

while more or less white skin, straight hair and an orthognathous [straight] face are the ordinary equipment of the highest groups in the human series (1866, p. 280). . . . A group with black skin, woolly hair and a prognathous face has never been able to raise itself spontaneously to civilization (pp. 295–296).

These are harsh words, and Broca himself regretted that nature had fashioned such a system (1866, p. 296). But what could he do? Facts are facts. "There is no faith, however respectable, no interest, however legitimate, which must not accommodate itself to the progress of human knowledge and bend before truth" (in Count, 1950, p. 72). Paul Topinard, Broca's leading disciple and successor, took as his motto (1882, p. 748): "*J'ai horreur des systèmes et surtout des systèmes a priori*" (I abhor systems, especially a priori systems).

Broca singled out the few egalitarian scientists of his century for particularly harsh treatment because they had debased their calling by allowing an ethical hope or political dream to cloud their judgment and distort objective truth. "The intervention of political and social considerations has not been less injurious to anthropology than the religious element" (1855, in Count, 1950, p. 73). The great German anatomist Friedrich Tiedemann, for example, had argued that blacks and whites did not differ in cranial capacity. Broca nailed Tiedemann for the same error I uncovered in Morton's work (see pp. 50–69). When Morton used a subjective and imprecise method of reckoning, he calculated systematically lower capacities for blacks than when he measured the same skulls with a precise technique. Tiedemann, using an even more imprecise method, calculated a black average 45 cc above the mean value recorded by other scientists. Yet his measures for white skulls were no larger than those reported by colleagues. (For all his delight in exposing Tiedemann, Broca apparently never checked Morton's figures, though Morton was his hero and model. Broca once published a one-hundred-page paper analyzing Morton's techniques in the most minute detail—Broca, 1873b.)

Why had Tiedemann gone astray? "Unhappily," Broca wrote (1873b, p. 12), "he was dominated by a preconceived idea. He set out to prove that the cranial capacity of all human races is the same." But "it is an axiom of all observational sciences that facts must precede theories" (1868, p. 4). Broca believed, sincerely I

assume, that facts were his only constraint and that his success in affirming traditional rankings arose from the precision of his measures and his care in establishing repeatable procedures.

Indeed, one cannot read Broca without gaining enormous respect for his care in generating data. I believe his numbers and doubt that any better have ever been obtained. Broca made an exhaustive study of all previous methods used to determine cranial capacity. He decided that lead shot, as advocated by "le célèbre Morton" (1861, p. 183), gave the best results, but he spent months refining the technique, taking into account such factors as the form and height of the cylinder used to receive the shot after it is poured from the skull, the speed of pouring shot into the skull, and the mode of shaking and tapping the skull to pack the shot and to determine whether or not more will fit in (Broca, 1873b). Broca finally developed an objective method for measuring cranial capacity. In most of his work, however, he preferred to weigh the brain directly after autopsies performed by his own hands.

I spent a month reading all of Broca's major work, concentrating on his statistical procedures. I found a definite pattern in his methods. He traversed the gap between fact and conclusion by what may be the usual route—predominantly in reverse. Conclusions came first and Broca's conclusions were the shared assumptions of most successful white males during his time—themselves on top by the good fortune of nature, and women, blacks, and poor people below. His facts were reliable (unlike Morton's), but they were gathered selectively and then manipulated unconsciously in the service of prior conclusions. By this route, the conclusions achieved not only the blessing of science, but the prestige of numbers. Broca and his school used facts as illustrations, not as constraining documents. They began with conclusions, peered through their facts, and came back in a circle to the same conclusions. Their example repays a closer study, for unlike Morton (who manipulated data, however unconsciously), they reflected their prejudices by another, and probably more common, route: advocacy masquerading as objectivity.

Selecting characters

When the "Hottentot Venus" died in Paris, Georges Cuvier, the greatest scientist and, as Broca would later discover to his delight,

the largest brain of France, remembered this African woman as he had seen her in the flesh.

She had a way of pouting her lips exactly like what we have observed in the orang-utan. Her movements had something abrupt and fantastical about them, reminding one of those of the ape. Her lips were monstrously large [those of apes are thin and small as Cuvier apparently forgot]. Her ear was like that of many apes, being small, the tragus weak, and the external border almost obliterated behind. These are animal characters. I have never seen a human head more like an ape than that of this woman (in Topinard, 1878, pp. 493-494).

The human body can be measured in a thousand ways. Any investigator, convinced beforehand of a group's inferiority, can select a small set of measures to illustrate its greater affinity with apes. (This procedure, of course, would work equally well for white males, though no one made the attempt. White people, for example, have thin lips—a property shared with chimpanzees—while most black Africans have thicker, consequently more “human,” lips.)

Broca's cardinal bias lay in his assumption that human races could be ranked in a linear scale of mental worth. In enumerating the aims of ethnology, Broca included: “to determine the relative position of races in the human series” (in Topinard, 1878, p. 660). It did not occur to him that human variation might be ramified and random, rather than linear and hierarchical. And since he knew the order beforehand, anthropometry became a search for characters that would display the correct ranking, not a numerical exercise in raw empiricism.

Thus Broca began his search for “meaningful” characters—those that would display the established ranks. In 1862, for example, he tried the ratio of radius (lower arm bone) to humerus (upper arm bone), reasoning that a higher ratio marks a longer forearm—a character of apes. All began well: blacks yielded a ratio of .794, whites .739. But then Broca ran into trouble. An Eskimo skeleton yielded .703, an Australian aborigine .709, while the Hottentot Venus, Cuvier's near ape (her skeleton had been preserved in Paris), measured a mere .703. Broca now had two choices. He could either admit that, on this criterion, whites ranked lower than several dark-skinned groups, or he could abandon the criterion. Since he knew (1862a, p. 10) that Hottentots, Eskimos, and Austra-

lian aborigines ranked below most African blacks, he chose the second course: “After this, it seems difficult to me to continue to say that elongation of the forearm is a character of degradation or inferiority, because, on this account, the European occupies a place between Negroes on the one hand, and Hottentots, Australians, and eskimos on the other” (1862, p. 11).

Later, he almost abandoned his cardinal criterion of brain size because inferior yellow people scored so well:

A table on which races were arranged by order of their cranial capacities would not represent the degrees of their superiority or inferiority, because size represents only one element of the problem [of ranking races]. On such a table, Eskimos, Lapps, Malays, Tartars and several other peoples of the Mongolian type would surpass the most civilized people of Europe. A lowly race may therefore have a big brain (1873a, p. 38).

But Broca felt that he could salvage much of value from his crude measure of overall brain size. It may fail at the upper end because some inferior groups have big brains, but it works at the lower end because small brains belong exclusively to people of low intelligence. Broca continued:

But this does not destroy the value of small brain size as a mark of inferiority. The table shows that West African blacks have a cranial capacity about 100 cc less than that of European races. To this figure, we may add the following: Caffirs, Nubians, Tasmanians, Hottentots, Australians. These examples are sufficient to prove that if the volume of the brain does not play a decisive role in the intellectual ranking of races, it nevertheless has a very real importance (1873a, p. 38).

An unbeatable argument. Deny it at one end where conclusions are uncongenial; affirm it by the same criterion at the other. Broca did not fudge numbers; he merely selected among them or interpreted his way around them to favored conclusions.

In choosing among measures, Broca did not just drift passively in the sway of a preconceived idea. He advocated selection among characters as a stated goal with explicit criteria. Topinard, his chief disciple, distinguished between “empirical” characters “having no apparent design,” and “rational” characters “related to some physiological opinion” (1878, p. 221). How then to determine which characters are “rational”? Topinard answered: “Other characteristics are looked upon, whether rightly or wrongly, as dominant.

They have an affinity in negroes to those which they exhibit in apes, and establish the transition between these and Europeans" (1878, p. 221). Broca had also considered this issue in the midst of his debate with Gratiolet, and had reached the same conclusion (1861, p. 176):

We surmount the problem easily by choosing, for our comparison of brains, races whose intellectual inequalities are completely clear. Thus, the superiority of Europeans compared with African Negroes, American Indians, Hottentots, Australians and the Negroes of Oceania, is sufficiently certain to serve as a point of departure for the comparison of brains.

Particularly outrageous examples abound in the selection of individuals to represent groups in illustrations. Thirty years ago, when I was a child, the Hall of Man in the American Museum of Natural History still displayed the characters of human races by linear arrays running from apes to whites. Standard anatomical illustrations, until this generation, depicted a chimp, a Negro, and a white, part by part in that order—even though variation among whites and blacks is always large enough to generate a different order with other individuals: chimp, white, black. In 1903, for example, the American anatomist E. A. Spitzka published a long treatise on brain size and form in "men of eminence." He printed the following figure (Fig. 3.3) with a comment: "The jump from a Cuvier or a Thackeray to a Zulu or a Bushman is not greater than from the latter to the gorilla or the orang" (1903, p. 604). But he also published a similar figure (Fig. 3.4) illustrating variation in brain size among eminent whites apparently never realizing that he had destroyed his own argument. As F. P. Mall, the man who exposed Bean, wrote of these figures (1909, p. 24): "Comparing [them], it appears that Gambetta's brain resembles the gorilla's more than it does that of Gauss."

Averting anomalies

Inevitably, since Broca amassed so much disparate and honest data, he generated numerous anomalies and apparent exceptions to his guiding generality—that size of brain records intelligence and that comfortable white males have larger brains than women, poor people, and lower races. In noting how he worked around each apparent exception, we obtain our clearest insight into Broca's

methods of argument and inference. We also understand why data could never overthrow his assumptions.

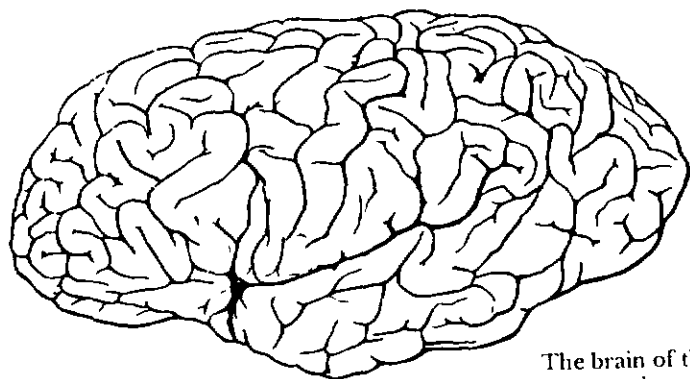
BIG-BRAINED GERMANS

Gratiolet, in his last desperate attempt, pulled out all the stops. He dared to claim that, on average, German brains are 100 grams heavier than French brains. Clearly, Gratiolet argued, brain size has nothing to do with intelligence! Broca responded disdainfully: "Monsieur Gratiolet has almost appealed to our patriotic sentiments. But it will be easy for me to show him that he can grant some value to the size of the brain without ceasing, for that, to be a good Frenchman" (1861, pp. 441–442).

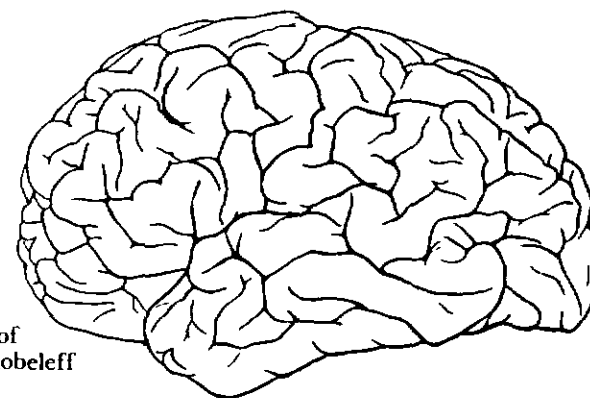
Broca then worked his way systematically through the data. First of all, Gratiolet's figure of 100 grams came from unsupported claims of the German scientist E. Huschke. When Broca collated all the actual data he could find, the difference in size between German and French brains fell from 100 to 48 grams. Broca then applied a series of corrections for nonintellectual factors that also affect brain size. He argued, quite correctly, that brain size increases with body size, decreases with age, and decreases during long periods of poor health (thus explaining why executed criminals often have larger brains than honest folk who die of degenerative diseases in hospitals). Broca noted a mean French age of fifty-six and a half years in his sample, while the Germans averaged only fifty-one. He estimated that this difference would account for 16 grams of the disparity between French and Germans, cutting the German advantage to 32 grams. He then removed from the German sample all individuals who had died by violence or execution. The mean brain weight of twenty Germans, dead from natural causes, now stood at 1,320 grams, already *below* the French average of 1,333 grams. And Broca had not even yet corrected for the larger average body size of Germans. *Vive la France*.

Broca's colleague de Jouvencel, speaking on his behalf against the unfortunate Gratiolet, argued that greater German brawn accounted for all the apparent difference in brain and then some. Of the average German, he wrote (1861, p. 466):

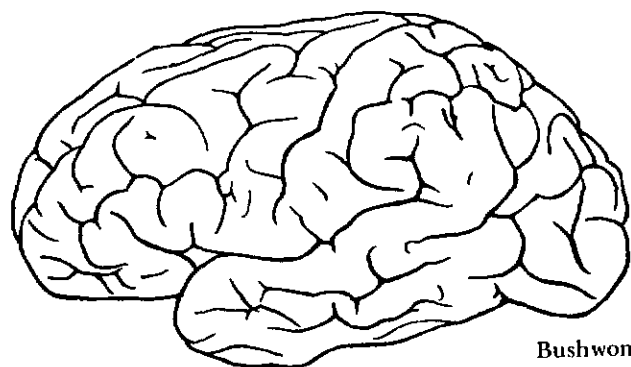
He ingests a quantity of solid food and drink far greater than that which satisfies us. This, joined with his consumption of beer, which is pervasive even in areas where wine is made, makes the German much more



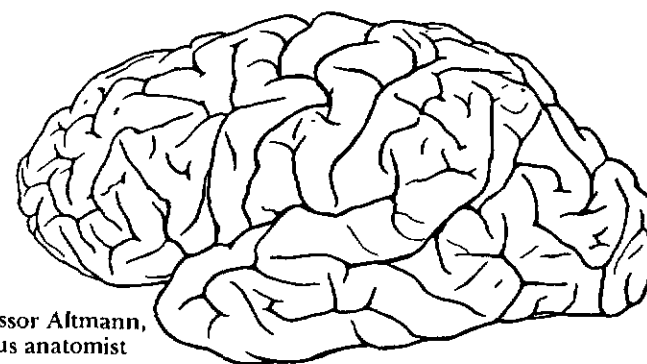
The brain of the
great mathematician
K. F. Gauss



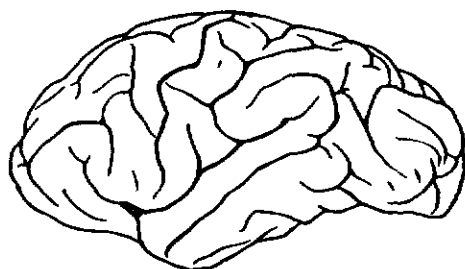
The brain of
General Skobelev



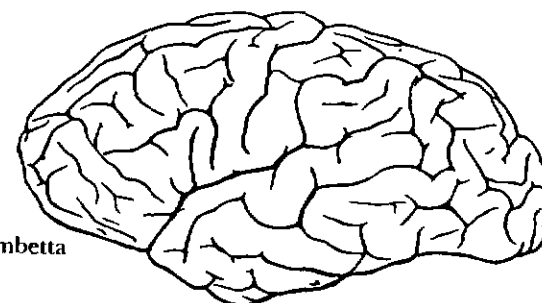
Bushwoman



Professor Altmann,
famous anatomist



Gorilla



Gambetta

3•3 Spitzka's chain of being according to brain size.

3•4 Spitzka's depiction of variation in brain size among white men of
eminence.

fleshy [*chamny*] than the Frenchman—so much so that their relation of brain size to total mass, far from being superior to ours, appears to me, on the contrary, to be inferior.

I do not challenge Broca's use of corrections but I do note his skill in wielding them when his own position was threatened. Bear this in mind when I discuss how deftly he avoided them when they might have challenged a congenial conclusion—the small brains of women.

SMALL-BRAINED MEN OF EMINENCE

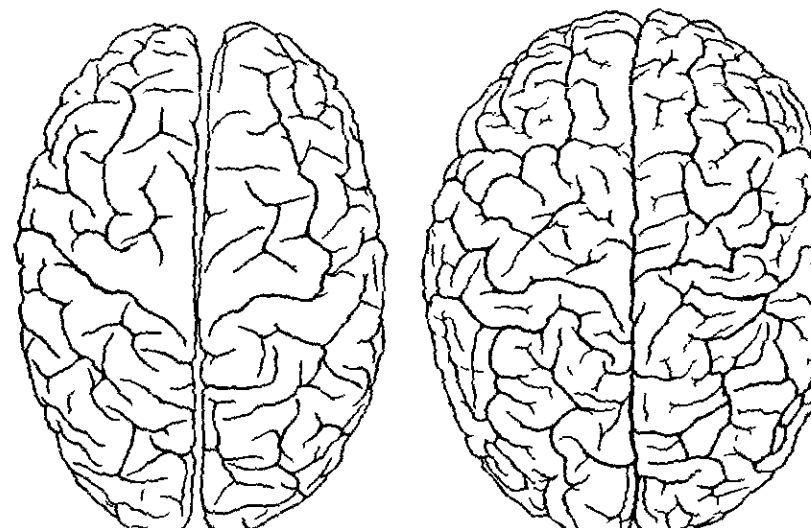
The American anatomist E. A. Spitzka urged men of eminence to donate their brains to science after their death. "To me the thought of an autopsy is certainly less repugnant than I imagine the process of cadaveric decomposition in the grave to be" (1907, p. 235). The dissection of dead colleagues became something of a cottage industry among nineteenth-century craniometricians. Brains exerted their customary fascination, and lists were proudly touted, accompanied by the usual invidious comparisons. (The leading American anthropologists J. W. Powell and W. J. McGee even made a wager over who carried the larger brain. As Ko-Ko told Nanki-Poo about the fireworks that would follow his execution, "You won't see them, but they'll be there all the same.")

Some men of genius did very well indeed. Against a European average of 1,300 to 1,400 grams, the great Cuvier stood out with his topheavy, 1,830 grams. Cuvier headed the charts until Turgenev finally broke the 2,000 gram barrier in 1883. (Other potential occupants of this stratosphere, Cromwell and Swift, lay in limbo for insufficiency of record.)

The other end was a bit more confusing and embarrassing. Walt Whitman managed to hear America singing with only 1,282 grams. As a crowning indignity, Franz Josef Gall, one of the two founders of phrenology—the original "science" of judging various mental capacities by the size of localized brain areas—weighed in at a meager 1,198 grams. (His colleague J. K. Spurzheim yielded a quite respectable 1,559 grams.) And, though Broca didn't know it, his own brain weighed only 1,424 grams, a bit above average to be sure, but nothing to crow about. Anatole France extended the range of famous authors to more than 1,000 grams when, in 1924, he donated for the other end of Turgenev's fame and clocked in at a

The small brains were troublesome, but Broca, undaunted, managed to account for all of them. Their possessors either died very old, were very short and slightly built, or had suffered poor preservation. Broca's reaction to a study by his German colleague Rudolf Wagner was typical. Wagner had obtained a real prize in 1855, the brain of the great mathematician Karl Friedrich Gauss. It weighed a modestly overaverage 1,492 grams, but was more richly convoluted than any brain previously dissected (Fig. 3.5). Encouraged, Wagner went on to weigh the brains of all dead and willing professors at Göttingen, in an attempt to plot the distribution of brain size among men of eminence. By the time Broca was battling with Gratiolet in 1861, Wagner had four more measurements. None posed any challenge to Cuvier, and two were distinctly puzzling—Hermann, the professor of philosophy at 1,368 grams, and Hausmann, the professor of mineralogy, at 1,226 grams. Broca corrected Hermann's brain for his age and raised it

3.5 The brain of the great mathematician K. F. Gauss (right) proved to be something of an embarrassment since, at 1,492 grams, it was only slightly larger than average. But other criteria came to the rescue. Here, E. A. Spitzka demonstrates that Gauss's brain is much more richly convoluted than that of a Papuan (left).



by 16 grams to 1.19 percent above average—"not much for a professor of linguistics," Broca admitted, "but still something" (1861, p. 167). No correction could raise Hausmann to the mean of ordinary folks, but considering his venerable seventy-seven years, Broca speculated that his brain may have undergone more than the usual amount of senile degeneration: "The degree of decadence that old age can impose upon a brain is very variable and cannot be calculated."

But Broca was still bothered. He could get around the low values, but he couldn't raise them to unusual weights. Consequently, to clinch an unbeatable conclusion, he suggested with a touch of irony that Wagner's post-Gaussian subjects may not have been so eminent after all:

It is not very probable that 5 men of genius should have died within five years at the University of Göttingen. . . . A professorial robe is not necessarily a certificate of genius; there may be, even at Göttingen, some chairs occupied by not very remarkable men (1861, pp. 165-166).

At this point, Broca desisted: "The subject is delicate," he wrote (1861, p. 169), "and I must not insist upon it any longer."

LARGE-BRAINED CRIMINALS

The large size of many criminal brains was a constant source of bother to craniometricians and criminal anthropologists. Broca tended to dismiss it with his claim that sudden death by execution precluded the diminution that long bouts of disease produced in many honest men. In addition, death by hanging tended to engorge the brain and lead to spuriously high weights.

In the year of Broca's death, T. Bischoff published his study on the brains of 119 assassins, murderers, and thieves. Their average exceeded the mean of honest men by 11 grams, while 14 of them topped 1,500 grams, and 5 exceeded 1,600 grams. By contrast, only three men of genius could boast more than 1,600 grams, while the assassin Le Pelley, at 1,809 grams, must have given pause to the shade of Cuvier. The largest female brain ever weighed (1,565 grams) belonged to a woman who had killed her husband.

Broca's successor Paul Topinard puzzled over the data and finally decided that too much of a good thing is bad for some people. Truly inspired criminality may require as much upstairs as

professorial virtuosity; who shall decide between Moriarty and Holmes? Topinard concluded: "It seems established that a certain proportion of criminals are pushed to depart from present social rules by an exuberance of cerebral activity and, consequently, by the fact of a large or heavy brain" (1888, p. 15).

FLAWS IN A PATTERN OF INCREASE THROUGH TIME

Of all Broca's studies, with the exception of his work on differences between men and women, none won more respect or attention than his supposed demonstration of steady increase in brain size as European civilization advanced from medieval to modern times (Broca, 1862b).

This study merits close analysis because it probably represents the best case of hope dictating conclusion that I have ever encountered. Broca viewed himself as a liberal in the sense that he did not condemn groups to permanent inferiority based on their current status. Women's brains had degenerated through time thanks to a socially enforced underusage; they might increase again under different social conditions. Primitive races had not been sufficiently challenged, while European brains grew steadily with the march of civilization.

Broca obtained large samples from each of three Parisian cemeteries, from the twelfth, the eighteenth, and the nineteenth centuries. Their average cranial capacities were, respectively, 1,426, 1,409, and 1,462 cc—not exactly the stuff for a firm conclusion of steady increase through time. (I have not been able to find Broca's raw data for statistical testing, but with a 3.5 percent mean difference between smallest and largest sample, it is likely that no statistically significant differences exist at all among the three samples.)

But how did these limited data—only three sites with no information on ranges of variation at a given time and no clear pattern through time—lead Broca to his hopeful conclusion? Broca himself admitted an initial disappointment: he had expected to find intermediate values in the eighteenth-century site (1862b, p. 106). Social class, he argued, must hold the answer, for successful groups within a culture owe at least part of their status to superior wits. The twelfth-century sample came from a churchyard and must represent gentry. A common grave provided the eighteenth-century skulls. But the nineteenth-century sample was a mixture,

ninety skulls from individual graves with a mean of 1484 cc, and thirty-five from a common grave with an average of 1403 cc. Broca claimed that if differences in social class do not explain why calculated values fail to meet expectations, then the data are unintelligible. Intelligible, to Broca, meant steadily increasing through time—the proposition that the data were meant to prove, not rest upon. Again, Broca travels in a circle:

Without this [difference in social class], we would have to believe that the cranial capacity of Parisians has really diminished during centuries following the 12th. Now during this period . . . intellectual and social progress has been considerable, and even if we are not yet certain that the development of civilization makes the brain grow as a consequence, no one, without doubt, would want to consider this cause as capable of making the brain decrease in size (1862b, p. 106).

But Broca's division of the nineteenth-century sample by social class also brought trouble as well as relief—for he now had two samples from common graves and the earlier one had a larger mean capacity, 1,409 for the eighteenth century vs. 1,403 for the nineteenth. But Broca was not to be defeated; he argued that the eighteenth-century common grave included a better class of people. In these prerevolutionary times, a man had to be really rich or noble to rest in a churchyard. The dregs of the poor measured 1,403 in the nineteenth century; the dregs leavened by good stock yielded about the same value one hundred years before.

Each solution brought Broca new trouble. Now that he was committed to a partition by social class within cemeteries, he had to admit that an additional seventeen skulls from the morgue's grave at the nineteenth-century site yielded a higher value than skulls of middle- and upper-class people from individual graves—1,517 vs. 1,484 cc. How could unclaimed bodies, abandoned to the state, surpass the cream of society? Broca reasoned in a chain of surprisingly weak inference: morgues stood on river borders; they probably housed a large number of drowned people; many drowned are suicides; many suicides are insane; many insane people, like criminals, have surprisingly large brains. With a bit of imagination, nothing can be truly anomalous.

Front and back

Tell me about this new young surgeon, Mr. Lydgate. I am told he is wonderfully clever; he certainly looks it—a fine brow indeed.

—GEORGE ELIOT, *Middlemarch* (1872)

Size of the whole, however useful and decisive in general terms, did not begin to exhaust the content of craniometry. Ever since the heyday of phrenology, specific parts of the brain and skull had been assigned definite status, thus providing a set of subsidiary criteria for the ranking of groups. (Broca, in his other career as a medical man, made his most important discovery in this area. In 1861 he developed the concept of cortical localization of function when he discovered that an aphasic patient had a lesion in the left inferior frontal gyrus, now called Broca's convolution.)

Most of these subsidiary criteria can be reduced to a single formula: front is better. Broca and his colleagues believed that higher mental functions were localized in anterior regions of the cortex, and that posterior areas busied themselves with the more mundane, though crucial, roles of involuntary movement, sensation, and emotion. Superior people should have more in front, less behind. We have already seen how Bean followed this assumption in generating his spurious data on front and back parts of the corpus callosum in whites and blacks.

Broca often used the distinction of front and back, particularly to extract himself from uncomfortable situations imposed by his data. He accepted Gratiolet's classification of human groups into "*racés frontales*" (whites with anterior and frontal lobes most highly developed), "*racés pariétales*" (Mongolians with parietal or mid lobes most prominent), and "*racés occipitales*" (blacks with most in the back). He often unleashed the double whammy against inferior groups—small size and posterior prominence: "Negroes, and especially Hottentots, have a simpler brain than ours, and the relative poverty of their convolutions can be found primarily on their frontal lobes" (1873a, p. 32). As more direct evidence, he argued that Tahitians artificially deformed the frontal areas of certain male children in order to make the back portions bulge. These men became courageous warriors, but could never match white heroes for style: "Frontal deformation produced blind passions, ferocious instincts, and animal courage, all of which I would willingly call

occipital courage. We must not confound it with true courage, frontal courage, which we may call Caucasian courage" (1861, pp. 202–203).

Broca also went beyond size to assess the quality of frontal vs. occipital regions in various races. Here, and not only to placate his adversary, he accepted Gratiolet's favorite argument that the sutures between skull bones close earlier in inferior races, thus trapping the brain within a rigid vault and limiting the effectiveness of further education. Not only do white sutures close later; they close in a different order—guess how? In blacks and other inferior people, the front sutures close first, the back sutures later; in whites, the front sutures close last. Extensive modern studies of cranial closure show no difference of timing or pattern among races (Todd and Lyon, 1924 and 1925).

Broca used this argument to extricate himself from a serious problem. He had described a sample of skulls from the earliest populations of *Homo sapiens* (Cro-Magnon type) and found that they exceeded modern Frenchmen in cranial capacity. Fortunately, however, their anterior sutures closed first and these progenitors must have been inferior after all: "These are signs of inferiority. We find them in all races in which the material life draws all cerebral activity to it. As intellectual life develops among a people, the anterior sutures become more complicated and stay open for a longer time" (1873a, p. 19).

The argument of front and back,* so flexible and far-ranging, served as a powerful tool for rationalizing prejudice in the face of apparently contradictory fact. Consider the following two examples.

THE CRANIAL INDEX

Beyond brain size itself, the two most hoary and misused measures of craniometry were surely the facial angle (jutting forward of face and jaws—the less the better), and the cranial index. The cranial index never had much going for it beyond ease of measurement. It was calculated as the ratio of maximum width to maximum

*Broca did not confine his arguments on the relative worth of brain parts to the distinction between front and back. Virtually any measured difference between peoples could be given a value in terms of prior conviction about relative worth. Broca once claimed, for example (1861, p. 187), that blacks probably had larger cranial nerves than whites, hence a larger nonintellectual portion of the brain.

length of the skull. Relatively long skulls (ratio of .75 or less) were called dolichocephalic; relatively short skulls (over .8), brachycephalic. Anders Retzius, the Swedish scientist who popularized the cranial index, constructed a theory of civilization upon it. He believed that Stone Age peoples of Europe were brachycephalic, and that progressive Bronze Age elements (Indo-European, or Aryan dolichocephalics) later invaded and replaced the original and more primitive inhabitants. Some original brachycephalic stocks survive among such benighted people as Basques, Finns, and Lapps.

Broca disproved this popular tale conclusively by discovering dolichocephalics both among Stone Age skulls and within modern remnants of "primitive" stocks. Indeed, Broca had good reason to be suspicious of attempts by Nordic and Teutonic scientists to enshrine dolichocephaly as a mark of higher capability. Most Frenchmen, including Broca himself (Manouvrier, 1899), were brachycephalic. In a passage that recalls his dismissal of Tiedemann's claims for equality between black and white brains, Broca labeled Retzius's doctrine as self-serving gratification rather than empirical truth. Did he ever consider the possibility that he might fall prey to similar motivations?

Since the work of Mr. Retzius, scientists have generally held, without sufficient study, that dolichocephaly is a mark of superiority. Perhaps so; but we must also not forget that the characters of dolichocephaly and brachycephaly were studied first in Sweden, then in England, the United States and Germany—and that in all these countries, particularly in Sweden, the dolichocephalic type clearly predominates. It is a natural tendency of men, even among those most free of prejudice, to attach an idea of superiority to the dominant characteristics of their race (1861, p. 513).

Obviously, Broca declined to equate brachycephaly with inherent stupidity. Still, the prestige of dolichocephaly was so great that Broca felt more than a little uncomfortable when clearly inferior people turned up longheaded—uncomfortable enough to invent one of his most striking, unbeatable arguments. The cranial index had run into a stunning difficulty: not only were African blacks and Australian aborigines dolichocephalic, but they turned out to be the world's most longheaded peoples. Adding insult to this injury, the fossil Cro-Magnon skulls were not only larger than those of modern Frenchmen; they were more dolichocephalic as well.