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# AN UNPUBLISHED LETTER FROM CHARLES BABBAGE F.R.S. TO PIERRE PREVOST

BY

**Paul A. TUNBRIDGE**

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In a letter written in 1827, Babbage set out for his friend Pierre Prevost of Geneva the details of his defective eyesight. A Professor at the Geneva Academy, of which he was a former Rector, Prevost had been elected a Foreign Member of the Royal Society in 1806 and was the author of a number of scientific works including a paper on the laws of vision published in the *Transactions* of the Royal Society of Edinburgh in 1807. His scientific interests were very wide, however, and his advice was often solicited by distinguished scientists in a number of countries.<sup>1</sup>

It appears that Prevost had asked for some details on the hygrometers used in England, probably in connection with his experiments on dew on which subject he was something of an expert as is shown by his correspondence with William Charles Wells particularly in 1815.<sup>2</sup> In his reply, Babbage refers to the dew-point hygrometer invented by John Frederic Daniell (1790-1845) who became famous with his *Meteorological Essays* published in 1823.<sup>3</sup> The "hair hygrometer" mentioned by Babbage would not have performed well when subjected to extremes of temperature or drought.<sup>4</sup> The Captain Parry referred to was of course the arctic explorer who had sailed from the Nore a fortnight previously in an attempt to reach the North Pole from Spitzbergen by travelling with sledge-boats over the ice and spaces of open water. The following year Parry published his *Narrative of an Attempt to reach the North Pole, etc.*, and was knighted in 1829.<sup>5</sup>

Babbage looked upon his mechanical notation as one of the most important additions he had made to human knowledge. In his own words "it placed the construction of machinery in the rank of a demonstrative science. The day will arrive when no school of mechanical drawing will be thought complete without it".<sup>6</sup>

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<sup>1</sup> A Cherbuliez, *La vie et les travaux de feu Pierre Prevost*, Geneva, 1839

<sup>2</sup> The subject of a forthcoming article by the Author.

<sup>3</sup> D.N.B.

<sup>4</sup> Chambers *Encyclopedia*

<sup>5</sup> D.N.B.

<sup>6</sup> Babbage, *Passages from the Life of a Philosopher*, London, 1864, p. 452

In 1826, Babbage had had two papers published on signs: "On a method of expressing by Signs the action of Machinery"<sup>1</sup> and "On the influence of Signs in Mathematical Reasoning".<sup>2</sup> He was in no doubt of the importance of the universal acceptance of the same notation so that all who used the signs would speak the same language. The first of these two papers was prepared with a view to the award of the *first* Gold Medal awarded by the Royal Society. It was a bitter disappointment to him that his "mechanical notation" which he named it did not gain for him this award.<sup>3</sup>



Charles Babbage, F.R.S.  
(1792-1871)

In his paper he stated his conviction "from experience of the vast power which analysis derives from the great condensation of meaning in the language it employs". He said that it had not taken long for him to decide that the most favourable path to pursue was to have recourse to the language of signs. Such a notation should be at once simple and expressive, easily understood at the commencement, and capable

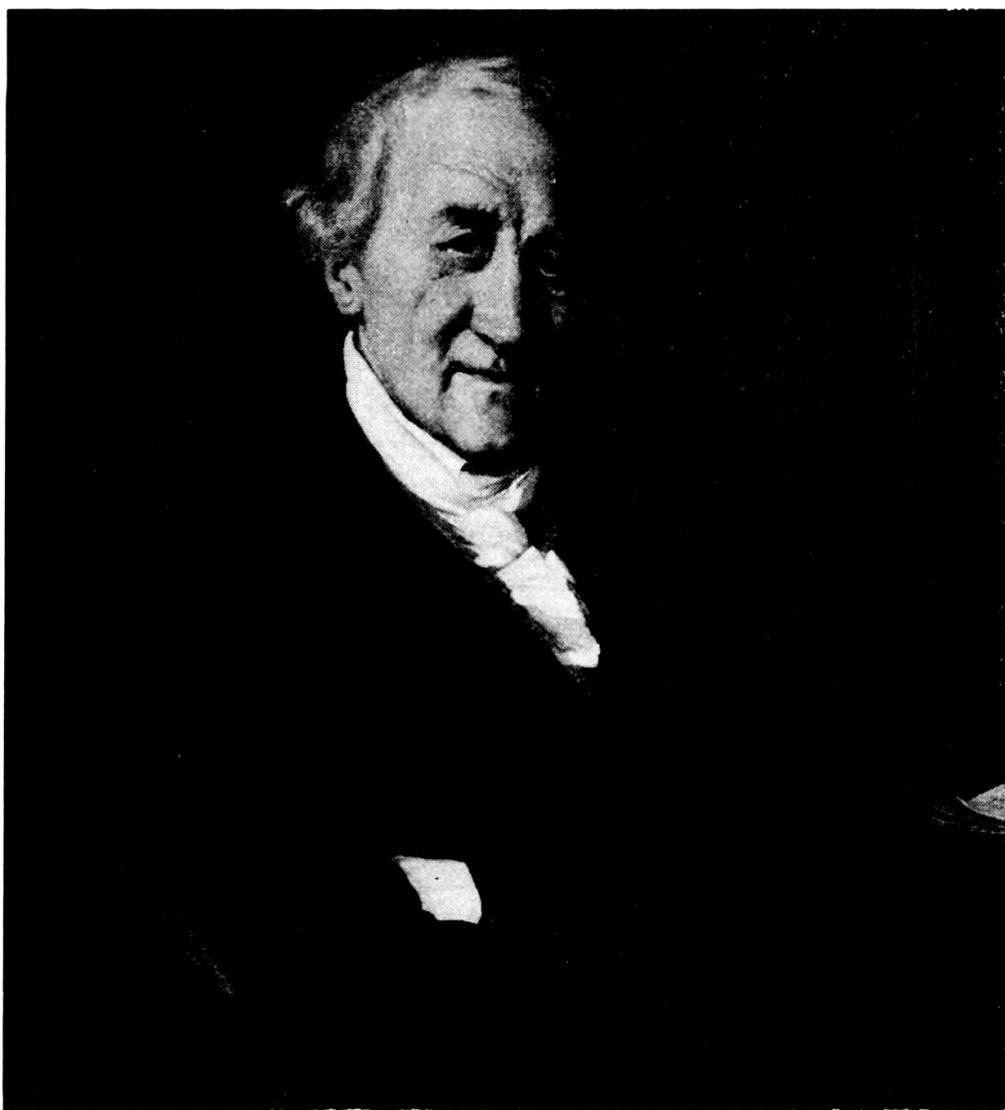
<sup>1</sup> *Phil Trans*, 1826, Vol ii, p. 250

<sup>2</sup> *Trans Cam. Phil Soc.* 1826, p. 218

<sup>3</sup> Babbage, *op. cit.*, pp. 142-146

of being readily retained in the memory from the proper adaptation of the signs to the circumstances they were intended to represent.<sup>1</sup>

It is most probable that Babbage was suffering from astigmatism or conceivably had some form of oculo-motor muscle anomaly, some form of strabismus, or latent strabismus, although astigmatism was probably the primary cause. There are various ways in which the condition may be alleviated, and in the early history of the subject, the condition was corrected by tilting the lens, or head. Presumably the concave lens referred to by Babbage was a spherical lens, which in itself would have altered the relationship of light rays travelling in two meridians at right angles, with respect to their focus on the retina. It would appear that the concave lens in Babbage's case solved the problem to a great extent.



Pierre Prevost F.R.S.  
(1751-1838)

<sup>1</sup> *Phil Trans, op. cit.*

Devenshire Street,  
Portland Place.  
19.4.1827.

My dear Sir,

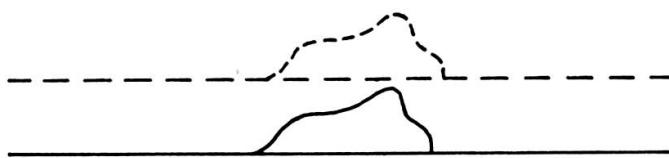
I received from your son a few days since your note of enquiry relative to the defect in my eyes. I will state the facts relative to it and shall be happy if it can be of any use to you in your reasonings or enquiries on the subject of vision. I have no objection to its being published if you think it can be of the least use.

1. I see two images of objects vertically above each other with both eyes or with either separately whenever I look at an object without constraining my eyes.
2. The upper image is fainter than the lower or real one and is separated from it by 12 minutes of a degree.
3. When I am in an ill state of health the second image becomes stronger but (I believe) its angular distance is not altered.
3. [sic] An account of the small distance between the images near objects do not appear double but an undistinctness is apparent about their edges. The most remarkable object is the distant horizon which always appears double. Stars are to my eyes so undistinct that I cannot say I see them double but clouded. I first noticed the fact by looking at the horizon when travelling.
4. When I look through a small hole in a card or through a very small opening between my fingers and thumb (which I frequently do in order to see more distinctly) I lose the first image. I can also get rid of the faint image by inclining my head forward and looking out under the eyebrow so that the ray from the object just grazes it.

I see only one image when looking through a concave lense with one eye. I can also get rid of the faint image by frowning but the effort must be great.

From the statement you will see that I could not directly measure the distance of the two images with a sextant or any instrument having a telescope. My method was as follows. Near my father's house on the sea coast there rose from the sea near the horizon a high rock. To me there always appeared two images the farthest one is above the other.

I walked from the rock into the country until the faint image of the horizon appeared just to graze the top of the rock, the ground rises inland. I then measured the angle subtended by the rock itself with a pocket sextant—this angle is the same as the distance between the two images of the horizon which I could not measure directly because on looking through a telescope or small aperture the faint image disappears.



I have made enquiries relative to the hygrometers used in this country and find that scarcely any are employed but those of Mr Daniel<sup>1</sup> or similar ones which give the dew point. Indeed it is difficult to get others at the instrument makers. Lieut. Forster<sup>2</sup> who was with Capt. Parry<sup>3</sup> only took Daniel's. A friend of mine lately sent to Paris for one of the hair hygrometers but does not speak highly of it.

I was highly gratified by your remarks on my paper on the influence of signs.<sup>4</sup> I have profited I hope by several of them as you will perceive in the memoir on notations which is just gone to the press.

In the copy of the paper of Mr Dufour explanatory of the mechanical notation which you were so kind as to send I have noticed the use of a sign

<sup>1</sup> J. F. Daniel, F.R.S., a Professor of Chemistry and a Meteorologist.

<sup>2</sup> Edward Forster, F.R.S.

<sup>3</sup> W. E. Parry, F.R.S. (North Polar Expedition).

<sup>4</sup> On enumerating those modes in which motion is usually communicated, it appeared that they may be reduced to the following.

One piece may receive its motion from another by being permanently attached to it as a pin on a wheel, or a wheel and pinion on the same axis.

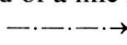
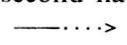
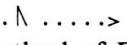
One piece may be driven by another in such a manner that when the driver moves, the other also always moves; as happens when a wheel is driven by a pinion.

One thing may be attached to another by stiff friction.

One piece may be driven by another, and yet not always move when the latter moves; as is the case when a stud lifts a bolt once in the course of its revolution.

One wheel may be connected with another by a ratchet, as the great wheel of a clock is attached to the fusee.

(Extract from *Phil. Trans.* paper by Charles Babbage on "A Method of Expressing by Signs the Action of Machinery", London, 1826, p. 5.)

One piece may receive its motion from another by being permanently attached to it as a pin on a wheel, or a wheel and pinion on the same axis.	This may be indicated by an arrow with a bar at the end. 
One piece may be driven by another in such a manner that when the driver moves, the other also always moves; as happens when a wheel is driven by a pinion.	An arrow without any bar. 
One thing may be attached to another by stiff friction.	An arrow formed of a line interrupted by dots. 
One piece may be driven by another, and yet not always move when the latter moves; as is the case when a stud lifts a bolt once in the course of its revolution.	By an arrow, the first half of which is a full line, and the second half a dotted one. 
One wheel may be connected with another by a ratchet, as the great wheel of a clock is attached to the fusee.	By a dotted arrow with a ratchet tooth at its end. 

which has perhaps been altered in copying as it is one which is important and as it is also of great consequence that all who employ these signs should speak the same language I will mention it. If motion is communicated from A to B they are connected by an arrow. I have placed the point of the arrow in contact with the line indication B and my . . is that an arrow has already been employed as a sign indicating the direction of a stream or river and will naturally suggest the direction in which power is transferred. Possibly the use of this sign in M. Dufour's paper is a mistake in copying or perhaps there may be some stronger analogy which directs it and which I have not caught. At all events I am most fortunate in having the subject taken up by so able an engineer and I shall greatly rejoice at seeing it applied to other machines. Colonel Colby<sup>1</sup> has contrived a very simple *notation* for impressing on the maps of his new survey of Ireland the boundaries between Countries, Baronies, Parishes and Townlands as well as all the possible combinations of these divisions.

Another friend of mine Mr Whewell<sup>2</sup> has just made a simple notation for crystallographs so that the proper use of signs and notation is spreading over other sciences beside mathematics. I have received the honorary diploma which I am indebted to your partiality and kindness

Believe me my dear Sir,  
 With the greatest respect and regard,  
 Very sincerely yours  
 C. BABBAGE.

#### ACKNOWLEDGEMENTS

I should like to thank the Director of the Public University Library Geneva for permission to reproduce Charles Babbage's letter and I am most grateful to Professor John R. Levene, Chairman of the Division of Optometry, Indiana University, who was kind enough to comment upon the brief description I gave him of Babbage's defective vision.

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<sup>1</sup> Colonel Thomas Colby, R.E., F.R.S.

<sup>2</sup> William Whewell, F.R.S.