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"O God of Newton and Clarke, have mercy on me!"

Nicholas Saunderson, Denis Diderot and the only possible answer to Molyneux's question

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Abstract

This essay deals with the early discussion of Molyneux's question - which may hopefully cast some light on the contemporary debate – and is written from an historical point of view. I will claim that, in the eighteenth century history of Molyneux's question, there is a leading figure: Denis Diderot; the most original and fruitful answer is given in his *Lettre sur les aveugles à l'usage de ceux qui voient* (1749). From the historical background of Diderot's analysis, both the merits and limitations of the negative and positive answers, along with the inadequacy of the standard classification between "empiricists" and "rationalists", will also emerge. Diderot's "relativistic" solution is a turning point in the whole philosophical discussion of Molyneux's question, in that it has been confirmed by clinical reports of surgical operations of blind people, starting from Cheselden's case.

Keywords

Berkeley · Condillac · Diderot · Empiricism · Leibniz · Locke · Molyneux · Rationalism · Saunderson

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William Molyneux (1656-1698) was an Irish scientist and politician, whose reputation is mainly due to the conception of an epistemological problem, which he posed to his friend John Locke, in a private letter in 1693. Molyneux was an astronomer, a physicist, a fellow of the Royal Society, the founder and first secretary of the Dublin Philosophical Society; he published *Sciothericum telescopicum* (1686) and *Dioptrica nova* (1692), a seminal text for opticians, natural philosophers and authors of perspective. He was also a deputy in the Irish Parliament.

In his private life, there is a painful contingent circumstance, which might have been decisive in the conception of his well-known question: in 1678, William Molyneux married Lucy Domvile, who became blind after three months, and was

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blind until her death, in 1691. Two years later, on 2 March 1693, Molyneux wrote to Locke; he understood the importance of the question posed by his friend, and divulged it in the second edition of his *Essay concerning Human Understanding* (1694), with utterances of deep esteem and appreciation towards Molyneux.

> To which purpose I shall here insert a problem of that very ingenious and studious promoter of real knowledge, the learned and worthy Mr. Molyneux, which he was pleased to send me in a letter some months since; and it is this: "Suppose a man born blind, and now adult, and taught by his touch to distinguish between a cube and a sphere of the same metal, and nighly of the same bigness, so as to tell, when he felt one and the other, which is the cube, which the sphere. Suppose then the cube and sphere placed on a table, and the blind man be made to see: quaere, whether by his sight, before he touched them, he could now distinguish and tell which is the globe, which the cube?" To which the acute and judicious proposer answers, "Not. For, though he has obtained the experience of how a globe, how a cube affects his touch, yet he has not yet obtained 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 does in the cube." I agree with this thinking gentleman, whom I am proud to call my friend, in his answer to this problem; and am of opinion that the blind man, at first sight, would not be able with certainty to say which was the globe, which the cube, whilst he only saw them; though he could unerringly name them by his touch, and certainly distinguish them by the difference of their figures felt.[1]

This "jocose problem" was destined to become one of the most interesting topics in the history of ideas, particularly in the history of theories of visual perception. It quickly became popular among philosophers and surgeons, and trendy in the public opinion, to the point that it was considered the most important theoretical problem in the eighteeenth century,[2] amounting to a successful formulation of the classical gnoseological problem: is our knowledge of the sensible world spontaneous, immediate, innate, or is it acquired, learned by experience?

By virtue of that question, the seventeenth century problem of the origin of ideas – whether innate or learned from experience – shifted from the idea of God to the idea of a cube. Moreover, an experiment was suggested, able to solve the problem itself. Conceived as an imaginary experiment, Molyneux's blind man who recovers sight becomes an experiment *in corpore vivo* since William Cheselden's report, in 1728. Indeed, from 1693 up to now, Molyneux's question has been uninterruptedly debated by philosophers, ophthalmologists, psychologists, neurophysiologists and cognitive scientists.

1 Locke (1975), II, IX, 8.
2 For example, by Cassirer (1932).

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This essay aims at reconstructing, from a strictly historical point of view, the early discussion of Molyneux's question – often neglected by analytical interpreters – which may hopefully cast some light on the contemporary debate. I will claim that, in the eighteenth century history of Molyneux's question, the most original, interesting, comprehensive, fruitful answer was given by Denis Diderot in his *Lettre sur les aveugles à l'usage de ceux qui voient* (1749).[3] This seminal work is a turning point in the whole philosophical discussion: in order to make this evident, the historical background of Diderot's analysis has to be outlined. In short, while philosophers usually answer "yes" or "no" – or, at best, "yes, but…" or "no, but…" –, Diderot answers: "it depends on…", thus introducing a radical change of perspective.

1 The historical background of Diderot's analysis

The most common answer – traditionally associated with the empiristic philosophy, because it was given by philosophers usually classified as empiricists[4] – is notoriously negative: the newly sighted person will not be able to distinguish a cube and a sphere, because he lacks "the experience, that what affects his touch so or so, must affect his sight so or so"; he could not associate the familiar ideas, obtained by touch, to the new set of visual sensations. Locke agrees with Molyneux, but adds a further restrictive condition: the identification has to occur "at first sight".

But is Molyneux and Locke's answer coherent with their epistemological doctrines? Unfortunately, the answer is negative: in his treatise on dioptrics, Molyneux gives a geometric explanation of vision. He adheres to the Euclidean theory – shared, in his time, by René Descartes – according to which we perceive the distance, magnitude and situation of objects by means of the angle of the optic axes: therefore, we should be able to immediately distinguish the sphere and the cube, *ex geometria quadam omnibus innata*[5] ("by a sort of innate geometry in everybody"). In order to perceive external objects, sighted people use the angle of the optic axes, in the same way as blind people use crossed sticks.

Perhaps, Molyneux was conscious of the inconsistency of his answer with his own theory of vision: therefore, he did not publish his question, but merely wrote to Locke. But is Locke in a better situation? There is a discussion on this point, but I don't think so, for two reasons. At first, Locke affirms that sight and touch

[3] Diderot (1975-2004), vol. 4.

[4] Starting from Hegel's *Lectures on the History of Philosophy* (1837), up to the "standard" historiographical theory, which distinguishes the "British empiricists" from the "continental rationalists": see Loeb (1981). Paolo Rossi (in Diderot, 1981, p. 61) openly considers Molyneux's question an *experimentum crucis* between the empiricists, like Locke and Berkeley, and the "rationalists", such as Leibniz. When Cheselden made his experiment, this was actually considered an *experimentum crucis* by George Berkeley and Voltaire, as will be shown later on.

[5] Descartes (1974), VI, 13.

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cooperate in giving us simple ideas of sensation, among which he includes the figure of bodies.[6] Therefore, the newly sighted person should be able to distinguish the sphere and the cube "at first sight". Moreover, Locke considers figure a primary quality of bodies:

> The bulk, figure, number, situation, and motion or rest of their solid parts. Those are in them, whether we perceive them or not; and when they are of that size that we can discover them, we have by these *an idea of the thing as it is in itself*;[7] as is plain in artificial things. These I call primary qualities.[8]

If figure is a primary quality, really existing in bodies "whether we perceive them or not", and the idea of figure can be obtained both by sight and touch, Locke should have answered "yes" to Molyneux's question.[9] In Locke's solution, there is another inconsistency: he is convinced that space, distance, figure and motion – for example, the shape of solid, three-dimensional objects, like a globe and a cube – are perceptual judgements, unconsciusly formulated "so constantly and so quick", on the basis of a repeated, "frequent experience", "by a settled habit".

> The ideas we receive by sensation are often, in grown people, altered by the judgment, without our taking notice of it. When we set before our eyes a round globe of any uniform colour, v.g. gold, alabaster, or jet, it is certain that the idea thereby imprinted on our mind is of a flat circle, variously shadowed, with several degrees of light and brightness coming to our eyes.[10]

But we never see our retinal images,[11] which are not the proper and immediate object of vision, nor is it possible to suppose uncounscious judgements, which should "correct" sensations. In fact, Locke's soul does not always think (it is a "dull" soul, in his own opinion),[12] but is always conscious of whatever happens in it: therefore, given this sort of epistemological transparency, unconscious judgements are not possible.[13]

This is the "standard interpretation";[14] some scholars, who adopt an analytical approach to the history of philosophy, have recently claimed that Locke's negative

[6] Locke (1975), II, 5.

[7] Italics mine.

[8] Locke (1975), II, VIII, 23.

[9] Park (1969); Morgan (1977); Ayers (1991).

[10] Locke (1975), II, IX, 9.

[11] This is a "vulgar error", denounced by Condillac (1947a) and Berkeley (1948), *Theory of vision vindicated*, §50.

[12] Locke (1975), II, I, 10.

[13] This objection was first made by Condillac (1947a).

[14] Berchielli (2002).

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answer to Molyneux's problem is consistent with his theories of the primary qualities and perceptual judgments, given that to see is not to recognize.[15] Therefore, the newly sighted person would be able to see bidimensional figures, without recognizing the globe and the cube, which would be "concepts", or abstract general ideas, based on experience. But this tenet – as well as the conversion of primary qualities into "common sensibles" – has no basis in Locke's *Essay*. Molyneux – in Locke's words – asks the newly sighted person to "*distinguish and tell* which is the globe, which the cube?"; that is to say, he asks the blind man who recovers sight to *recognize* the two solids, not only to *see* them, more or less confusedly. As to "common sensibles", Locke, as well as any other late seventeenth and early eighteenth century philosopher, never uses that Aristotelian term: the epistemological debate is about simple and complex ideas, primary and secondary qualities. In addition, the globe and the cube cannot be abstract general ideas, which Locke considers as "fictions and contrivances of the mind, [...] something imperfect, that cannot exist; an idea wherein some parts of several different and inconsistent ideas are put together, [...] marks of our imperfection".[16]

Condillac gives two different answers to Molyneux's question: in the *Essai sur l'origine des connaissances humaines* (1746),[17] he states that the newly sighted person will be able to see the globe and the cube. He is the first to underline the inconsistency between Locke's theory of unconscious perceptual judgements and his negative answer. He also points out an unnecessary condition posed by Molyneux in the original formulation of the problem: why should the cube and the sphere be "of the same metal, and nighly of the same bigness"? Whether the blind person is able to recognize the two solids or not, their size and the metal they are made of are completely irrelevant. However, eight years later, in his *Traité des sensations* (1754),[18] Condillac changes his mind: he answers in the negative, argues that recognition cannot occur "at first sight", because the newly sighted person's eyes need some time in order to recover from the surgical trauma, and introduces the well-known example of an animated statue, using its sense organs one after another, in order to get ideas. The senses cooperate in giving us images or ideas of the external objects; therefore, the visual perceptions of the sphere and the cube should agree with the idea already present in the newly sighted person's mind, due to his tactual sensations.

In the most complete eighteenth century historical account of Molyneux's problem, Jean-Baptiste Merian considers Berkeley as the only empiricist philosopher who gives a fully coherent negative answer to Molyneux's question.[19] In fact, in order to be consistent with their negative answer, Molyneux and Locke should have stated that: 1) geometry has no part in visual perception, which is

15 See Vaughn (2019), and the references therein.

16 Locke (1975), IV, VII, 9.

17 Condillac (1947a).

18 Condillac (1947b).

19 Merian (1770-1779).

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entirely the result of the experience of association between visual and tactual data; 2) distance, or depth, or the third dimension of space, is not a visual idea; 3) there are not common ideas of sight and touch (heterogeneity thesis); 4) there is no distinction between primary and secondary qualities (*esse est percipi* thesis). If we don't see anything without our mind; if the seen and felt globe and cube have nothing in common; if we have to learn to see as we learn to speak and read, then it is correct to answer "no" to Molyneux's question.

There is indeed only one empiricist philosopher who fulfils the aforesaid conditions of consistency: George Berkeley.

> In short, the ideas of sight are all new perceptions, to which there be no names annexed in his mind: he cannot therefore understand what is said to him concerning them: and to ask of the two bodies he saw placed on the table, which was the sphere, which the cube? were to him a question downright bantering and unintelligible; nothing he sees being able to suggest to his thoughts the idea of body, distance, or in general of anything he had already known. It is a mistake to think the same thing affects both sight and touch. If the same angle or square, which is the object of touch, be also the object of vision, what should hinder the blind man, at first sight, from knowing it?[20]

Berkeley describes the behavior of a newly sighted person, according to the mental experiment conceived by Molyneux, in terms of his psychological theory of vision, based on the constant and universal association between the ideas of sight and touch.

> A man born blind, being made to see, would, at first, have no idea of distance by sight; the Sun and stars, the remotest objects as well as the nearer, would all seem to be in his eye, or rather in his mind. The objects intromitted by sight would seem to him (as in truth they are) no other than a new set of thoughts or sensations, each whereof is as near to him, as the perceptions of pain or pleasure, or the most inward passions of his soul. For our judging objects perceived by sight to be at any distance, or without the mind, is intirely the effect of experience, which one in those circumstances could not yet have attained to.[21]

The philosophers who doubt of the visual skills of blind people are certainly more numerous than those who trust them. After Berkeley, many celebrated philosophers answer in the negative: Voltaire (*Eléments de la philosophie de Newton,* 1738),[22] Buffon (*Histoire naturelle de l'homme*, 1749), who compares the blind person recovering sight to a newborn and to Adam, the first created man,

[20] Berkeley (1948), *New theory of vision*, §135-136.

[21] Ivi, §41.

[22] Voltaire (1967).

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because all of them have to learn to see; Charles Bonnet (*Essai analytique sur le facultés de l'âme*, 1760).

The most famous and complete positive answer was given by Gottfried Wilhelm Leibniz in his *Nouveaux essais sur l'entendement humain*, written in 1703-1704 and posthumously published in 1765.[23] The confidence in the visual skills of the newly sighted person is subject to a further restrictive condition: he has to be told the *names* of the two solids in front of him; otherwise, it would be impossible to distinguish and recognize the cube and the sphere. Leibniz is convinced that the ideas of the sphere and the cube are the same in sighted and blind people, because they are not images – as the empiricists think – but geometrical concepts, which remain unaltered, even if their images are different. Leibniz's assumptions are: mathematical nativism and the non-equivalence of images and concepts. Hence it is possible to have mathematical concepts (for example, a cube and a sphere), without any corresponding visual images. The "distinct and mathematical ideas" of geometrical optics are equally shared by blind, paralytic and sighted people, provided that they study that science.

The knowledge of the names of the two solids is a necessary condition, enabling the "principles of reason" to work, on the basis of the tactile sensible knowledge, previously acquired.

> But to return to what the man born blind, who begins to see, would think of the globe and the cube, seeing them without touching them, I reply that he will distinguish them, as I have just said, if any one informs him that the one or the other of the appearances or perceptions which he has of them belongs to the cube or to the globe. [...] In this case it appears to me beyond doubt that the blind man who ceases to be such can distinguish them by the principles of reason, united with that sense-knowledge with which touch has before furnished him. For I do not speak of that which he will do perhaps in fact and immediately, dazzled and confused by the novelty, or from some other cause little accustomed to draw inferences. The basis of my view is that in the globe there are no points distinguished by the side of the globe itself, all there being level and without angles, while in the cube there are eight points distinguished from all the others. If there were not this means of discerning the figures, a blind man could not learn the rudiments of geometry by touch. But we see that those born blind are capable of learning geometry, and have indeed always certain rudiments of a natural geometry, and that most often geometry is learned by sight alone, without the use of touch, as indeed a paralytic or other person to whom touch has been almost denied might and even must do. And these two geometries – that of the blind man and that of the paralytic – must meet and agree, and indeed return to the same ideas,

[23] Leibniz (1916).

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> although there are no common images. This again shows how necessary it is to distinguish images from exact ideas, which consist in definitions. It would really be very interesting and instructive to make a complete examination of the ideas of a man born blind, to understand the descriptions he makes of figures. For he may come to this, and he may even understand the doctrine of optics, so far as it is dependent upon distinct and mathematical ideas, although he could not attain to a conception of *clair-confus*, that is to say, the image of light and of colors.[24]

But – Leibniz maintains – perhaps Molyneux and Locke "are not so far from my opinion as at first appears"[25]: in fact, if the newly sighted person does not know the names of the two solids in front of him, his geometrical concepts, which are ideas without corresponding images, will be useless, in order to recognize the cube and the sphere.

> Without this previous instruction, I admit that he will not at first venture to think that the kinds of pictures which they make of themselves in the depths of his eyes, and which might come from a flat picture upon the table, represent the bodies, until touch convinces him of the fact, or until, by force of reasoning upon the rays of light according to optics, he understands by the lights and shades that there is a something which arrests these rays of light, and that it must be exactly what remains for him in touch, which result he will finally reach when he sees this globe and this cube revolve, and change the shadows and the appearances in accordance with the motion, or even when, these two bodies remaining at rest, the light which illuminates them changes its place, or his eyes change their position.[26]

That is to say, the tactual-kinesthetic experience of the movements of the eyes, the movement of the two solids themselves, or of the light source, and the corresponding changes in our visual perceptions, make newly sighted people able to distinguish the cube and the sphere, "by force of reasoning". Moreover, even if blind people are told the names of the two solids, as Leibniz requires, there may be some differences between the ideal expected behavior of a blind person who has learned geometry and the contingent circumstances of his actual behavior: "for I do not speak of that which he will do perhaps in fact and immediately, dazzled and confused by the novelty, or from some other cause little accustomed to draw inferences".[27]

[24] Leibniz (1916), II, IX, pp. 139-141.

[25] Ivi, p. 139.

[26] Ivi, p. 141.

[27] Ivi, p. 139.

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"But – Voltaire asks – where was the blind person to be found, on whom the indisputable decision of this question depended?"[28] In 1728, in London, William Cheselden – "one of those famous surgeons who unite a great extent of knowledge with dexterity in operations"[29] – operated on a fourteen-years-old blind boy for a bilateral congenital cataract, and observed that newly sighted subject's behavior, perhaps with some Berkeleian biases.[30] Cheselden's well-known and widely debated case, reported in the *Philosophical Transactions of the Royal Society of London*, was quoted by Berkeley himself in the *Theory of Vision Vindicated and Explained* (1733), as a decisive proof of the correctness of his answer to Molyneux's problem, and in general of his theory of vision:

> "When he first saw, he was so far from making any judgment about distances that he thought all objects whatever touched his eyes (as he expressed it) as what he felt did his skin. [...] He knew not the shape of anything, nor any one thing from another, however different in shape or magnitude. [...] Several weeks after he was couched, being deceived by picture, he asked which was the lying sense, feeling or seeing?"[31] [...] Thus, by fact and experiments those points of the theory [i. e. his theory of vision] which seem the most remote from common apprehension were not a little confirmed, many years after I had been led into the discovery of them by reasoning.[32]

The blind boy who recovers sight behaves just as he is expected to do, if Berkeley's theory of vision is true. Therefore, "the manner in which we see objects, is no immediate consequence of the angles formed in our eyes; for the same mathematical angles were formed in the eyes of this youth, as in ours; and were of no manner of use to him without the aid of experience, and the other senses":[33] Molyneux's geometrical optics is not the right theory of vision. Voltaire declares Cheselden's experiment an *experimentum crucis*, able to solve Molyneux's question once and for all: "this experiment confirmed all that Locke and Barclay (*sic!*) had justly foreseen". Is Voltaire and Berkeley's optimism justified and well-grounded? The numerous stories of blind people who recovered sight after a surgical operation – in different times, forms, ways and degrees – starting from Cheselden and up to the twentieth century, show the indefensibility of such an optimistic assessment.

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[28] Voltaire (1763), pt. II, chap. V, p. 175.

[29] *Ibid.*

[30] In his *Histoire naturelle de l'âme* (1745), Julien Offray de La Mettrie – who also agrees on the positive answer – hypothesizes Cheselden's Berkeleian inclinations: there is a concrete risk of observing newly sighted people from a Berkeleian point of view, therefore finding confirmations of Berkeley's theory of vision. That is to say, La Mettrie doubts that a surgeon's expectations and beliefs may influence the performance and outcome of the experiment. In his opinion, Cheselden was a Berkeleian surgeon, who had Berkeleian answers to Berkeleian questions.

[31] Cheselden (1728).

[32] Berkeley (1948), *Theory of vision vindicated*, §71.

[33] Voltaire (1763), p. 176.

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2 Diderot's "relativistic" solution

The main characteristic of Denis Diderot's *Lettre sur les aveugles à l'usage de ceux qui voient* – which cost his author three months in prison in Vincennes – is that it poses questions, more than offering solutions. Diderot explores Molyneux's problem in depth, and shows its engaging concreteness, through a subtle analysis which results in a collection of different cases.

> You shall now see by my examination how very far they, who asserted that the blind man would see geometrical figures and distinguish between them, were from realising that they were right; and what good reasons their opponents had to think that they were not in the wrong.[34]

This cryptic sentence means that Diderot gives a positive answer to Molyneux's question, but with so many conditions and restrictions, that the problem itself changes, giving rise to a subtle, effective casuistry. Diderot's cases may serve as a grid for the stories of blind people, told by surgeons or observers more or less sympathetic and well-trained in philosophy, in the following two centuries. Here is Diderot's formulation of Molyneux's question:

> This problem of the blind man, stated in somewhat more general terms than by Molyneux, embraces two problems which we will consider separately. We may ask: 1) if the blind man would see immediately after the operation for cataract; 2) supposing he is able to see, could he see well enough to distinguish between figures; could he, in seeing them, correctly give them the same names which he gave them by the sense of touch; and if he can, prove that these names are the right ones?[35]

The problem, presented as simple by Molyneux and Locke, is at least twofold, but may be divided into four distinct questions: a) will the blind man *see* the sphere and the cube?; b) will he *identify* a sphere and a cube?; c) will he be able to *name* the sphere and the cube?; d) will he be able to *prove* that his recognition and naming are correct?

The aim of this essay is to explain why Diderot's arguments are so crucial, and how his solution has been confirmed by clinical reports of surgical operations of blind people, starting from Cheselden's case. My thesis is that Diderot's analysis is fundamental for the following reasons:

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[34] Diderot (1916), p. 123.

[35] *Ibid.*

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1) He clearly defines the epistemological conditions of the experimental observations of newly sighted subjects;

2) He shows how and why the previous answers are unsatisfactory;

3) His answer is compatible with the clinical reports of surgical operations of blind people, both in his time and in recent years.

2.1 The epistemological conditions

First of all, Diderot asks the surgeon to give the blind some time – not quantified: he only speaks of a "considerable period"[36] –, in order to let him overcome the surgical trauma; during this period, the blind should remain in the dark. Then, the experiment should be done "in a kind of twilight", avoiding strong daylight, which sometimes prevents even a normally sighted person from seeing. Hence, the condition – posed by Locke – that the recognition occurs "at first sight" cannot, and should not be fulfilled: "I cannot conceive what information we could expect from a man who had just undergone a painful operation upon a very delicate organ".[37]

> The first time the eyes of one born blind open to the light, he will see nothing at all; some time will be necessary for his eye to practise sight; it will practise alone and without the aid of touch, and will eventually distinguish not only colours, but the main outlines of objects. [...] Yet if I were told that a man born blind saw nothing for the space of two months, I should not be surprised. I shall only conclude from it the necessity of the organs becoming practised, not the necessity of touch. It will be another reason why it is important to let such a person remain for some time in the dark, when he is to be the subject of experiment; to allow him the opportunity of exercising his eye, which will be done more conveniently in the dark than in full daylight; and only to permit a kind of twilight during the experiments.[38]

To think that "an eye couched from cataract was like an arm that ceases to be paralysed",[39] that is to say, immediately able to see as the arm is immediately able to feel, is an unrealistic expectation.

Second, the observer should not expect the blind to distinguish and recognize solids, but only plain, bidimensional figures: "I have substituted a circle for a sphere and a square for a cube, because there is reason to think that we only judge of distances by experience".[40] Diderot agrees with Berkeley on the non-visibility of

[36] Ivi, p. 117.
[37] *Ibid.*
[38] Ivi, pp. 131, 133-134.
[39] Ivi, p. 121.
[40] Ivi, p. 137.

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distance, or depth: the visual scene is bidimensional; only touch can add the third dimension.

Third, the experimenter should receive a philosophical training, because “the task would not be beneath the intelligence of the best and wisest of men; to train and question one born blind would be an occupation worthy of the combined talents of Newton, Descartes, Locke and Leibniz”.[41]

Fourth, the blind too should receive a philosophical education, which makes him able to compare his perceptions as a blind with his perceptions as a newly sighted person.

> To obtain some certainty in such experiments, the subject must at least have been prepared a long time beforehand; he should be made a philosopher – no rapid process even with a philosopher for teacher! And imagine the task if the teacher were not enlightened, or (worse still!) fondly and mistakenly imagined himself enlightened![42]

Diderot contemplates four different cases: if the newly sighted person is an illiterate, uneducated person, without any adequate preparation, he will be completely unable to distinguish a circle and a square, and to give them their names, “being unaccustomed to any kind of reasoning”.[43] If he is a simple, ordinary man, he will probably be able to distinguish bidimensional figures, “mentally applying touch to distant objects”, but without any proof, certainty or justification: “without well knowing why, his comparison of the ideas he has acquired by sight not being sufficiently distinct in his mind to convince his judgement”.[44]

If the blind man is a metaphysician, he will argue like Molyneux, Locke and Berkeley:

> “I am very much inclined to think that this is the body which I have always called a circle, and that again what I named a square, but will not assert it to be really so. What is to prevent their disappearance if I were to touch them? How am I to know whether the bodies I see are also meant to be touched? I do not know whether visible things are palpable; but were I assured of this, and did I take the word of those about me that what I see is really what I have touched, I should be no better off. These bodies may transform themselves in my hands and transmit on contact sensations quite different from those resulting from sight. ‘Gentlemen’, would he conclude, ’this body appears to be the square, that the circle; but that they are the same to touch as to sight is what I have no knowledge of”.[45]

[41] Ivi, p. 118.
[42] Ivi, p. 117.
[43] Ivi, p. 134.
[44] Ivi, p. 135.
[45] *Ibid.*

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Not only Diderot’s metaphysician assumes that distance is a tactile, not an innate visual perception; he also supports Berkeley’s thesis of the heterogeneity of visual and tactile perceptions. Nevertheless, Diderot is convinced that a blind philosopher would not be sure of the correctness of his recognition and naming of geometrical figures.

There is only one person who could get this certainty: a blind mathematician, such as Nicholas Saunderson (1682-1739). He held the Lucasian chair at the university of Cambridge; was a fellow of the Royal Society since 1719, and was blind since the age of one year, due to smallpox; nevertheless, he taught geometry and optics to sighted people, and his students understood his lessons. Saunderson used a “palpable arithmetic”, which he himself had created: putting some pins, with a bigger or smaller pinhead, on a tablet divided into squares, each of them with little holes, he was able to represent numbers, from one to nine, and to do quickly long and complex arithmetical operations. He could also form plain figures, connecting the pinheads with silk threads, and thus do geometric demonstrations.

> He was the author of an excellent work: *The Elements of Algebra*,[46] where the only signs of his blindness are the peculiarity of certain demonstrations, which a sighted man would probably not have thought on. [...] Saunderson was extremely successful as professor of mathematics at the university of Cambridge. He gave lessons in optics, he lectured on the nature of light and colours, he explained the theory of vision; he wrote on the properties of lenses, the phenomena of the rainbow, and many other subjects connected with sight and its organ.[47]

Therefore, if geometry and optics are common to blind and sighted people, there have to be some innate mathematical concepts in our minds, as Leibniz thought. It might seem that Diderot agrees on the positive answer to Molyneux’s question; but he disagrees with Leibniz on a crucial point: the blind is not allowed to know the names of the two solids, or figures. There is also an important condition, which Diderot takes from Berkeley: Molyneux’s question should concern only plain figures, not solids, because “the eye may perhaps have to learn to see as the tongue to speak” and “there is reason to think that we only judge of distances by experience”.[48] In other words, Diderot’s analysis highlights the pros and cons of the previous answers: on the one hand, it is correct to emphasize the role of experience in the perception of depth and the heterogeneithy thesis; on the other hand, Leibniz’s “rationalistic” answer is correct, but only for bidimensional figures. All the previous answers are lacking, because it is not useful, or possible, to answer Molyneux’s question in categorical terms of “yes” or “no”, but only in relativistic terms: “it depends on...”.

[46] Posthumously published in 1740.

[47] Diderot (1916), pp. 99, 101.

[48] Ivi, pp. 125, 137.

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In short, Diderot's answer to Molyneux's question is thus articulated: 1) it depends on the conditions under which the experiment is conducted; 2) it depends on the blind person: his story, training, previous skills, experience, knowledge and culture; 3) it depends on the experimenter: his sensibility, training and philosophical biases. This apparently skeptical answer seems the only possible one.

2.2 Nicholas Saunderson and other blind people

In Diderot's *Lettre*, there is a long, central digression: the moving story of Saunderson's life, works and death, with his moral, theological and cosmological opinions.

> It has always been very clear that the state of our organs and our senses has a great influence on our metaphysics and our morality, and that those ideas which seem purely intellectual are closely dependent on the conformation of our bodies. […] The great argument for the wonders of nature falls flat upon the blind.[49]

In fact, Saunderson dramatically denounces the deep injustice he suffered in not being able to see the wonders of nature. Close to death, he discusses with Gervaise Holmes, "a clergyman of great ability", on the proofs of the existence of God.

> "I have been condemned to spend my life in darkness, and you cite wonders quite out of my understanding, and which are only evidence for you and for those who see as you do. If you want to make me believe in God, you must make me touch Him".[50]

When Saunderson cries out against God, because he cannot believe in Him, Diderot openly agrees with him. The argument from the wonders of nature, from cosmological order and design – sopported by Isaac Newton and Samuel Clarke – is incomprehensible, ineffective and even senseless for blind people. When Saunderson claims: "Look at me, Mr. Holmes: I have no eyes. What have we done, you and I, to God, that one of us has this organ, while the other has not?", everybody weeps in the room where Saunderson is dying. We may say, without any doubt, that Saunderson exposes Diderot's own materialistic philosophy, at this stage of its development. Nevertheless, Saunderson's last words, while dying, are "O God of Newton and Clarke, have mercy on me!". [51]

As far as I know, Saunderson is the only example of a blind mathematician, who (in Diderot's opinion) can solely justify the positive answer to Molyneux's problem. But, in the next two centuries, there are other stories of blind people – some of them as tragic as Saunderson's –, which confirm Diderot's casuistry.

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[49] Ivi, pp. 80, 82.

[50] Ivi, p. 109.

[51] Ivi, pp. 112, 114.

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No doubt, Cheselden's fourteen-year-old boy can be classified in the first case: he was ignorant, uneducated, untrained, and in fact was not able to see anything for a long period after the operation. There are other examples: Home operated on a seven-year-old child in 1807; his observations began just ten minutes after surgery. Home asked him to recognize triangles and circles of bright, different colours, and the little boy prayed him: "Let me rest a little; I will tell you later". In 1846, a fourty-six-year-old woman was operated by James Wardrop: twenty days after surgery, she was not able to distinguish simple objects, such as a pencil-holder and a key, even after touching them; forty-two days after the operation, she had still no idea of distance; she could only see, and distinguish, colors.[52] An illiterate Arabic girl, aged twenty, was operated by the surgeon Strampelli in Rome in 1968; twenty-nine days after the operation, she was asked about her visual perception by an interpreter. Her answer was: "I can't see same or different, only color…nor same or different…I don't know: nothing".[53]

The second case hypothesized by Diderot is a common person, able to distinguish plain figures, without any certainty nor of their identification or naming. An example is G. V., a girl aged fifteen, schooled and with a good social background, operated by Strampelli in Rome in 1968: she recognized simple, plain figures, but only after touching them. A twenty-year-old boy, operated by Dufour in 1876, could distinguish a square and a circle two days after the operation, but only if the surgeon told him their names. Nevertheless, he did not understand the meaning of such words as: long, short, big or small, unless he used touch.[54]

The third case is a philosopher, that is to say, someone accustomed to arguing and reasoning: he will be able to recognize and name plain figures, without getting any proof of the correctness of his recognition and naming. A blind women, L. G., operated by Strampelli in 1968, had actually a degree in Philosophy. Her new visual perceptions were so refined, that she was subject to the classic Müller-Lyer optical illusion, not unlike the normally sighted people. She was able to recognize plain geometrical figures, though rotated forty-five degress. An eighteen-year-old boy, operated by Franz in London in 1841, could read the shop signs and tell the time on Saint Paul's clock, only four months after the operation. The experimenter tells us that even his dreams changed: he dreamt visible people, while before the operation he only dreamt tangible and audible persons. He succeeded in recognizing a sphere and a cube, by imaging to touch them, but identified them with a circle and a square; after touching them, he wondered how he could not recognize such familiar solids.[55]

A very famous case, comparable to Diderot's third case, is told by Richard Gregory (1966): S. B. became blind at ten months, and was operated from corneal opacity at fifty-two. During his blindness, he was active and cheerful, eager to learn,

[52] Bourdon (1902).

[53] Banissoni & Ponzo (1968).

[54] Bourdon (1902).

[55] Preyer (1892).

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able to do simple manual labour, and even to ride a bicycle. He had many expectations from the surgical operation, and after recovering sight he concentrated on the knowledge of the new visual world. But things did not go as he had hoped: his mood changed, becoming sad and fearful. He was not able to cross a street alone, and was depressed by twilight, waiting for night in the darkness. Nonetheless, he was able to recognize objects satisfactorily: he could read numbers and capital letters, tell the time, and was able to immediately recognize an elephant, which he had previously drawn on the basis of his tactual perceptions. But the inventory of the new visual world was discouraging, because of its infinite complexity and length. In short, S.B.'s life was unhappy after the operation: three years later, he died.

We can't find another blind mathematician, after Saunderson; however, one century ago there was a famous blind French scholar: Pierre Villey (1879-1933). In the first two decades of the twentieh century, he published a trilogy on the psichology, pedagogy and sociology of blind people. Both Villey and Saunderson were blind until their death; anyway, Villey gives a positive answer to Molyneux's question. He is convinced that, some time after the surgical trauma, a blind who recovers sight will be able to recognize a sphere and a cube without touching them, because the spatial concepts are the same in blind and sighted people: unfortunately, neither Villey nor Saunderson could do the test.

> We should learn to understand his psychology and should compare it with ours, and perhaps we should thereby come to a solution of the difficulties which make the theory of vision and the senses so intricate and so confused.[56]

Saunderson's story may enlighten us not only about blind people's psychology, but also on "the theory of vision and the senses" of normally sighted people, as well as about metaphysics and morality. In fact, an Italian follower of Condillac's philosophy, who taught metaphysics at the university of Pisa, considered Molyneux's question "the most famous problem in my profession".[57]

Though my essay focuses on the history of eighteenth century debate, Diderot's answer could be the only possible answer to Molyneux's question still today.

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[56] Diderot (1916), p. 117.

[57] Sarti (1792), p. XIV.

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