AN EXPERIMENTAL INVESTIGATION OF PERCEPTION.

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WHAT are the factors involved in the process of perception? Are we justified in making a classification of individuals according to their 'type of perception,' as has been attempted by Binet¹? Do adults and children show any fundamental differences in their manner of perceiving? These are the questions which the following experiments were undertaken to answer.

¹ *L'Etude expérimentale de l'Intelligence*, Paris, 1903, ch. xi.

1. SUBJECTS OF EXPERIMENT.

The subjects in these experiments were thirty-two adults and thirty-eight school children of different ages. The majority of the adults were Cambridge graduates and undergraduates; with the exception of two domestic servants, all of them had had excellent education. There were seven women among the adults. Nine of the thirty-two were science students. The children belonged to three neighbouring schools—the — Grammar School, an elementary school in a good residential district, and an elementary school in one of the poorest parts of the town.

Experiments on the adults were carried out at the Cambridge Psychological Laboratory; in the case of the children I visited each of the schools in turn, and worked in one of the class rooms.

2. APPARATUS EMPLOYED.

In the Laboratory the apparatus I used was a form of tachistoscope devised by Mr Hales, which has already been described in this *Journal*¹. By means of this instrument transparent objects can be exposed for a very brief period, and where nothing is said to the contrary it may be assumed that the time of exposure in the present experiments was about one-thirteenth of a second. Variations of the time interval were tried occasionally, and will be mentioned in their place. In the school experiments I used a smaller and simpler apparatus, which had a photographic shutter in place of the pendulum. The time of exposure in this case was longer, and probably not quite so constant, the average time being about one-fifth of a second.

The effect of these very brief exposures was to spread out the process of perception (and apprehension) over a longer time than usual, so that the different factors involved therein could be noted with fair ease. Even subjects who were quite unaccustomed to introspection were able to indicate accurately what progress in the process they were making, and how the progress came about.

The objects were presented in the form of lantern slides. They varied in nature and in difficulty. They were chosen for various reasons,—simplicity, complexity, familiarity or strangeness. The pictures

¹ 1908, II. 244 ff.

numbered 1 to 7 were coloured; the remainder were in black and white. The following is a brief summary of their contents :

1. A railway track with an engine and passenger train travelling quickly towards the right hand bottom corner. There are two pairs of rails, and also a pipe running parallel to them. On the left are several posts and a green hedge. On the right the ground falls away.

2. The platform of a small station, with the rails also showing on the right. Several groups of people are standing about, the most prominent being an old lady and her son, who are going to part. Half of a bridge is visible, rising from the platform on the left and turning at right angles to cross the line. Behind the bridge is a mass of station buildings, and in the left foreground are rails and a lamp-post.

3. Two men: a sweep on the left with a bundle of brushes on his shoulder, and a gentleman on the right with frock coat and silk hat. A vertical line down the centre indicates that they are about to collide with each other in turning the corner.

4. The sequel to No. 3. The corner is now to the right and the sweep's brushes have struck the gentleman in the face and knocked his hat off. His glove is also falling.

5. A child's face with a circular background of blue. The child's hair is unkempt and his right eye is screwed up mischievously, thus drawing the mouth to one side. The upper part of a white garment is shown round the neck but nothing further can be seen.

6. A man is busy tarring a wall with a long brush, the tar being in a bucket on his left. Another man seen in profile on the right has just begun to expostulate with him and the former, raising his brush on the left and turning his head to the right, has tarred the face of a lady who is just coming round the corner of the wall on the left.

7. On a table at the bottom of the picture are a cat, an inkpot, a book and a vase of flowers. Above the cat, and quite near it, is a bird in a cage. At the top of the picture is a scroll containing the words: "A bird fancier."

8. A pug dog on the left and a Persian cat on the right—lying on a table, with their faces towards the observer.

9. A three-masted ship of the *Victory* type, lying broadside-on in calm water. The port holes are very prominent. On the right and beyond is another ship of the same type.

10. A lifeboat standing on the slips in a harbour. The slips are very prominent in the foreground. Beyond the bay is a town with several large buildings showing indistinctly.

11. A donkey, standing nearly in profile, with its head to the right. The ground is rough and rising to the right. The donkey's ears are stretched out, the hind feet together and the fore feet slightly apart.

12. A Brittany bed: consisting of a richly carved cupboard containing two beds, one above the other. The doors slide apart and are open. Kneeling on a ledge by the upper bed is a woman in the costume of a Brittany peasant, and there is someone sleeping in the lower bed. Outside the cabinet is a carved settee.

13. A muzzled bear in the middle of a suburban street, standing on its hind legs and holding a high pole. There are houses with prominent bow windows on

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each side and the sun, evidently shining brightly on the right, is casting strong shadows.

14. An elephant standing in profile, head to the right. The trunk is curved upwards and near it is the keeper. There are trees in the background and some people show faintly on the right.

15. Six yachts, at varying distances, sailing up a lake which is backed by ranges of hills. All the yachts are inclined towards the right and there are ripples on the water.

16. A chaos, made by a few blots of ink. To the left are a few straight lines which suggest a box or a small hut, but the rest is without meaning.

17. Queens' College, Cambridge, as seen from Silver Street bridge. The college buildings are on the right, and dense trees on the left. The river flows between, and is spanned by a wooden bridge near which are two small punts.

It may be here remarked that it was generally impossible to foretell whether any given picture would prove easy or difficult to a given subject,—some subjects finding pictures very difficult which caused no trouble to others, while the latter perhaps stumbled at those pictures which appeared easy to the majority.

3. METHOD OF INVESTIGATION.

The experiments were carried out in the following way: first, the subject was told something about the nature of the experiment, and the part he was to play therein. He was then shown exactly where the image would fall on the screen, and was also habituated to the speed of exposure. If desired, a small fixation mark was affixed to the screen. A lantern slide was then put into place, a warning signal was given, and about a second later the exposure was made. The subject reported as fully as possible what he had seen; he was asked also to describe any associations the picture had called up, any feelings, emotions, etc. he had experienced, any inferences he had made, and so on. This introspective record I wrote down almost *verbatim*. After the subject had told me all he could remember, I questioned him in order to clear up any vagueness of statement and to make sure that nothing had been forgotten. When the report on the first flash was completed, a second exposure was made of the same picture, and the subject reported the additions or corrections he wished to make. This procedure was repeated several times, until the subject had seen the whole picture, or had become tired of it, or had found it too difficult to solve completely. Hence the number of exposures varied with each picture and each subject, sometimes five or six being found sufficient, and in some cases a hundred not being found too many. Occasionally, after the warning

had been given, the picture was not shown but the subject was asked to report his experiences while he was preparing to attend to the coming flash. The records of these 'fore-periods' threw light on the subjects' activity in planning out their work, and showed how far they attacked the problem systematically.

4. RESULTS.

An analysis of the introspective records leads to the following results :

The process of perception, as it here occurs, takes place in two stages. There is first (a) an immediate interpretation of the object as a whole, and next (b) an analysis of this vaguely apprehended whole into its component parts. Subjects of all ages showed striking uniformity in the first process, whereas in the second there was a no less striking variability.

(a) The interpretation is immediate, and my experiments did not throw much light on this point, though with other material it might be possible to investigate it more completely. "We begin," as Stout says, "by apprehending a whole in its distinctionless totality, and then proceed to unfold its details¹." It is important to insist that previous experiences, which give meaning and distinction to this complexity, need not themselves be present to the mind. Some writers have insisted very strongly on the necessity of the revival of past experiences in perception, but these experiments support the view that the mind can give a meaning to experience without any such revival taking place². For the time being we may go no further than this general interpretation. "It is possible to think of a whole in its unity and distinctness, without discerning all or even any of its component details³."

As examples of this instantaneous recognition I quote from the introspection of different subjects :

"Recognition is quite instantaneous. I didn't notice any *process*."

"I couldn't distinguish between the instant of seeing and recognition."

"Recognition was immediate."

"Recognition is very rapid, and the word is as quick as the recognition."

¹ G. F. Stout, *Groundwork of Psychology*, 1911, 70, 71.

² Cf. "What is Perception?" by C. H. Judd, *J. of Philos., Psychol., and Sci. Methods*, 1909, vi.

³ G. F. Stout, *Analytic Psychology*, I. 78.

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In rarer cases recognition, although immediate, developed greater clarity after a perceptible interval. Thus:

"Recognition is quite immediate, but it gets much clearer as one thinks about it."

"Recognition is instantaneous, though there's something like an unfolding."

A few subjects (at least three of the thirty-two,—probably more, as I did not question all about the matter), distinguished between the recognition of differences in luminosity and the recognition of form. That is, they first saw an illuminated patch with certain black marks, and then these immediately assumed some definite shape. Examples of this distinction are found in the following:

"A white background and black things in front. It looked like acrobats in all sorts of attitudes. There was a slight searching for an explanation, but not long." (No. 16.)

"My first impression was of black masses without outline. Then it suggested a dog."

I am not sure that these cases are as genuine as they look. Two of the three subjects were quite untrained in introspection, and the third gave very few answers of this nature. In one of the subjects I think it was due to excessive caution. This subject always began with the most general interpretation he could, and only approached the particular after great deliberation. Thus in picture No. 6 he described the central man as follows: "I saw something like an inverted Y. I take it to be a man." And in picture No. 11 he said: "The picture of a quadruped. There is something sticking out of the head—horns or ears. I associated it with a cow."

It will be seen that by this method of answering he left room for retreat in case of mistake, and gave first an interpretation broad enough to avoid nearly every likelihood of error. In one of the remaining two subjects I think more was seen than she reported at first—either through vagueness or forgetfulness. In the picture of the bear (No. 13), she said:

"Nothing but white and black. I couldn't say what, unless the white is snow. I was quite ready, but not so concentrated as usual. It might have been a boy standing up in a snowy street. But I dismissed that as impossible. It was all too blurred. He came up involuntarily."

I then asked whether any more came back to her, even vaguely, and she replied: "Well, the boy might be standing with his legs apart." It is therefore probable that the perception of form here was more complete than the first report indicated.

The third case of this kind was one who had had long training in psychology and in experimental work. With the nonsense picture (No. 16) she described her experience as follows:

"I can't say much of the first stage. The picture rolls on, but doesn't take a final interpretation at first. I feel there is a preparation for a definite final something. I had confidence of something definite which would come up when the picture was gone. Then I saw other parts, and the previous interpretation was choked down by this new sensation, and so the other never appeared in full consciousness."

Perhaps I have unduly emphasized these few exceptions, but it is because they are the more striking in face of the uniformity found with the remaining subjects. In my own case I had the experience of a blinding flash of light from which the awareness of certain forms immediately emerged. That is, while I was still in a state of surprise at the speed and brightness of the exposure, I found I was conscious of what I had seen, without the least effort being necessary. The whole process was one and indivisible.

In order to try and discover something more about this point I modified the conditions of the experiments by cutting down the time of the exposure to considerably less than one-hundredth of a second. Yet even with this very short exposure the immediateness of recognition was unchanged. I quote the following reports:

"Recognition was as immediate as before."

"A three-masted ship of the type *Victory*. There are port holes and white band. It is facing my right. The exposure was considerably shorter. Open sea. No land in the background. I have an impression of small boats, but I am uncertain. My certainty about the general thing is just the same, but the details are more uncertain. The recognition of the three-masted ship was just as immediate as it would be with a longer exposure." (No. 9.)

Subjects were usually unconscious of any change in the speed of the flash in the cases where I secretly altered it from the normal to the very rapid time. They often reported, however, that the picture had become "very dull," and conversely, when the duration of exposure was lengthened, they would remark that the picture had become "much brighter."

I also tried the effect of showing a picture which was outside the experience of the subjects. This proved to be a difficult matter, and pictures Nos. 12 and 16 were the best I was able to obtain. Both were interpreted very differently by different subjects, but it is significant that there was never any hesitation about interpreting them as something of every-day experience. The former of these pictures received such descriptions as the following:

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"It looked like the balcony of a window and somebody standing on it."

"Something like the frontage of the Laboratory, but much more pretentious. I was not aware of any interval between the sensation and the interpretation."

"It was like a glass case, standing in a sort of trough. Immediate interpretation."

In the case of the latter picture similar fantastic accounts were given:

"It looks like a most extraordinary coat of arms, made up of quite unintelligible figures."

"Like a cartoon in *Punch*."

"It might be a lot of rapiers and boxing gloves—the paraphernalia of a gymnast."

"Three little animals with funny little heads."

Although interpretation was so immediate, doubt might afterwards arise as to its accuracy, but this never prevented an immediate judgment being made in subsequent experiments. Even the faintest sensations will bring about the perception of complex things. Picture No. 12, by its regular form, might suggest a door or a window, or the part like a settee near the floor might even suggest a fireplace and fender. Hence when the picture was incompletely and imperfectly seen, ideas connected with one or other of these interpretations at once arose, and the picture was filled in mentally by association and expectation. In this way so strange an object was interpreted in terms of very familiar objects.

Our experience in normal life is often very similar. No doubt, we repeatedly misinterpret the things about us in our rapid glances to and fro, and we only look more closely when doubt arises, or when we are greatly surprised at what we have seen. I have occasionally made most grotesque mistakes in glancing quickly along a crowded street while thinking of something quite remote from the scene; a second careful look has failed to reveal any very obvious reason for the first interpretation.

It is interesting also to note that many young children, who had at first seen No. 12 as a window or a door, persisted in the same interpretation when they saw the picture properly at the end of the experiment. Here the mental factors at work were apparently much stronger than the visual sensations which were responsible for the process.

(b) After the immediate recognition, which, as I have shown, is of universal occurrence, the mind seeks to know the details, and to analyse the vague whole into its various parts. In this process of analysis, enormous individual differences appear; indeed, at first sight, it is difficult to discover any uniformity whatever. I have found it vain to attempt to set up 'types' of individuals with distinguishing and

constant characteristics, because the peculiarities of what I thought might be a 'type' rarely turned out to be constant, and often appeared in other subjects whom I had decided on other grounds to belong to another type¹.

A. *Experiments on Adults.*

I propose to give, first, an account of the introspection from adult subjects, reserving the children's introspection till later, in order that a clearer comparison may be made between the two groups.

(i) *Procedure adopted by the subjects.* Subjects may be roughly divided into two classes according to their method of procedure during the analysis. Some continued to see each picture as a whole, except when an outstanding feature attracted their attention or happened to fall on the focus of vision. Sometimes one detail would appear so prominent that it was seen continually, even when there was a faint intention to look away from it. Other subjects made a more or less systematic search for details. In the most pronounced cases of this class, they were able to concentrate on an exceedingly small area of the screen, and so saw only a very minute portion of the picture clearly and the rest very vaguely:

"The clear part was a small semi-circle at the bottom."

"One seems to see just one part at a time."

The subjects in the first class made, in general, very little progress in the solving of the pictures, and, indeed, often asserted they were making no progress at all. Typical reports are:

"I haven't got much more than at first."

"It seems to me one gets more out of it the first time. I suppose that my mind gets confused."

"I think the second time was as clear as any time since."

These subjects did not usually persevere much. They began to feel baffled after a few exposures, and unable to proceed:

"I am gradually getting the feeling I am stuck and can go no further."

"I am beginning to feel hopeless about it. With increased hopelessness comes increased impatience to see the picture in a long exposure."

¹ "Moreover it happened that any subject whatsoever, who from his description of one picture must have been classified as an 'observation type,' would behave in the description of the next picture as if he were of the 'description type.' We have therefore preferred to abandon this attempt (to classify by types), rather than undertake an arbitrary and artificial classification." Marie Borst, "Untersuchungen über die Erziebarkeit und die Treue der Aussage," *Beitr. z. Psychol. d. Aussage*, 2^{te} Folge, 1905-6, 105-6.

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Those, on the other hand, who searched closely for details made steady progress and were content to spend a long time with each picture. They showed very great anxiety over their accurate procedure :

"I was too high. I don't get it unless I hit the exact spot."

"I seem to see only the point where my eyes are concentrated."

"After the first impression I should naturally go for the details."

This power of minute observation was most strikingly developed in students of science, and the two best cases were those of a University Lecturer who has spent many years in scientific investigation, and a Research Student of some years' experience. I will quote from the report of the latter, given with picture No. 3, and in order to show the development of his analytical method I will present his answers after the first flash and after the tenth flash. It will be seen that all parts of the picture are mentioned in the first, but only a very small area in the second answer :

"A sweep and a gentleman. The sweep is coming round a corner apparently. The well-dressed man has a top hat and a cut-away coat. He can't see the sweep apparently. It may not be a corner, but there is a line between them which suggests one. The sweep is black, and has brushes over the left shoulder. I believe he had something in his left hand. It looked like a bag without handles, as though for soot. The upper part of the picture was more definite on the whole. The gentleman had a moustache ; I am not so certain about a beard, but I think he had one. There were no bricks marked in the wall. I think it was a corner, because each one seemed ignorant of the other's approach. There is something on the right of the sweep in the distance which gave me the idea of a lamp. The gentleman was a tiny bit bent. The sweep had the attitude of a man carrying something. He looked slovenly. I couldn't see the top of the wall : it went straight up out of the picture. I didn't see the edge of the pavement if there is one."

I asked him if the picture was coloured or plain, and he replied :

"Plain. It was not a photo. It may have been done with ink and brush. I didn't see the picture in detail enough for that. It reminded me of a picture I saw two years ago in Birmingham."

I further asked him if he saw all these things at the moment of exposure, and he answered :

"I keep recalling the image, and I can recall almost as faithfully as I saw. The association with the Birmingham picture came, however, at the moment of exposure, but got dropped for a time."

This long description, it will be seen, gives a comparatively accurate and full grasp of the picture as a whole, with a very probable explanation

of the relation between the two main figures. But at the tenth flash his attention was turned to one part only :

"I saw the sweep's face and eyes. They are not very dirty, but a little black. They are in profile. He seems to be in a hurry judging from his face. His eyes are fairly wide open. He is too boyish for a beard. The nose is fairly prominent. I am not quite certain whether there is a moustache or not. It may be the shadow of his nose. I did not see his ear. I haven't seen his boots at all. And I'm not certain about the pavement. I'll look at the right bottom corner—then I shall want to go to the other corner and compare."

When we compare the following answers from other subjects with those just quoted we see clearly the difference between the two classes :

"A face ; I think a woman's." (No. 5.)

"A street." (No. 17.)

"Two men fighting. Then I thought they might not be fighting, but clasped in one another's arms. The one on the right had light trousers on." (No. 4.)

These are the complete reports after the first exposition of a picture.

Subjects of the second class, who analysed fairly thoroughly, usually reported that the pictures gradually lost their unity and became mere collections of parts :

"It is made much more now of pieces put together than at the beginning. This is due to seeing different parts separately."

"It is made up of parts and distinctly less unified."

"The picture seems to have got divided into two parts." (No. 3.)

"The more I see the picture the more I take bits of it. If you showed it me twenty times I should never take it all in."

"It needs an effort to recall the whole."

The same effect was produced when I showed pictures to some subjects with an exposure of two or three seconds: "I got no impression of the whole." Once, when I changed the time of exposure from one second to one-thirteenth of a second, a subject remarked: "The picture was more of a whole then, without time to concentrate."

There was one case, and only one, where mention was made of the reverse effect of seeing the picture as a unity more and more as the experiment proceeded: "The picture is now a whole, and I see everything vanishing away to a point about the middle of the picture. There is more unity than at the beginning."

The group with more strongly marked analytical powers showed more systematic procedure and mental activity¹ than the others in

¹ Cf. A. J. Schulz: "We might speak of an 'active' and 'passive' type. The first analyses the exposed object—compares, unites, separates. The other behaves more

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many ways. They constantly planned out their procedure beforehand and fulfilled their aim in spite of all obstacles :

"I was going to look on my right. I had a sort of mental struggle first and then decided to look for the people on my right."

"My attention to the man was intentional." (No. 14.)

"I'll look to the stern." (No. 9.)

"I can't make out the people on my left. I must give attention there." (No. 2.)

This systematic procedure is well illustrated by the following extract from the introspection of the University Lecturer already mentioned. The picture is No. 1, and the figure before each answer refers to the number of the exposure :

(35) "Let me think what to do. I think they are ordinary sleepers. I'll look."

(36) "I got a general impression then of green lines—actually on the lines. It doesn't seem quite normal."

(37) "Yes, the same. I was a bit too low."

(38) "I couldn't get the nature of the sleepers. There's a tremendous lot of green which seems out of place."

(39) "I am not sure if there aren't more than two sets of lines. I can't be certain about the number."

(40) "My impression then was of four lines and a rail to one side. I had that before. It may be a pure illusion."

(41) "Yes, an impression again of more than two sets of rails. I can't be certain about the number."

(42) "I am sure there are more than two pairs."

(43) "I think the train is on the far rails. But I think there is more than one pair there. It is frightfully difficult to decide."

(44) "I can't be sure whether I am taking this rail on the left from its mate. I have an idea of more than four. I'll give it up for a bit."

This is an excellent instance of consistent application to the solution of a small point; it is but one of numerous similar instances given by this subject throughout the experiments.

Some subjects were only guided to an active search by some kind of outside stimulus. The stimulus might come from a part of the picture which had aroused curiosity, or arise from the monotony of seeing the same thing several times :

"I feel now I want to look at the expression, to find what it is."

"I am bored with the train, and am looking round it."

passively, and lets the picture simply 'work on him,' in order to enumerate the elements afterwards one after the other, without concerning himself about their relations. However, a sharp distinction is impossible. Under favourable conditions, and for certain relations (especially identity or strong similarity) all subjects were active—of course in different degrees. But the same subjects were not constant." "*Untersuchungen über die Wirkung gleicher Reize auf die Auffassung bei momentaner Exposition,*" *Ztsch. f. Psychol.* **LIII.** 251.

In total contrast to this active direction of the perception process, some subjects showed a listlessness and lack of method which is best called 'passivity.' Sometimes it arose merely from lack of interest, as in the following:

"I feel more passive and less curious about details."

"I have been letting things come as they will."

"I haven't tried to find any explanation."

The difficulty of a picture was sometimes enough to prevent active effort:

"It's an awful effort to look at one thing. It's easier to be passive than active."

"It is more difficult to concentrate on a detail in this picture—there's such a lot to see." (No. 2.)

Certain outstanding features of a picture would often attract attention, and would prove stronger than the subject's intention to look at another part:

"The curve of the trunk attracted me again." (No. 14.)

"I meant to look that time at the side, but the engine again attracted me." (No. 1.)

"I meant to look at the two people, but the other platform caught my eye." (No. 2.)

"I can't get away from the bear in the foreground." (No. 13.)

Indeed sometimes this attractiveness of striking parts prevailed over the opposing intentions of subjects who showed systematic power to direct the process:

"The rails always catch my eye. I didn't want to see them then." (No. 1.)

"The forepart is so conspicuous that it attracts my attention."

I agree with Schulz¹ that most subjects show the characteristics of either 'type' at different times. But among my subjects a few could clearly be designated as 'active' (nearly all of these were science students); while at the other extreme some subjects were almost wholly passive (science students were not found in this class). There remained, however, a large group, the members of which showed at various times certain characteristics of both classes (among these were a few of the science students). The majority of this group were often active in the fore-period: they would, for example, decide to look for some definite detail, or to settle some doubt; but in the actual exposure their attention would be passively diverted to some outstanding feature, and their intention would not be carried out.

¹ See footnote, pp. 331, 332.

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The advantages of a scientific training were well-marked: a rough calculation shows that the science students made three times as many inferences as the others¹.

Several of the almost wholly passive subjects made no inferences whatever, not even, for example, the obvious inference that when there was a shadow marked in a picture the sun must have been shining. This was the commonest inference of all, and was made occasionally by children. No doubt all subjects could make this inference if directly asked; the important point is that they did not do so spontaneously. One subject noticed that the feet of the central man in picture No. 6 were turned away from him, yet he only remarked on it as a curious fact: he certainly did not infer that the man's back must also be turned towards him.

Active subjects not only made more inferences than passive ones, they also carried them further. Thus, they not only saw that the sun must be shining in picture No. 13, they also added that it must be rather high in the sky, because of the fairly short shadows. Two subjects decided that as there were three or four posts on the left in picture No. 1, therefore they must be telegraph posts and not signals; whereas most subjects were content to leave the question open. Other typical inferences that were made were the following:

"The wind must be blowing from the left." (No. 15.)

"The train must have been photographed from a low position." (No. 1.)

"It must be a street corner, because the sweep and the gentleman do not see each other." (No. 3.)

"The bear's face must be towards the stick, because it is all in shadow."

Inferences were not always so correct as these I have quoted, and sometimes led the subject quite astray. Thus in No. 14, one subject thought he saw fur on the animal's legs, and inferred a shire horse, and this idea persisted for a very long time. The ears of the donkey were occasionally seen as horns, a cow being inferred. The bear was often seen as a man in the first flash, holding a brush, and the picture was inferred to represent a crossing-sweeper. This interpretation occurred in a surprisingly large number of cases, and occasionally could only be dismissed with difficulty.

Hence a wrong inference at the outset might add very considerably to a subject's difficulties, though, as a rule, one who could infer quickly and at the same time had independence of judgment and activity of

¹ These facts, while they do not prove that a scientific training will produce an analytical power of observation, suggest a high degree of correlation between the two.

outlook, had a strong advantage over others. By inference he was able to arrive at various possibilities and hypotheses to which he might turn his attention.

So far as I could tell, inference was weaker in women than in men. Of the five women subjects whom I investigated fully, inference was practically absent in four. By the remaining subject only very simple deductions were made, such as the position of the camera which took the picture and the length of the exposure (this subject was interested in photography). The limited number of cases, however, makes it impossible to speak on this matter with much certainty.

Pictures were divided by the subjects into two classes: simple and complex. The simple were those whose subject-matter was only one thing—a donkey, a bear, etc. The complex were those which related an incident, and whose meaning was more or less hidden, and depended on the discovery of the relations of the figures to one another (Nos. 2, 3, 4, 6). Now detail obviously plays a smaller part in the complex picture than it does in the simple, and subjects who could make an accurate and exhaustive survey of a simple picture did not always arrive at a satisfactory solution of the incident pictures. Hence it was that some subjects excelled in the incident pictures without any very careful analysis of details. This was well expressed by one subject in passing from No. 1 to No. 6:

"I feel here a marked difference of perception. In the engine picture it was a question of details. Here it is a question of the sense of the story, for which details are unnecessary. This is a proof in the case of art that pictures that tell stories almost necessarily force to superficial contemplation. I have a feeling that I have seen less of this than of the train, for the reason that I was occupied with the story it tells."

Another subject said:

"The parts hardly exist in a story picture. Details would be a nuisance. So I keep to the story interest."

One subject, however, said that details were far more important in a problem picture "as the problem is greater: the figures might be doing a thousand things." But this subject was not strikingly successful in solving such pictures.

The differences between scientific and other students can be expressed more accurately by figures. Thus, if the number of objects and qualities of objects correctly mentioned by a subject in a given number of pictures be tabulated, we shall be better able to see how far a division into classes is justified. It is significant that of the five subjects who stand

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highest in such a table (with an average of 30.6 marks for each picture), four had had scientific training, whereas of the five lowest on the list (with an average of 13.3), only one was a scientist, and he was the highest of those five. The remaining three science students occupy the sixth, ninth and twentieth places respectively on the list. This shows that science students possess a decided advantage, in general, over other students as regards the discovery of the contents of an object, but that this advantage is not invariably possessed by all such students.

We may carry out this method of tabulation still further. In giving correct reasons for things, four of the five best subjects were scientists, but only one of the five worst. Similarly, of the five who mentioned the largest number of correct positions occupied by different parts of the pictures, three were scientists, and of the five worst in this respect only two were scientists. In describing the movements or actions of the figures in the pictures, four of the five best subjects and only one of the five worst had had scientific training.

Of the five who made the fewest mistakes and the five who made the most mistakes in each picture there was only one person of scientific training in each group. But to get a correct measure of accuracy we must divide the total number of mistakes by the number of objects correctly seen, since subjects who mentioned a large number of objects ran a far greater risk of error than did those who mentioned only a few. Of the most accurate five determined in this way three were scientists, whilst among the least accurate five there were no scientists.

In every respect, therefore, the scientists taken as a group proved superior to the others, but this superiority did not necessarily apply to them individually.

(ii) *Subjective Factors.* There are a number of subjective factors which can be best treated separately before an attempt is made to deduce from them more general conclusions.

(a) *Imagery.* In varying degree visual imagery was, of course, very common among the subjects. It was absent in two cases only. In one of the cases it was replaced by "a sort of verbal memory." In the other case there was a nearly complete lack of all kinds of imagery, and this subject frequently complained of his disadvantage. Thus, he found great difficulty in locating special parts of the pictures in the fore-periods. His method was to examine very small areas at a time, and he tried to fixate the exact spot before the exposure, but as he had no image he frequently made mistakes of localisation. He was also more liable than most subjects to forget to tell me all he had seen unless he told me at once.

As a rule visual imagery was a very useful aid. There were cases where it seemed to be almost as clear as the percept, and could be resorted to, even after a considerable interval, in order to settle some doubt or answer some question, much as one would look, under normal conditions, at the actual object. I quote some examples:

"Just after I said that I wondered where his feet would be. I argued that his right foot would be behind, so I recalled the image, and I think it is so."

"One moment! There are railings, I remember now. I was thinking, and saw them in my image." (No. 14.)

"I believe I project the image on the glass and compare the two."

"I can recall the image almost as faithfully as I saw it."

The subject from whom I have last quoted thought he saw the sweep coloured blue in one exposure, though he was not able to see the blue again in later exposures. Yet he could revive either of the two images—with and without colour—quite easily, and he realised that he had only seen the blue sweep once. The two images seemed to remain quite separate and constant in his mind.

In many cases imagery was selective, and might be good for form and not for colour, or good for outlines and poor for detail, and so on.

A most interesting discovery was the peculiar behaviour shown by the visual image in a few subjects, in that it seemed to possess a 'self-activity,' and began to change and develop almost at once. That a mental image changes as time goes on is well known¹, but the change in this case seemed to begin immediately. There were five clear cases of this kind, and one was specially remarkable. The pictures were intensely real to this subject, and her image had all the movement and change that reality itself has. I quote first the most important parts of her report on picture No. 13 (the numbers again indicating the different flashes):

(1) "There was a street and it was sunny. Whether there was a man or a bear with a pole or not—it's something with a pole. It's something too big for a man, and looked like a bear standing on its hind legs. It felt hot and sunny."

(2) "I feel sure it's a bear with a pole in its paws. It is still hot and dusty and sunny."

(3) "I am quite sure it's a bear. It seemed brighter and sunnier. I had rather a feeling of fear—I didn't like to see a bear in a thoroughfare. There was nothing round about it."

(4) "I see the shadow of the bear distinctly on the left. The background seems fearfully indistinct. I can't get away from the bear in the foreground. Some

¹ "The imagery tends, with the lapse of time, toward the imagery of the object represented by the picture, and with this change takes on characteristics that belong to the object, but which are not represented by the picture." F. Kuhlmann, "On the Analysis of the Memory Consciousness," *Amer. J. of Psychol.* 1907, 411.

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movement seems to go on in my visual image on the left. There is a man in a straw hat, and people crossing the road a long way behind the bear. I still feel it's a fear-some thing."

(6) "Yes, there are houses on the left and something on the right. Still dusty and sunny and a foreign land. I don't like seeing a bear on the road."

(8) "...I have a feeling of wishing they would take the bear away."

(9) "...I don't know how much I see and how much I imagine, because I feel it is in a big town, and the bear has no business there."

(12) "I feel there are two men about, but I don't see them. There's still that man in a straw hat walking across the road, though he's only in my image."

(16) "I see the men in the after-image—the keepers. I don't see them in the picture. There's a lot of movement afterward in my image."

In this case the cause for these additions seems to be her own fear because of the unusual sight of an unattended bear in the streets. It will be noticed that she is *conscious* of the 'activity' of her image. I quote a second example from the same subject where the additions seem to be caused more by associations than by imagination. The picture is No. 1:

(1) "A Great Northern train coming towards me. I can hear it and I feel that it is going towards a tunnel. It is certainly Great Northern and going to Scotland. I imagine I saw a child waving a handkerchief on the left. I still hear the noise of it—puffing and going. I imagine luggage and people and everything. There's a tremendous lot of movement."

(2) "...It is full of people in all the carriages. I have a pleasant feeling of excitement about it. I'm sure it's on a long journey."

(3) "...I still feel somebody is waving out of the window to my left but I can't see them. I still feel it is going, and hear and smell it."

(4) "...I was looking for the person on my left. I couldn't see him, but I feel he's there...I see the people in the compartment—the way they are dressed and everything."

(6) "...I still feel it's about to go through a tunnel. I feel the landscape changing as the train goes on. The people all look like travellers—as though they have settled down for a long journey. It couldn't be a local train."

(7) "I think some of the windows are open. But I don't see them very distinctly. It's slowing down a little. I don't know why."

When I showed the picture at the end she added:

"I was going to Edinburgh by day by the Great Northern—though I have never been to Edinburgh by day. Yet I felt it was the same journey—though I was sure I was not going to London in this case as I was when I travelled on that route by day. The people were a mixed crowd—Americans and such like. It was not a crowd on a local train. There was a woman with a veil. I have to pull myself together to see it as a picture—it's so absolutely real."

This case was rather exceptional, though there were four others who belonged to the same category. One of them, in looking at the donkey,

got an idea that there was also a pony's head somewhere attached to the donkey, and this idea persisted with varying strength through several flashes, though he added:

"I am not sure whether I see this or whether it is imagination. It suggested that to me. I saw an image of a pony nibbling. It is a matter of perception at first but, may be, worked upon in my image."

Evidently he was not sure exactly what had been perceived and what had been imagined.

Subjects with mobile imagery may easily be unconsciously untruthful¹, and mistake imagination for fact. Such people are known in ordinary life, wholly unconscious of their failing. But, as I have shown, a subject with mobile imagery may be fully conscious of the difference between image and percept.

Other kinds of imagery than visual were not very common. Olfactory and auditory images were only mentioned by one subject, verbal-motor imagery by three. Unpractised subjects probably overlooked the nature of their imagery in many cases.

(b) *Subjective additions.* Very closely connected with the phenomenon of self-active imagery was the tendency shown by some subjects to make additions from their associations and imagination. This tendency was shown by all the five subjects who had self-active imagery, and also by a few others in a less marked degree, one of whom possessed either no visual imagery at all, or so little that it was of no importance in his mental life. However, it was scarcely more than a tendency in his case, about which he was cautious it is true, but which he could keep in control. Thus, he said: "I am almost ready to persuade myself I can see a man on the smallest provocation."

Other typical reports dealing with subjective additions were the following:

"I feel now I could see anything I wanted in this face, as regards expression."

"I thought I saw a turban on the figure." (No. 14.)

"I think there are some trappings on the elephant—part of a howdah."

"My mind wanders afterwards, and seems to raise up new things."

"I thought bulldogs wouldn't have ribbons on, and so I seemed to see heavy collars."

¹ See "Sur les transformations de nos images mentales," by Jean Philippe, *Rev. philos.* XLIII. 482: "When a new state of an image has replaced the former state of this same image, it presents itself alone in the place and instead of the former one: we cannot therefore compare these two successive states of the image, nor see, consequently, that it has changed—unless a fortuitous meeting reveals the transformation that has occurred."

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It would be an interesting question for future inquiry whether self-activity of imagery is a necessary cause of subjective additions. In some cases, of course, they are the same thing. Then it is the image which is described, not the object.

(c) *Objective changes in the pictures.* Ten of the subjects reported that there were inconsistencies in the successive percepts, as though the picture itself changed during the course of the experiment. This phenomenon occurred, of course, mostly in people of strong subjective tendencies. The cause probably was that they would see a part of the picture, interpret it immediately, and complete the unseen parts mentally. In a later flash they would see a different part and find certain discrepancies. Their experience was thus like seeing two different pictures. Typical reports were :

"I am not quite sure it is the same picture."

"My notions are continually clashing."

"The train always appears more in the foreground of the picture than I expect it to be."

"It seemed a different picture of another donkey."

It is interesting to note that the two scientist subjects who showed such great similarity in their method of procedure belonged to different classes in this respect: one spoke of objective changes several times in each experiment, the other never mentioned them.

In a few cases the pictures seemed strikingly larger or smaller at the end of the experiment than they appeared in the flashes. With one subject each was definitely smaller at the end. With different subjects this change occurred most often in the case of the train picture, and many were surprised to find how small the engine really was.

(d) *Subjective certainty.* Subjects varied considerably in the certainty and confidence they had of their decisions and achievements. It must be remembered that subjective certainty is no guarantee of accuracy; it is merely a mental attitude which may accompany sufficient or wholly insufficient reasons, and may be found accompanying utter inaccuracy.

Thus, one subject, who was very certain throughout, mistook the bear for a man. I allowed the mistake to go on for some time before I told her she had made a mistake—that it was not a man at all. She was quite unshaken in her opinion: "But it's a human being. If it's a woman she's in a man's get-up. You are fooling me." I added that it wasn't even a human being, and she replied: "That upsets all my ideas then. You haven't shaken my faith though." This certainty

persisted in subsequent flashes: "It still looks like a human being."
"Still the same exactly."

The certainty of some subjects, on the other hand, was obtained by reasoned argument, and by deduction from observed phenomena: "I saw three posts. They must be telegraph posts then, and not signals."

Some subjects showed a complete degree of uncertainty, which sometimes persisted through the whole experiment. Those who were uncertain accepted corrections readily, whereas the certain often refused them, or only accepted them after a struggle. One who had seen the bear as a man for twenty-one flashes was then told that it was not a man. After the next flash he said:

"Well, then, it's a bear dancing. The position of the legs gave me that, and it explains the shortness of the legs which I attributed to an apron."

This attitude of certainty or uncertainty did not seem to run parallel with any other characteristic, though on the whole the certain subjects made far better progress than the uncertain ones.

(e) *Readiness of decision.* Some subjects decided easily and at once, however insufficiently they had seen the picture; others remained undecided, divided between alternatives for a long time¹. The former were, as a rule, the least careful in their examination of the object, and wrong decisions did not affect their procedure in subsequent experiments. Children belong almost uniformly to this class, as we shall see. Many adults were quite uncritical as regards their own opinions. And when such subjects did change their opinions they decided on a second interpretation quite as readily as they had previously done on the first.

Sometimes a subject would begin his report in an undecided attitude, but would achieve a final decision by the end of it:

"It might be a railway station. The left part is suspiciously like a station. I saw people. Yes, I believe it's a railway station. Yes, it's a railway station." (No. 2.)

The subjects who only arrived at their decisions after an interval of some duration were generally very painstaking in their attempts to see everything of importance. They carefully weighed alternatives and examined possibilities. I quote from a case where, after deciding that the

¹ "With a few subjects the answer once given must remain unchanged. Whether it was right or wrong, whether a complicated figure was nearly round or angular—nothing or exceedingly little could be said. Other subjects, on the contrary, were able after a still longer time to criticise and correct the given answer, to find excrescences (*Ausgelassenes*), and so on." Schulz, *op. cit.*, 287-8.

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bear was a man in the first flash, the subject began to suspect a mistake after the eighth flash. His subsequent reports were:

(9) "I am beginning to suspect it isn't a man at all—it's a performing bear. It's the way bears hold a staff. I was looking then to see about this."

(10) "I saw his legs. They seem to be short and thick for the body. He's not a typically built man if he is one. The legs are a considerable distance apart."

(11) "The whole suggestion is that of a bear. I didn't see any ears, but the head and especially the shape of the figure suggest this."

(12) "I seemed to see the face, which is in profile. It is elongated and more like an animal's."

(13) "I saw the other leg. It seems to be short and without calf."

(14) "I seem to see that the back of the head is hairy. But I'm diffident about details of that kind. It's either an animal or a man dressed as an animal. From the figure I should say an animal, and probably a bear."

In extreme cases there was complete indecision. This occurred both with ignorance of the subject matter, and also with complete knowledge of it. I quote briefly from one case—the actual introspective record is very long—where the subject was very well acquainted with animals. The picture was that of the donkey (No. 11):

(1) "A donkey."

(2) "More like a cow. Hind legs are those of a cow at any rate. Head indistinct."

(5) "I can't associate the neck with any beast."

(6) "It seems to be a cow's legs."

(7) "I should still say a cow, but I am undecided."

(8) "Still a cow by the body. I was thinking of various breeds to test it by."

(9) "A cow by the head. The ears are not up high, but they are not drooping like a donkey's. They may be horns."

(10) "It may be a bull from its head."

(11) "I think it's a bull from the neck—an arch on the top."

(12) "I doubt whether it's a bull."

(13) "The shape of the body makes me hesitate between a cow and an ass."

(14) "Distinctly more like a donkey from the whole impression."

(16) "Nose and mouth look like a donkey."

(17) "By the nearest hind leg I should say it's a cow."

(18) "Fore legs are those of a donkey."

(19) "Donkey or pony from the nose."

This wavering went on for thirty-six exposures, during which the subject made mention of bulls, horses, cows and donkeys. At the end he was still a bit uncertain:

"I think a donkey by the way it stands. I would express my decision as five to three in favour of a donkey."

Curiously enough, indecision was never attributed to any fault of the pictures; it was the accurate and decided subjects who made adverse comments on them.

(f) *Associations.* Subjects in whom the various subjective tendencies were strongly marked generally had so abundant a flow of associations that they were unable to report them all:

"I just get a flash, and associations crowd in."

"Vague fleeting associations passed very quickly—figures in *Pilgrim's Progress*—one of a man with a whip trying to pull a donkey along, though I can't see its connexion with the picture." (No. 6.)

"Associations so vague that I can't tell them to you."

Subjects in whom subjective factors had less sway, on the other hand, had usually few associations.

It is interesting to note that associations very often ran along some definite line, such as localities visited, or pictures seen, or events of childhood. Thus, of seven associations detailed by one subject, five were definitely of places. In another case, of nine associations six were definitely remembered events of childhood.

Associations might be vague and general, or individual and vivid. They were nearly always a source of pleasure. In a few cases self-projection occurred with them:

"I felt myself actually showing the picture book (an association) to my niece." (No. 5.)

"This is a picture, but I was thinking of an actual bear dancing, not so much of the picture here. I felt it to be ludicrous to watch a bear standing up like that."

Like imagery, associations were sometimes a source of error. This occurred when they were so strong that they replaced the actual percept. I quote from a few cases of this kind:

"It was associated very vividly with a station in Devonshire. I think I may have imagined the steps from that. The associated station took the place of this one immediately." (No. 2.)

"I find it hard to distinguish between what is seen and what is associated."

"I saw a peculiar expression on the dog's face, and then some association interpreted it as contempt."

Associations had, to some extent, a reciprocal relation to inferences. Those subjects who were able to proceed by inference did not usually get many associations, whereas those whose thoughts were one long train of associations rarely made inferences at all.

(g) *Self-projection.* In a few cases the pictures were seen as real things, and the subjects projected themselves into the events and became

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actors instead of onlookers. I have already quoted at length (page 338) from the most pronounced case of this kind, and add a few quotations from other subjects:

"There's a kind of excitement about it that gives me pleasure."

"It reminded me of a square in Copenhagen. I was looking at it from my hotel window. It was very pleasing."

"I am in the street but not frightened. He looks quite nice and tame. I am prepared to believe the master is near. I am some little distance away. He's not looking in my direction, and doesn't see me." (No. 13.)

Self-projection occurred only rarely with adults, and with children I think it is quite impossible to say whether it occurred at all, because I am not sure that they understood such questions as "Did you feel as though you were there?" or "Did you seem to be in front of a real thing?" although they answered "Yes" or "No" to such questions quite readily. Moreover it was easy to make them change their answers. A few cases occurred where the projection was not quite complete—thus, one subject reported of the station picture that although she was not actually there she was near enough to feel the excitement of the crowd.

In all cases of self-projection, of course, the picture was seen as reality, but the pictures might also become real without the subject projecting himself into it. I quote different cases:

"I think on the whole it is a real train. Any picture would do that. But I am certainly not in it." (No. 1.)

"It isn't a picture. It's a real station—the Quai d'Orsay." (No. 2.)

"It is a pure picture."

"I don't know whether a picture or real. I wasn't concerned with that question, and it didn't arise."

This question has been investigated recently by Mr Aveling¹, whose results show that pictures were perceived by his subjects in three different ways:

(a) As spots of colour—37 times.

(b) As pictures (where the object of thought was the picture *plus* the thought that it pictured a thing)—282 times.

(c) As symbols (where the object of thought was a thing which the picture represented)—295 times.

Compared with my own observations, class (c) here seems to be abnormally high in numbers, for I found such cases to be quite the

¹ "The Relation of Thought-Process and Percept in Perception." *This Journal*, iv. 211 ff.

exception. However as these results were obtained from a very small number of subjects they might be considerably modified if a larger number were investigated. I agree with Mr Aveling when he says (p. 227): "The same picture may be symbolic for one observer and asymbolic for another....The explanation of this phenomenon would seem to lie in the facility with which a symbolic subject assimilates, in the perception, previous experiences of many years anterior date."

(h) *Improbability.* Some subjects were influenced by the improbability of their answers:

"The whole idea was of a sweep carrying brooms. Then I thought of the light blue suit, and so inhibited the idea." (No. 3.)

Others were not influenced in the least in this way. They might mention the fact that what they were saying was improbable, but that did not seem to them a sufficient reason for rejecting it.

(i) *Influence of the first idea.* The first idea was often of very great importance in determining the subsequent course of the interpretation, and frequently led subjects astray when it was wrong. Such a subject, an ex-schoolmaster, on seeing picture No. 14, took it to be some school children drilling. In the succeeding flashes he saw, under the dominating influence of this idea, the regularity of the lines and the division into squads. This illusion held during forty-four exposures when I told the subject he was wrong. He had had no doubt about the matter.

Other subjects seemed to lay no more importance on the first interpretation than on any other. They might change completely at the second flash, or even after a large number of flashes they showed themselves just as open to modification as at the beginning.

In concluding this section on subjective factors it is not an easy task to draw any general conclusions from such complex results. But the five subjects who had what I have called a 'self-active' imagery possessed many other characteristics in common. All of them made frequent subjective additions. Four of them spoke very often of objective changes in the pictures. All had a strong flow of associations. Four were fairly undecided. None made really good progress along one definite line. All were drawn passively to outstanding features of the objects, though they showed activity of intention in the fore-period. Inference was weak in four. None was influenced by improbability, and all seemed to receive a strong impetus from their first interpretation.

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There was also one subject who showed many of the same characteristics as the other five, but who did not make mention of any image changes. Whether these took place and were overlooked, or whether they were altogether absent, it is impossible to say, but his connexion with this group seems a very close one.

Other factors appeared in very different arrangements among the remaining subjects. Thus, those who analysed the pictures carefully were generally those who made the best progress, but there are striking exceptions to this statement. Other conclusions I have already indicated.

I did not investigate all the subjects with equal thoroughness, so that among the thirty-two there were several of whom I can say very little. But it seems justifiable to separate a small group with marked subjective tendencies, and another class with a more objectively accurate and exact attitude. A large number of subjects were hard to classify, for they did not possess any strongly-marked characteristics.

(iii) *The Perception of Colour.* The experimental conditions under which the investigation was carried out were not calculated to favour accurate colour perception, but several interesting points appeared which are worth mentioning.

In a few cases colour was commented on even before form, and aesthetic judgments were then often made:

"That's in colours."

"I found the attractiveness of the colour, especially of the sky, almost a disturbance at the moment of recognition." (No. 1.)

"I found the strong light and shade very confusing."

"A cheap process."

"The sky is a horrid unpleasant green colour." (No. 1.)

Other subjects showed a marked indifference to colours, and only mentioned them fairly late in the experiment, after other matters had been investigated and settled. One subject correctly saw green in the engine at the first exposure, but made no mention of the blue sky, which was very bright and prominent, till the fifty-eighth exposure. Another missed a very prominent bluish-green colour in picture No. 7 till the forty-fourth exposure. I then told him to look in a certain direction, and he at once saw the colour.

When I used the shortest exposure, about one-hundred-and-thirtieth of a second, colours tended to disappear altogether with the majority of subjects, except where the colours were very highly saturated, or where the subjects were interested in and attracted by them. Thus, if I began an experiment with a coloured slide at the shortest exposure, I often

had the report "Not coloured." This occurred almost always with pictures 2, 3 and 4. In the case of picture No. 2, I showed it to ten subjects at this quickest speed, and eight of the ten reported that there was no colour in it. As I slowly lengthened the time of exposure this judgment generally remained unaltered for a long time; sometimes, indeed, colour was not mentioned till the picture was permanently exposed. Occasionally, a colour seemed to be just on the margin of perception. Thus, in picture No. 3, at the normal times of exposure, a subject saw blue in the third flash, but not again till the fourteenth, when he specially looked for it.

Fatigue had great influence on colour perception. This was well shown by one subject with whom I was working fairly late at night. He failed to see any colour in No. 3 at normal exposure time, though I asked him about it. As he was tired we did not finish the picture that night, and on continuing it next morning he saw at once that it was coloured.

Although I did not use any quicker flash than one lasting one-hundred-and-thirtieth of a second, yet even at that speed some subjects continued to see almost as much in the first flash as they had previously seen with the normal time of exposure. On the other hand, I had one subject where the time threshold for colour perception seemed to be exceptionally high.

(iv) *Feeling Tone.* These experiments were not very favourable to a satisfactory investigation of feeling tone. As Kuhlmann says: "Pictures as such have not the interest and emotional colouring that belong to objects. Such emotional colouring, when it takes possession of consciousness, brings with it the visual imagery with which it is connected. Again, in so far as meaning and interpretation is read into the picture at all, so far, of course, the picture ceases to be what it is and becomes the object. The picture to this extent creates the tendency to substitute the imagery of the object in its natural setting¹." One subject said: "Feelings are an after thought with me. I have to recall the picture."

At the outset the shortness of the flash was a disturbing factor, because subjects felt somewhat hurried, and their chief attention was given to the subject-matter of the pictures. Owing to the pre-eminence of this claim the emotional tone was apt to be ignored by the less practised observers. The shortness of the flash irritated quite a number of subjects:

¹ F. Kuhlmann, *op. cit.* 415-6.

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"I have a feeling of discomfort because it is so short."

"I am aggravated because the picture disappears so quickly."

"The instantaneous exposure is aggravating."

One or two subjects, on the other hand, were stimulated:

"Speed gives piquancy to it."

"The shortness of exposure does not irritate me. It arouses my curiosity."

Subjects who experienced some difficulty in solving the pictures often developed disturbing feelings of self which rather added to their inability:

"I am beginning to feel irritated at my inability to decipher it."

"I have a nascent feeling of shame that I have to make two great corrections."

(The corrections, however, were not 'great'.)

B. *Experiments on Children.*

I now pass to an examination of the results obtained with children. These were kept separate from the rest, so that the two groups might be the more easily contrasted and compared.

The three schools were chosen because of their typical differences, and at each I worked with a group of children of the average age of twelve years, and also at the two elementary schools with a group whose average age was six years. Unfortunately I was unable to get children of this age in the Secondary School.

Stern has worked out with some completeness the mental development of children, and the modifications due to age and sex¹, but my experiments are much less complete as I was working at a more general problem. Hence I confined myself to two ages in order to see generally in what direction changes occur with the advance of age. Moreover, I did not use many girls in these experiments. But it is possible that this same method of investigation might throw light on the question of mental development in school children, if it were applied uniformly to groups of both sexes at many different ages.

(i) *Six years of age.*

I will deal first with the results of the youngest children.

¹ "The time from seven to ten years is for boys a period of strong development, whilst girls during the same period virtually remain at a standstill and their reliability even recedes; between ten and fourteen years girls, by rapid development, recover the lost ground and even overtake the boys a little, whereas the latter show no improvement. Therefore the difference between boys and girls is greatest at the age of ten." Stern, "Die Aussage als geistige Leistung und als Verhörsprodukt," *Beitr. z. Psychol. d. Aussage*, Erste Folge, 291-2.

(a) *An elementary school in a very poor district.*

In this school, where the children were from the poorest homes, and of parents of a very inferior type, I worked with four normal children, two boys and two girls, whose average age was a little over six years.

The most outstanding feature of the boys' results was a very pronounced tendency to add imaginative detail. Nothing seemed too grotesque or too impossible to apply to any picture. This tendency was not so marked in the girls, but in the case of the boys there seemed to be no ability to distinguish between what was accurate and what was inaccurate, between what was seen and what was imagined. I will quote from one case:

(1) "A house and windows and door. A little boy peeping out of the window."
(Picture No. 1.)

(2) "A house and a bedroom."

(3) "A little boy outside."

(4) "The little boy is hiding. I saw him peeping."

This continued until the eleventh exposure, when I told him it was not a house. He continued:

(12) "It was a house."

(13) "A train. And a woman in it peeping and waving her hand."

In the Queens' College picture this same subject saw a little boy, and described his "hat and blue sailor coat." When I suggested there was also a woman he agreed, and added that she was waving her hand to the little boy, and he was waving his hand to her. At the end I showed him the picture, and asked where the woman was. He replied very confidently: "She's in her house."

Many of the boy's replies seemed to be faint memories of past experiences. Thus, he described the bear as a "woman," and added the curious description that she was deaf and dumb. When I asked him the reason for this, he replied that "she carried a pole." On further questioning, I found that he had once seen a deaf and dumb woman with a long stick, and undoubtedly the idea had come from this recollection. And again, his first answer in the station picture was: "Little boy. Green hill. Stick in his hand." All these three phrases had been used by him previously in other pictures and undoubtedly came back to him from them.

The other boy showed the same tendency. In the picture of the child (No. 4), he described shoes, stockings and coat quite readily. When I showed the picture at the end, and asked him to point to these things, he touched the bottom of the glass screen vaguely, and said they were

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"down there." In the same picture he said there was "green grass, and in the bear picture he spoke of a "train." These answers, too, were undoubtedly due to the other pictures. Some of the additions cannot be explained in this way. Thus, when he saw a house in the bear picture he added quite spontaneously: "There's a house with windows, where the little boy lives, and he's got a father and a mother and a baby and a cow."

Sometimes these boys developed a kind of 'additive' description of some object, which consisted of adding together all the possible qualities of such an object, utterly regardless of objective accuracy. Thus, in picture No. 6, this second boy described the central figure, after an exposure of one second, in the following way: "A man. Red. Green hat. Black shoes. Black trousers. Red scarf. Blue waistcoat. Blue eyes. White ears. White nose. White mouth."

The two girls were much more exact and reliable than the boys in describing what they had seen and in repeating what they had said, though one of them showed a passive tendency to repeat former sayings regardless of their meaning. Thus, in the child picture, she first described it as a "man" and gave several qualities, including "whiskers." When she discovered it was a child, she corrected her mistake, but added the other features, including "whiskers," in full, and only withdrew the impossible ones when I drew her attention to them.

It would be interesting to discover the cause of this indifference to a strict line between reality and imagination. It may be that both boys had a 'self-active' imagery, but this explanation would not cover all the answers. I think, rather, that the problem is one of environment. The mistress of the school agrees that the peculiarity I have described is far more common among slum children than among those from better class homes. She suggested that the explanation is that these children have to give answers at home which will please their parents. The strict truth of the answer is not an immediate concern. If the answer displeases, the child is punished. Hence with a stranger he is willing and even anxious to see what he thinks he ought to see, and this brings about an attitude favourable to 'creative imagination.'

This explanation also accounts for the very marked susceptibility of these children to accept suggestions quite readily, and even to add descriptive details to the objects suggested. The two boys and one girl did not show the least inclination towards caution, but caught up each suggestion I gave immediately and fully. When I suggested a dog in the station picture, one boy said he had seen it and that it was barking.

I asked one of the girls if she had seen a swan in the Queens' College picture, but she did not know what the word meant. I also told her there was something going right across the picture (meaning the bridge), which she had not yet seen. After the next flash she showed how very passively suggestible she was by saying: "It's a swan up there."

The other girl was more independent and critical. She refused suggestions often, and only accepted them when there was some justification of their probability, and at the end she was careful to correct her mistakes.

These subjects had no problems and showed no indecision. In the donkey picture one boy mentioned six animals successively, and each was given with an air of confidence and finality. There was never any postponement of decision, no matter how incompletely the picture had been seen. Each judgment, when made, was final for the time being, though if it had to be abandoned another would be offered with the same finality. One of the boys interpreted picture No. 12 as, in turn, a mountain, a ladder, a motor car, a little boy, a chair, a tram, a bus, and a picture. There was no hesitation about each judgment, no balancing of alternatives, no consciousness of the need of deliberation.

The pictures were looked at as a whole, and there was no analysis¹. Practice did not seem to bring about any modification of method, or to develop any caution. Inferences were quite absent. Associations were rare, though this was partly due to the inability of the children to recognize them as such, and to their neglect in reporting them.

As was to be expected from the experimental conditions, the perception of colour was very difficult, as was also the exact localisation of the colours seen for so short a period. This accounts in some measure for the many mistakes made. The child was described as having a "blue coat and black hair," whereas the blue was round the child, and the hair was brown; the train was said to have "grey" carriages, whereas in reality they were brown.

So far as it is safe to distinguish between the sexes in such a small number of cases, the girls showed some superiority over the boys in several ways. Thus, if we take the average number of facts correctly observed in each picture and divide the two boys from the

¹ As Binet says, "What is lacking in the child is that he does not possess to the same degree as ourselves the power of analysis." "Perceptions d'Enfants," *Rev. philos.* xxx. 592. In the same article Binet relates that a child of one year and nine months was able to comprehend the drawing of a horse, but even at four years was still unable to understand the drawing of a nose, or of an eye.

two girls, we find that while the boys only observed 7.1 facts in each picture, the girls observed 10.9, and that whilst the girls made only 8.0 mistakes in each picture, the boys averaged 9.6. In describing correctly the positions of objects, the girls also had the advantage, the figures being 2.1 as against 1.5.

(b) *An elementary school in a good district.*

At the other elementary school, where the children were of a higher social status and from more cultured homes, I had five boy subjects whose average age was six years.

Here there was very little tendency to add imaginative detail. It appeared occasionally, as when one boy called the donkey a "horse" and then added that there was a cart fastened to it; and also when he said he saw telegraph wires on both sides of the railway lines. But the first of these additions was afterwards corrected quite voluntarily.

Suggestions, too, were not accepted so readily and were often resisted quite firmly. In the case where a mistake had been made (such as calling the bear a man), these children, when told they were wrong, did not make their correction immediately and rashly as had done the others: they looked again. One boy, when I told him he had made a mistake, looked a few more times and then said: "I don't know. I don't think I shall get it."

In many particulars there was close agreement, of course, between the children of the two schools. The method of solution was the same: that is, the whole picture was looked at each time, and no analysis was attempted. Decisions were made at once, and the subjects were soon satisfied without making very close examination. Alternatives were not expressed, and a judgment made with confidence at one moment was often cast aside almost immediately for a contrary one, which would be given with equal certainty.

But the superiority of this group over the previous one was marked. Two children made the inference that as there was a shadow the sun must be shining, and another said he saw a steeple, and so argued a church from it. Reasons were often given for statements: thus, in the station picture one child naïvely argued there was a bride, because he saw a "lady with a veil and baby"! He afterwards corrected himself and said she could not be a bride because she had a bonnet on and had no roses. To another boy the donkey was a cow "because it had horns," then a horse "because it had reins." Another saw what he thought were chimneys at the bottom of the bear picture "as though the picture

was upside down." This tendency to give a reason for a statement, even if the reason is a wrong one, shows a much higher mental process than do the unreasonable answers given by the first group.

The language was very similar in the two cases, though at the second school more verbs were used, such as "curves" and "walks"; and longer sentences were formed.

Some of the subjects had a great power of seeing very small things: thus, the engine driver, who can just be distinguished looking out of the engine, was first noticed by one of these children. Colour perception was again rather poor. One of the five refused for some time to change his opinion when I told him he was wrong. Another told me before one of the exposures that he had made up his mind where to look; this, however, only occurred once. The complex picture No. 6 was thus interpreted by one subject: "He's dabbing the brush in her face on purpose, and the old man is telling him not to do it." Associations were often mentioned and appeared to be much more frequent than at the first school.

The average number of facts correctly observed by each subject was 10·5, and the number of mistakes 6·15. The average number of positions given correctly was 3·35. Hence these boys showed marked superiority over the two boys, and are slightly better than the girls of the other school.

We may conclude generally that this group showed much more reliability and activity than the other. There was a more critical attitude, a greater accuracy and much less sway of subjective tendencies.

(ii) *Twelve years of age.*

I now pass to the older children, a group of whom came from each of the two schools just described, and a third group from the — Grammar School¹.

(a) *An elementary school in a very poor district.*

In the first elementary school, with children of the poorest class, I had seven subjects—four boys and three girls—whose average age was twelve years and four months.

There was greater evidence of activity than among the younger children at the same school. This was shown by the occasional refusal

¹ This school is well known for its adoption of modern methods of teaching, and for its educational experiments. A spirit of independence among the scholars is more marked than at other schools.

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to accept the suggestions I made. Thus, one boy saw something white coming under the bridge in the Queens' College picture, but my suggestion that it was a swan did not influence him, and he was content to leave it with a non-committal "I can't tell." Another boy showed quite commendable caution in the Brittany picture: he agreed it was "something like a window," but he refused to go any further without more evidence. Occasionally, some of the subjects decided what to look for in the fore-period, though this was exceptional. A few inferences were made, too, and at the end some of the subjects enumerated their chief omissions, and corrected the most obvious of their mistakes.

But on the whole these subjects must be described as largely passive. The first idea that came to them seemed to determine very largely their subsequent answers. Thus, in picture No. 6, the male figures, which were seen as boys in the first flash by one subject, remained boys throughout. Many more suggestions were accepted than were refused. The following answers to three successive flashes of picture No. 2 show how completely susceptible this subject was to every suggestion:

- (8) Have you seen the dog? "Yes, near the little boy on the right."
 What colour is it? "I didn't quite see."
 (9) "The dog looked brown, with two patches of white
 on its front feet."
 Is it like any dog you know? "No."
 (10) "It seemed like Mr Brown's dog, with a short
 tail."

There was a clear case in this group of 'self-active' imagery. In the picture of the train he made the following reports (I omit details):

- (1) "A little boy crossing the lines at the left side, waiting till the engine passes. He's waving his hand."
 (2) "It looked as if the stoker had just made up the fire—smoke was coming out of the chimney on the side where the boy was. The boy was waiting on one side, and the engine was nearly past him."
 (3) "It looked as though people were popping their heads out of the window and waving their hands at the little boy."
 (6) "The engine seems past the little boy now, and he's just going to step across the lines."

Objective change was present in several of the subjects, as the following answers indicate:

- "This is a different boy." (No. 5.)
 "The train is nearer and bigger every time." (No. 1.)

Colour perception was still poor and inaccurate. Four of the seven did not mention the blue circle behind the child's head, though the colour was very striking: they may have seen it, but it evidently did not seem of importance to them. There was also a vagueness about colour answers which indicated inaccurate localisation. Thus, in the train picture, one said there were "red, blue and white flowers on the floor," whereas the stones on the left were a vivid reddish-brown, and the hedges and ways were a bright green. Many said the child had "dark" hair and a "blue" coat, as did the younger children at this school.

If we compare the girls and boys in the group, the former show a decided superiority in several ways, a result which is in agreement with many other observers. Thus the average number of correct facts discovered in each picture was 12.58 in the case of the boys, and 14.5 in the case of the girls, whilst the latter only averaged 3.58 mistakes, and the former made 7.0 mistakes.

The girls gave more correct reasons for their statements than did the boys. They also seemed better able to discover the explanation of the complex pictures. Thus, of the station scene, one girl said: "The man looks like the woman's son. He may be going away." This is the correct explanation, and was only given very rarely even by adult subjects. Picture No. 6 was also 'explained' very creditably by the girls, whereas the boys rarely solved or attempted to solve these complex puzzles.

Girls had more associations than boys, and made better progress in getting out the details in succeeding flashes. They also showed greater power of analysis. The number of subjects is too small to warrant any certain generalisations being drawn from these differences between the two sexes, although the distinctions were fairly consistent in the cases observed.

(b) *An elementary school in a good district.*

At the second elementary school I had six boys as subjects with an average age of eleven years. This lower average was due to the fact that three of the boys were only about ten years of age.

Mental activity was more generally noticeable than in the group just mentioned at the first school, and was shown in several different ways. Thus one boy, the youngest of the group, constantly worked down to causes:

"His hair is rather rough, as though he is just up." (No. 5.)

"His lips are only a pale red, as though not completely healthy." (No. 5.)

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Another subject said of the same picture :

"He is closing his right eye, as though somebody has thrown something at him, or is going to hit him."

Probable things, not yet seen, were specially sought. Thus, in the picture of the donkey, one subject said :

"There ought to be some sky. I haven't noticed any."

After the next exposure he added :

"I couldn't see any sky. The cow seems to be on a hill, and the ground rises up behind."

Another subject noticed that he had not seen a signal in the train picture, and so looked for one.

Two subjects, on the other hand, were amazingly uninquisitive. They were satisfied after a very few flashes that they had seen everything, and would keep saying at the end of subsequent exposures, as though tired of the picture: "That's all." These subjects accepted suggestions as readily as any in the previous group.

Introspection was more exact at this school than at the first, as the following examples show :

"I think I noticed the colour first. I saw it was white. Then I thought a white cow." (No. 11.)

"It reminded me of going from Cambridge to Yarmouth. I felt in the train but it was still. I also thought of my brother and sister in the train." (No. 1.)

Colour perception was again weak. Two missed the colour altogether in picture No. 5, and all subjects made mistakes.

There was an excellent example at this school of a subject showing his predisposition to one special aspect of the pictures. In this case it was to geometrical notions and concepts, and the boy compared lengths, proportions, sizes and angles in almost every picture :

"It did not seem to have long legs compared with the body." (No. 13.)

"The sides of the road seemed to vanish quickly." (No. 13.)

"The elephant seemed about one and a half times as high as the man."

When I asked the headmaster to place the boys in the order of their ability in mathematics, he gave this subject the top place, without knowing anything of these results.

There were no cases of self-active imagery, and objective change was reported by one subject only :

"I have a different idea." (No. 13.)

"I get a different view." (No. 1.)

The average number of correct facts discovered in each picture was seventeen in the case of the three older boys, but if we take all the boys together the average was only 14·2. These results show a significant superiority over the average of 12·58 gained by the older boys at the first school. (Unfortunately I had no girl subjects in the second school.) The average number of mistakes made in each picture was 5·65 for all the six subjects, this again comparing favourably with the other group. More correct reasons for statements were discovered, and more exact positions of objects were stated by the second group than by the first; also, more associations were mentioned.

Besides this general superiority which is evident in the second school, there is also evidence of more individual variation, and generalisations are more difficult to make. Some subjects showed a fairly independent active attitude, as I have shown, whereas others were amazingly passive.

In this group, too, the subjects had the benefit of a wider experience than in the other, and seemed better able to deal with the strange and unusual. Although the school is much further away from Queens' College, two of the four to whom the picture of the College was exposed recognised it at once, a third knew it was a Cambridge College but could not name it, and the fourth recognised it correctly at the end.

(c) *A Grammar School.*

At the — Grammar School I examined nine boys, whose average age was twelve years and two months (varying from eleven years and ten months to twelve years and six months).

Two striking differences from the results obtained in other schools may be mentioned at once. The first was the caution used in describing the nonsense picture (No. 16). From the children in other schools, as indeed from many adults, I got many very elaborate and extravagant interpretations, as the following:

"Some ducks walking about on land."

"A picture of St George and the Dragon."

"A boy on a donkey's back, and some more children standing at the side."

And to these interpretations further details were often subsequently added. But at the — School the boys gave a very meagre and restricted interpretation to the picture. The following answers were returned by different boys, all after the first flash:

"A whole lot of jumbled figures with a box in the middle. Done in blue ink. All dancing round a box. Little ink smudges."

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"A pattern, isn't it? Blue colour."

"Like a landscape puzzle. Green colour."

"I don't know what it is. Blue things. Might be Japanese writing. It goes in all directions."

"A lot of blots. It reminded me of when I put ink on a lantern slide and showed it on a sheet."

"Black figures on a white background."

These answers show great objective accuracy, and the ability to keep very close to the bare percept—an attitude which is the antithesis of the tendency to subjective addition so clearly marked at the first elementary school.

The second difference was the very systematic and careful examination of each picture at the end of the experiment. Corrections were made with great accuracy, and omissions were noted, the subjects showing a very general absence of bias and prejudice. I quote two examples:

"Oh! it's a bear performing in the street." (The subject had previously thought it was a man.) "There are houses and shadows—not a sledge. A chain, muzzle, trees either side, big buildings, some very tiny vehicle at the end of the street. The white thing on the bear is a muzzle. The head is shaggy on the top. There's a chain attached to the pole, and I believe a bit of chain attached to the paw. There's a little boy in a white jersey and black trousers looking at the bear; he's leaning against the wall of the house nearest to me on the right. The trees extend the whole way up."

The second is the picture of Queens' College:

"There are no swans. It's a College I think." (This subject was not a Cambridge boy.) "At the far end are two boats and men rowing. On the left a low sort of wall. A clump of trees. Stone buttress pointed at the top. Behind the bridge and on the right a part of the building sticks out. A pointed roof. Three chimneys. Windows deep set and round. Buttress supports bridge. Brick house. Two rows of windows. At the end of the picture there are two windows at the top, then three windows, then a division, then three windows. They are square and have bars on them. I can see the roof of the part with round windows. It is black and has garrets."

Children at other schools generally ignored the mistakes they had made, and some would stare at a picture, exposed to them at the end of the experiment, without adding a single correction.

Suggestions were most often refused quite decisively, though they were occasionally accepted when there was some ground for their probability.

Several boys looked out specially for objects which were likely to be found, but which they had not yet seen, and chose special parts of the pictures for examination:

"I haven't seen the tender yet." (No. 1.)

"There ought to be some posts nearer me." (No. 1.)

"I am going to see if there are houses on the same side as the pavement."
(No. 13.)

"I was going to see what the woman was sitting on." (No. 12.)

One boy is to be distinguished from the rest as showing much less care and caution. He had been attending the school for a short time only, though this, of course, may only be a coincidence. He did not correct his mistakes at the end. He went far from the actual percept. He said there were "about six people" in No. 6, and "a cat" between the man and woman. In the bear picture he saw "a crowd of people on the right." He made generalisations on very insufficient data. In No. 6 he said the figures were "dressed in bluish stuff." In the station picture there were "no porters or officers about." However, he made inferences with fair ease, and of the Queens' College picture he said very shrewdly: "The trees form a very deep grove, and make the place very dark. The windows are not much good because the light doesn't get to them very well. The river is not very wide."

Complex pictures were not very well solved as a rule, and it was evident that the main interest was not in the hidden story of a picture, but in the observable details it contains. One boy was remarkably clever in discovering the important features of a picture at once. He seemed to be able to ignore instinctively what was unimportant, and to concentrate on the significant parts.

Language was more complex and varied than among the other groups, and expressed finer shades of meaning. There was one case where a subject added so many qualifications to his answer that I could not write them down quickly enough.

The average number of correct facts discovered by these subjects in each picture amounted to 19.4, and the mistakes numbered 3.15. These numbers show a considerable superiority in discovering detail and in caution possessed by this group as compared with the others. Associations, too, show a marked increase, evidence, it may be, of a fuller experience. The ability to state the exact positions of objects and to give the correct reason for things was also possessed in a higher degree at this third school than at the others.

Objective change was remarked upon by one subject, but subjective addition was quite absent. The power of analysis was present to a very much more marked degree than in the other groups.

To sum up, we may say that the children in this group showed evidence of remarkably advanced mental powers in dealing with the

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problems before them. They were systematic in the fore-period, and careful during the experiment. They showed caution against subjective errors, and independence of judgment. They based their answers on good reasons and did not lightly dismiss alternative possibilities without good cause. In all these respects they approached the characteristics of adults, and showed a very pronounced superiority over the other two groups of similar age.

This fact of variation from school to school is of importance in psychological investigation, and offers possibilities of further research. It is easy to see that the second of the three schools occupies a position midway between the other two. At the first school the older children did not seem to have advanced very far, in some respects, over the younger children at the same school.

The figures which I have already given may be set out in tabular form for greater ease of comparison :

School	No. of subjects	Age	Av. no. of correct facts in a picture	Av. no. of mistakes in each picture	Av. no. of correct reasons for things	Av. no. of positions correctly described
1. Elementary (poor district)	2 girls	6	10.9	8.0	0	2.1
	2 boys	6	7.1	9.6	0	1.5
2. Elementary (good district)	5 boys	6	10.5	6.15	0.15	3.35
3. Elementary (poor district)	3 boys	12	12.58	7.0	0.25	4.75
	3 girls	12	14.5	3.58	0.4	3.8
4. Elementary (good district)	3 boys	10	11.4	3.8	0.1	4.2
	3 boys	12	17.0	7.5	0.58	5.25
5. Grammar	9 boys	12	19.4	3.15	0.4	7.6

(iii) *A mentally defective child.*

An interesting case presented itself at one of the schools, where I had a mentally defective child as a subject. This was a boy of eight-and-a-half years of age. He was inferior to children much younger than himself, and was very open to suggestion, but his chief fault was his inconsistency. He showed no power of making gradual progress over an extended period, no ability to solve a problem by degrees. Lack of memory largely accounted for this weakness, though not entirely, I think. His attention would wander off in a distressing way. When left to himself he merely gave enumerations of the things he had

seen and imagined. Thus, in a picture of two bulldogs (not included in the descriptions given earlier), I did not interfere at all with him, and his answers were:

1. "Two dogs." ♣	12. "Sun" (imaginary).	22. "River" (imaginary).
2. "Two dogs."	13. "Moon" (imaginary).	27. "Dog's nose."
3. "Sitting down."	15. "Ears."	28. "Other dog's nose."
5. "Dog's legs."	17. "Head."	31. "Pavement."
7. "Tail at the back"
(imaginary).	20. "Sky" (imaginary).	32. "Road" (imaginary).
10. "Road" (imaginary).	21. "Star" (imaginary).	33. "Sea" (imaginary).

It will be noticed how one answer often suggests the next (12 and 13; 20 and 21; etc.). Others are probably vague memories of previous pictures: the "river" from Queens' College, the "road" from the bear picture, and so on.

When I asked this subject questions in order to make the reports more explicit, I was soon in a maze of contradictions and inconsistencies, for he would accept even the slightest suggestion and then promptly forget it in favour of something else.

This research is incomplete at many points, but the problem is so vast, and involves so many factors, that this fault could not be avoided in the time at my disposal.

In conclusion, I should like to express my very great indebtedness to Dr Myers, who first suggested the experiments to me, and who has helped me unceasingly during their progress. My thanks are likewise due to Dr Rivers and to Mr E. Bullough for much valuable criticism and advice; to Dr Rouse, Miss Wing, Mr Haynes, Mr Inglis and Mr Mullett for their courteous help in the school experiments; and also to my numerous subjects, who often visited the Laboratory at great personal inconvenience.

5. CONCLUSIONS.

The process of perception begins with an immediate interpretation of the object, and this is strikingly uniform in different subjects. It is followed by an analysis of the object, and, in this, very marked individual differences emerge.

Among adults, persons of scientific training show advantages in the method of analysis, and are generally better able to direct the process systematically and carry the analysis further than are other subjects, though there are exceptions to this statement.

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Some persons with strongly marked subjective tendencies behave very consistently in many respects, and it is probable that the cause of their similarity is to be found in a 'self-active' imagery, which plays a more important part than the actual percept. There are also subjects who show very little tendency to be influenced by subjective factors, and with whom the image has little or no importance.

Among children, perception becomes more complex as age increases. Children of six years of age have no power of analysis, and see the object as a whole. They cannot balance alternatives or postpone decisions. They are very passive to suggestions. Children of twelve years of age show a greater power of analysis, a more active mental attitude, and an improvement in the discovery of detail. Compared with the younger children there are greater individual differences.

Children of the same age from different schools vary in a marked way. At a secondary school children of the age of twelve have already many of the powers and methods of adults. At a 'slum' school they are much inferior and even show some of the characteristics of the youngest. Mental activity is as marked at the first type of school as passivity is at the second. An elementary school of a good type shows characteristics midway between the other two.