Life and Character of Dr Nicholas Saunderson, supposedly written by one William Inchlif Esq. *** observes that readers who are able to read the work in the original, 'y remarqueront un agrément, une force, une vérité, une douceur qu'on ne rencontre dans aucun autre récit, et que je ne me flatte pas de vous avoir rendus, malgré tous les efforts que j'ai faits pour les conserver dans ma traduction' [will remark in it a certain something that is charming, powerful, true and gentle, which is to be found in no other tale and which I do not flatter myself to have rendered for you, in spite of all the efforts I have made to preserve it in my translation]. ***'s claim is ironic, not least because it would seem that there is no real original to which the reader could compare his translation.[5] That is not the case for the readers of my translation and so the sentiments that *** expresses ironically are ones that I wish to express here for real.

The two footnotes are Diderot's, as is the Index. The endnotes are mine and have been kept to a minimum. Where the *Letter* makes reference to other works of the period, the endnotes refer, where available, to the standard English translation. Names are given in their modern spelling (e.g. 'Puiseaux' for 'Puisaux', 'Molyneux' for 'Molineux') or have been corrected (e.g. 'Raphson' for 'Rapson', 'Saunderson' for 'Saounderson'). The six plates are reproduced by courtesy of the University Librarian and Director, The John Rylands University Library, The University of Manchester.

5 See above, p. 45.

Letter on the Blind for the Use of Those Who Can See

Possunt, nec *posse videntur*[1]

(London, 1749)[2]

I had my doubts, Madame, about whether the blind girl whose cataracts Monsieur de Réaumur[3] has just had removed, would reveal to you what you wanted to know, but it had not occurred to me that it would be neither her fault nor yours. I have appealed to her benefactor in person and through his best friends, as well as by means of flattery, but to no avail, and the first dressing will be removed without you. Some highly distinguished people have shared with the philosophers the honour of being snubbed by him. In a word, he only wanted to perform the unveiling in front of eyes of no consequence.[4] Should you be curious to know why that talented Academician makes such a secret of his experiments, which cannot, in your view, have too many enlightened witnesses, I should reply that the observations of such a famous man do not so much need spectators while they are being performed as an audience once the performance is over. So, Madame, I have returned to my initial plan, and having no choice but to miss out on an experiment which I could not see would be instructive for either you or me, but which will doubtless serve Monsieur de Réaumur rather better, I began philosophizing with my friends on the important matter that it concerns. How delighted I should be were you to accept the account of one of our conversations as a substitute for the spectacle that I so rashly promised you!

The very day that the Prussian[5] was performing the cataract operation on Simoneau's daughter,[6] we went to question the man-born-blind of Puiseaux.* He is a man not lacking in good sense and with whom many people are acquainted. He knows a bit of chemistry and followed the botany lessons in the King's Garden quite successfully.[7] His father taught philosophy to much acclaim in the University of Paris and left him an honest fortune, which would easily have been enough to satisfy his remaining senses had his love of pleasure not led him astray in his youth. People took advantage of his inclinations, and he retired to a little town in the provinces whence he comes to Paris once a year, bringing with him liqueurs of his own distillation, which are much appreciated. There you have, Madame, some details which, though not very philosophical, are for that very reason all the more suitable for persuading you

* Small town in the Gâtinais.

that the character of whom I am speaking is not imaginary.[8]

We arrived at our blind man's house around five o'clock in the evening to find him using raised characters to teach his son to read. He had only been up for an hour, since, as you know, the day begins for him as it ends for us. His custom is to work and see to his domestic affairs while everyone else is asleep. At midnight, there is nothing to disturb him and he disturbs no one. The first task he undertakes is to put back in its place everything that has been moved during the day, and his wife usually wakes up to a tidy house. The difficulty the blind have in finding things that have been mislaid makes them fond of order, and I have noticed that people who are well acquainted with them share this quality, either owing to their good example or out of a feeling of empathy that we have for them. How unhappy the blind would be without the small acts of kindness of those around them! And how unhappy we would be too! Grand gestures are like large gold and silver coins that we rarely have any occasion to spend, but small gestures are the ready currency we always have to hand.

Our blind man is a very good judge of symmetry. Between us, symmetry is perhaps a pure convention, but between a blind man and the sighted, it is certainly so. By using his hands to study how the parts of a whole must be arranged such that we call it beautiful, a blind man can manage to apply this term correctly, but when he says *that's beautiful*, he is not judging it to be so; he is simply repeating the judgement of the sighted. And is that any different to what three quarters of people do when they judge a play they have listened to or a book they have read? To a blind man, beauty is nothing more than a word when it is separated from utility, and with one less sense organ, how many things are there, the utility of which escapes him? Are the blind not to be pitied for deeming beautiful only what is good? So many wonderful things are lost on them! The only compensation for their loss is the fact that their ideas of beauty, though much less broad in scope than ours, it is true, are much more precise than those of the clear-sighted philosophers who have written long treatises on the subject.

Our blind man constantly talks about mirrors. You are right in thinking he does not know what the word 'mirror' means, and yet he will never place a mirror face down. He expresses himself with as much sense as we do about the qualities and defects of the organ he lacks, and though he

does not attach any ideas to the terms he uses, he nonetheless has an advantage over most other men in that he never uses them incorrectly. He speaks so well and so accurately on so many things that are absolutely unknown to him, that conversing with him would undermine the inductive reasoning we all perform, though we have no idea why, which assumes that what goes on inside us is the same as what goes on inside others.

I asked him what he understood by a mirror: 'A machine,' he replied, 'that projects things in three dimensions at a distance from themselves if they are correctly placed in front of it. It is like my hand inasmuch as I mustn't place it to one side of an object if I want to feel it.' Had Descartes been born blind, he would, it seems to me, have congratulated himself on such a definition. Indeed consider, if you will, the subtlety with which he had to combine certain ideas in order to arrive at it. Our blind man knows objects only through touch. He knows on the basis of what other men have told him that it is by means of sight that we know objects just as they are known to him through touch. At least, that is the only notion he can have of sight. He also knows that we cannot see our own faces, though we can touch them. Sight, so he is bound to conclude, is a kind of touch that only applies to objects other than our faces and which are located at a distance from us. Moreover, touch only gives him the idea of three dimensions and so he will further believe that a mirror is a machine that projects us in three dimensions at a distance from ourselves. How many famous philosophers have employed less subtlety to arrive at notions that are equally false? How surprising must a mirror be for a blind man though? And he must have been even more astonished when we told him that there are other machines that enlarge objects and others still that, without duplicating the objects, make them change place, bring them closer, move them further away, make them visible and reveal their tiniest parts to naturalists' eyes, and that there are some that multiply objects by the thousand and others that seem to alter what they look like completely. He asked us hundreds of bizarre questions about these phenomena. For example, he asked if it was only people called naturalists who could see with a microscope, and whether astronomers were the only people who could see with a telescope, whether the machine that enlarges objects was larger than the object that makes them smaller, whether the one that brings them closer was shorter

than the one that moves them further away, and he was completely unable to understand how that other one of us who is, as he put it, repeated in three dimensions by the mirror, could elude the sense of touch. 'Here you have two senses', he said, 'that are made to contradict each other by means of a little machine. A better machine might perhaps make them agree with each other without the objects being any more real as a result; and perhaps a third, even better and less perfidious machine would make them disappear altogether and notify us of the error.'

'In your opinion, what are eyes?' Monsieur de . . . asked him. 'They are organs', replied the blind man, 'that are affected by the air in the same way as my hands are affected by my stick.' His reply took us aback, and as we stared at each other in wonder, he continued, 'That must be right because when I place my hand between an object and your eyes, you can see my hand but not the object. The same thing happens to me when I am looking for one thing with my stick and I come across something else instead.'

Madame, open Descartes' *Dioptrics* and there you will find the phenomena of vision related to those of touch, and optical plates full of men seeing with sticks.[9] Descartes and all those who have come after him have been unable to provide any clearer ideas of vision, and in this respect the great philosopher's superiority over our blind man was no greater than that of the common man who can see.

None of us thought to ask him about painting and writing, but it is clear that there is no question to which his comparison could not give a satisfactory answer, and I am in no doubt that he would have said that trying to read or see without eyes was like looking for a pin with a great big stick. We spoke to him only of those kinds of pictures that use perspective to give objects three dimensions and which are both so similar and so different to our mirrors, and we realized they confused as much as they confirmed his understanding of a mirror and that he was tempted to believe that since a mirror paints objects, a painter representing them would perhaps paint a mirror.

We saw him thread very small needles. Might I ask you, Madame, to look up from your reading here and imagine how you would proceed if you were he? In case you can't think how, I shall tell you what our blind man does. He places the needle long-ways between his lips with the eye of the needle facing outwards and then, sucking in with his

tongue, he pulls the thread through the eye, except when it is too thick, but in that case someone who can see is in no less difficulty than someone who can't.

He has an amazing memory for sounds, and faces afford us no greater diversity than voices do him. They present him with an infinite scale of delicate nuances, which elude us because we do not have as much interest in observing them as the blind man does. Such nuances are like our own faces inasmuch as, of all the faces we have ever seen, the one we recall the least well is our own. We only study faces to recognize people, and if we cannot remember our own, it is because we will never be in the position of mistaking ourselves for someone else nor someone else for ourselves. Moreover, the way the senses work together prevents each one from developing on its own. This will not be the only time I shall make this observation.

On this matter, our blind man told us that he might have thought himself to be pitied for lacking our advantages and have been tempted to see us as superior beings, had he not on hundreds of occasions felt how much we deferred to him in other ways. This remark prompted us to make another. This blind man, we said to ourselves, has as high a regard for himself as he does for those of us who can see, perhaps even higher. Why then if an animal has reason, which we can hardly doubt, and if it weighed up its advantages over those of man, which it knows better than man's over it, would it not pass a similar judgement? He has arms, the fly might say, but I have wings. Though he has weapons, says the lion, do we not have claws? The elephant will see us as insects; and while all animals are happy to grant us our reason, which leaves us in great need of their instinct, they claim to be possessed of an instinct, which gives them no need for our reason. We have such a strong tendency to overstate our qualities and underplay our faults that it would almost seem as though man should be the one to do the treatise on strength, and animals the one on reason.

One of us decided to ask our blind man whether he would like to have eyes. He replied, 'If I wasn't so curious, I'd just as well have long arms, as it seems to me that my hands could teach me more about what's happening on the moon than your eyes or telescopes can, and besides, eyes stop seeing well before hands stop touching. It would be just as good to improve the organ I already have, as to grant me the one I lack.'

Our blind man locates noises or voices so accurately that I have no doubt that, with practice, blind people could become highly skilled and highly dangerous. I shall tell you a story that will convince you how wrong we would be to stay still were he to throw a stone at us or fire a pistol, regardless of how little practice he might have had with a firearm. In his youth, he had a fight with one of his brothers who came out of it very badly. Angered by some unpleasant remarks that his brother directed at him, he seized the first object that came to hand, threw it at him, hit him right in the middle of his forehead and laid him out on the ground.

This affair and some others made him known to the police. The visible signs of authority that affect us so powerfully do not impress the blind. Our blind man appeared before the magistrate as if before his equal. Threats did not intimidate him. 'What will you do to me?' he asked Monsieur Hérault.[10] 'I shall throw you in the dungeon', replied the magistrate. 'Oh, Sir,' replied the blind man, 'that's where I've been for twenty-five years.' What a reply, Madame! And what a line for a man who likes moralising as much as I do! We depart this life as though it were an enchanting spectacle, whereas the blind man departs it as though it were a prison, and although we enjoy living more than he does, you must agree he has many fewer regrets in dying.

The man-born-blind of Puiseaux works out how close he is to the fire by how hot it is, how full a receptacle is by the sound liquid makes as he decants it, and how near he is to other bodies by the way the air feels on his face. He is so sensitive to the most minor changes in the atmosphere that he can tell a street from a cul-de-sac. He can guess with astonishing accuracy how much something weighs and how much a bottle can hold, and his arms make such precise scales and his fingers such experienced compasses that, in matters of statics, I would always back our blind man against twenty sighted people. The surface of the skin is no less subtly differentiated to him than the sound of the voice, and there is no reason to fear that he might mistake his wife for another woman, unless he stood to gain by it. It would very much appear, however, that in a land of the blind, either wives would be communal or its adultery laws would be very strict. It would be very easy for wives to deceive their husbands by using a sign they had agreed with their lovers.

He judges beauty by touch. That is understandable, but what is not so easy to grasp is that he also bases his

judgement on the sound of a person's voice and the way they pronounce words. We would need an anatomist to explain whether there is some relationship between the parts of the mouth and palate and the external shape of the face. He can make little things by turning them on a lathe and do small pieces of needlework; he can level using a set square; he can take ordinary machines apart and put them back together; and he knows enough music to be able to play a piece if he is told the notes and their relative values. He is able to judge the duration of time much more precisely than we can by the sequence of actions and thoughts. The beauty of someone's skin, their firm, plump curves, the sweet smell of their breath and the charming sound of their voice and diction are qualities by which he sets great store.

He married so as to have eyes of his own. He had previously intended to marry a deaf woman who would have lent him her sight and to whom he would have lent his hearing.[11] Nothing surprised me so much as his singular ability to do a great number of things, but when we revealed our surprise, he said: 'It is clear to me, Gentlemen, that you are not blind, since you are surprised at what I can do. So why aren't you also amazed that I can speak?' There is, I believe, more philosophy in that reply than he intended. It is surprising how easily we learn to speak. We only succeed in attaching an idea to a large number of terms that cannot be represented by sensible objects and which have, as it were, no body, by means of a series of subtle and profound analogies which we perceive between these non-sensible objects and the ideas they excite in us. As a result, we must admit that a blind man is bound to find it more difficult to learn to speak, since the number of non-sensible objects is much greater for him than it is for other people, and so he has much less scope for comparing and combining. How can we expect the word 'physiognomy', for example, to become fixed in his memory? It is a charming kind of quality consisting of things that are so barely perceptible to a blind man and hardly more so to those of us who can see, that we would have great trouble saying exactly what it is to be possessed of a physiognomy. If it is in the eyes, touch is unable to grasp it; and in any case, what are blank eyes, lively eyes, intelligent eyes, etc. to a blind man?

From this, I conclude that we are well served by the ways in which our different senses and sense organs cooperate. But it would be a very different thing if we exercised each

one separately and never used two together when one on its own would suffice. To add touch to sight when the eyes are sufficient on their own is like taking two already very lively horses and harnessing a third to them at ninety degrees so that one pulls in one direction while the other two pull in the other.

Since I have never doubted the great influence of our senses and organs on our metaphysics and morals, nor that our most purely intellectual ideas, if I may call them that, are closely related to the organisation of our bodies, I began to ask our blind man about vice and virtue. First I learnt that he had an extraordinary aversion to theft, which was caused in him by two things: the ease with which other people could steal from him without him noticing and, perhaps even more importantly, the ease with which they could see him stealing from them. It's not that he doesn't know perfectly well how to guard himself against the additional sense he knows us to have nor that he is unaware of how best to cover up a theft. He sets little store by modesty. If it weren't for the protection they afforded from draughts, he could hardly comprehend why we wear clothes, and he openly admits to being unable to work out why we cover one part of our bodies rather than others, and is even less able to grasp our bizarre practice of covering particular parts of the body, whose functions, combined with the disorders to which they are prone, ought to require them to be kept free. Although we live in a century in which the philosophical spirit has rid us of a great number of prejudices, I don't think we will ever go so far as to misunderstand the prerogatives of modesty quite as completely as my blind man. To him, Diogenes would not have been a philosopher.[12]

Since of all the external signs that evoke ideas of sympathy and pain in us, the blind are only affected by the sound of suffering, I suspect them, in general, of being inhumane. What difference can there be for a blind man between a man urinating and a man shedding blood without a whimper? Don't we too stop sympathising when something is so far away or so small that we can't see it any more clearly than a blind man can? How dependent virtue is on our way of feeling and on the degree to which we are affected by external things! Consequently I don't doubt that, were it not for the fear of punishment, many people would find it less difficult to kill a man, were he far enough away that he looked as small as a swallow, than to kill a bull with their

bare hands. If we feel compassion for a horse in pain and squash an ant without giving it a moment's thought, are we not following the same principle? Madame, how different blind morality is to ours! And how different again a deaf man's is to a blind man's, and how imperfect, to say the least, would our morality seem to a being who had one more sense than we do!

Our metaphysics are no more in line with theirs. How many of our principles are absurd to the blind, and vice versa! I could go into detail about that here, which would no doubt be to your amusement, but some people who see crime everywhere would have no hesitation in accusing me of irreligion, as though it were down to me to make the blind perceive things in a manner other than that in which they perceive them. I shall be content to make one observation with which I believe everyone must agree, namely that the grand argument that is derived from nature's marvels is very weak for the blind. The ease with which we create, as it were, new objects by means of a little mirror is something more incomprehensible to them than the stars, which they have been condemned never to see. That luminous globe that moves from east to west is less astonishing to them than a little fire which they can increase or decrease at their own convenience, for since they see matter in a much more abstract way than we do, they are less unlikely to believe it can think.

If a man who had only been able to see for a day or two were to find himself lost in a land of the blind, he would have to decide between keeping quiet and being taken for a madman. Every day he would proclaim some new mystery, which would only be a mystery to the blind and which the freethinkers would pride themselves on not believing. Could the defenders of religion not make good use of such stubborn and, to some extent, such fair and yet such ill-founded unbelief? If you entertain that supposition for a moment, it will bring to mind in another guise the history and persecutions of those who were unlucky enough to discover the truth in the dark ages and unwise enough to reveal it to their blind contemporaries, among whom they had no crueller enemies than those whose order and education ought, it seemed, to have made them hold the least dissimilar views.

So I leave behind the morality and metaphysics of the blind and move on to less important things, though they

are more closely related to the point of all the observations people are constantly making ever since the Prussian arrived. Question one: how does a man-born-blind form ideas of shapes? I think he gains the idea of a line by moving his hands from one place to the next and feeling a body pass continuously through his fingers. If he slides his fingers along a taught thread, he gains the idea of a straight line, and by following the curve of a slack thread, he gains the idea of a curved line. More generally, it is from repeated experiences of touch that he acquires the memory of the sensations he had at different points, and since he is able to combine these sensations or points, he can form shapes. A straight line for a blind man who is not a geometer is nothing other than the memory of a series of sensations of touch arranged in the same way as a taut piece of string, and a curved line the memory of a series of sensations of touch as they relate to the surface of some concave or convex body. With practice, a geometer is able to rectify these lines by working out their properties, but geometer or no, the man-born-blind relates everything to his fingertips. We combine coloured points, whereas he only combines palpable points or, to be more precise, the sensations of touch that he can remember. Nothing happens in his head the way it does in ours because he cannot imagine, since to imagine you must colour in a background and make some points stand out against it by supposing them to be of a different colour. If you make the points the same colour as the background, they immediately merge together and the shape disappears; at least, that's how things happen in my imagination and I presume other people don't imagine any differently. So when I decide to perceive a straight line in my head other than by means of its geometrical properties, I begin by stretching out a white canvas, on which I pick out a series of black points that are all arranged in a line. The stronger the colour of the backdrop and the colour of the points, the more clearly I perceive them, and a shape in a colour that is very similar to that of the background is no less tiring to contemplate in my imagination than outside my head and on a canvas.

So you see, Madame, it would be possible to come up with some simple rules for imagining several objects of several different colours at the same time, but such laws would be of no use whatsoever to a man-born-blind. Since he is unable to imagine colour and, as a result, unable to make shapes in the way we understand, he has no memory

of anything other than the sensations gained through touch, which he relates to different points, places or distances, and out of which he makes shapes. It is so uniformly the case that we do not make shapes in our imagination other than by colouring them, that if we were asked to touch little spheres in the dark, we would immediately suppose them to be black or white or some other colour, and if we did not suppose them to be any colour, we would be like the man-born-blind and have nothing more than the memory of little sensations at our fingertips that would be consistent with those produced by small round bodies. If this memory is very fleeting in us and we barely have any idea how a blind man grasps, remembers and combines the sensations of touch, it is because our eyes have put us in the habit of doing everything with colours in our imaginations. I have myself, however, had the experience of being in the grip of a violent passion and felt my whole hand tremble as the impressions of bodies that I had touched a long time ago were reawakened in me as vividly as if they were still present to my touch, and I could very clearly perceive an exact correlation between the outlines of my sensation and those of these absent bodies. Although sensation is indivisible in itself, it occupies, if I may put it like this, an extended space, which the man-born-blind is able to enlarge or reduce by making the affected area larger or smaller. In so doing, he composes points, surfaces and bodies, and he could even make a body as large as the earth's sphere, were he to suppose his fingertip as large as the sphere and feel its full height, width and depth.

I don't know what could more clearly demonstrate the existence of the inner sense[13] than that faculty, which is weak in us but strong in men-born-blind, and which enables us to feel or recall the sensations of bodies even when they are absent and no longer perceptible. We are unable to make a man-born-blind understand how our imaginations paint absent objects to us as though they were present, but we can very easily recognize in ourselves the faculty that makes us able to feel an absent body at our fingertips, just as a man-born-blind can. To achieve this effect, press your index finger and thumb together and close your eyes; separate your fingers and immediately examine what happens inside you afterwards, and tell me if the sensation does not last for a long while after you have stopped pressing down, and whether while that pressure persists, you feel as

though your soul is more in your head or in your fingertips, and whether the pressure does not give you the feeling of a surface equal to the space occupied by the sensation. It is only on the basis of the strength or weakness of the sensory impression that we can tell the difference between the sensation of beings that are present outside us and their representation in our imaginations. Similarly, the man-born-blind can only tell the difference between the real presence of an object at his fingertips and the sensation of it, on the basis of the strength or weakness of that same sensation.

If a philosopher who was born blind and deaf were ever to come up with a man on Descartes' model, I dare say, Madame, he would place the soul in the fingertips because they are the source of his principal sensations and all of his knowledge.[14] And who would tell him that his head is the main seat of his thoughts? If our heads find the labours of the imagination exhausting, it is because the effort of imagining is quite similar to that of perceiving objects that are very close to us or very small. But it is not like that for the man-born-blind-and-deaf, since the sensations he gains from his touch form, as it were, the cast of all his ideas, and so I would not be surprised if thinking deeply left his fingertips as tired as it does our heads. I would not be concerned by a philosopher objecting that the nerves are the cause of our sensations and that they all start at the brain, because even if he were to demonstrate those two propositions with a clarity to match their present lack of it, the blind man would need only to be told of all the things that doctors have dreamt up on the subject and he would hold onto his own opinion.[15]

Yet if a blind man's imagination is nothing other than the faculty of recalling and combining the sensations of palpable points, and that of a man who can see, the faculty of recalling and combining visible or coloured points, it follows that the man-born-blind perceives things in a much more abstract manner than we do, and that when it comes to questions of pure speculation, he is perhaps less prone to error than we are, since abstraction consists simply of mentally separating the sensible qualities of bodies either from each other or from the body that underlies them, and errors are made when that separation has either been performed in the wrong way or at the wrong stage; in the wrong way when it's a question of metaphysics, and at the wrong stage when it's a question of physico-mathematics.[16]

One way that is almost guaranteed to produce an error in metaphysics is not to make the objects in question as simple as possible, and the secret to obtaining a wrong answer in physico-mathematics is to suppose the objects to be less complex than they are.

There is one kind of abstraction of which so few men are capable that it seems to be reserved for pure intellects. It is one that reduces everything to numerical units. Everyone must agree that the results of this kind of geometry would be very accurate and that its formulas would be very general, since there are no objects, either real or possible, that such simple units cannot represent, be they points, lines, surfaces, solids, thoughts, ideas, sensations, and . . . if, by chance, this was the basis for Pythagoras's doctrine,[17] we could say of him that he failed in his project because that kind of philosophizing is too far beyond us and much closer to that of the Supreme Being who, according to the ingenious expression of an English geometer, is perpetually *geometrizing* in the universe.[18]

The pure and simple unit is too vague and too general a symbol for us. Our senses always bring us back to signs that are better suited to our mental capacity and physical organisation. We have even made these signs communal so that they can serve as a storehouse, so to speak, for the mutual commerce of our ideas. We have instituted some for the eyes, namely characters, and some for the ears, namely spoken sounds, but we have none for touch, even though there is a proper way of talking to this sense and of obtaining a reply. In the absence of this language, the channel of communication between men-born-deaf-dumb-and-blind and us is broken. They develop, but they remain feeble-minded. Perhaps they could acquire ideas if we could communicate with them as children and in a manner clearly defined and agreed, regularized and standardized; in short, if we were to draw the same characters on their hands as the ones we draw on paper, and if we were always to attach the same meaning to them.

Would this language not seem to you, Madame, to be as good as any other? In fact, does it not already exist? And could you swear that no one has ever used it to communicate anything to you? All we would need to do, if we found it too slow to use ordinary written characters to communicate through this sense, would be to formalize it and create a dictionary and grammar of it.

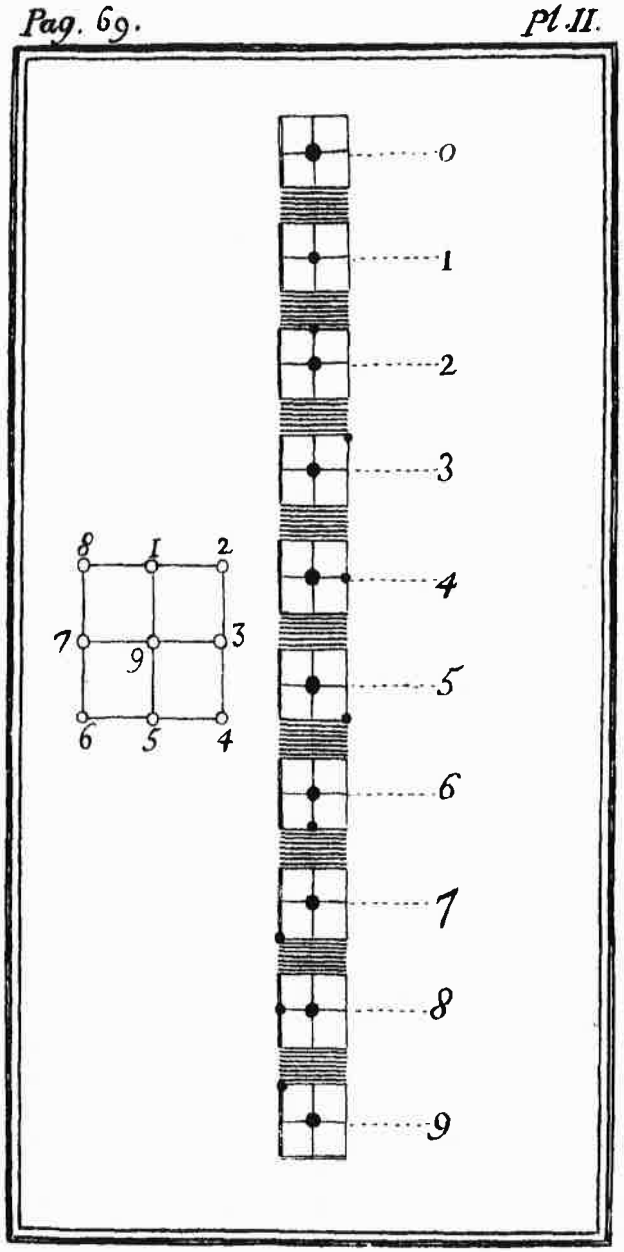
Knowledge has three points of entry into the soul, and we have blocked one of these up through lack of signs. Had we neglected the other two, we would have been reduced to the condition of animals. Just as squeezing tight is the only way we can communicate by touch, animal cries would have been our only means of aural communication. Madame, only someone who is deprived of a sense can understand the benefits of the symbols that are available to their remaining senses, and people who are unlucky enough to be deaf, dumb and blind or who come to lose these three senses in some accident would be delighted to have a clear and precise language for touch.

It is so much easier to use symbols that have already been invented than it is to be the inventor of them, as one has to be when they are lacking. How much better it would have been for Saunderson[19] if, at the age of five, palpable arithmetic had been waiting for him, instead of him having to invent it at the age of twenty-five! This Saunderson, Madame, is another blind man who is not irrelevant to our conversation. They say amazing things about him, and there is not a single one that is not to be believed on the basis of his achievements in literature and his talents in the mathematical sciences.[20]

He used the same machine for algebraic calculations as he did for the description of rectilinear shapes. You would not be displeased to have the machine explained to you, providing you could understand it, and you will see that it presupposes no knowledge you don't already have and you would find it very useful should you ever fancy feeling your way through some long calculations.[21]

Imagine a square, as shown in Plate II, divided into four equal parts by perpendicular lines going down the sides so as to give nine points, 1, 2, 3, 4, 5, 6, 7, 8, 9. Suppose this square had nine holes in it and you could put two kinds of pins in the holes, both of the same length and the same width, but one kind with a slightly larger head than the other.

The large-headed pins were only ever placed next to the centre of the square, while the small-headed ones were only ever placed on the sides, except in the case of the zero. The zero was marked by a large-headed pin placed in the centre of the little square with no other pin next to it. The number 1 was represented by a small-headed pin placed in the centre of the square with no other pin near it; the number 2 by a large-headed pin in the centre of



the square with a small-headed pin to one side at point 1; the number 3 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 2; the number 4 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 3; the number 5 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 4; the number 6 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 5; the number 7 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 6; the number 8 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 7; the number 9 by a large-headed pin in the centre of the square with a small-headed pin to one side at point 8.

There you have ten different expressions accessible to touch, each corresponding to one of our arithmetical characters. Now imagine a table as large as you wish, divided into little squares arranged in a horizontal line and spaced at an equal distance apart, as shown in Plate III, and there you have Saunderson's machine.

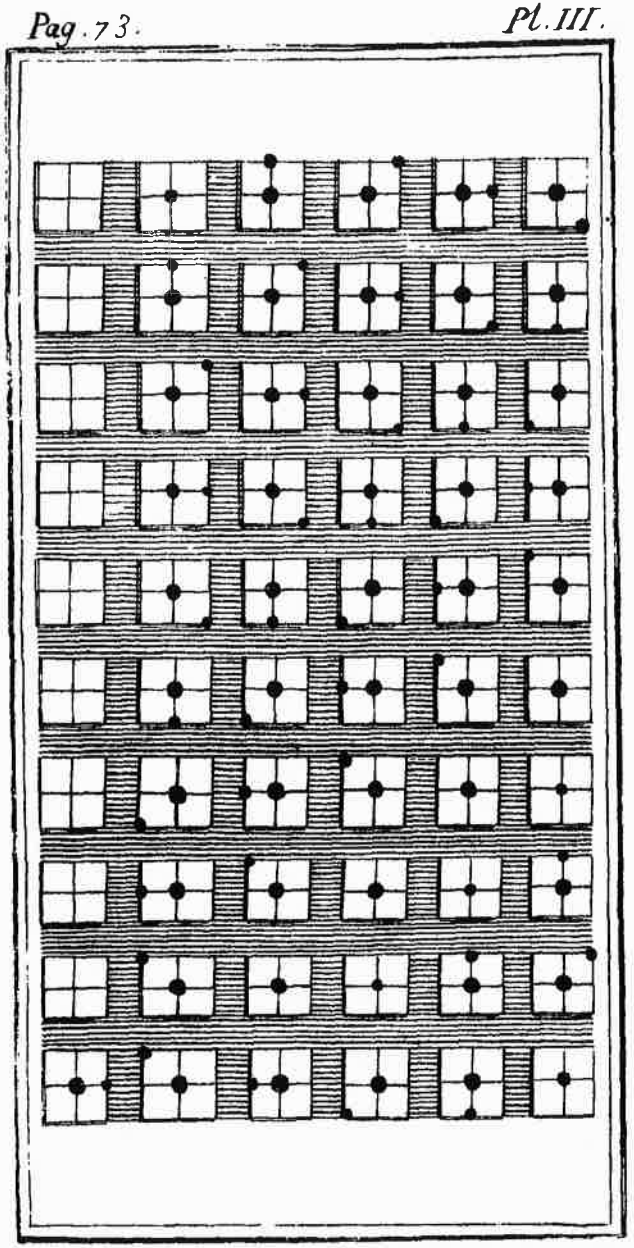
You can easily understand that there is no number that cannot be written on that table, and that, as a result, no arithmetical operation that cannot be performed on it.

Suppose, for instance, that you wish to add up the following nine numbers and find out the total:

1 2 3 4 5
2 3 4 5 6
3 4 5 6 7
4 5 6 7 8
5 6 7 8 9
6 7 8 9 0
7 8 9 0 1
8 9 0 1 2
9 0 1 2 3

I write them on the table as you say them to me, the first digit of the first number on the left and on the first square to the left of the first line; the second digit of the first number on the left and on the second square to the left of the same line and so on.

I put the second number on the second row of squares, units beneath units, tens beneath tens, etc.



I put the third number on the third row of squares and so on, as you see in Plate III. Then running my fingers down each row from top to bottom, starting with the one furthest to my left,[22] I add up the numbers expressed in that column, and write the remainder of the tens at the bottom. I move on to the second column to the left and work in the same way, and from that column to the next until I have completed the sum.

Here is how he used the same table to demonstrate the properties of rectilinear shapes. Supposing he was to demonstrate that parallelograms sharing a base and height also share a surface area, he would place his pins as shown in Plate IV. He would attach names to the corners and finish the demonstration with his fingers.[23]

Supposing Saunderson only used large-headed pins to mark the edges of his shapes, he could have arranged small-headed pins around them in nine different ways, all of which were familiar to him. Therefore he was only in difficulty in cases when the need to denominate a large number of corners in his demonstration forced him to have recourse to the letters of the alphabet.[24] We are not told how he used them.

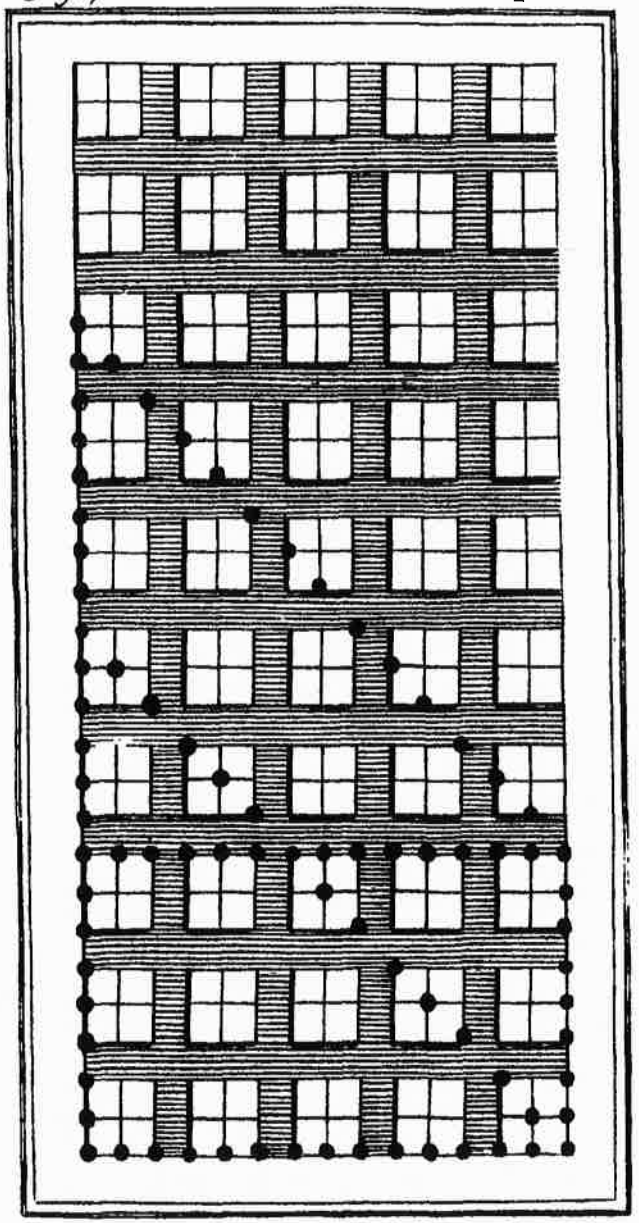
We only know that he could run his fingers across his table with surprising agility, that he could successfully perform the longest of calculations, that he could stop and recognize when he had made a mistake, that he could check his work easily and that this task did not take him nearly as long as one might imagine, owing to the convenient way he prepared his table.

That preparation involved putting the large-headed pins in the centre of the square. Once he had done that, all he had left to do was decide on the value of the small-headed pins, except in those cases when he had to record a unit by putting a small-headed pin in the centre of the square in place of the large-headed one that was there before.

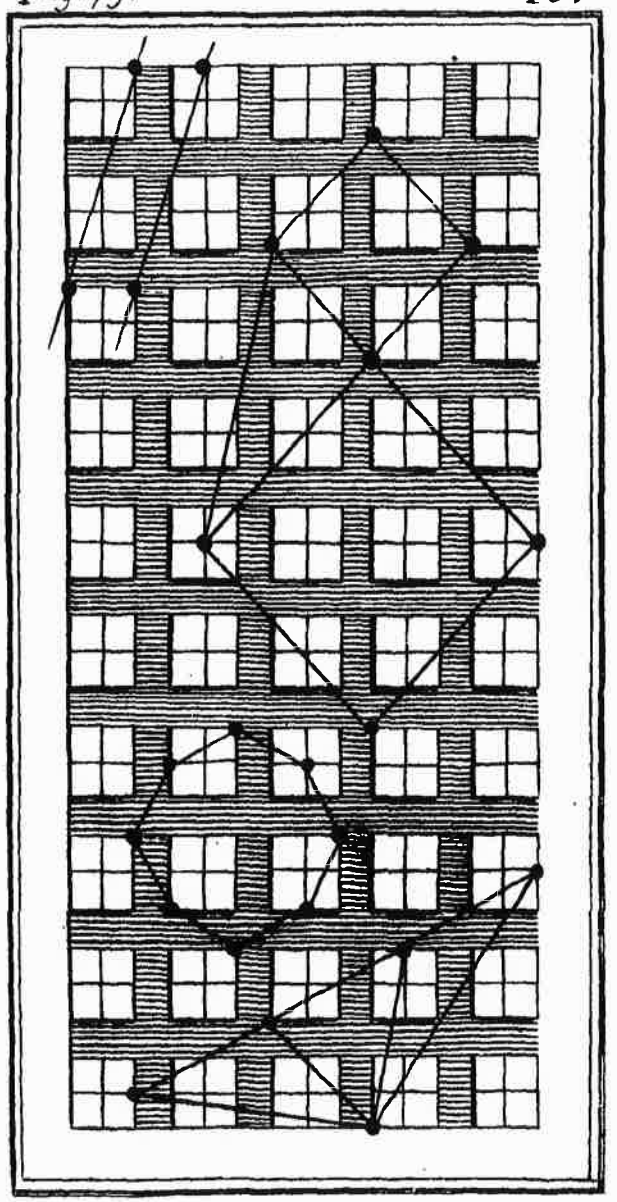
Sometimes, instead of marking a solid line with his pins, he would be content simply to put one pin at each corner or point of intersection, around which he would wind silk threads to create the edges of his shapes.[25] See Plate V.

He left behind some other machines that aided his study of geometry, but we don't know how exactly he used them, and it may require more wisdom to work it out than to solve any problem with integral calculus. Let some geometer try and explain to us what use he had for four pieces of solid

Pag. 76. Pl. IV.



Pag. 79. Pl. V.



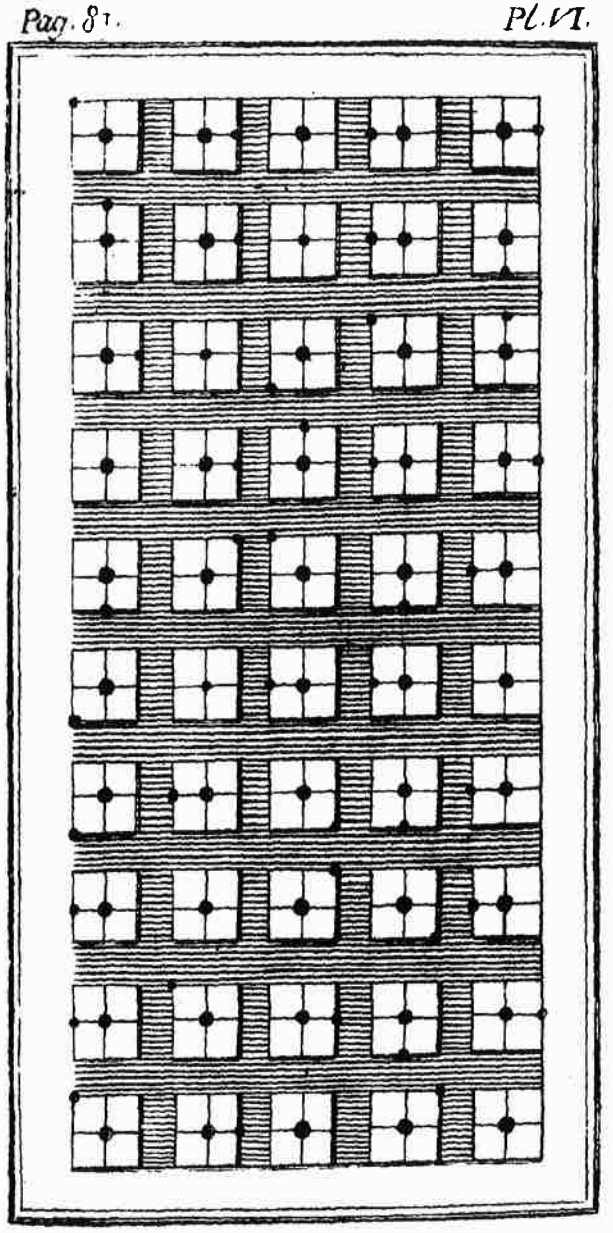
wood shaped like rectangular parallelepipeds, each one eleven inches long by five and a half wide and just over an inch thick, the opposite faces of which were divided into little squares similar to those of the abacus I have just described, except that they only had holes in places where the pins were pushed down as far as the head. Each surface showed nine arithmetical tables, each made up of ten numbers, and each of these ten numbers was made up of ten digits. Plate VI shows one of these little tables;[26] and here are the numbers it contained:

9 4 0 8 4
2 4 1 8 6
4 1 7 9 2
5 4 2 8 4
6 3 9 6 8
7 1 8 8 0
7 8 5 6 8
8 4 3 5 8
8 9 4 6 4
9 4 0 3 0

He is the author of an excellent work of its kind, the *Elements of Algebra*.[27] The only sign that he was blind is to be found in the singular nature of some of his demonstrations, which a man who can see might not have encountered before. It was he who first came up with the division of a cube into six equal pyramids, the points of which are at the centre of the cube with the bases forming each of its sides, and which is used in the simple mathematical proof that a pyramid is the third of a prism of the same base and height.

Saunderson's taste led him to study mathematics, and his poor fortune and his friends' advice obliged him to give public lessons. They were in no doubt that he would be better at it than he thought, owing to his prodigious talent for making himself understood. In fact, Saunderson spoke to his students as though it was they who were deprived of sight, but a blind man who expresses himself clearly to the blind must have much to gain from those who can see, since they have an extra telescope.

The people who wrote his biography say he was full of felicitous expressions and that seems very likely.[28] But what do you mean by felicitous expressions, you will perhaps ask? And I shall reply, Madame, that they are those that



are appropriate to one sense, for instance, to touch, and at the same time metaphorical to another, such as sight, making them doubly enlightening for the listener, who can perceive both the true and direct light of the expression and the reflected light of the metaphor. Obviously on such occasions, Saunderson, extremely clever though he was, could only half understand himself because he could only perceive half the ideas that were attached to the terms he was using. Yet who doesn't find himself from time to time in the same situation? Such a mishap is common to idiots who occasionally crack excellent jokes, and to the cleverest of people who sometimes let slip a stupid remark, and neither realize what they have said.

I have noticed that a paucity of words also produces the same effect on foreigners who are not yet familiar with the language; they are obliged to say everything using a very small number of words, which obliges them to place some of them most felicitously. Yet languages in general lack suitable words for writers with lively imaginations, and so they find themselves in the same position as the foreigners with quick wits; the situations they invent, the subtle nuances they perceive in characters and the simplicity of the pictures they have to draw constantly lead them away from ordinary ways of speaking and make them adopt turns of phrase that are admirable as long as they are neither precious nor obscure, qualities we forgive more or less easily depending how much more wit and how much less knowledge of the language we have than they do. That is why, of all French writers, Monsieur de M . . .[29] is the one the English love most, and why Tacitus is the Latin writer whom *Thinkers* hold in the highest esteem.[30] The linguistic liberties they take pass us by, and we are struck only by the truth of the terms.

Saunderson was astonishingly successful at teaching mathematics at the University of Cambridge. He gave lectures on optics and the nature of light and colour; he explained the theory of vision; he wrote on the effects of lenses, the phenomena that produce rainbows, and many other subjects related to vision and the eye.

These facts will appear much less marvellous, Madame, once you realize there are three things that must be taken into consideration in any question that combines physics and geometry, namely the physical phenomenon that is to be explained, the suppositions that have been made by

the geometer and the calculation that is done on the basis of those suppositions. It is obvious that however perspicacious the blind man may be, light and colour are unknown phenomena to him. He will be able to understand the suppositions because they relate to palpable causes, but he will be unable to grasp why the geometer supposed some things rather than others, for to do so, he would have to be able to compare the suppositions with the phenomena. The blind man thus accepts the suppositions as he finds them: a ray of light is a thin and elastic thread or a series of little bodies that strike our eyes at incredible speed, and he does his calculations on that basis. Physics turns into geometry, and the question becomes purely mathematical.

But what are we to make of the results of such calculations? 1. That they are sometimes extremely difficult to obtain, and that a physicist could happily come up with hypotheses that were as in keeping with nature as it was possible for them to be, but they would be worthless if he could not prove them geometrically, and that the greatest physicists, Galileo, Descartes, Newton, were therefore also great geometers; 2. That we derive more or less secure results from more or less complex initial hypotheses. When the calculation is founded on a simple hypothesis, the conclusions have the force of geometrical demonstrations; but when there are a large number of suppositions, the probability of each hypothesis being true diminishes, on the one hand, in proportion to the number of hypotheses, but increases, on the other, owing to the improbability of so many false hypotheses correcting each other accurately enough to obtain a result that is confirmed by the phenomena. Such a case would be the equivalent of a total sum being correct, though errors had been made in the partial sums of each of the numbers. It cannot be denied that such an outcome is possible, though you can see that it must be very unlikely all the same. The more numbers there are to be added together, the greater the likelihood that a mistake will have been made in each addition, but also the smaller the likelihood of a mistake if the result of the operation turns out to be correct. There is therefore one point at which the number of hypotheses is such that the calculation is as unlikely to be correct as it as possible to be. If A plus B plus C makes 50, shall I conclude from the fact that 50 is indeed the quantity of the phenomenon, that the suppositions represented by A, B and C were also correct? Not at all,

for there are an infinite number of ways of reducing one of these letters and increasing the other two such that I still arrive at the answer 50, though the combination of three hypotheses is perhaps one of the most unfavourable.

One advantage of the calculus that I mustn't omit is that it excludes false hypotheses, because the result would contradict the phenomenon. If a physicist proposes to find the curve of a ray of light as it passes through the atmosphere, he is obliged make an assumption about the air density, the law of refraction, the nature and shape of light particles, and perhaps about some other essential elements too, which he does not include, however, either because he deliberately leaves them out or because they are unknown to him; he then works out the curve. If his calculation produces a result that contradicts nature, his suppositions were either incomplete or false. If the ray of light is described by the curve he produced, one of two things follows: either the suppositions have corrected themselves or they were correct. But which? He doesn't know, and yet that's the only thing he can be sure of.

I went through Saunderson's *Elements of Algebra* in the hope of finding out what I wanted to know from those who knew him well and had reported some details of his life, but my curiosity was not satisfied, and I imagined that an elements of geometry, after his fashion, would have been a more singular work on its own terms and much more useful for us. It would have given the definitions of point, line, surface, solid, angle, of intersections of lines and planes, using, I have no doubt, some highly abstract metaphysical principles close to those of the idealists. The name *Idealists* is given to those philosophers who are conscious only of their existence and of the sequence of sensations they experience inside themselves, and therefore admit nothing else. It is an extravagant system which could only, it seems to me, have been born of the blind and which, to the shame of the human mind and philosophy, is the most difficult to refute, though the most absurd of all. It is set out with as much sincerity as clarity in three *Dialogues* by Doctor Berkeley, Bishop of Cloyne.[31] The author of the *Essay on Human Knowledge*[32] should be invited to examine this work as it would give him the material for some useful, agreeable and subtle observations, in a word, for observations of the kind he does so well. It is well worth accusing him of idealism too, and this claim is liable to excite him owing less to its

singularity than to the difficulty of refuting it according to his own principles, which are exactly the same as Berkeley's. According to them both and according to reason, the terms essence, matter, substance, substrate etc. offer the mind no insights. Furthermore, as the author of the *Essay* judiciously observes, whether we raise ourselves into the heavens or descend into the abyss, we never go beyond ourselves and it is only our own thought that we perceive.[33] Such is the conclusion of Berkeley's first dialogue and the very basis for his whole system. Would you not be curious to see these two enemies, whose weapons so closely resemble each other, take each other on? If one were to emerge victorious, it could only be the one who put them to the best use, but the author of the *Essay on Human Knowledge* has just written a *Treatise on Systems*,[34] in which he provides new evidence of the skill with which he wields his weapons and shows how formidable an adversary he is for systematic philosophers.

We're a long way from our blind men, I hear you say. But, Madame, you must be kind enough to allow me all these digressions, for I promised you a conversation, and I can't keep my promise unless you allow me this indulgence.

I read as attentively as I could what Saunderson had to say about infinity, and I can assure you that his ideas on that subject were very accurate and very clear, and that to him, most of our infinitesimalists would have been mere blind men. It will be up to you to judge for yourself, for although it is a difficult subject that takes you a little beyond your mathematical knowledge, with some preparation I should not despair of making it accessible to you and initiating you into that infinitesimal logic.

The example of this illustrious blind man proves that, with practice, touch can develop and become more sensitive than sight, since by running his hands over a series of medals, he could tell real from fake ones, despite the fact that the latter were forged convincingly enough to deceive a collector with a good eye.[35] He could also judge the precision of a mathematical instrument by feeling its markings with the very ends of his fingertips. Certainly those things are more difficult than judging how well a bust represents a person by touching it. All of this goes to show that a land of the blind could have its sculptors and could profit from statues in the same way we do, namely by preserving the memory of heroic actions and of people who were held dear. I have no doubt that the feelings they would have

when they touched a statue would be even more powerful than the feelings we have when we look at one. How sweet it would be for a man who had been a very tender lover to run his hands over the charms he could recognize, and experience the illusion, which must work more powerfully on the blind than on the sighted, of them being brought back to life. Perhaps the greater the pleasure he would take in the memory though, the fewer regrets he would feel.

Saunderson shared with the blind man of Puiseaux the capacity to be affected by the most minor changes in the atmosphere and to perceive, particularly in calm weather, the presence of objects that were not more than a few paces away. It is said that one day he attended some astronomical observations that were being carried out in a garden, and the clouds, which from time to time hid the sun from view, caused a faintly perceptible change in the rays of light he could feel on his face, such that he could tell when the observations were possible and when they were not. You will perhaps be thinking that some disturbance occurred in his eyes to inform him whether it was light, but not whether objects were present or not, and I would have thought the same were it not for the certain fact that Saunderson was not only deprived of the sense of sight but also of its organ.

Saunderson's sight was in his skin. He had such an exquisitely sensitive epidermis that if a draughtsman were to sketch a friend's portrait on his hand, he would undoubtedly have been able, with a bit of practice, to recognize it and, feeling the sequence of sensations caused by the pencil, declare: 'It's Monsieur So and So'. There is therefore such a thing as painting for the blind: their own skin would be the canvas. These ideas are so far from being fanciful that I have no doubt that if someone drew Monsieur . . .'s little mouth on your hand, you would recognize it instantly. You must agree though that it would be even easier for a blind man to recognize it, despite the fact that you are used to seeing it and being charmed by it, because there are two or three things that enter into your judgement: the comparison between the painting done on your hand and the one deep inside your eye; the memory of the way you are affected by the things you feel and by the things you enjoyed seeing and admired; and finally, the application of this data to the question the draughtsman asks as he traces the outline of a mouth on your hand with the nib of his pencil, namely, 'Whose mouth am I drawing?' For a blind man, by contrast,

the sum of the sensations produced by someone's mouth on his hand is identical to the sum of the sequence of sensations produced the draughtsman's pencil as he represents it.

I could add to the stories of the blind man of Puiseaux and Saunderson those of Didymus of Alexandria, Eusebius the Asiatic, Nicaise of Mechlin and some others who seemed to be so far above the rest of mankind despite having one fewer sense,[36] that poets might have said, without any exaggeration, that the gods were jealous and deprived them of a sense so as to have no equals among the mortals. For who was this Tiresias, who discovered the gods' secrets and had the power to see into the future, if he wasn't a blind philosopher, whose memory has come down to us through fable? But let's move no further away from Saunderson and follow this extraordinary man to the grave.

As he was nearing death, a very talented minister, Mr Gervaise Holmes,[37] was called to his bedside, and together they had a conversation about the existence of God, which has come down to us in fragments and which I will do my best to translate for you as they are well worth the trouble. The minister began by arguing in favour of nature's marvels; 'Ah Sir', replied the blind philosopher, 'forget that beautiful great spectacle that was never made for me! I have been condemned to live my life in darkness, and you cite wonders I can't understand and which are proof only for you and those who see as you do. If you want me to believe in God, you must make me touch him.'

'Sir,' the minister skilfully replied, 'run your hands over your own body and you will feel God in the admirable mechanism of your sense organs.'

'Mr Holmes,' Saunderson said, 'I repeat, all that is not as beautiful to me as it is to you. And even if the animal mechanism were as perfect as you claim, and I want to believe it is because you are an honest man and wholly incapable of deceiving me, what does it have in common with a supremely intelligent being? If you marvel at it, it might be because you tend to think anything that seems to be beyond your powers is a marvel. I have been the object of your wonder so often that I have a very low opinion of the things that amaze you. People have come to see me from all over England because they could not imagine how I was able to do geometry, which you must admit means that such people did not have a very clear notion of what is possible. If we think a phenomenon is beyond man, we immediately

say it's God's work; our vanity will accept nothing less, but couldn't we be bit less vain and a bit more philosophical in what we say? If nature presents us with a problem that is difficult to unravel, let's leave it as it is and not try to undo it with the help of a being who then offers us a new problem, more insoluble than the first. Ask an Indian how the world stays up in the air, and he'll tell you that an elephant is carrying it on its back; and the elephant, what's he standing on? A tortoise. And that tortoise, what's keeping him up? . . . To you, that Indian is pitiful, yet one could say the same of you as you say of him. So, Mr Holmes, my friend, start by confessing your ignorance, and let's do without the elephant and the tortoise.'[38]

Saunderson paused for a moment; he seemed to be waiting for the minister to reply; but where can one attack a blind man? Mr Holmes took pride in the good opinion Saunderson had of his integrity and of the insights of Newton, Leibniz, Clarke and some other compatriots,[39] the world's foremost geniuses, all of whom had been struck by nature's marvels and recognized an intelligent being as its creator. There was no denying that this was his strongest argument against Saunderson. And the good blind man agreed that it would indeed be rash of him to deny what a man such as Newton had not found it beneath him to admit, but he explained nonetheless to the minister that Newton's testimony was not as powerful to him as that of the whole of nature had been to Newton, and that where Newton had taken God's word, he was reduced to taking Newton's.

'Consider, Mr Holmes', he added, 'how confident I have to be in what you and Newton say. I can't see anything and yet I will accept that everything is admirably ordered, but I am counting on you not demanding anything more of me. I defer to you as regards the current state of the universe in return for the freedom to think what I will about its ancient and primary state, to which you are no less blind than I am. You have no witnesses present that can testify against me, and in this respect your eyes are of no use to you. So you go on imagining, if you will, that the order that strikes you has always been in existence, but allow me to believe that nothing could be further from the truth, and that if we went back to the beginning of the universe and time,[40] and we felt matter start to move and chaos dissipate, for every couple of beings that were put together properly, we would encounter a multitude of shapeless ones. If I have no objection to your

view of the present state of things, I can nonetheless question their former state. I can ask, for example, who told you all – you, Leibniz, Clarke and Newton – that when animals first came into being, there weren't some with no heads and others with no feet? I can claim that some had stomachs missing and others lacked intestines, that the ones with stomachs, teeth and palates, who looked as though they might survive, ceased to exist owing to some heart or lung defect, that monsters were wiped out one after another, that all defective combinations of matter disappeared and that the only ones to remain have mechanisms with no serious disorders, and can survive on their own and reproduce.

'On that basis, had the first man had a blocked larynx or not had suitable nourishment or had a problem with his reproductive organs, had he not met a mate or had he mated with another species, what would have happened to the human race then, Mr Holmes? It would have been swallowed up in the general purge of the universe, and that proud being called man would have been dissolved and scattered throughout the molecules of matter, and would have been and perhaps forever would have remained one of a number of possible outcomes.'

'Had there never been any shapeless beings, you would have no hesitation in saying that there never will be any and that I am indulging in fanciful hypotheses, but the order of the universe is not so perfect,' continued Saunderson, 'that monstrous outcomes are not produced from time to time.' And turning to the minister, he added, 'Look me in the face, Mr Holmes; I have no eyes. What have we done to God, you and I, such that one of us has that organ and the other is deprived of it?'[41]

Saunderson looked so deeply moved as he uttered these words that the minister and the rest of the gathering could not help feeling his pain and began to cry bitterly over him. The blind man noticed and said to the minister, 'Mr Holmes, I had heard about your goodness of heart and the evidence of it is very touching to me in my last moments, but if you hold me dear, do not deprive me in death of the consolation of knowing that I never caused anyone any pain.'

Then adopting a firmer voice once again, he added: 'It is therefore my conjecture that in the beginning when the universe was hatched from fermenting matter, my fellow men were very common. Yet couldn't my belief about animals also hold for worlds? How many lopsided, failed

worlds are there that have been dissolved and are perhaps being remade and redissolved every minute in far away spaces, beyond the reach of my hands and your eyes, where movement is still going on and will keep going on until the bits of matter arrange themselves in a combination that is sustainable? Oh philosophers! Come with me to the edge of this universe, beyond the point where I can feel and you can see organised beings; wander across that new ocean with its irregular and turbulent movements and see if you can find in them any trace of that intelligent being whose wisdom you admire here.

'But why bother taking you out of your element? What is this world, Mr Holmes? It's a composite, subject to cycles of change, all of which exhibit a tendency towards destruction; a rapid series of beings that appear one after another, one replacing the next before vanishing; symmetry is fleeting, and order momentary. I criticized you a moment ago for judging the perfection of things by the standard of your own, and I could criticize you now for measuring how long things might last in relation to the length of your own life. You judge whether or not the world will continue to exist, in the same way the ephemeral fly judges whether or not you will. The world is eternal to you, just as you are eternal to the being that only lasts an instant. In fact, the insect is more reasonable than you are. What an amazing series of ephemeral lives it is, that stands as proof of your eternal life! How far that tradition stretches back! Yet we will all pass away without being able to determine either the actual area we occupied or the precise length of time we lasted. Time, matter and space may be only a single dot.'

Saunderson became more agitated in this conversation than his state of health would permit, and he went into a delirium lasting several hours,[42] from which he emerged only to exclaim, '*Oh God of Clarke and Newton, take pity on me!*' and die.

Thus Saunderson ended his days. You see, Madame, even all those arguments he had just put forward to the minister were not enough to reassure a blind man. It puts to shame those people whose arguments are no stronger than his but who are able to see and to whom the amazing spectacle of nature, from the rising of the sun to the setting of the tiniest stars, proclaims the existence and glory of its author! They have eyes, which Saunderson did not, and yet he had a purity of morals and an innocence of character that

they lack. Thus they live their lives blind, and Saunderson dies as though he could see. The voice of nature can make itself heard clearly enough through his remaining organs, and his testimony will thereby be an even greater challenge to those who stubbornly shut their eyes and ears. I should willingly ask whether the true God was not more veiled to Socrates by the pagan darkness than he was to Saunderson, whose blindness deprived him of the spectacle of nature.

I am rather upset to discover, Madame, that other interesting details from the life of this illustrious blind man have not been passed down to us for your satisfaction as well as mine. There was perhaps more enlightenment to be had from his replies than from all the experiments that are currently being proposed. How very unphilosophical those who lived with him must have been! I make an exception for his disciple, Mr William Inchlif, who only saw Saunderson in his final moments and recorded his dying words, which I recommend anyone who can understand a little English to read in the original and which are contained in a work published in Dublin in 1747, entitled *The Life and Character of Dr Nicholas Saunderson, late Lucasian Professor of the Mathematics in the University of Cambridge. By his disciple and friend William Inchlif, Esq.*[43] They will remark in it a certain something that is charming, powerful, true and gentle, which is to be found in no other tale and which I do not flatter myself to have rendered for you, in spite of all the efforts I have made to preserve it in my translation.

Saunderson married the daughter of Mr Dickons, rector of Boxworth, in the county of Cambridge in 1713, and he had by her a son and a daughter who are still living.[44] His final farewell to his family is very touching: 'I am going,' he told them, 'where we all go. Spare me your distress, which I feel moved by. The signs of pain that escape your lips only make me more sensitive to the signs that elude my grasp. I feel no sorrow at leaving a life that has been nothing more to me than one long deprivation and endless yearning. Live as virtuously as I have and more happily, and learn to die as peacefully.' With that he took his wife's hand and held it tight in his for a while. Then he turned to face her as though trying to see her, blessed his children, embraced them all and begged them to withdraw as their presence was a crueller pain for his soul than the approach of death.

England is the country of philosophers, of the curious and the systematic, and yet without Mr Inchlif, all we

would know of Saunderson is what the most ordinary of men would have told us, such as the fact that he could recognize places he had once visited by the sounds of the walls and the cobblestones, and a hundred other things of that sort, which he had in common with almost all other blind men. Is it common in England to meet blind men of Saunderson's merit, and is it an everyday occurrence to come across people who have never been able to see and who give lessons in optics?

People are trying to give sight to those born blind, but on closer examination, I think it would be found that philosophy has as much to gain by questioning a blind man of good sense. He would explain how things happen inside him, which could be compared to the way they happen inside us, and this comparison might solve all the problems that make the theory of vision and of the senses so complicated and so uncertain. However, I cannot, I confess, understand what it is hoped might be gained from a man who has just undergone a painful operation on a very sensitive organ that is disturbed by the slightest accident and often deceives those in whom it is healthy and who have enjoyed its benefits for some time. For my part, I would rather listen to a metaphysician familiar with the principles of physics, the elements of mathematics and the physical organisation of the body, lay out a theory of the senses, than to a man with no education and no knowledge and who had just acquired sight following a cataract operation. I should have less confidence in the responses of a man seeing for the first time than in the discoveries of a philosopher who had meditated long and hard on the matter in the dark or, to put it in poetic terms, had gouged out his eyes, the more comfortably to discover the workings of vision.[45]

If the experiments were to be at all reliable, the subject would need, at least, to have been be prepared for them a long time in advance, and have been brought up as and perhaps made into a philosopher, but making someone a philosopher cannot be done overnight, even when one is a philosopher oneself, and how long would it take if one were not? It takes even longer when one thinks one is. It would be most appropriate to wait a while after the operation before beginning the observations. To this end, the patient should be treated in darkness, his wounds must definitely have healed and his eyes must be healthy. I should not wish him to be exposed to daylight immediately; the glare of a bright

light is blinding to us, so what must it be like to an extremely sensitive organ that has never received any sensory impressions to which it could have become accustomed?

But that's not all. It would still be very tricky to ensure that a subject who had been prepared in this way was put to good use and questioned subtly enough to make him explain precisely what was happening inside him. The questioning should be performed before a full Academy or rather, to ensure there were no superfluous spectators, only those people should be invited whose knowledge of philosophy, anatomy, etc. would make them deserving of an invitation. The most talented of men and the finest of minds would not be too good for it. Training and questioning a man-born-blind would have been a task not unfit for the combined talents of Newton, Descartes, Locke and Leibniz.

I shall finish this letter, which is already too long, with a question that was asked a long time ago. Thinking about Saunderson's singularity has made me see that it has never fully been answered. Suppose a man, born blind and now adult, who has been taught by his touch to distinguish between a cube and a sphere of the same metal and about the same size, so as when he felt one and the other, he could tell which was the cube, which the sphere.

It was Mr Molyneux who first asked this question and tried to answer it. He declared that the blind man would not be able to distinguish the sphere from the cube, 'for', he said, 'although he has learnt from experience in what manner the sphere and the cube affect his touch, he nonetheless does not yet know that what affects his touch in such or such a manner, must strike his eyes in such or such a fashion, nor that the protuberant angle of the cube that presses his hand in an uneven way must appear to his eyes as it does in the cube.'[46]

When Locke was consulted on this question, he said: 'I am entirely of Mr Molyneux's sentiment. I believe that the blind man would not be able, at first sight, to say with any confidence which is the cube and which the sphere if he only looked at them, although on touching them he could name them and distinguish them with certainty according to the difference in their shapes which he could recognize by his touch.'[47]

Monsieur l'abbé de Condillac, whose *Essay on Human Knowledge* was as pleasurable to read as it was useful, and whose excellent *Treatise on Systems* I am sending you along

with this letter, has a particular sentiment in this matter.[48] There is no need to relate all the reasons he gives to support his argument, as that would be to deny you the pleasure of rereading a work in which his reasons are set out in such an agreeable and philosophical manner that it would be too risky for me to quote them out of context. I shall be content to observe that they all tend to demonstrate that the man-born-blind can either see nothing or see the cube and the sphere clearly, and that the condition, according to which the two bodies must be of the same metal and of about the same size, which it was judged necessary to include in the question, is incontestably superfluous for, so he might have said, if there is no essential relationship between the sensation of sight and that of touch, as Messrs Locke and Molyneux claim, they must agree that even a body that is two feet in diameter to the eye would disappear when it was touched. Monsieur de Condillac adds, however, that if the man-born-blind can see the bodies and distinguish the shapes, but nonetheless hesitates in his judgment of them, this can only be for some quite subtle metaphysical reasons that I shall explain to you in a moment.

So here we have two different sentiments on the same question, each belonging to a first-rate philosopher. It would seem that, having been discussed by men like Messrs Molyneux, Locke and the abbé de Condillac, there could be nothing left to say, but the same thing can be viewed from so many different angles that it wouldn't be surprising if they had not all been exhausted.

Those who have declared that the man-born-blind would be able to distinguish the cube from the sphere began by supposing a fact that is important to examine and which relates to whether or not a man-born-blind who had had his cataracts removed would be in a fit state to make use of his eyes in the moments immediately following the operation. They have simply said, 'As the man-born-blind compares the ideas of the sphere and the cube that he had gained by his touch with those he now gains by his sight, he will necessarily recognize that they are the same, and it would be bizarre to claim that it is the cube that gives him the idea of the sphere and that it is from the sphere that he gains the idea of the cube. He will therefore call cube and sphere what he called cube and sphere when he touched them.'

Yet what have their opponents argued in reply? They have also supposed that the man-born-blind would see as

soon as his eyes were cured, and they have imagined that an eye that has had a cataract removed is like an arm that has recovered from paralysis. They claim that just as the latter does not need to exercise in order to have some feeling, so the eye does not either, and they add, 'Let us accord the man-born-blind a bit more philosophy than you did. Once he has reached the point in the argument where you left him, he will go a stage further and wonder who said that when I move towards the shapes and place my hands on them, they will not immediately undermine my expectations, the cube will not transmit the sensation of a sphere, and the sphere that of a cube? Only experience can teach me whether sight and touch relate to and agree with each other; these two senses could contradict each other without my knowing it; I might even believe that what I see is nothing but an appearance, had I not been told that these are the same bodies that I touched. It seems to me, in truth, that this one must be the one I was calling cube and that one, the one I was calling sphere. However, I am not being asked what seems to me to be the case, but rather what is the case, and I am simply not in a position to give a satisfactory answer to that last question.'

This line of thinking, so the author of the *Essay on the Origin of Human Knowledge* says, would be very confusing for the man-born-blind, and only experience can provide the answer. It would very much appear that Monsieur l'abbé de Condillac means to refer only to the experience that the man-born-blind would himself repeat by touching the bodies for a second time. You will sense in a moment why I am making this observation. That talented metaphysician could have added that a man-born-blind was obliged to think it all the less absurd that two senses might contradict each other, since that is what he thinks a mirror does, as I noted earlier.

Monsieur de Condillac goes on to observe that Mr Molyneux has confused the question by adding several conditions which can neither prevent nor remove the difficulties that metaphysics would present to the man-born-blind. This observation is all the more accurate since it is not out of place to assume the blind man to be acquainted with metaphysics, because in these philosophical questions, the experiment should always be done on a philosopher, that is, on a person who is able to grasp everything that his reason and the physical condition of his organs permit him to perceive in the questions being asked.

There, Madame, you have a summary of what has been said for and against this question; and in my examination of it, you will see how far those people who declared the blind man would see the shapes and distinguish the bodies were from realizing they were right, and how right those people who denied it were to think they were not wrong.

If we consider the question of the man-born-blind in more general terms than Mr Molyneux did, we can see that it involves two other questions, which we are going to consider in turn. It is possible to ask 1. whether the man-born-blind will see immediately after the cataract operation has been performed; 2. should he be able to see, whether he will be able to do so well enough to distinguish the shapes, whether he will be able, with any certainty, to give them the same names as he gave them when he touched them, and whether he will be able to prove that those are the right names.

Will the man-born-blind see immediately after his eyes have been treated? Those who claim that he won't be able to, say, 'As soon as the man-born-blind is possessed of the faculty of sight, the whole scene he has in front of him will enter and paint itself on the inside of his eyes. This image, which is made up of an infinite number of objects assembled in a very small space, is nothing but a confused mass of different shapes that he will be unable to tell apart. It is almost certainly the case that only experience can teach him how to judge the distance of objects and that he needs to move towards them, touch them, move back again, move towards them and touch them again in order to be sure that they are not part of him, that they are foreign to his being and that he is sometimes close to them and sometimes far away from them. Yet why should experience not also be necessary for him even to perceive them? Without experience, someone who perceives objects for the first time ought to think that when they move away from him or he so far away from them so that he can no longer see them, they stop existing, since it is only the experience of perceiving objects that do not move and of discovering that they remain where we left them that can tell us they continue to exist in our absence. It is perhaps for this reason that children are so readily consoled for toys that have been taken away. We cannot say they forget them readily since, if we consider that there are children aged two and half who know a considerable number of words and find it easier to remember a word than to say it, it is obvious that memory is strongest in childhood.

Wouldn't it be more natural to suppose that children think that things they can no longer see no longer exist, especially since their joy seems to be mixed with surprise when objects that were lost from view reappear. A nanny can help them acquire the idea of absent things by playing a little game with them in which she covers her face and suddenly uncovers it again. In this way, their experience teaches them a hundred times in a quarter of an hour that what ceases to be visible does not cease to exist. Whence it follows that it is experience that teaches us the notion of the continued existence of objects, that it is through touch that we acquire the idea of distance, that the eye may have to learn to see just as the tongue learns to talk, that it would not be surprising if one sense needed the help of another, and that touch, which guarantees the existence of objects outside ourselves when we see them, is perhaps the only sense able to tell us not, I think, what shape or other modifications objects may have, but simply that they are there.'

Added to these arguments are Cheselden's famous experiments.* The young man, whose cataracts this talented surgeon removed, could not for a long time see size, distance, location or even shape. An object the size of his thumb, placed in front of his eye to hide a house from view, seemed to him to be as large as the house. All objects felt as thought they were on his eyes, and they seemed to him to be touching the organ of sight in the same way that objects touched his skin. He could not tell the difference between something he judged to be round with his hands and something he judged to be angular by his sight, nor could he tell just by looking whether what he felt to be high or low was, in fact, high or low. He managed, though not without difficulty, to perceive that his house was larger than his room, but he was unable to conceive how it could be that his eye gave him that idea. He needed to repeat the same experience many times before he could be sure that paintings represented solid bodies, and having repeatedly looked at paintings and become convinced that he was not just seeing flat surfaces, he came to touch them with his hands and was most surprised to discover a single plane with no relief to it all, and he asked which was the lying sense, touch or sight? Paintings had the same effect on savages the first

* See *Elements of Newton's Philosophy* by Monsieur de Voltaire.[49]

time they saw them; they took painted figures to be living men, asked them questions and were astonished to receive no reply. This mistake was certainly not the result of their having little experience of seeing.

But how are we to respond to the other difficulties? By saying that, in fact, a man whose eyes are used to seeing sees objects more clearly than either a man-born-blind who has just had his cataracts removed or a child, whose organs are foolish and raw. Look, Madame, at all the evidence given by Monsieur l'abbé de Condillac at the end of his *Essay on the Origin of Human Knowledge*,[50] where he proposes an opposite reading of the experiments performed by Cheselden and reported by Monsieur de Voltaire. The effects of light on an eye feeling it for the first time and the conditions required in the humour of the eye, the cornea, the crystalline lens, etc. are set out with great clarity and persuasiveness there, and they make it impossible to doubt that vision occurs only very imperfectly in an infant who opens his eyes for the first time, or in a blind man who has just undergone an operation.

We must therefore agree that we must be able to grasp an infinite number of things in objects, which neither the infant nor the man-born-blind can grasp, although objects are painted inside their eyes just as they are in ours; that it is not enough for objects to make an impression on us, we must also be attentive to the impressions they make; that, as a result, we cannot see anything the first time we open our eyes; that in the first moments of vision, we can only see a multitude of blurred sensations that only become clear over time and as a result of our habitually reflecting on what is happening inside us; that it is experience alone that teaches us to compare sensations with what occasions them; that our sensations do not essentially resemble objects in any way; and that it is up to experience to teach us about the analogy between them, which seems to be purely conventional. In a word, it is impossible to doubt that touch is most useful in giving the eye a precise sense of the manner in which the object conforms to the representation of it that the eye receives, and I think that if everything did not occur in nature according to infinitely general laws, if, for example, certain hard pointed objects did not hurt to the touch and others did not provoke feelings of pleasure, we would die without having had a hundred millionth of the experiences necessary for the conservation of our bodies and for our well-being.

However, I simply do not think that the eye cannot teach itself or, if I may put it like this, give itself experience. In order to be sure of the existence and shape of the objects we touch, we do not need to be able to see them. Why then would we need to touch objects in order to be sure we could see them? I am aware of all the benefits of touch and I did not disguise them when I was discussing Saunderson or the blind man of Puiseaux; that, however, was not one I recognized. It is easy to conceive that we are able to make better and more efficient use of one sense if another one lends its support, but it is not at all easy to conceive that the senses are essentially dependent on each other for their functioning. There are certainly qualities in bodies that we would never perceive without touch; it is touch that informs us of certain features that are invisible to the eyes and which can only be seen once touch has pointed them out, but this assistance is mutual, and in those people whose sight is more acute than their touch, it is the former that tells the latter of the existence and features of objects that are so small as to escape its grasp. If a piece of paper or some other smooth, thin and flexible substance were placed between your thumb and index finger without you knowing it, only your eye could tell you that your fingers were not in direct contact with each other. I shall observe in passing that it would be infinitely more difficult to deceive a blind man in such a fashion than someone who is used to seeing.

A lively and spirited eye would no doubt find it hard to be sure that external objects were not part of itself, that it was sometimes close to them and sometimes far away, that they had a shape, that some were larger than others, that they had depth, etc., but I have no doubt at all that it would eventually see them and would be able to see them clearly enough to be able to distinguish, at least roughly, their outlines. To deny this would be to lose sight of the aim of the organs; it would be to forget the principal phenomena of vision, to pretend to oneself that no painter is talented enough to come close to the beauty and accuracy of the miniatures that are painted inside our eyes, that there is nothing more precise than the resemblance between the representation and the object represented, that the canvas of this painting is not that small, that the shapes are not blurred, that they are about half an inch square in size and that there would be nothing so difficult as explaining how

touch could manage to teach the eye to see, were it absolutely impossible for the eye to see without the assistance of touch.

But I shall not rely on simple assumptions and I shall ask whether it is touch that teaches the eye to see colours? I don't think we can accord tact such an extraordinary privilege, and thus it follows that if we show a blind man who has just acquired the sense of sight a black cube and a red sphere on a large white background, it will not take him long to see the edges of the shapes.

It will take as long as it takes, one might argue, for the eye's humours to settle properly, for the cornea to acquire the necessary convex shape, for the pupil to be able to dilate and contract as it should, for the retina's filaments to be neither too sensitive nor too insensitive to the effect of the light, for the crystalline lens to perform the forward and backward movements we suspect it makes, for the muscles to perform their functions properly, for the optic nerves to become accustomed to transmitting sensation, for the whole eyeball to arrange itself in the necessary manner and for all the parts that make up the eyeball to work together to execute the miniature of which we make such good use; that's how long it will take before the eye is able to give itself experience. I confess that however simple a picture I show the man-born-blind, he will only be able to distinguish its parts once his eyes have fulfilled all the preceding conditions, but that may only take an instant, and it would not be difficult to apply the argument that has just been put to me to a fairly complex mechanism such as a watch, and prove by listing all the movements that occur in the barrel, the fusee, the wheels, the pallets, the balance, etc. that it would take two weeks for the second hand to move. If the reply to that is that those movements happen simultaneously, I shall reply that the same may be true of the ones that occur in the eye when it opens for the first time and of the judgements that take place as a result. Whatever you make of the conditions that are necessary for the eye to be able to see, you must agree that it is not touch that creates them, that the eye acquires them by itself and that as a result, it will succeed in distinguishing the shapes that are painted inside it without the assistance of another sense.

But I hear you say once again, when will it be able to do so? Perhaps more quickly than you think. When we went

to the King's Garden together, do you remember, Madame, seeing the concave mirror, and how frightened you were when you saw the tip of a sword coming towards you at the same speed as that at which the tip of the one you had in your hand was moving towards the surface of the mirror? And yet you are used to relating objects in mirrors to a space beyond them. Experience is thus neither as necessary nor as infallible as we think when it comes to perceiving objects or their images in the right places. Even your parrot proves my point. The first time he saw himself in a mirror, he went up close to it with his beak, and when he did not encounter his brother who was, in fact, himself, he walked round the back of the glass. I don't want to make too much of the parrot's evidence, but as an animal, preconceived ideas can have no part in its experience.

However, if you were to tell me that a man-born-blind would not be able to see anything for two months, I should not be surprised. I should simply conclude that the organ needs experience and not that it needs touch for that experience. I should merely have a clearer understanding of the importance of letting a blind man who will be the object of these observations rest in the dark, of allowing his eyes to exercise, which they can do much more comfortably in darkness than in light, and of putting him in a kind of dusk for the experiments or at least in a place where it is possible for him to choose to have more or less light. It would make me all the more inclined to agree that these kinds of experiments are always very difficult and very uncertain, and that the quickest way of doing them, though seemingly the longest, is to equip the subject with philosophical training sufficient to enable him to compare the two conditions he has known and to acquaint us with the difference between the state of a blind person and that of one who can see. I say it again, how precise can one expect someone to be if they are not used to thinking and self-examination, and if they, like Cheselden's blind man, are so unaware of the benefits of sight that they are ignorant of their misfortune and cannot imagine how the loss of that sense impairs their pleasures? Saunderson, whom we cannot refuse the title of philosopher, was certainly not indifferent to his loss, and I very much doubt whether he would have been of the opinion of the author of the excellent *Treatise on Systems*. I rather suspect the latter philosopher of having indulged in a system himself when he says that, 'if man's life had been

nothing other an uninterrupted sensation of pleasure or pain, either happy with no idea of unhappiness, or unhappy with no idea of happiness, he would have known only pleasure or suffering; and as if that were his very nature, he would never have looked around to see whether some being was keeping a protective watch over him or plotting to do him harm. It is the shift from one state to the other which made him think, etc.'[51]

Madame, do you think it was by proceeding from one clear idea to another (for that is the author's way of philosophizing and the right one) that he arrived at such a conclusion? Happiness and unhappiness are not like darkness and light; the one does not consist in the pure and simple deprivation of the other. We might perhaps have said that happiness was no less essential to us than existence and thought, had we enjoyed it without interruption, but I cannot say the same of unhappiness. It would have been perfectly natural to think of it as an enforced condition, to feel oneself to be innocent yet believe oneself to be guilty, and blame or excuse nature, which is what we do.

Does Monsieur l'abbé de Condillac think a child only cries when he is in pain because he has not been in pain without respite since he was born? If he were to reply that 'existing and suffering would be one and the same for someone who had always been suffering, and he would be unable to imagine that his pain could come to an end without his existence coming to an end too,' I should reply in turn that, though the man who had constantly been unhappy would perhaps not have said, 'What have I done to deserve this pain?', what would have prevented him from asking, 'What I have done to exist?'? Moreover, I see no reason why he wouldn't have had two synonyms, *I exist* and *I suffer*, one for prose and one for poetry, just as we have two expressions, *I live* and *I breathe*. However, you will observe better than I, Madame, that this part of Monsieur l'abbé de Condillac is very beautifully written, and I rather fear you will say, as you compare my criticism with his observations, that you would still rather an error by Montaigne than a truth by Charron.[52]

You're digressing again, I hear you say. Yes, Madame, it is the very nature of our treatise. Now, here is my opinion on the two previous questions. I think that the first time the blind man's eyes receive light, he will see nothing at all. His eye will need some time to give itself experience, but it will

do so on its own and without the help of touch, and it will succeed not only in seeing colours but also in making out the rough edges of objects. Now let us see whether, supposing he acquires this ability in a very short space of time or gains it by exercising his eyes in the darkness, as he had been told to do by those who carefully confined him to it for some time after the operation and before the experiments, let us see, I say, whether he would recognize by his sight the bodies he had touched, and whether he would be able to give them the appropriate names. This is the last question I have to answer.

In order to do so in a manner that will please you, since you are fond of method, I shall distinguish between several kinds of persons on whom the experiments may be carried out. If they are common people with no education or knowledge and who have not been trained for it, I think that, were the operation to remove the defect completely from the eye and the eye to be healthy, the objects would be painted very clearly inside it, but that such people who are unused to any kind of rational thought, not knowing what is meant by sensation or idea and unable to compare the representations they have gained from touch with those they have gained from their eyes, would declare, 'That's the circle, that's the square', without there being any basis for their judgement. Alternatively, they may even naively agree that they could perceive nothing in the objects now present to their sight that resembled those they were used to touching.

There are other people who, by comparing the shapes they would perceive to the bodies whose shapes used to impress themselves on their hands, and by mentally applying their sense of touch to those bodies at a distance, would say of one that it was a square and the other that it was a circle, but without knowing why, because the comparison between the ideas gained by touch and those received by sight would not occur in them clearly enough for them to be certain of the truth of their judgment.

I shall turn now, Madame, without digressing, to a metaphysician on whom one might try the experiment. I have no doubt that from the very first moment he saw them clearly, he would, by contrast, think about the shapes as if he had been able to see them all his life, and that having compared the ideas that came to him by his eyes with those he gained by his touch, he would say, with the same assurance as you and I, that, 'I should be tempted to believe that this body is the one I have always called circle and this the one I have

always called square, but I shall refrain from saying so. Who says that were I to approach them, they wouldn't disappear from beneath my hands? How do I know whether the objects I can see are destined also to be the objects of my touch? I do not know whether what is visible is also palpable. However, even if I were not uncertain of this and took the people around me at their word when they say that what I can see really is what I touched, I should not be any better off. Those objects could easily change in my hands and transmit sensations by my tact that are the very opposite of those I have sensed by my sight. Gentlemen, he would add, this body seems to me to be the square and this the circle, but I cannot know for certain that they feel the same as they look.'

If we replaced the metaphysician by a geometer, Locke by Saunderson, he would also say that, were he to believe his eyes, of the two figures he could see, this is the one he would call a square, and this the circle, 'for I can see,' he would add, 'that the first one is the only one that would allow me to arrange threads and position large-headed pins in such a way as to mark out the corners of a square, and the second one is the only one that I can inscribe or circumscribe with the threads necessary for the demonstration of the properties of a circle. So, that's the circle, and that's the square! However,' he would have continued, following Locke, 'perhaps when I come to apply my hands to the shapes, one will change into the other such that the same shape could serve to demonstrate the properties of a circle to blind people and to those who can see, the properties of a square. Perhaps I should see a square and at the same time, feel a circle. No,' he would continue, 'I am wrong. Those people who witnessed my demonstration of the properties of the circle and the square did not have their hands on my abacus, and they couldn't touch the threads I had tied to make the outlines of my shapes; yet they could understand me. Therefore, they were not seeing a square when I was feeling a circle, otherwise we would never have understood each other for I should have been drawing one shape and demonstrating the properties of another, giving them a straight line instead of a curve, and a curve instead of a straight line. Yet since they all understood me, must everyone therefore see in the same way? I therefore see a square when they see a square and a circle when they see a circle. So that's what I have always called a square, and that's what I have always called a circle.'

I have substituted circle for sphere and square for cube, because it very much appears that we can only judge distance by experience, and as a result, someone using his eyes for the first time will only see surfaces and not understand projection, which consists in some of its points of a body seeming to be closer to us than others.

Yet even if the man-born-blind were able to judge of the projection and solidity of bodies from the very first moments of clear vision and tell the difference not only between the circle and the square but also between the sphere and the cube, I nonetheless do not believe he would be able to do the same for more composite objects. It would very much seem that Monsieur de Réaumur's girl-born-blind could tell colours apart, but I bet you thirty to one she guessed the sphere and the cube, and I am certain that, short of some revelation, she was unable to recognize her gloves, dressing gown and slippers. These objects are laden with so many modifications, and their overall shape bears so little relationship to the parts of the body they are designed to adorn or cover, that Saunderson would have found it a hundred times more difficult to work out what his square bonnet was for than it would be for Monsieur d'Alembert or Monsieur Clairaut to work out what his tables were for.[53]

Saunderson would not have failed to suppose there to be a geometrical relationship between things and their use and he would therefore have realized by means of two or three analogies that his skullcap was made for his head, since its shape has nothing arbitrary about it to mislead him. But what would he have thought of the corners and the tassel of his mortar board? 'What's the point of the tassel? And why four corners and not six?' he would have wondered. And those two features, which are a decorative matter to us, would have been the source of a whole host of absurdities to him or, rather, the opportunity for an excellent satire on what we call good taste.

All things seriously considered, we must confess that between someone who has always been able to see but who doesn't know what an object is for, and someone who knows what an object is for but has never been able to see, the latter does not have the advantage. However, do you believe, Madame, that, were you shown a headdress for the first time today, you could manage to work out that it is a dressing to go on your head? Yet if it is that much more difficult for a man-born-blind who can see for the first time to

judge correctly what an object is because of the many forms it can take, what would prevent him from thinking that an observer who was fully clothed from head to toe and sitting motionless in an armchair in front of him was not a piece of furniture or a machine, and that a tree with its branches and leaves waving in the wind was not a self-moving, animate and thinking being? Madame, how many things our senses suggest to us, and if we didn't have eyes, how difficult we would find it to suppose that a block of marble could not think and feel!

So it is obvious that it is only with respect to the circle and the square that Saunderson would have been sure his judgement was not wrong, and that there are cases in which the reasoning and experience of others can clarify how sight relates to touch, and teach the sense of sight that what is so for the eye is also so for the hand.

Yet it would nonetheless be essential in any attempt to demonstrate some eternally true proposition, as they are called, to test such a demonstration by performing it in the absence of sensible evidence because, Madame, you will see that were someone to set about proving to you that two parallel lines should be drawn on a plane as two convergent lines because that is how two paths look, he would be forgetting that the proposition is as true for a blind man as it is for him.

And the previous supposition regarding the man-born-blind suggests two more: one about a man who had been able to see since birth but had no sense of touch, and the other about a man whose senses of sight and touch constantly contradicted each other. It might be asked of the first man whether, were he accorded the sense he lacked and deprived of the sense of sight by a blindfold, he would be able to recognize the bodies by his touch. It is obvious that geometry, were he to have any knowledge of it, would provide him with an infallible way of discovering whether or not his senses contradicted each other. He would have only to pick up the cube or the sphere, demonstrate some of its properties to others and declare, provided they could understand him, that they were seeing as a cube what he was feeling as one, and that it was therefore the cube he was holding. As for the man who had no knowledge of this science, I think he would find it no easier to distinguish the cube and the sphere by his touch than Mr Molyneux's blind man would by his sight.

With respect to the man whose sensations of sight and

touch were in constant contradiction, I don't know what he would think of shapes, order, symmetry, beauty, ugliness, etc. It would very much appear that he would know as much about them as we do about the size and duration of animal life in relation to real space and time. He would make the general declaration that a body has a shape, but he would necessarily be inclined to think that it is neither the one he sees nor the one he feels. Such a man could easily be discontented with his senses, but his senses could neither be contented nor discontented with their objects. If he were tempted to accuse one of them of lying, I think it would be his sense of touch. A hundred details would incline him to think that an object changes shape when his hands act on it rather than when it acts on his eyes. Yet such preconceptions would mean that the different degrees of hardness and softness that he could observe in bodies would trouble him.

Yet if our senses do not contradict each other over shapes, does this mean that shapes are any better known to us? How do we know that our senses are not deceiving us? And yet we make judgements nonetheless. Alas! Madame, once we have weighed human knowledge in Montaigne's scales, we are not far from adopting his motto.[54] For what do we know? What matter is? Absolutely not. What mind and thought are? Even less so. What movement, space and duration are? Not at all. Geometrical truths? Ask any honest mathematician and he will tell you that his propositions are all identical, and that all those tomes devoted to the circle, for example, can be reduced to the same statement which they make in a hundred, thousand different ways, namely that it is a shape in which all the lines leading from the centre to the circumference are equal. We know therefore almost nothing, and yet how many works there are whose authors have all claimed to know something. I cannot imagine why people do not tire of reading and yet learning nothing, unless it is for the same reason that I have had the honour of conversing with you for two hours without either boring myself or telling you anything. I am, with the deepest respect,

MADAME,

Your most humble and most obedient servant,
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Notes

1 'They can, but they don't seem to be able to'. The line is adapted from Virgil; see above, pp. 24–6.
2 The real place of publication was Paris.
3 René Antoine Ferchault, Seigneur de Réaumur et de La Bermondière (1683–1757), member of the Académie Royale des Sciences [Royal Academy of the Sciences] since 1708 and elected its Director on eleven occasions. He was most famous for his six-volume study of insects, *Mémoires pour servir à l'histoire des insectes* [Memoirs for Use in the Study of Insects], 6 volumes (Paris: Imprimerie Royale, 1734–42).
4 According to Rousseau's *Confessions*, this remark may have been what triggered Diderot's arrest and imprisonment (Jean-Jacques Rousseau, *Confessions*, Angela Scholar (trans.), Patrick Coleman (ed., intro. and notes) (Oxford: Oxford World's Classics, 2008), p. 338).
5 Joseph Hillmer (born c. 1720), Prussian oculist; see above pp. 127–9.
6 She may be a relation of the Simoneau who was one the engravers of Réaumur's *Mémoires*.
7 The King's Garden [Jardin du Roi], directed by Georges Leclerc, comte de Buffon (1707–1788) since 1739.
8 There is some evidence for his real-life existence, see above pp. 38–41.
9 René Descartes, *Dioptrics* (1637). The figure reproduced in the *Letter* is taken from an eighteenth-century edition and differs in significant ways from the original; see above pp. 60, 72.
10 René Hérault, Seigneur de Fontaine-l'Abbé et de Vaucresson (1691–1740), Lieutenant General of the Paris Police (1725–1739).
11 This is a reversal of Montaigne's description of a good marriage as one between a blind wife and a deaf husband (*Essays*, in *The Complete Works: Essays, Travel Journal, Letters*, Donald M. Frame (trans.), Stuart Hampshire (intro.) (London: Everyman, 2003), p. 804).
12 Diogenes was a Greek Cynical philosopher, known for his lewd and provocative behaviour that challenged social customs.
13 For a history of this term, see Daniel Heller-Roazen, *The Inner Touch* (Cambridge, MA: MIT Press, 2007).
14 Descartes located the soul in the pineal gland, see *The Passions of the Soul* (1649), in *The Philosophical Writings of Descartes*, vol. 1.
15 For a discussion of medical theories of the nerves and brain, see Ann Thomson, *Bodies of Thought: Science, Religion, and the Soul in the Early Enlightenment* (Oxford: Oxford University Press, 2008), pp. 175–215.

16 For a history of this term, see Peter Dear, 'The Meanings of Experience', in *The Cambridge History of Science*, David C. Lindberg and Ronald L. Numbers (eds), 7 volumes (Cambridge: Cambridge University Press, 2003), vol. 3, pp. 106–31, especially the section entitled 'Event Experiments and 'Physico-Mathematics', pp. 124–30.
17 Pythagoras, Greek mathematician and mystical philosopher.
18 The Index reveals the English geometer to be Joseph Raphson (died 1712?); the phrase is to be found in Latin in the final lines of his work, *Analysis æquationum universalis, seu, Ad æquationes algebraicas resolvendas methodus generalis, & expedita, ex nova infinitarum serierum methodo, deducta ac demonstrata. Editio secunda cum appendice; cui annexum est, De spatio reali, seu entre infinito conamen mathematico-metaphysicum* (London: Typis T. Braddyll, prostant venales apud Johannem Taylor, 1697).
19 Nicholas Saunderson (1682–1739), mathematician, holder of the Lucasian Chair of Mathematics at the University of Cambridge (1711–1739), and author of the posthumously published *The Elements of Algebra, in Ten Books: by Nicholas Saunderson LL.D. Late Lucasian Professor of the mathematics in the University of Cambridge, and Fellow of the Royal Society. To which is prefixed, an account of the author's life and character, collected from his oldest and most intimate acquaintances*, 2 volumes (Cambridge: Printed at the University-Press: and sold by Mrs. Saunderson at Cambridge, by John Whiston bookseller at Boyle's Head in Fleet Street London, and Thomas Hammond in York, 1740).
20 There is no evidence for Saunderson's literary achievements; is the text is hinting that the Saunderson of the *Letter* is, at least in part, a literary creation?
21 Much of what follows is taken from John Colson, 'Saunderson's Palpable Arithmetic Decyphered', in Saunderson, *Elements*, vol. 1, pp. xx–xxvi.
22 This appears to be a mistake and should read 'right' not 'left'. Given Diderot's fondness for reversals and puzzles, it is not impossible that the mistake is deliberate, designed perhaps to test the limits of the reader's concentration.
23 See Saunderson, *Elements*, vol. 1, p. xxiv.
24 See Saunderson, *Elements*, vol. 1, p. xxiv.
25 See Saunderson, *Elements*, vol. 1, p. xxiv.
26 See Saunderson, *Elements*, vol. 1, p. xxiv.
27 See note 18.
28 See Saunderson, *Elements*, vol. 1, p. iv.
29 The Index reveals 'Monsieur de M . . .' to be Pierre Carlet de Chamblain de Marivaux (1688–1763), journalist, novelist and

playwright. A number of the ideas in the preceding section echo his 'Du Style' [On Style]. See *Le Cabinet du philosophe* (1734) in *Journaux et œuvres diverses* (Paris: Garnier, 1969), pp. 380–88.

30 Tacitus, Roman historian, known for his difficult Latin.

31 George Berkeley, *Three Dialogues between Hylas and Philonous* (London: printed by G. James for Henry Clements, 1713); a French translation, *Dialogues entre Hylas et Philonous*, by the mathematician and Encyclopedist, Jean Paul Gua de Malves (1713–1785), was published in Amsterdam in 1744.

32 Etienne Bonnot de Condillac, *Essay on the Origin of Human Knowledge* [1746], Hans Aarsleff (trans.) (Cambridge: Cambridge University Press, 2001).

33 This is a close quotation of the first paragraph of the first chapter of Condillac's *Essay*, which reads 'Whether we raise ourselves, metaphorically speaking, into the heavens or descend into the abyss, we do not go beyond ourselves; and we never perceive anything but our own thought' (p. 11). The omission of the qualification, 'metaphorically speaking', is key to enabling the comparison with Berkeley.

34 It had appeared earlier in 1749.

35 See Saunderson, 'Memoirs', in *Elements*, vol. 1, p. xii.

36 These are all famous blind men of antiquity, listed in Saunderson, 'Memoirs', in *Elements*, vol. 1, pp. ix–x.

37 Gervaise Holmes seems to have been Saunderson's vicar, see Saunderson, 'Memoirs', in *Elements*, vol. 1, p. xix.

38 References to this 'Indian' philosophy can be found in a number of French and English writers of the period; see Fontenelle, 'Premier Soir' [First Evening], *Entretiens sur la pluralité des mondes* [Conversations on the Plurality of Worlds] (1686); Locke, *Essay Concerning Human Understanding* (1690), book 2, chapter 13, paragraph 9, and chapter 23, paragraph 2; Maillet, *Telliamed, ou, entretiens d'un philosophe indien avec un missionnaire français sur la diminution de la mer* [Telliamed, or Conversations between an Indian Philosopher and a French Missionary on the Diminution of the Sea] (c. 1692–1708, publ. 1748); Shaftesbury, *The Moralists* (1711), Part 1, section 2; Diderot, *De la suffisance de la religion naturelle* [On the Sufficiency of Natural Religion] (1746), paragraph 22.

39 These three names had been associated with each other since the publication in 1717 of parts of the correspondence between Leibniz and Clarke, in which the latter defended Newton's ideas, notably those on the attributes of God, against Leibniz's criticisms, see *The Leibniz-Clarke Correspondence*, H. G. Alexander (ed.) (Manchester: Manchester University Press, 1956).

40 Much of what follows echoes Lucretius, *De Rerum natura* [On the Nature of the Universe], book 4, lines 835–860 and book 2, lines 1060–70.

41 His question echoes that asked by the disciples to Jesus, see John 9.2.

42 See Saunderson, 'Memoirs', in *Elements*, vol. 1, p. xix.

43 The title is close to that of the 'Memoirs of the Life and Character of Dr. Nicholas Saunderson', but no such work has been found.

44 See Saunderson, 'Memoirs', in *Elements*, vol. 1, p. xii.

45 Democritus, Greek atomist philosopher. The story about him gouging out his own eyes is reported in, for example, Aulus Gellius, *Noctes Atticæ* [Attic Nights], book 10, chapter 17.

46 See Locke, *Essay*, book 2, chapter 9, paragraph 8.

47 Ibid.

48 Condillac's discussion of Molyneux's Problem is to be found in the *Essay*, pp. 100–10.

49 It had appeared in 1738.

50 They are to be found at the end of the first part of Condillac's *Essay*.

51 See Condillac, *Œuvres philosophiques*, Georges Le Roy (ed.), 3 volumes (Paris: Presses Universitaires de France, 1947), vol. 1, p. 134.

52 This is an echo of Pascal's comparison between the two writers (*Pensées and Other Writings*, Honor Levi (trans.), Anthony Levi (intro. and notes) (Oxford: Oxford World's Classics, 2008), p. 139). This edition uses the Sellier classification and gives the fragment as number 644.

53 Jean Le Rond d'Alembert (1717–1783), mathematician and co-editor with Diderot of the *Encyclopédie*; Alexis Claude Clairaut (1713–1765), mathematician.

54 Montaigne's motto was 'Que sçays-je?' [What do I know?] inscribed over a pair of scales, see Montaigne, *Essays*, p. 477.

55 The Index is Diderot's.