some time and look very hard at the paper, I sometimes can.

I can project an image on to anything, but the longer I keep it the fainter it gets, and I don't think I could keep it long enough to trace it.

I find indirectly from the answers to other questions that visual representations are by no means invariably of the same apparent size as the real objects. The change is usually on the side of reduction, not of enlargement. Among the Charterhouse boys there are thirteen of the one to two cases of the other, and I think, but I have not yet properly worked it out, that the returns from adults generally, male and female, show somewhat similar results. The following are extracts from the reports of the boys:—

IMAGES LARGER THAN REALITY.

The place and objects in a mental picture seem to be larger altogether than the reality; thus a room seems loftier and broader, and the objects in it taller.

They look larger than the objects [? such objects as may be handled] really are, and seem much further off, . . they look about five yards off.

IMAGES SMALLER THAN REALITY.

Very small and close.

Much smaller and very far off.

All the objects are clearly defined, but the image appears much smaller.

The difference that I see is, that everything I call up in my mind seems to be a long way off.

The difference is that it is much smaller.

Space does not admit, neither is this the most suitable opportunity of analysing more of the numerous data which I have in hand, but before concluding I would say a few words on the "Visualised Numerals" which I described first in *Nature*, Jan. 15, 1880, but very much more fully and advisedly in a memoir read before the Anthropological Institute in March, 1880, which will be published in its *Transactions* a few weeks later than the present memoir. It will contain not only my own memoir and numerous illustrations, but the remarks made on it at the meeting by gentlemen who had this curious habit of invariably associating numbers with definite forms of mental imagery. It is a habit that is quite automatic, the form is frequently very vivid and sometimes very elaborate and highly coloured, and its origin is always earlier than those who see it can recollect. Those who visualise numerals in number-forms are apt to see the letters of the alphabet, the months of the year, dates, &c., also in forms; but whereas they nearly always can suggest some clue to the origin of the latter, they never can, or

hardly ever can, to that of the numerals. I have argued in the memoir just mentioned, partly from this fact and partly because some of the number-forms twist and plunge and run out of sight in the strangest ways, unlike anything the child has ever seen, that these are his natural, self-developed lines of mnemonic thought, and are survivals of the earliest of his mental processes, and a clue to much that is individual in the constitution of his mind. I found that only about one in thirty adult males saw these forms, but suspected that they were more common in early life, and subsequently lost by disuse. This idea is abundantly confirmed by the returns of the Charterhouse boys. Nearly one in four has the habit of referring numbers to some visual mental form or other; often it is only a straight line, sometimes more elaborate. No doubt as the years go by, most of these will be wholly forgotten as useless and even cumbrous, but the rest will serve some useful turn in arithmetic and become fixed by long habit, and will gradually and insensibly develop themselves. For want of space I must here close my statement of facts; and, my data being thus imperfectly before the reader, it would be premature in me to generalise. I trust, however, that what has been adduced is enough to give a fair knowledge of the variability of the visualising faculty in the English male sex, and I hope that the examples of the use of my "Statistics by Intercomparison" will convince psychologists that the relative development of various mental qualities in different races admits of being pretty accurately defined.

FRANCIS GALTON.

II.—THE UNITY OF THE ORGANIC INDIVIDUAL.

I.

IN the free exercise of our thought and volition, we would laugh to scorn the intimation that not in our own undivided personality are lodged these sovereign powers, but that they originate outside of it, dispersedly, within the diminutive lives of a vast number of microscopical threads and dots. We would resign our autonomy to the five or six billions of corpuscles composing our bodies, upon no other conditions than such as have convinced us that, in spite of all appearances to the contrary, the earth is moving round the sun. It constitutes the loftiest pride of our culture to abnegate subjective impressions in favour of the demonstrations of science. We know, therefore, how we shall have to deport ourselves in the presence of facts, if they visibly confront and obstinately oppose our feeling