Phrenology—a myth behind Darwinism

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The history of the phrenological movement is reviewed, focusing on its influence on evolutionary thought, specifically on Darwin himself as well as the co-founder of evolution, Alfred Russell Wallace. Why the movement became enormously popular, and the harm it caused by diverting attention from better theories of behaviour causation, is explored. Other harm it caused included fostering racism, and indirectly helping to open the door to materialism, naturalism, and Darwinism. The idea has been rejected today with solid scientific evidence. It is not only baseless but irresponsible, and has misled many people due to its erroneous conclusions. Ironically, it was empirically disproved only in 2018.

On my desk sits a white porcelain phrenology model of a bald human head covered with words and lines representing different brain areas. Phrenology theory essentially interprets bumps (called peaks) on the skull surface as brain areas that are more developed, and indentations (called valleys) as brain areas that are less developed (see figure 1). Phrenology focused only on surface head features, not the brain's interior, which is the proper study of the brain.[1] Phrenology was mainstream for decades until it was largely debunked by several limited studies in the early 1900s. It was empirically totally discredited only in 2018 by the largest, most carefully designed study ever completed on phrenology. This study used MRI neuroimaging on 5,724 subjects, producing 40,962 vertex measures of the skull for each subject which were compared with a set of lifestyle parameters drawn from the same subjects.[1]

Its history

The founding of phrenology has been attributed to Franz Joseph Gall, a Viennese medical doctor and anatomist, in 1796. The idea was influential throughout most of the 19th century. The term 'phrenology'—Greek φρήν (phrēn), 'mind', and λόγος (logos), 'knowledge'—involves measuring bumps on the skull surface in an attempt to predict mental and personality traits. It is based on the materialistic concept that the brain is the mind, and the mind has no existence aside from the physical structure of this organ.[2] Although many persons contributed to its early development, almost from the beginning the movement was naturalistic and anti-biblical, which later attracted Darwin to the theory.[3]

Phrenology is based on the belief that storage of the many parts of the 'mind' must be localized in certain brain areas which have specific functions. Although the general functions of some parts of the human brain have been confirmed by empirical research, mostly from studies of brain damage, phrenology went well beyond the empirical evidence known when phrenology was popular.

Although it was recognized that some brain structures, such as the brain stem, function like separate organs as phrenology predicted, phrenologists were concerned mainly with the brain cortex, as well as the cerebellum, which is involved in the coordination of muscle control and motor skill learning—and not the brain stem.

Researchers now have some understanding of the function of many portions of the cortex. For example, the frontal cortical lobe, located at the front of the brain, is associated with reasoning, motor skills, higher level cognition, and expressive language, but we have only been able to isolate general areas that control these functions. Furthermore, phrenologists evaluated only the cortex and cerebellum surface areas as reflected in their effect on the skull, ignoring the brain's interior. Phrenology was for this reason derisively referred to by some as bumpology, or craniology.[4] External measurements are obviously invalid measures of the brain's internal structure because the thickness of the skin, bones, dura mater (uppermost meninges), and other tissues varies, distorting measurements of the cortex.

Not all phrenologists accepted the ideas behind phrenology, and some who rejected phrenology accepted a related idea, physiognomy. Physiognomy was the belief that character can be read in the face and other body parts. Phrenological journals also published numerous articles on physiognomy. One article (figure 2) discussed moral character as revealed in nose shape and traits, an idea later exploited to debase Jews and other ethnic groups.[5] Some phrenologists taught that the brain is actually composed of different separate organs, not just areas.[6] The organ theory concluded that the bumps represent larger organs, a focus called organology.

Most of the behaviour traits the phrenology system measured require much subjective judgment. Examples include a disposition for delight in colours, circumspection, pride,

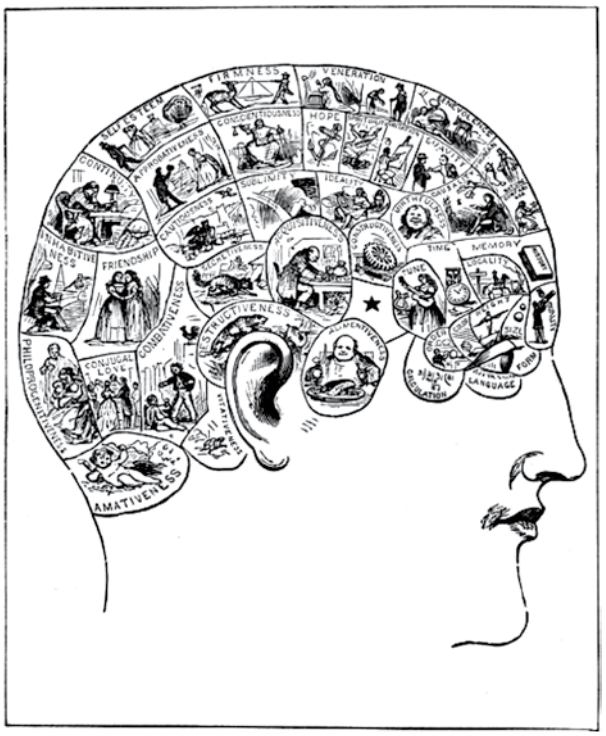

Figure 1. Phrenology chart showing the personality traits supposedly associated with various areas of the skull (from *People's Cyclopedia of Universal Knowledge*[71])

arrogance, love of authority, and the impulse to propagate (have large families). A major appeal of phrenology was that it "was seductively simple and logical … it both entertained and educated".[7]

According to one of the early founders of phrenology, Franz Gall, 27 distinct organs exist in the brain which produce 27 different faculties. He later looked for a few more distinct organs and the number eventually reached 42.[8] These included ones in persons with a mirthful disposition (i.e. liking to laugh), who supposedly had two prominent bumps on their forehead compared to their more dour contemporaries.[1]

Its importance

Throughout the 19th century intellectuals discussed the relationship between nature, secularism, and religion. What the "Left found most attractive in phrenology was that it offered the masses an alternative to religion as a means of explaining the world."[9] It is often assumed that the scientific naturalism propagated by writers such as T.H. Huxley and John Tyndall was the result of the 'Darwinian revolution' unleashed in 1859. Darwin's work, though, existed in the context of the vigorous debates about naturalism that were taking place before Darwin penned his 1859 *Origin* book. At the forefront of these debates were phrenology advocates who applied their theories to subjects ranging from medicine, treatment of the insane, education, theology and even economics.[10] Ideas about naturalism and natural law were often first born in early phrenology controversies. One book in particular, *The Constitution of Man in Relation to External Objects* (1828) by phrenologist George Combe, "replaced God with natural laws", and had an enormous influence on scientific thinking and the popularity of the 'naturalistic movement'.[11]

The *Constitution*, published from 1828 to 1899, sold over 350,000 copies throughout the world, far more than the 50,000 copies of Darwin's *Origin of Species* during the same period.[12] It also at first surpassed Darwin's 1859 book both in importance and intellectual heat generated, and its natural law philosophy influenced Darwin's *Origin*.[13] Furthermore, the phrenological community "was rich soil for naturalistic thinking", creating a large population that influenced acceptance of this worldview.[14]

> "[It] impressed hundreds of thousands of readers with a plausible alternative sense or narrative for the world to that of the traditional Christianity. It was largely this alternative sense to the world and the potential threat to traditional Christian-based understanding of Man which made *Constitution* so controversial."[15]

Combe was also in complete agreement with the "sweeping account of the evolution of life" in Robert Chambers' book *The Vestiges of the Natural History of Creation,* the first book to introduce evolutionary theory in detail to the world.[16] And Chambers was in almost complete agreement with phrenology, even ending his *Vestiges* book with an endorsement of the idea.[17] Chambers was enormously influenced by, and embraced, the doctrine of natural law from *Constitution*.[18] He also cited some of the scientific studies of the man regarded as phrenology's founder, Dr Gall, and drew on "phrenology for further evidence as to the materiality of mind".[19]

Thus, as early as 1844 the phrenology movement had endorsed evolution. The only area of disagreement evident was that Combe did not agree with Chambers' "assertion that organic life arose from chemical processes", referring to naturalistic abiogenesis.[16] Nonetheless, reviews of *Vestiges* published in *The Phrenological Journal* were uniformly positive.[20] One review defended the book, and condemned critics, writing that "men of science did not confine their attention to its alleged objections, but urged against its moral and theological objections, calculated to rouse popular prejudices against the unknown author and his work".[20]

The progressive phrenologists soon also adopted Darwinism into their theory since many similarities existed

between the phrenological and Darwinian worldviews. For example, like "Darwinism, phrenology left the laboratory and thereafter its 'proof' lay in debating forums and public acceptance, not in scientific experiments".[21]

Phrenology and materialism

Soon practitioners in various science disciplines incorporated phrenology into their worldview. Professor John Davies concluded phrenology "was a precursor of the larger Darwinian movement; years later the same audience who heard Fowler's lectures [on phrenology] and bought Combe's books [on phrenology] would be listening to Robert Ingersoll [lectures on atheism] and reading Thomas [Huxley's books on evolution]".[22] In 1858 the leader of the secular society wrote:

> "More converts have been made this last century by *The Constitution of Man* to freethought than any other agency … . They hailed phrenology as an atheistic and naturalistic doctrine, a fresh source of ammunition to use in the ongoing battle against revealed religion."[23]

Phrenology also "provided a way station on the road to a secular view of life … [and] prepared the way for [Darwin's] *On the Origin of the Species*".[24] As McLaren observed in his study of phrenology, the "role played by phrenology in early evolutionary theory has not been fully appreciated".[25] Furthermore, the acceptance of Darwinism gave phrenology a major boost.[26]

The Darwinian phrenology theory

The theory behind phrenology began with the premise of materialism, and that the human brain, like any other organ, developed by naturalistic means. No soul was needed to explain humanness. To early evolutionists, the implications of phrenology were obvious: the brain, and therefore the mind, evolved like any other organ.[27] This supported the notion that the human brain evolved from an ape common ancestor which had a smaller brain. Our enormous language, creative, artistic, musical, and mechanical abilities resulted from adding on to the ape brain. Humans allegedly still retain the primitive brain which is located in the occipital area, and the enlargement of this part on the human skull indicates humans have retained many primitive traits. Phrenology and evolution supported and reinforced each other, especially after the 1860s when phrenologists often related their theory to evolution, especially the supposed evolution of the head and skull.

Some of phrenology's major critics were clergy, who correctly concluded that phrenology promoted materialism and fatalism, and had dispensed with the need for the human

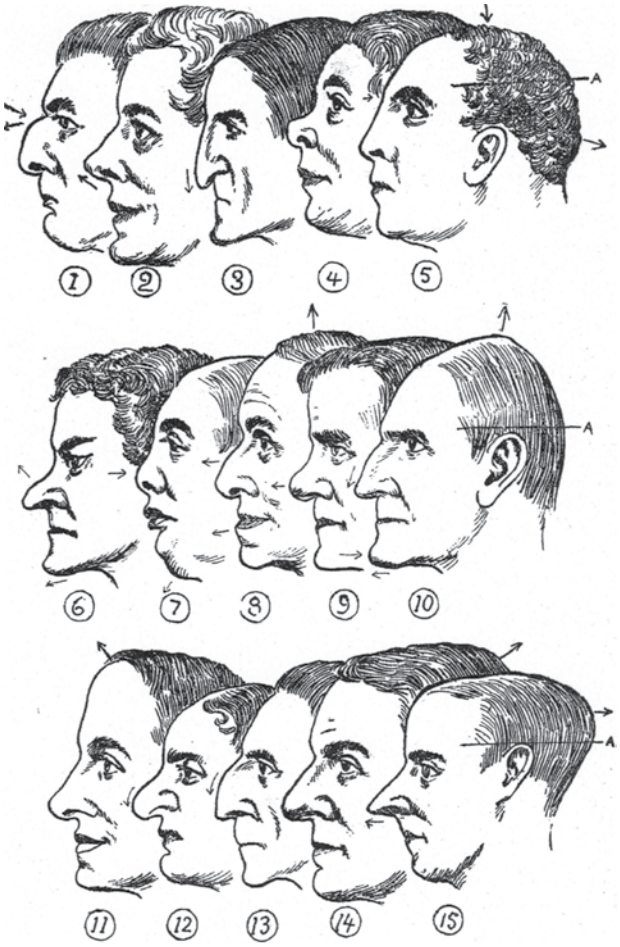

Figure 2. Basic nose shapes which some phrenologists used in addition to skull traits to determine personality (from Parks [5])

soul.[28] Even though many phrenologists were not atheists, the underlying conclusion of phrenology was materialism, a view supported by many of its leaders. Materialism teaches that mind is purely matter and nothing more; humans have no soul, and death is the final end of life.[29] One example of Darwin's exposure to this line of thinking was from his undergraduate friend, phrenologist William A.F. Browne.[30] When Darwin was a University of Edinburgh Medical School student he was an active member of a student group, which included a few professors, called the Plinian Society.[31]

As a student, Darwin observed the 1826–1827 debates involving his friend Browne, who is now considered the founding father of British Psychiatry.[32] Browne's behaviour in the Plinian Society debate was as a "fiery radical" who "gave such an inflammatory harangue on matter and mind that it sparked a raging debate … with no soul, no after-life, no punishment or reward, where was the deterrent against immorality?"[34]

Browne, who openly influenced Darwin, "believed the mind to be completely understandable in terms of material

processes, and relished a thorough demolition job on metaphysical and Christian fantasies".[32] Gruber's careful studies of Darwin's early writing concluded the Plinian event played a crucial role in Darwin's thinking and even his psychological development.[33]

In 1838, Darwin revisited Edinburgh and his former undergraduate haunts, recording his psychological speculations in his M notebook—the 'M notebook' was one of many notebooks that Darwin used to record his notes on his ideas on evolution.[40] Darwin was then preparing to marry his Unitarian cousin, Emma Wedgwood, and was in some emotional turmoil due to their religious conflicts. On September 21, after his return to England, he recorded a vivid and disturbing dream in which he was involved in an execution. The corpse came to life and claimed to have died as a hero. This dream was quite likely related to his conflicts about, in his words, 'murdering God'.[34]

Another exposure Darwin had to phrenology was with his friend and colleague Hewett Cottrell Watson (1804–1881) who endorsed evolution as early as 1836.[35] In 1836, Watson published a paper in *The Phrenological Journal* titled 'What is the use of the double brain?' In this paper Watson speculated on the function of the two human cerebral hemispheres. His idea soon achieved scientific status when, encouraged by the French phrenologist/physician Jean-Baptiste Bouillaud, evolutionist Paul Broca published his research on the brain's speech centre, now known as Broca's area.

Watson later turned his energies to the question of evolution. He purchased *The Phrenological Journal,* and appointed himself editor in 1837. In the 1850s, Watson conducted an extensive correspondence with Charles Darwin who mentioned him 10 times in the first edition of his *On The Origin of Species* including two very generous acknowledgements for his scientific assistance. His exact words were "Mr. Watson, to whom I lie under deep obligation for assistance of all kinds",[36] and to "Mr. H.C. Watson to whom I am much indebted for valuable advice and assistance on this subject".[37]

As an undergraduate, Charles Darwin privately sympathized with phrenology. He saw in the process evidence of free will, writing:

> "One is tempted to believe phrenologists are right about habitual exercise of the mind altering [the] form of the head, and thus these qualities become hereditary. When a man says I will improve my powers of imagination, & does so,—is not this free will [?]—he improves the facility … an animal improves because its appetites urge it to certain actions which are modified by circumstance."[38]

This was an important idea in view of the fact that the major issue Darwin was forced to deal with in his evolution theory was not the survival-of-the-fittest, but rather the arrival-of-the-fittest. Phrenology implied, according to Darwin, that desire and will can alter the body, producing physical changes that natural selection can act on. In his M notebook Darwin wrote:

> "I believe, in Materialism, say only that emotions, instincts, degrees of talent, which are hereditary, are so because [the] brain of [the] child resembles parent stock.— (& phrenologists state that brain alters [the body])."[39]

In a letter dated January 3, 1830, Charles wrote to his cousin and friend Rev. William Darwin Fox that he "dined with Sir J. Mackintosh & had some talk with him about Phrenology, & he has entirely battered down the very little belief of it that I picked up at Osmaston [the home of the Fox family]". Evidently, some discussion in favour of phrenology, and about which personality factors affected the size of certain bumps on the head of interest to phrenologists, had occurred in the Fox family home. Darwin added one reason for his doubts about phrenology, as Mackintosh expressed: "as long as Education is supposed to have any effect decreasing the power of any organ of the brain, he cannot see how it [phrenology] ever can be proved to be true."[40] In other words, if experience affects phrenology-relevant traits, changing the brain structure, then the readings of the innate brain traits phrenology is designed to interpret will be distorted or may even be invalid. Nonetheless, as we will show, phrenology had a major influence on Darwin's beliefs, and especially his evolution movement.

Darwin, according to the above quotes, appears to accept the basic idea of phrenology that the cerebellum and cerebrum each consist of many different organs in which the person, or the soul in Christian terms, resides. However, phrenology in general accepts that brain organs can change through education, as Darwin noted in his M notebook. Thus, changes in these organs will change the shape of the skull. Consequently, the skull surface traits will produce an accurate reading when the measurements are completed. And if the skull surface traits change, the later reading will produce a different result, reflecting the change due to education. As a result, both readings would be accurate when they were done.

Phrenology ideas spread beyond Europe

Phrenological teachings soon rapidly spread to much of the Western world. In 1834, Professor Combe lectured in the United States, where phrenology soon become a popular movement. Fowler also began publishing his journal titled

The Phrenological Journal and Science and Health, from 1839 to 1911, to spread his ideas.[41] Fowler's journal included a large number of articles written by educated professionals, including many medical doctors and college professors.

The intellectual elite found phrenology especially attractive because it provided a materialistic, evolutionary explanation of mental processes based on direct observation. For example, within a year of the formation of the French phrenology society, of the 150 members, 82 were physicians, both those in private practice and in academia, and 6 were lawyers.[42] Leek claims a long list of highly educated persons have supported phrenology.[43] However, some intellectuals accepted the organology brand of phrenology while at the same time questioning the cranioscopic orientation of phrenology.

By 1838 "phrenological ideas had achieved widespread acceptance throughout the United States".[44] Phrenology lectures attracting thousands gave advice on matters including the best way to hire new employees or find a suitable marriage partner.[45] In the end, phrenology became a part of applied psychology accepted by many intellectuals of the 19th and 20th centuries.[46]

The popular success of phrenology helped supporters ignore its significant lack of scientific evidence. Its influence on evolution is illustrated by the fact that Alfred Russell Wallace, the co-founder of Darwinian evolution, opined that the "greatest failure of the nineteenth century was its turning away from phrenology," which Martin adds was a "patently wrong idea [that] made a tremendous impact on the nation".[47] Wallace as a young man "became hardened in his naturalistic views by a study of … phrenology", and even "in his old age he prized the delineations of his cranium done by phrenologists Edward Hicks and James Rumball, the latter having also read Herbert Spencer's head".[48]

Spencer, a major contributor to evolutionary thinking, converted to phrenology as a youth and, although he rejected some of their ideas, remained a believer for much of his life, even writing articles for phrenology journals.[49] The belief that character and intellect were mere materialistic functions subject to deterministic psychology had a profound effect on his ideas and writings, and consequently on society due to his development and promotion of Social Darwinism, one of the most destructive ideas in history.[50]

Facial angle theory incorporated into phrenology

The study of face and body features, a field called physiognomy, accentuated the "tendency in phrenology to establish a rank order of races and nationalities along a scale of perfection" toward the Caucasian ideal.[51] The influence of physiognomy in phrenology resulted in its incorporation into phrenology.[52] Facial angle theory hypothesized that the facial angle reflected not only the trend from fish to humans, but also could be used to *rank* human racial groups from inferior to superior. An article in *The Phrenological Journal* by an author using the pseudonym 'Cranium' included an illustration commonly found in 19th-century literature ranking life from simple to complex, from snakes to humans (figure 3).

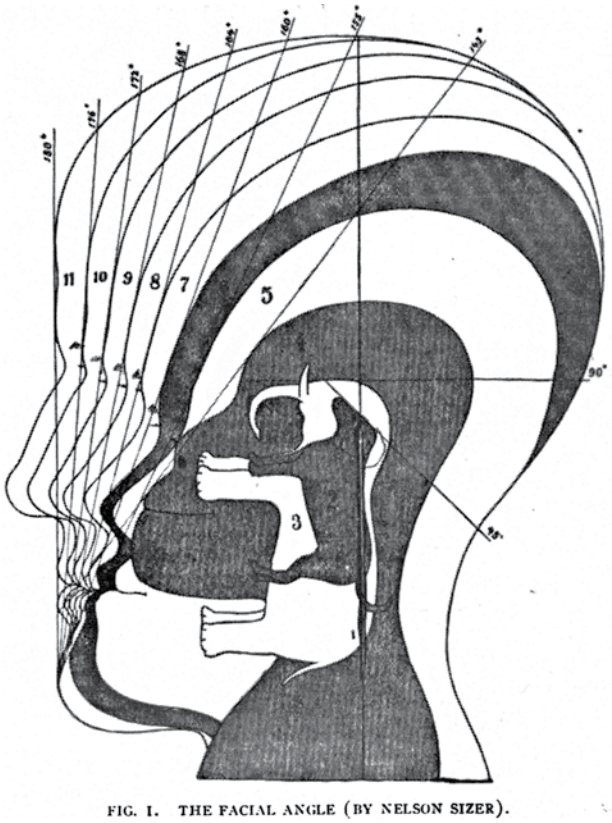

Figure 3. Illustration of how facial angles were used to show human evolution from mammals as well as for ranking 'races' from the lowest to the highest (from Cranium[53])

Facial angle theory was also used to rank humans from inferior to superior.[53] The *Phrenological Journal* author showed photos of actual heads of a 'civilized' Caucasian and a Negro whom he called a 'savage', adding that Negroes were one of "the lower classes of men" that ever lived (see figure 4).[54] The facial angle theory influenced phrenologists to use it in an attempt to 'predict' intelligence levels. It was noted that even the ancient Greeks and Romans believed a 90° facial line was a sign of a great level

> "… of knowledge and reflection, and a corresponding contraction of the mouth, jaws, tongue, nose, indicated a noble and generous nature. Hence they have extended the facial angle to 90° in the

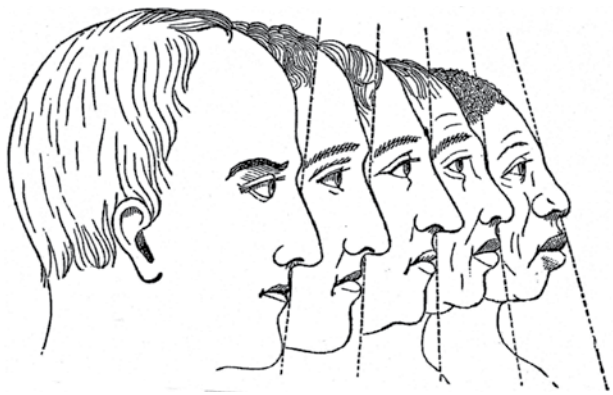

Figure 4. Facial angle was used not only to document evolution, but also to rank the races from inferior (the least vertical one) to superior (the more vertical line) (from Jeffries[72]).

> representation of legislators, sages, poets, and others, on whom they wished to bestow the most august character. In the statues of their heroes and gods they have still further exaggerated the human, and reduced the animal characteristics; extending the forehead over the face, so as to push the facial line beyond the perpendicular, and to make the angle 100°."[55]

Thus, facial angle was believed by scientists to have effectively quantified, not only the "very striking difference between man and all other animals", but also the difference between the various people groups.[56] Science historian John Haller concluded that the "facial angle was the most extensively elaborated and artlessly abused criterion for racial somatology" in the late 1800s.[57]

Phrenology used to justify racism

Scientists and others searching for a scientific basis for racism found phrenology very appealing as a justification for the belief in Western superiority over the evolutionarily inferior races.[58] The phrenologist compared skulls of different ethnic groups to find evidence for ranking races from the least to the most evolved. Dr François J.V. Broussais, a disciple of Gall, proclaimed the Caucasians were the 'most beautiful' race while claiming peoples like the Australian Aboriginals and New Zealand Maoris would never become civilized since they lacked the cerebral organ required. Some phrenologists even argued against the emancipation of the slaves on the basis of phrenology. Conversely, other phrenologists argued that even less evolved people could improve through education and interbreeding.[59]

Evolution also influenced phrenologists. One review of *Vestiges*, quoting the original book, included the following passage:

> "Our brain goes through the various stages of a fish's, a reptile's and a mammifer's [obsolete term for mammal] brain; and finally becomes human … after completing the animal transformation, it passes through the characters in which it appears in the Negro, Malay, American [Indians], and Mongolian nations, and finally is Caucasian."[60]

He added:

> "… the various races of mankind, are simply representations of particular stages in the development of the highest or Caucasian type. The negro exhibits permanently the imperfect brain, projecting lower jaw … . The aboriginal American represents the same child nearer birth. The Mongolian is an arrested infant newly born."[61]

These are yet other examples showing how evolution influenced phrenology even before Darwin. Its influence after Darwin increased significantly. The racism in phrenology was also heavily influenced by evolution as, likewise, phrenology significantly influenced evolution, although often indirectly. A racial hierarchy was not inevitable in the phrenology worldview, but was common, influenced by the fact that many phrenologists concluded that some 'savage' races were innately uncivilizable.[62]

In short, phrenology readings in some cases strongly reinforced racial prejudice and commonly rated non-Europeans as stupid, ignorant, cruel, hopeless, and having other very negative traits.[63] The Hottentots were believed to be less evolved than most other races and "were under the complete domination of animal instincts", and south-east Africans were "at the bottom of the human [evolutionary] chain … hardly superior to animal instincts … there was … more resemblance between the heads of certain Negroes and of great apes than between Negroes and Europeans."[64] Therefore, instead of allowing bumps to do the talking, racial bias was used to exploit the terrain of heads to support preconceived opinions.

Gender stereotyping

Gender stereotyping was also common in phrenology. Like racial inferiority, gender inferiority was read from the skull contours of females. For example, women whose occipital region (back of their head) was larger, and who had lower foreheads, were believed to have inferior brain organs for success in the arts, sciences, and intellectual tasks in general, while having larger mental brain organs was related to the better care of children and the acceptance of religion.[65] And, while phrenologists did not deny the existence of talented women, they felt this minority was too

small to provide justification to allow women's participation in politics.[66]

Support by doctors, professors, and liberal ministers

Phrenology was proposed by a number of leading psychiatrists as a viable model to reform both psychology and corrections. It was in this area that phrenology moved from a harmless entertainment to causing harm. Because phrenology was taken seriously in the Victorian era and permeated both literature and novels, it influenced many areas of society. Prominent public figures, even the Rev. Henry Ward Beecher (a college classmate and initial partner of one of America's leading phrenologists, Orson Fowler), actively promoted phrenology as a source of psychological insight.

Italian psychiatrist Biagio Miraglia proposed a new classification of mental illness based on brain functions described by Gall. Miraglia also relied on Gall's phrenological localization of mental functions in the brain to guide him when doing therapy. He even argued that madness was a consequence of cerebral organ dysfunctions that could be detected by phrenology: "The organs of the brain that may become ill in isolation" or in conjunction with other genes and/or structures, and obtain "their activities infected through energy or depression, or inertia or deficiency".[67]

Finally phrenology was scientifically disproved

The first detailed and most complete study of phrenology was by Parker, *et al.*, which

> "… sought to test in the most exhaustive way currently possible the fundamental claim of phrenology: that measuring the contour of the head provides a reliable method for inferring mental capacities. We found no evidence for this claim … a more accurate phrenological bust should be left blank since no regions on the head correlate with any of the faculties that we tested."[68]

Conclusions

The central phrenological notion that measuring the contours of the skull can be used to determine personality traits has now been discredited by empirical research using the scalp as a proxy measure to determine its validity.[1] One problem among many was "its emphasis on the outer head (i.e. skull and scalp) [contours] as an indirect measure of the brain, and thus of personality and behavior".[69] Likewise, external chest traits usually tell us little about the condition of the internal organs, such as the heart or lungs. Phrenology contributed significantly to the rise of naturalism, materialism, and atheistic worldviews. And, as advanced by men like Gall and Combe, phrenology "became one of the most influential ideological and cultural developments in Victorian Britain" that moved society towards materialism.[70]

References

1. Parker, J.O., Alfaro-Almagro, F., and Jbabdi, S., An empirical, 21st century evaluation of phrenology, *Cortex* **106**:26–35, 2018.
2. Gregory, R., *The Oxford Companion to the Mind,* Oxford University Press, New York, p. 618, 1987.
3. Staum, M., The ambivalence of phrenology; in: *Labeling People: French scholars on society, race and empire, 1815–1848,* McGill-Queen's University Press, Montreal, Canada, chap. 3, pp. 49–84, 52, 2003.
4. Williams, W.F. (Ed.), Phrenology; in: *The Encyclopedia of Pseudoscience: From alien abductions to zone therapy*, Facts on File, New York, pp. 266–268, 2000; p. 266.
5. Parks, C., Character as indicated in the nose, *The Phrenological J.* **114**(3):290–292, September 1902.
6. Williams, ref. 4, pp. 266–267.
7. McLaren, A., Phrenology: medium and message, *J. Modern History* **46**(1):86–97, March 1974; pp. 91–92.
8. Mainwaring, M., 'Phys/Phren'—why not take each other at face value, *Smithsonian* **11**(8):193–212, 1980; p. 194.
9. McLaren, ref. 7. pp. 88–89.
10. van Wyhe, J., *Phrenology*, Bfs Entertainment, Richmond Hill, Ontario, Canada, 2001.
11. van Wyhe, J., *Phrenology and the Origins of Victorian Scientific Naturalism*, Routledge, New York, p. 153, 2004.
12. van Wyhe, ref. 11, p. 128.
13. van Wyhe, ref. 11, p. 21.
14. van Wyhe, ref. 11, p. 97.
15. van Wyhe, ref. 11, p. 127.
16. Tomlinson, S., *Head Masters: Phrenology, secular education and nineteenth-century social thought,* The University of Alabama Press, Tuscaloosa, AL, p. 304, 2005.
17. Tomlinson, ref. 16, pp. 304–305.
18. van Wyhe, ref. 11, pp. 175, 178.
19. Millhauser, M., *Just Before Darwin: Robert Chambers and vestiges*, Wesleyan University Press, Middletown, CT, p. 109, 1959.
20. Warson, H., Review of *Explanations: A sequel to "Vestiges of the Natural History of Creation"*, J. Churchill, London, UK, 1845, *Phrenological J.* **33**:159, January 1846.
21. Davies, J., *Phrenology: Fad and science*, Yale University Press, New Haven, CT, p. 162, 1955.
22. Davies, ref. 21, p. 172.
23. McLaren, ref. 7, p. 95.
24. Davies, ref. 21, pp. 172–173.
25. McLaren, ref. 7, pp. 92, 94.
26. Mainwaring, ref. 8, p. 93.
27. Millhauser, ref. 19, p. 109; Trippett, D., Exercising musical minds: phrenology and music pedagogy in London circa 1830, *19th-Century Music* **39**(2):99–124, 2015.
28. Williams, ref. 4, p. 267.
29. Gruber, H.E., *Darwin on Man: A psychological study of scientific creativity*, E.P. Dutton, New York, pp. 205–206, 1974; Kaufman, M.H., The Edinburgh phrenological debate of 1823 held in the Royal Medical Society, *J. Neurolinguistics* **11**(4):377–389, October 1998.
30. Walmsley, T., Psychiatry in descent: Darwin and the Brownes, *Psychiatric Bulletin* **17**:748–751, 1993; p. 751.

31. Richards, R.J., *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior.* University of Chicago Press, Chicago, IL, p. 76, 1987.
32. Walmsley, ref. 30, p. 749.
33. Desmond, A. and Moore, J., *Darwin: The life of a tormented evolutionist,* Warner Books, New York, p. 38, 1991; Walmsley, ref. 30, p. 750.
34. Bergman, J., *The Dark Side of Darwin*, New Leaf Press, Green Forest, AR, 2015.
35. van Wyhe, ref. 11, p. 147.
36. Darwin, C., *On the Origin of Species*, 2nd edn, John Murray, London, UK, p. 40, 1860; darwin-online.org.uk/content/frameset?itemID=F376&viewtype=text&pageseq=1.
37. Darwin, ref. 36, p. 43.
38. Trippett, D., "Exercising Musical Minds: Phrenology and Music Pedagogy in London circa 1830." *19th-Century Music*, **39**(2):99–124, 2015; p. 117. Quote is from the M notebook, p. 30. The M notebook quote is found here: Charles Darwin, The M Notebook (1838):30. See darwin-online.org.uk/content/frameset?viewtype=side& itemID=CUL-DAR125.-&pageseq=1. The M notebook was reprinted in Gruber, p. 271, page 30 of Darwin's M notebook, 1974.
39. Gruber, ref. 29, p. 276. The quote is on p. 57 of Darwin's M notebook. See darwin-online.org.uk/content/frameset?viewtype=side& itemID=CUL-DAR125.-&pageseq=1. The M notebook was reprinted in Gruber, ref. 29, p. 271, page 30 of Darwin's M notebook, 1974.
40. Burkhardt, F., *The Correspondence of Charles Darwin: 1821–1836*, Cambridge University Press, Cambridge, UK, p. 97, 1985.
41. Many issues beginning with 1870 from The University of Michigan are on line at catalog.hathitrust.org/Record/000677989.
42. Staum, ref. 3, p. 50.
43. Leek, S., *Phrenology*, Collier Books, London, UK, 1970.
44. McCandless, P., Mesmerism and phrenology in Antebellum Charleston: enough of the marvelous, *J. Southern History* **58**(2):199–230, 1992; p. 205.
45. McCandless, ref. 44, pp. 209–210.
46. Chambers, R., *The Vestiges of the Natural History of Creation*, John Churchill, London, UK, p. 200, 1844.
47. Martin, M., *Bumps & Brains: The curious science of phrenology*, 19th edn, *American History*, vol. 1, pp. 38–43, 43, 1979.
48. Richards, ref. 31, p. 178.
49. Richards, ref. 31, pp. 250–251.
50. Bergman, J., *The Darwin Effect: Its influence on Nazism, eugenics, racism, communism, capitalism & sexism*, New Leaf Press, Green Forest, AR, 2014; Kevles, D.J., *In the Name of Eugenics: Genetics and the uses of human heredity*, Alfred A. Knopf, New York, 1985.
51. Staum, ref. 3, p. 54.
52. See Bergman, J., *Evolution's Blunders, Frauds and Forgeries*, CMI Publishing, Atlanta, GA, chap. 6, pp. 89–100, 2017.
53. Cranium, A., The brain and skull, *The Phrenological J. and Science of Health* **122**(7):205–216, July 1909, p. 206.
54. Cranium, ref. 53, pp. 208–209.
55. Lawrence, W., *Lectures on Physiology, Zoology, and the Natural History of Man,* Foote and Brown, Salem, MA, p. 148, 1828.
56. Lawrence, W., *Lectures on Comparative Anatomy, Physiology, Zoology, and the Natural History of Man*, 9th edn, Henry G. Bohn, London, UK, p. 115, 1848.
57. Haller, J., *Outcasts from Evolution*, University of Illinois Press, Urbana, IL, p. 9, 1971.
58. Staum, ref. 3, pp. 49–84.
59. Staum, ref. 3, p. 62.
60. Roberson, D. (Ed.), Review of *Vestiges of the Natural History of Creation*, *The Phrenological J.* **18**:69–75, 1845.
61. Robertson, ref. 60, p. 75.
62. Staum, ref. 3, p. 65.
63. Staum, ref. 3, pp. 58–59.
64. Staum, ref. 3, p. 59–61.
65. Staum, ref. 3, pp. 64–65.
66. Staum, ref. 3, pp. 65–66.
67. Miraglia, B., Reprinted in: A new classification of mental illness based on brain functions, *Dialogues in Philosophy, Mental and Neuro Sciences* **7**(2):636–637, 1847; p. 63.
68. Parker, ref. 1. p. 10.
69. Parker, ref. 1, p. 26; Chambers, H., *Phrenology for the Millions*, Sherbourne Press, Los Angeles, CA, 1968.
70. van Wyhe, ref. 11, p. 11.
71. *People's Cyclopedia of Universal Knowledge,* Depuy, W.H. (Ed.), Eaton & Mains, New York, 1883.
72. Jeffries, J., *Natural History of the Human Races*, E.O. Jenkins, New York, p. 347, 1869.

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