

## V.—FRESH LIGHT ON MOLYNEUX' PROBLEM. DR. RAMSAY'S CASE.

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MOLYNEUX' problem, as my readers will doubtless remember, was as follows :—

"Suppose a man born blind and now adult and taught by his touch to distinguish between a cube and a sphere (suppose) of ivory<sup>1</sup> and nighly of the same bigness, so as to tell, when he felt the one and the other, which is the cube and which the sphere. Suppose then the cube and sphere placed on a table, and the blind man made to see; query, whether by his sight alone, before he touched them, he could now distinguish, and tell, which is the globe, which the cube."

It will be observed that the problem is reduced to a very simple form. The subject of the experiment is to be told that one of the objects presented to him is a cube and the other a sphere, and he is only asked to say which is the sphere and which the cube. Molyneux answers his own question in the negative. "For, though he has obtained the experience of how a globe, how a cube affects his touch, yet he has not yet attained the experience that what affects his touch so or so, must affect his sight so or so; or that a protuberant angle in the cube, that pressed his hand unequally, shall appear to his eye as it doth in the cube." The reasoning seems inconclusive when the question put is only which of the two objects is the cube. Locke says that he agrees with Molyneux, but it is curious that while doing so, he substitutes for Molyneux' expression "by his sight" the very different one "at first sight".

Berkeley came to the same conclusion by a different path, holding as he did that the ideas of extension as given by sight and touch respectively have no resemblance or homogeneity whatever. He thought, however, that Locke on his

<sup>1</sup> Locke has "of the same metal".

own principles ought to have judged otherwise ; for, he says, "it is no more but introducing into his mind, by a new inlet, an idea he has already been well acquainted with". The argument seems convincing, yet a little consideration will show that it requires qualification. For, admitting that the idea of extension is the same whether conveyed by sight or by touch, it does not follow that the patient, in the case supposed, should be able by sight to perceive a sphere as a sphere or a cube as a cube. In fact, even experience cannot enable us to do this. If the question were only that between Locke and Berkeley, viz., whether the ideas of extension given by sight and touch respectively be of the same kind or entirely heterogeneous, it would be better to test the patient with a ring and a cross, rather than a sphere and a cube. But even with this simpler form of the experiment, we must bear in mind that the blind man's perception of extension has been invariably associated with tactual sensations, which indeed are predominant ; so that the necessary dissociation may require time and attention. Also the new visual perception of extension is complicated with a perfectly new and puzzling set of sensations.

In illustration of this I may point to the fact that if we have been reading, say Gothic characters in red on a blue ground, and then are presented with characters of a similar kind in blue on a red ground, we do not at once recognise them. A still more striking illustration is furnished by the engravings issued in the time of the first French Republic, and circulated amongst the Royalists. These consisted sometimes of figures of trees, the outline of which comprised profiles of members of the Royal family, which when once pointed out could not be mistaken. Nevertheless, the figures might be often looked at without the observer having any suspicion that they contained any profiles at all. Yet it was only a question of viewing the outline as the boundary of the blank instead of the printed space, the intelligible figure of the tree forcing the attention. Puzzles based on the same principle were widely circulated a few years ago.

It is no doubt very difficult, perhaps impossible, for us with our life-long habit of visualising absent objects, or those which we handle in the dark, or with shut eyes, to put ourselves in the position of one who on first acquiring sight has to reproduce in imagination a tactual perception. Nevertheless it is not unreasonable to expect that in the case supposed the subject of the experiment would be able to discriminate correctly between the two figures. For as the

eye or the attention<sup>1</sup> travels round the outline of the circle it does so in a uniform manner and without check or interruption, whereas in the case of the square there is an abrupt change of direction, and this might be expected to recall the change experienced by touch, not perhaps so as to identify them, but at least so far as to enable the person in question to say which of the two figures is the sphere. This is on the extreme supposition that the patient is not allowed to move his head so as to view the figures from different sides. To Leibnitz the affirmative reply to Molyneux' question appeared indubitable, for in the globe all is uniform, whereas the cube has eight points distinguished from all the others (not eight visible, however). "I do not speak," he says, "of what he would do at the moment, being dazzled and confounded by the novelty, and besides, not accustomed to draw inferences." He adds the striking remark that if it were otherwise the born blind would be unable to acquire even the rudiments of geometry, which we know they are capable of doing. The same view is defended by a Mr. Syngé in a letter to Molyneux included in Locke's Works. But the most detailed examination of the problem is that by Dr. Jurin in a note in Smith's *Optics* (1738), in which he points out that the patient in question must be supposed to be at liberty to view the figures from all sides; in doing which he would find that the globe always presented the same aspect, whereas the cube varied.

(Dr. Jurin's note would be worth quoting were it not that we are proceeding to the experimental verification.) This was also the view taken by Dr. Franz, who writes: "The supposed person will certainly be able to distinguish by his sight the cube from the sphere, though he will not, it is true, recognise the two figures as a *cube* and a *sphere*, but will

<sup>1</sup> I say "the attention," for motion of the eye is not necessary. J. S. Mill indeed, holding that 'extension' is only a succession of muscular sensations, affirmed that the eye could distinctly see only one point or spot, so that the visual perception of a circle involved, or rather was, the consciousness of a series of eye movements. That this is not so is proved by the phenomenon of after-images. An excellent example is furnished by Messrs. Pears' advertisement, in which the letters PEARS in red occupy the middle of a circle. After looking at this for a few seconds, when we look away we see the same letters in the complementary colour.

I frequently pass a blackboard on which VISITORS is painted in white letters; the after-image consists of the same word in black.

In such cases the after-image proves that the eye has not moved; and it is also clear that in contemplating the parts of the after-image itself motion is out of the question.

pronounce the one to be a disc and the other a square ; it must be premised, however, that some little time must be allowed for the mind to recover from the confused sensation produced by the novelty and multitude of objects suddenly presented to the newly acquired faculty " (*The Eye*, London, 1839, p. 32). Dr. Franz not long after the publication of this treatise had an opportunity of testing the soundness of his opinion. Sir W. Hamilton also expresses the opinion that a slight consideration would show that Molyneux' view was erroneous (*Reid*, p. 137 n.).

It is unnecessary to discuss the question further from the speculative point of view, and these remarks are only intended to prepare the reader for the appreciation of the facts which I am about to mention. For the experiment has been recently tried with interesting results. But before calling attention to this most recent experiment it will be well to quote some of the older cases. I have given a fuller account of these in *Sight and Touch*, published in 1864.

The first case I shall mention is reported by Mr. (afterwards Sir) Everard Home in the *Philosophical Transactions*, 1807. The subject of the operation was a child seven years of age, and everything had been got ready for the experiment previously to the operation. The eye was allowed ten minutes to recover itself ; then a round yellow card was placed about six inches from it. Immediately the child said that it was yellow and round. Before the operation he had been able to distinguish bright colours "with tolerable accuracy, particularly the more bright and vivid ones". When a square blue card about the same size was shown him he called this blue and round. Similarly, a triangular card he called round. Two hours afterwards he again at first called the three cards round, but on being shown a square, and being asked if he could find any corners, he was very desirous of touching it, but this being refused, he examined it for some time and said that he had found a corner. "His eye went along from corner to corner."

In the same paper Home records another case (of a child twelve years of age) in which the blindness was unusually complete, and although the sight acquired was extremely imperfect, the facts are of great interest. This patient before the operation could just distinguish light from darkness, or the light of the sun from that of a fire or of a candle. When he looked at the sun, he said it appeared to touch his eyes, as also did a lighted candle if nearer than twelve inches. At twenty-two inches the candle became invisible. But it is

very remarkable that he had a visual apprehension of form and magnitude, and compared the visual with tactual. The sun appeared to him the size of his hat; the flame of the candle larger than his finger, not so large as his arm. This is important, as all possibility of even the most rudimentary association of the tactual and visual experiences is excluded. He could not see his hat or his arm, neither could he have any tactual experience of the size or form of a candle flame or of the visual image of the sun. This is perhaps a unique instance of a person who could only see objects which from their nature it was impossible to feel.

The most important case on record, however, before that of 1903, was that of Dr. Franz of Bristol, reported in the *Philosophical Transactions* for 1841. The youth on whom the operation was performed was seventeen years of age, and was familiar with geometrical figures, including the simple solids. "His sense of touch had attained an extraordinary degree of perfection," and "in order to examine an object minutely he conveyed it to his lips". Dr. Franz satisfied himself that he could have no perception of objects, although he was capable of perceiving with the left eye colours of an intense and decided tone. He had strong internal strabismus in both eyes, and the right eye had no perception of light at all. When his eyes were first uncovered after the operation he saw "an extensive field of light in which everything appeared dull, confused and in motion," but could not distinguish objects. When his eyes were again uncovered, two days later, he described what he saw as a number of opaque watery spheres, moving about with the movement of the eye, and partially covering each other. One would like to know how he got the idea of "watery spheres". No doubt Dr. Franz is giving his own interpretation rather than the patient's words. As to the appearance intended, perhaps it resembled what may be observed in the case of a normal eye, if we almost close it and look at the window or a lamp. However, this appearance is stated to have diminished daily, and the patient was able to "look through the spheres". As soon as these had disappeared, and he was able to distinguish objects, the experiments were tried. The first was with colours and does not concern our question. In the second he was shown two strong black lines (at a distance of three feet), one horizontal and one vertical. After attentive consideration he "called these by their right denominations". When asked to point out the horizontal line he moved his hand slowly as if feeling and pointed to the vertical, but after a short time he corrected himself. This

simple experiment was sufficient to show that the idea of extension which he now got from sight was not of a wholly different nature from that which he previously had from touch. His initial mistake of the vertical for the horizontal merely proves, if proof were necessary, that no association had been established between the impression conveyed by the two senses. He was next shown the outline of a square (six inches in diameter) within which was a circle and within this a triangle. A very complex figure! and one is a little surprised to learn that after careful examination he recognised the figures and described them correctly. When asked to point out either figure, he moved his hand, as if feeling, and with caution. Being shown a cube and a sphere, he said he saw a quadrangular and a circular figure, and after some consideration pronounced the one a square and the other a disc. These figures were each four inches in diameter and placed at a distance of three feet. He was next shown a pyramid, which appeared to him triangular, but when it was turned about a little so as to present two of its sides to view, after considering it a long time he said it was an extraordinary figure, neither triangular, quadrangular, nor circular, and at last said: "I give it up". When asked to describe the sensation produced by the different objects, he replied that he had seen a difference between the sphere and cube at once, and that they were not drawings, but had not been able to form from them the idea of a square and disc until he perceived a sensation of what he saw in the points of his fingers, as if he really touched the objects. Similarly persons possessed of normal vision, on feeling a strange object in the dark, will try to form a visual representation of it. This is an instance of a well-known general principle. When the three bodies were put into this patient's hands, he was surprised that he had not recognised them by sight, as he was well acquainted with these solid figures by touch. It is significant that what surprised him was not the dissimilarity of the tactual and the visual perceptions. It may interest the reader to learn that the young gentleman upon whom this operation was performed subsequently entered the medical profession, and had a practice in the neighbourhood of Dublin. His name was Ferdinand C. Jencken. Some thirty years ago Dr. Mahaffy made his acquaintance and had some conversation with him respecting his experience. He told Dr. Mahaffy that if his parents had been aware that Dr. Franz was writing a paper on the case, they could have supplied him with additional particulars of interest. He also mentioned that he had studied the

psychological theory of vision, and entirely disagreed with the theory of John Stuart Mill. He died before there was any further opportunity of questioning him as to his recollection of his experience before and after the operation. This was to be regretted, for a well-educated youth, who had gone through such an experience in his eighteenth year, would be likely to retain a vivid recollection of it.

The regret is mitigated by the fact that a similar case has lately been reported in which the observations were conducted with the utmost care. I refer to the case reported by Dr. A. Maitland Ramsay, of Glasgow, in the *Lancet* of 16th May, 1903. A reprint of this report, with additions, has been issued under the title *A Clinical Study of Three Cases of Blindness in which Sight was Acquired in Adult Life* (Glasgow: Printed at the University Press, by Robert Maclehose & Co., 1903). Dr. Ramsay has favoured me with a personal communication containing some additional interesting details.

The patient in question, whose name was Carruth, was a man aged thirty, blind from birth, both lenses being completely cataractory. He was quite unable to distinguish objects, although he could tell day from night, and could easily perceive a light and locate it accurately, but he seems not to have any perception of bright colours such as the blind sometimes have. He worked in a garden and had learnt to pluck flowers, arrange them in bunches, and pack them in boxes for market, not only without the slightest difficulty, but with very great accuracy. He distinguished different blossoms, partly by touch, but chiefly by smell; and by dint of asking questions he got at last to know so much about their form and colours that he could arrange them in a bouquet.

Dr. Ramsay extracted the lens from the right eye on the 11th of March, 1903, and from the left a week later. For about ten days after the operation the patient appeared quite dazed, and could not realise that he was seeing. From the outset he took a most intelligent interest in his own case, and asked numerous questions of his fellow patients. "The first thing he actually perceived was the face of the house-surgeon. He says that at first he did not know what it was he saw, but that when Dr. Stewart asked him to look down, the sense of hearing guided his eye straight to the point whence the sound came, and then recalling what he knew from having felt his own face he realised that this must be a mouth, and that he must be looking at a face." This seems even more difficult than the discrimination of a sphere and a cube, which was tried very early in the case. "On the



second day, I think it was [writes Dr. Ramsay], that the patient got out of bed. I went into the day-room and showed him a ball and a toy brick, and asked him if he could tell the one from the other. I told him I was showing him a ball and a brick. He looked at them for several minutes, moving his head from side to side, and backwards and forwards so as to see all round about them, and at the same time I noticed his fingers were moving nervously, trying to feel them in imagination. He at length and without any hesitation told me that I was showing him a ball and a brick. I ought to have said " (i.e., in the article in the *Lancet*) " 'named them correctly' instead of saying 'described them correctly'. I was struck by the decision he displayed and asked him how it was he knew the ball from the brick, when he said that 'he was so accustomed [to] handling objects that he had come to have a notion in his mind regarding the form of things'. It was suggested," says Dr. Ramsay, "that Carruth had probably seen a chair or a table before I showed him the ball and the brick, and in that way had come to have an idea of a corner. Of course that may be so, as my test was made after he had left his bed and gone into the patients' day-room, but my own feeling is, both from my observation and the time, and from what the patient said about it afterwards, that he answered correctly because he was able to compare what he saw with an imaginary tactile impression. That this was so is, I think, further proved by another observation made by Prof. Latta, who asked Carruth one day if he could describe the pattern on the back of a wooden couch. It was a fenestrated back, and the openings represented a series of Gothic arches. Carruth said he was not sure, but when asked if he had ever felt anything like what he saw on the pattern, he replied, 'I think it resembles a bridge.' 'Is it like a bridge?' Prof. Latta asked him again. 'Well, I think it would be more like what I have felt if the top opening was lower down.' At the time I was much struck by that reply, as it showed me again what I had observed on several occasions, that Carruth was learning to see by a process of reasoning."

This seems to be the first instance in which Molyneux' question was put exactly as he suggested. From the fact that Dr. Franz's patient, without being told what was before him, called the sphere and the cube a disc and a quadrangular figure respectively, it might fairly be inferred that if the question had been proposed to him in the same form as to Carruth he also would have answered correctly. But this would have been only an inference, and it is more satisfactory



to have the direct answer as in the present instance. It will be seen that it harmonises with the observations made in other cases.

There is another and kindred question on which Dr. Ramsay's observations throw fresh light; I mean the question whether the visual apprehension of magnitude and distance is wholly derived from tactual or locomotive associations. I have maintained the contrary in the book already referred to, *Sight and Touch*, and my view is strikingly confirmed by Dr. Ramsay's observations. "From the time he got out of bed after the operation [says Dr. Ramsay] he could guide himself with ease through a doorway, and walk about on the level, but he had considerable difficulty in ascending a stair, because the steps seemed so high that to begin with he raised his foot much farther than was necessary, and without meaning to do so, went up two steps at a time. Whenever he discovered his mistake, he began to pay attention to the rise of each, and he has now no difficulty in estimating their height." Association obviously came in here to connect the effort with the existing visual perception. "This, of course, was part of his difficulty of judging distance, though when he first looked out of a window on to the street, and saw the pavement below, he said he felt that if he had a stick he should be able to touch it, and thus had not the feeling recorded of the boy operated on by Cheselden in 1728, who thought that all objects 'touched his eyes' just as he had formerly got his impressions of things by pressure against them."

Carruth was not singular in the impression made on him by the apparent magnitude of objects. Cheselden's patient also said that objects appeared extremely large. Similarly Grant's patient on first seeing his guide, and being asked what idea he had of him before he saw, said he thought him "a much smaller machine, but of the same kind as himself". Mr. Jencken also "saw everything larger than he had supposed from the idea obtained by his sense of touch". There is, I believe, no observation recorded in the contrary sense. These facts seem to prove that there is a visual apprehension of magnitude independent of association. On the other hand, one or two instances are on record in which the patients agreed with Cheselden's in saying that objects appeared to touch their eyes. Thus Mr. Nunneley states that his patient did so think. Nevertheless "he walked most carefully about with his hands held out before him to prevent things hurting his eyes by touching them". This seems to indicate that

he did not think they already touched his eyes, in the sense which we should attach to the words. If I were walking in the dark, and felt something touching my face I should not proceed to walk forward holding my hands before me. Dr. Trinchinetti also, who operated on two children, brother and sister, at the same time, inferred from his observations that they thought visible objects were in actual contact with the eye, but his inference is not justified by the facts that he records. Thus, the boy, on being asked to take an orange placed about one metre from him, at first brought his hand close to his eye, and closing his fist of course found it empty. But he then tried again a few inches away, and in this way at last succeeded. This, of course, proves that the object did not seem to touch his eye as we understand the words. If we felt a flat object touching our forehead, we should not try to grasp it with our fist held near the face. The girl, on the contrary, when she failed to seize the orange with her hand very near her eye, simply pushed her forefinger in a straight line slowly until she succeeded in touching the object. What these observations show is that the patients had not learned to correlate the visual impression with the locomotive effort, a correlation which, of course, can only be learned by experience. On the other hand, a patient of Mr. Ware, a youth of fourteen, on his first trial after the acquisition of sight, took hold of Mr. Ware's hand when held at different distances, or carried farther from him; and in order to satisfy the observers of the accuracy of his perceptions, he conveyed his hand to Mr. Ware's "in a circular direction," whatever that may mean. Both he himself and his parents affirmed that he had never seen the figure of any object. A patient of Mr. Wardrop's, a lady of forty-six years of age, who before the operation was even more completely blind than Cheselden's patient, having been unsuccessfully operated on (and one eye destroyed) at the age of six months, on seeing a coach pass as she was returning home after the operation, asked, "What is that large thing that passed us?" M. Cunier relates the case of an idiot girl on whom he operated, and whose sense of sight he could never educate, so that she constantly stumbled against objects, and several times fell downstairs. Yet when her passion for sweetmeats was excited, she had no difficulty in estimating distance, but easily seized fruit or bonbons, and saw them at the same distance as other people. This is interesting as showing the important part played by attention. M. Cunier does not state how long she took to acquire this facility. Obviously it must have taken some time.

In Dr. Franz's case all objects appeared to his patient so near that he was sometimes afraid of coming in contact with them. If he wished to form an estimate of their distance from himself or from one another without leaving his place, he examined them from different points of view, turning his head from right to left.

There are other cases in which the patients, in reply to questions, expressly denied that objects appeared to touch their eyes. Indeed, the expression "touching the eye," simple as it seems, requires explanation. Does it mean touching the eyeball, *i.e.*, the cornea? But the cornea is as insensible to the passage of light as an eyeglass, and, moreover, we are unconscious of its place. It cannot be meant that objects seemed to touch the retina of whose situation we are equally unconscious, and the stimulation of which conveys the sensation of light, not of touch. We may conclude, therefore, that clearly this feeling was exceptional, and where such an impression existed it may have been due in part to a more or less painful sensation in the eye. For ordinarily the impression of light on the retina is not accompanied by any consciousness of the part on which the impression is made. This is confirmed by the observation in one of Home's cases, before referred to, in which before the operation a candle held at less than twelve inches distance from the patient appeared to touch his eye, while beyond that distance it did not. We must also make allowance for the fact that touch was the only mode of perception of objects with which the patients had been previously acquainted.

To return to Dr. Ramsay's patient Carruth. It is remarkable that he has not retained his faculty of moving easily about in the dark. "Before the operation he could guide himself fearlessly through a ward without coming in contact with the beds or any other obstacle that might be in the way, but since he has been able to see, he says he has lost all that feeling of confidence, and when his eyes are shut he is afraid to move and is impelled to open them to ascertain where he is going—so much so that he does not know what he would do if he again became blind."

I may add that Dr. Ramsay's pamphlet contains an account of two other cases, one of them the sister of Carruth. She was in many respects the antithesis of her brother, being weak and timid. Whereas he in his boyhood was a leader in every game, and would climb the highest trees, bird-

nesting, as fearlessly as any of his companions, she was frightened to go about alone except in places with which she was perfectly familiar. She was also greatly inferior to her brother in intelligence and memory. After the operation (on both eyes) she expressed no wonder at what she saw, but she has great difficulty in describing her sensations in such a way as to convey any clear conception of them to another. It is certain, however, that she can now perceive a human face, and in her own home she can recognise the furniture and other objects in the house; but it is noticed that, although she is manifestly delighted at her ability to see, she never trusts her sight, and always tries to handle an object before naming it.

Dr. Ramsay's third case (really an earlier one) was that of a woman, not born blind, who had lost her sight through an accident when six months old. Before she left the hospital she could recognise the nurses and doctors and everything about the wards. Later, she told the doctor that when she had returned home it had been a peculiar pleasure to her to examine with her eyes the different things with which she had formerly been in the habit of working (on a dairy farm), and she said that they all appeared very much as she had imagined. This is interesting, as it seems to indicate that the knowledge of spatial relations acquired in the first six months of her life had continued to affect her ideas of objects. In this the case resembles one recorded by Wardrop (*Sight and Touch*, p. 152). It is very curious that with such a promising beginning this woman, two years after, had made no further progress in learning the value of vision, and said that she had been kept very hard at work and had used her sight very little. She found it a great trouble to look at an object.

The writer of the article "Cataract" in the *Encyclopædia Medica*, speaking of operations for congenital cataract later than the first few months of life, says: "Later operations will admit of a certain degree of sight being acquired. But the acquiring of these conditions is a slow laborious process, requiring often much training. It always stops short of perfection, often much short of it." As we have seen there are exceptions, and the case recorded by Dr. Ramsay is one of the most remarkable.