THE HERSCHEL CONDITION

By Brian Warner

There is an advanced concept in the design of imaging optics, used to ensure aberration-free images after passage through a series of optical elements, published in 1821 in the *Philosophical Transactions* by John Herschel and known as The Herschel Condition.[1] The present article has nothing to do with that. Instead, the expression suggested to me that it might be a good occasion to praise a great human being, and interesting to trawl through the extensive Herschel publications and correspondence for personal comments to discover Herschel as a person, rather than as a dry Victorian scientist, albeit one of the leading researchers and philosophers of the nineteenth century. The correspondence is huge, preserved in libraries and archives around the world but made accessible through a project that paralleled a similar effort made for the Charles Darwin letters. The Herschel Calendar lists and summarizes 14 815 letters.[2]

John Frederick William Herschel and his family arrived at the Cape of Good Hope in January 1834, John to complete the survey of the sky which his famous father William Herschel (discoverer of the planet Uranus and of infrared radiation) had begun in the 1780s. A great deal has been written about John Herschel, as polymath, scientist, philosopher and artist, but here, unusually, we are interested in him as a human being, and as a scientific instrument in his own right — what can be deduced about his personal sensitivities to physical stimulations such as light, sound and smell?

First, of Herschel's optical proficiency there is no doubt — made evident through the published results of the years that he spent at the telescope. The most telling relative assessment is the comment by the historian Agnes Clerke: "[his telescopes] certainly afforded him better

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1 J. W. C. Gates and J. Maxwell, *John Herschel 1792 – 1871: A bicentennial commemoration* (London: The Royal Society, 1992): 101.

2 John Hershel, *A calendar of the correspondence of Sir John Herschel*, M. J. Crowe, D. R. Dyck & J. R. Kevin, eds. (Cambridge: Cambridge University Press, 1998).

views of the nebulae than had been obtained by his father",[3] which has been attributed[4] both to more skillfully polished telescope mirrors and to better eyesight (perhaps merely that of a younger man — father William was nearly fifty years old when he started his survey) and resulted in John finding 525 faint northern nebulae and clusters that were overlooked by his father. John himself, out of filial respect, avoided making this comparison. The final product of Herschel's complete survey of the sky (the only one conducted before the introduction of celestial photography at the end of the nineteenth century), of which the southern portion was published in 1847,[5] is a monument to his ocular abilities and stoic labours.

But the eye does not exist as a mere detector — the eye-brain combination is crucial and is revealed most clearly in its artistic applications. Again we have a succinct statement concerning John Herschel — his aunt Caroline (William's sister) wrote "I heard Hauptman Müller wishing to have but one of John's Talents, viz. that of drawing";[6] Georg Müller was an artist and engraver in Germany and produced many of the best known admirable portraits of members of the Herschel family. But the proof lies in the end product: Herschel made over 750 drawings in his life, all but a few using the *camera lucida*, an optical device invented by William Wollaston (a friend of William Herschel) which enables accurate outlines and perspective to be achieved but leaves the finished quality entirely in the skill of the artist.[7] Several books have been published containing Herschel's drawings.[8,9,10] Here we draw attention to the amazing eye-brain-hand

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[3] Agnes Mary Clerke, in Agnes Mary Clerke, Alfred Fowler & J. E. Gore, *The Concise Knowledge Astronomy* , 2nd ed. (London: Hutchinson & Co., 1912): 23.

[4] Brian Warner, "John Herschel at the Cape of Good Hope", *Transactions of the Royal Society of South Africa*, 49 (1994): 19.

[5] John Frederick William Herschel, *Results of astronomical observations made during the years 1834, 5, 6, 7, 8 at the Cape of Good Hope* (London: Smith, Elder & Co., 1847).

[6] C. Herschel, Biographical note on John Herschel, 27 May 1838, in *Herschel Papers* (University of Texas, Austin: Harry Ransome Humanities Research Center): M1084.

[7] David Hockney, *Secret knowledge* (London: Penguin Putnam, 2006).

[8] L. J. Schaaf, *Tracings of light* (San Fransisco: The Friends of Photography, 1989).

coordination of John Herschel: an example is given in Figure 1, which is a detail from his sketch made on 29 September 1827 of the suspension bridge over the Menai Straits. Note the perfect convergence and divergence of the steel suspension hawsers. In none of Herschel's drawings is there any sign of any erasure or ammendment — he was able to put onto paper exactly what he had in mind, and with considerable rapidity. One of his skills was an ability to indicate the texture of foliage so well that it is often possible immediately to identify the species of tree. A similar artistic coordination is seen in the finest surviving Stradivarius violin — *Le Messie*, in the Ashmolean — where the double purfling ornamentation inset around the outside of the belly was cut freehand and is machine perfect. Whenever I am in Oxford I pay homage to *Le Messie*.

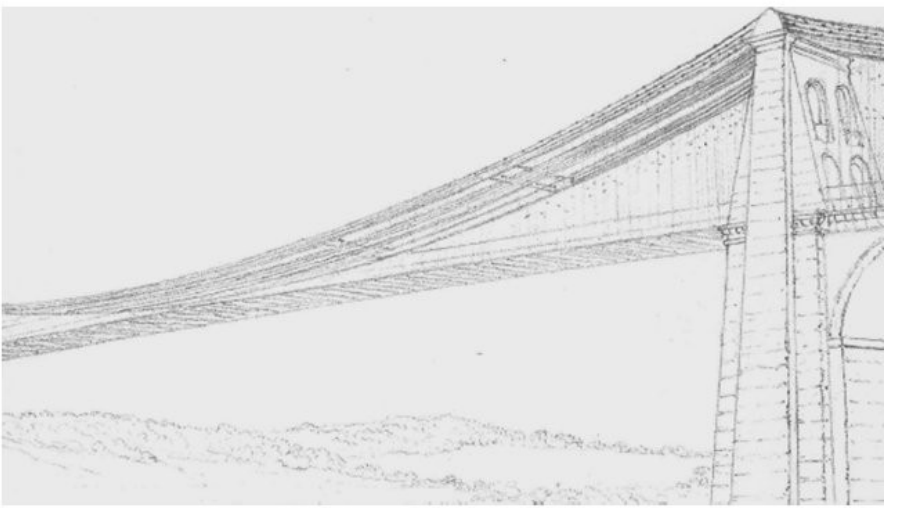

Figure 1. Detail from Herschel's drawing of the bridge over the Menai Straits. Original dimension 110 x 50 mm.[11]

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[9] Brian Warner & J. Rourke, *Flora Herscheliana* (Johannesburg: Brenthurst Press, 1996).

[10] Brian Warner, *Cape landscapes* (Cape Town: University of Cape Town Press, 2006).

[11] Schaaf, *Tracings of light*.

The Herschels' response to the natural floral beauty when they arrived at the Cape was simply to be dazzled. John and his wife Margaret relaxed during their four years in Wyberg by generating over one hundred exquisite water colours, John outlining in superlative detail in pencil, and Margaret brushing in the colour. I don't know of another example of such successful conjugal artistry. The paintings have been published by the Brenthurst Press.[9]

Next, Herschel's hearing. Though far from genetically preordained, it is not surprising to find that John, the son of a composer/performer, was a good musician — (an extant descendant, John Herschel-Shorland, plays John's baroque-pitch flute and his cousin Anthony Herschel Hill is a composer). Aunt Caroline, in the note praising his artistry (see *supra*) added that even before going to university "…he was a good poet …a good Pianoforte player; afterwards an excellent flute". The emphasis that an enamoured John placed in a letter to his mother on his intentions to marry Margaret is also significant: "One of her talents (for she has talents of the first order) will win your heart through your ear — She is a most divine musician — Oh! You should hear her play Mozart's music — and her singing is the sweetest, most touching, gentle, unpretending thing you ever heard".[12] He evidently possessed absolute pitch — in his diary for March 1836 (and again in November 1837) under *Occasional memoranda*, he reports of a nightjar's song "The Goat Sucker (March 30th & 31st) very loud and frequent in the woods at night" and draws a staff on which he accurately notates the song (Figure 2.).

For his acuity of hearing we have the statement by his wife that, from the top of Table Mountain, overlooking Cape Town, "Herschel said he could hear the church clock sound from below", which was not attested by any of the rest of the party.[13]

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12 Letter from John Herschel to Lady Mary Herschel, 15th December 1828 in *Herschel Papers* (University of Texas, Austin: Harry Ransome Humanities Research Center): UT L0516.

13 Brian Warner, *Lady Herschel, Letters from the Cape 1834 – 1838* (Friends of the South African Library, 1991): 138.

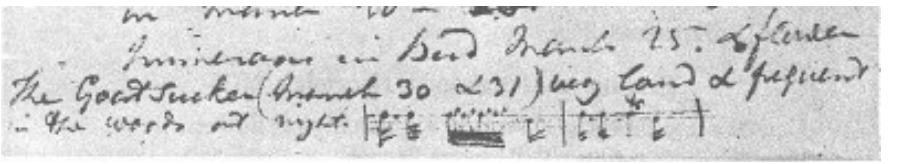

Figure 2. Detail from Herschel's diary for March 1836.[14]

Next, Herschel's olfactory organ. Unlike Galileo's finger, which was taken *post mortum* from the funeral cortège and is still on display in Florence,[15] John Herschel's nose remained attached to its owner, buried next to the tomb of Isaac Newton in Westminster Abbey. And we have unusual evidence that it was a very retentive nose, judging from a letter by Herschel to Irishman William Henry Harvey, undated but written in response to an enquiry from Harvey about the scents of Cape flowers;[16] the latter himself replied on the 6th of November 1837 which dates the sequence. [17] Harvey became Colonial Treasurer at the Cape of Good Hope almost inadvertently — he thought he had been offered the post but through a clerical error it was his brother Joseph who had been appointed. They both sailed to the Cape, arriving in September 1835, but Joseph's health declined and they returned to England in April 1836, Joseph dying on the voyage. William then was (re)appointed to replace him and sailed back to the Cape. But Harvey was rather more than a competent finance manager — already he had a reputation as a botanist of distinction, soon to publish the earliest South African Flora[18] and, post-Cape, became one of the leading Victorian botanical experts. At the Cape Herschel and Harvey became close friends, Herschel submitting to the latter the results of his bulb-collecting expeditions for identification; when Herschel sailed back to England in April 1838 he took with him a collection of some hundreds of bulbs packed in dry sand, most of which he managed to grow on — incidentally causing him to be recognised as an authority on Cape

[14] David Stanley Evans, Terence J. Deeming, Betty Hall Evans and Stephen Goldfarb, eds., *Herschel at the Cape* (Balkema, Cape Town, 1969).
[15] Peter Atkins, *Galileo's finger* (Oxford University Press, 2003).
[16] Wellcome Trust, Wellcome Institute of Medical History Library, London, WT 65667.
[17] Royal Society of London, Herschel Papers, HS 9.244.
[18] William Henry Harvey, *Genera of South African plants* (Cape Town: Robertson, 1838).

bulbs, consulted by the Hookers, successive Directors of Kew Gardens.

Harvey's original letter of enquiry about scents has not survived, but his the 6th of November comment enumerates one reason why he asked: "Unfortunately my nose is a very undiscriminating one — I can therefore say little on the smells of our wild flowers, which unless they be very strong indeed, I cannot perceive". Herschel's nose, on the contrary, was a sensitive detector — used as an analytical instrument:

> …but the subject of vegetable odours is perhaps as curious a one as any. I distinguish among the Cape scents several quite separable although often coexisting in the same flower and cannot but believe that these depend on certain definite chemical compounds which these plants in common with others secrete in more or less quantity.
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> First on the list stands the odour of the Tonquin bean which I believe to exist in some kinds of hay — in the intense scented Morea of the Constantia flats (now spreading into this neighbourhood) and in the Gladiolus Viperatus — in the two latter to an extraordinary degree. The Tonquin bean has no pungency [?] does not cause sneezing or produce cough. In many [people] the odorous principle is evidently accompanied with a violent irritating one, that which produces the 'Hay asthma' which I have myself experienced on one occasion in the form of a cough lasting several days — of a very painful kind & hardly allowing any rest. Something similar to what arises on breathing chlorine.
>
> The same irritating principle exists in an inferior degree in the Gladiolus & somewhat more in the Morea. In the 'Sneeze-wood' it is uncombined with the odorous principle — if the same.
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> Second the peculiar scent of the Orange flower. This occurs in perfection in the Hesperantha (? Pilosa) — the white Satyrium of the flats — less intense but equally grateful in a small-

> rooted, early flowering, yellow Anthericum or ? Bulbine — not to mention the yellow Jasmine or that white flower they call the Cape Jasmine in w^{c} it is mixed with another scent.
>
> Spicy flavours. Thirdly Cinnamon — in the early green Satyrium common under the shade of Shubberies — ? cucullatum? Pepper — most intense and ridiculously characteristic in the commonest of all the Satyriums just now out of flower. Why not call it Sat^{m} Piperitum? Ginger — In the Hesperantha (? Spathaeca) the richest of the Hesperantha scents — in which it occurs mixed with & almost over powered by that of honey. It is worth remark that this is almost the only flower I can call to mind (except perhaps the Sunflower and that only in certain states) which recalls the flavour of honey, though honey is a product of all flowers. I am reminded of a small white heathy plant hereabouts with a powerful honey scent. Does the odorous principle of honey than depend on a secretion from the bee and not the flower? Bees are all in bed when the Hesperanthus opens. The young leaves of the common …poplar in early spring often scent of honey and so does the fir tree of our avenues in very hot sunny and calm days — but it is not then flowering. The intensity of honey scent which is felt on the road to Kirstenbosch is due to an insect — an Aphis inhabiting the Caffer Chestnuts. Pimento — The Satyrium Herscheliae (the only specific name of which I feel certain).

We see here the all round enquiring scientist at work. But let us divert attention briefly but helpfully to still-life painting — which exploded in the 16th century concomitant with growth of interest in the natural world. Thousands of paintings were commissioned — ranging from the Florentine Medici court to those chosen by merchants who wished to be seen as successful.[19] Caravaggio in particular, at the beginning of the 17th century, pioneered painting of life-like baskets of fruit decorated by sprigs of vines and flowers, which have influenced artists

[19] L. Jardine, *Wordly goods*: *A new history of the Renaissance* (London: Macmillan, 1996).

ever since.[20] Throughout that century oil paintings of flower groups in vases flourished, particularly in Flanders and the Netherlands, usually with symbolic significance to the choice of the flowers. Although deliberately constructed to be as realistic as possible, these paintings were in fact idealised and often false in content, in that they depicted flowers that did not bloom all at the same time of year. Of course, the artists had only to look at their old sketch books to assemble a suitable Elysian[21] field for the purchaser.

What has all this to do with Herschel's description of flower scents? It arises through realising that in late summer, when the exchange between Herschel and Harvey took place, probably only one of the species listed by Herschel was in flower: he was assembling a group of scents from memory (there is nothing in his diaries or papers to suggest that he recorded olfactory impressions as they occurred). A few explanatory comments may be in order:

The tonquin (or tonka) bean (*Dipteryx odorata*), seed of a tree native to Brazil and Guiana, containing the aromatic coumarin, tasting of almonds or hay, used as a vanilla substitute in some countries, but banned in others because overdose causes heart and liver problems. Herschel's comment on a resemblance to breathing in chlorine is not unexpected — he was one of the leading experimental chemists of his day. Constantia Flats moreas; of the two common moreas at the time, *Morea papilionacea* is the most likely — it is sweet scented and blooms from August. The other flower, *Morea aristata*, now very rare, has almost no scent. Sneeze-wood, *Ptaeroxylon obliquum*, a member of the citrus family, was common in Herschel's time at the Cape; it can cause respiratory complications. *Hesperantha (?) pilosa*, which Herschel refers to as the white satyrium of the flats, and mentioms in his diary "the Great sweet scented Satyrium (white)" is probably *Satyrium candidum*,

[20] Edward Saunders, lecture series at University of Cape Town Summer School, 2011.

[21] The word *Elysium* is thought to be derived from the place where people struck by lightning (*enelysion)* live in peace surrounded by beautiful flowers.The author almost joined them recently – Zeus missed by about 4 metres, hitting instead an innocent lamp post of greater height, intellect and conductivity.

flowering September to January. Anthericum, or Bulbine — not definitely identified, but Herschel himself says that it is early flowering. Cape Jasmine is the well known strongly scented *Gardenia Jasminoides*. Commonest Satyrium — said by Herschel to be just out of flower: probably *Satyrium carneum*, which blooms from September. *Satyrium Herscheliae*, now known as *S. erectum* (the genus originally called *Herscheliae* by Harvey, intending to pay tribute to Margaret Herschel, was preempted by a different name assigned by the botanist John Lindley). Described as having a pungent scent by Hamman in a very interesting general article on the scents of South African orchids;[22] Herschel's 'pimento' is rather more creatively descriptive.

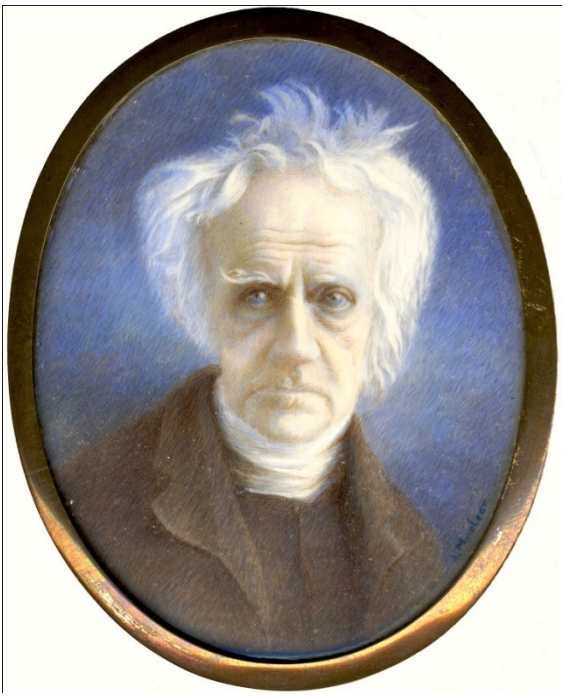

Figure 3. Watercolour of John Herschel after an 1867 photograph by Julia Margaret Cameron.[23]

[22] Linet Hamman, *Project Fragrance*, http://www.orchidssa.co.za/Project fragrance.htm. More generally see Steven A. Frowine, *Fragrant Orchids* (Portland OR: Timber Press, 2005).

[23]Artist unknown, but probably Augusta Emily Maclear, daughter of Herschel's colleague at the Royal Observatory, Cape of Good Hope. From

John Herschel was big hearted in both senses of the expression. Early in the voyage to Cape Town, writing to Herschel's cousin Mary Baldwin, Margaret asks "what dose would you propose Cousin Mary for a man with a pulse at 46".[24] Such a pulse rate is near the lower end of the range for highly active athletic males, which Herschel was not noted as, and might be diagnosed as bradycardia — but he survived until his eightieth year, albeit in poor health through most of his life. He was described as having 'delicate' health while a child and suffered particularly from neuralgia — complaining frequently of "sinkings" while at the Cape (Dutch "zinkings" — described by Herschel as "a most excruciating and distressing form of Rheumatism which is the great plague of this Climate")[25] — and endless rheumatism and bronchitis in England for the rest of his life — unlike his father who was robust almost to the end.

Drawings and photographs of him show a haggard visage, which gave a superficial appearance of a melancholic character, but at least within his family nothing could be further from the truth. There are many references to Herschel as a good family man, the following description by Maria Mitchell, a leading American astronomer, who visited the Herschels in 1857, is characteristic:

> After dinner the family assembled in the drawing-room, and the elder daughters were introduced to me. There were twelve children, although Lady Herschel seemed young and was still handsome; she must have been fifty years old. Sir John was at that time sixty-six years old, but he looked much older, being lame and much bent in his figure. ...In the evening we played with letters, putting out charades and riddles, and telling anecdotes. Sir John joining the family party and chatting away like the young people", and added "I could scarcely believe when I saw Sir John Herschel in his family, guessing conundrums with the children, playing at spelling, and telling funny anecdotes,

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the Hardcastle Archive, at Armagh Observatory.

[24] Letter Margaret Herschel to Thomas and Mary Baldwin (8 December 1833), quoted in: Warner, *Lady Herschel,* 19.

[25] Letter, J. Herschel to F. Baily, Royal Society Herschel Papers, HS. 3.138.

> that he was the same man of whom one had said to me when I first landed in England, 'He is living at Hawkhurst, not very well, and not very good-natured'. Probably the expression on his countenance of physical suffering has been mistaken for ill temper".[26]

Despite his poor physical health, John Herschel maintained his alert intellect. As if to re-establish his early proficiency at classics, in his late life he translated the whole of Homer's *Iliad* into English hexameter form, published in a 550 page tome[27] — even then looked on as an out-moded form, but accepted as a more accurate rendering of the original.

There is less latitude nowadays for scholars to reveal the full range of their talents — the demands of early and sustained specialisation in order to generate academic recognition probably limits development of alternate skills. There must be as many, indeed more, polyhedric individuals in the twenty-first century as in the nineteenth, but they are not as conspicuous. There were many in the 1800s who successfully combined talents both sides of the putative two cultures divide. If any vote is needed in Herschel's case, both the eyes and the nose have it!

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[26] Maria Mitchell, "Maria Mitchell's Reminiscences of the Herschels", *The Century* 38 (1889).

[27] J. F. W. Herschel, *The Iliad of Homer, translated into English accentuated Hexameters* (London: Macmillan, 1866).

"Near Feldhausen", watercolour by John Herschel. [28]

[28]A previously unknown Herschel landscape which is not included in his own catalogue of Cape Landscapes; the locale is inscribed on the back and it is signed JFWH (John Frederick William Herschel). From the Hardcastle Archive.