

FECHNER: INADVERTENT FOUNDER OF PSYCHOPHYSICS

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Certainly the most interesting tool that science employs in its perpetual pursuit of knowledge is the scientist, with his enthusiasms, egoisms, and prejudices, his inevitable unconscious attitudinal orientation in the consensus of contemporary opinion, which we call the *Zeitgeist*. One wonders what science would be like if automation could take over completely. Are there mechanical equivalents for jealousy and pride and pigheadedness and insight, and those other interacting personal forces that contribute to contemporary truth in the scientific field?

Fechner never tried to found psychophysics or a new experimental psychology. He was, in his own estimation in those last forty-five years of his life, a philosopher, fighting what he regarded as the crass materialism of his day, the *Nachtsansicht* or "night view," as he called it, and promoting the faith that mind and soul are the ultimates of reality, the *Tagesansicht* or "day view." This favoring of the clear philosophical vision in the day view as opposed to the materialistic darkness of the night view is Fechner's panpsychism, a faith that seems mystical to most modern scientists, partly because the German word *Seele* does not distinguish between mind and soul, between that which compares the sensory intensities of two lifted weights and whatever it is that persists after the body's death.

Let us take time to recall what Fechner did with the 86 years of his life between 1801 and 1887. At the age of 16 he went to Leipzig to study physiology, which in those days meant taking a doctorate in medicine. He stuck to physiology for only seven years and then turned to the study of physics and mathematics. He began work in this new field humbly, making his early reputation by the translation into German of French handbooks of physics and chemistry. At the age of 33, after some research in the new physics of electricity, he was made professor of physics at Leipzig; he held that post until 1839, when he resigned for reasons of poor health.

For 15 years he had been a physicist, but three other interests were emerging. Under the nom de plume of Dr. Mises, he provided scope for his humanistic interests by beginning a series of essays on various topics, the first of which was a satire on the current medical faith in the potency of iodine: *Proof that the Moon is Made of Iodine* (1821). Out of this side of Fechner's nature emerged his vigorous support of spiritualism as opposed

to materialism: he wrote *The Little Book on Life after Death* in 1836. On the scientific side there was his growing interest in sense-physiology, and presently his papers on subjective colors and afterimages in 1838 and 1840. It must have been then that he permanently injured his eyesight by gazing too long at the sun through colored glasses.

There followed from 1839 to 1851 a dozen years of retirement in Leipzig. During the first three or four years he suffered from some form of psychoneurosis, and it would seem that this German academic never quite escaped from unusual seclusiveness as he lived on in Leipzig outside of the University. It was during this period that his concern with the "day view" of reality, with panpsychism, emerged. In 1848 he published *Nanna*, a volume named for the goddess of flowers, in which he argued for the mental life of plants. Then in 1851 came the *Zend-Avesta*, with a subtitle specifying that the volume was about the things of heaven and the life to come.

Actually this philosophical period of Fechner's life extended altogether over 43 years from 1836 to 1879, during which, in writing in 1861 on the problem of the soul, he remarked that he had already called four times to a sleeping world which had not awakened, and he was now calling a fifth time, and "if I live, I shall call yet a sixth and a seventh time, 'Steh! auf!' and always it will be the same 'Steh! auf!'" He did call twice more, the seventh in 1879 in the volume on the "day view and the night view."

Fechner's philosophy won him little respect among the scientists, nor any great acclaim by the philosophers. William James took him seriously, hailed the *Zend-Avesta* when he belatedly discovered it, told Bergson that Fechner "seems to me of the real race of prophets." James described Fechner's philosophy in *A Pluralistic Universe* [4] and related Fechner's views to his own. It was this excitement about spiritualism that pushed Fechner into psychophysics—strange parentage it was for psychophysics.

On that now famous morning of 22 October 1850, Fechner, lying in bed and puzzling how to do away with materialism, had the thought that, since conscious events are necessarily related to events in the brain—at least in the living person—an equation between the two systems would have the effect of identifying them and of abolishing the dualism, abolishing it in favor of a psychic monism which was what Fechner wanted. If he knew about Weber's law, he did not think about its relevance then. Later, however, he realized the significance of Weber's experiments and also of Daniel Bernoulli's contention in 1738 that *fortune morale* (psychic) is proportional to the logarithm of *fortune physique* (physical). Now Fechner thought: sensation is a function of its stimulus; you can measure stimuli, but how can you measure sensations? He concluded that sensory magnitude can be measured in terms of sensitivity, and he laid down the general outlines of his program in *Zend-Avesta*, the book about heaven and the future life. Imagine sending a graduate student of psychology nowadays to the Divinity

School for a course in immortality as preparation for advanced experimental work in psychophysics! How narrow we have become!

After the publication of the *Zend-Avesta* Fechner had 14 years of intense activity in psychophysics, the first 9 of them in experimentation. After that came the epochal event, the publication of the *Elemente der Psychophysik* in two parts in 1860, the occasion that we celebrate today. It was the psychophysics, not the panpsychism, that attracted attention. Fechner's alleged measurement of sensation met with criticism and objection which indeed showed its importance in the current scientific belief that belonged to the mid-nineteenth century. History was now ready for a scientific psychology, but how can you become scientific unless you can measure your phenomena? Fechner's scheme was plausible and the need for sensory measurement led some to overlook its defects. He argued that sensation cannot be measured directly but can be indirectly. What you do is to measure sensitivity by determining differential thresholds; then, to find the magnitude of the sensation, you calculate the number of just noticeable differences (jnd) from zero sensation at the absolute threshold to the sensation that is being measured. Of course, this business of counting up jnd to measure a sensation met with the question: How do you know that all jnd are equal? And indeed, when measured by certain other scales, jnd may turn out not to be equal.

About 1865 Fechner turned from psychophysics to a new interest in experimental esthetics, publishing his classic in that field in 1876. The world, however, would not leave him free. Applause from some reinforced criticism from others, and Fechner was forced—for it was not easy for a German scholar to let criticism go unanswered—to reply to objections and to defend his measurement of sensation. He must have thought that he would himself have been content to go on crying to a sleeping world that the measurement of sensation had now made plausible man's grasp on immortality; but when the world at last awoke, it was to the wrong cry—unfortunately for Fechner, fortunately for us.

Tolstoy, speaking of History in his *War and Peace* and arguing for cultural determination—and thus indirectly against the importance of Great Men in the determination of History—remarked that “History, the unconscious, general hive-life of mankind, uses every moment of the life of kings as a tool for its own purposes . . . A king is History's slave.” History itself is the sum of the myriad of events that make it up, and every one of these is caused, though there be so many that prediction from a knowledge of them becomes impossible. As to the Great, Tolstoy imagined a young cavalry commander who achieved high honor because, exuberant with good health, unaware of danger but without orders, he led his men at a gallop across the level plain in what turned out to be a successful charge. So with Fechner. He attacked the ramparts of materialism and was decorated for measuring sensation.

Scientists, for the most part, believe in the operation of deterministic causality between events, yet they also like in ordinary professional conversation to leave room for the originality of Great Men. There is a contradiction here. To see the Great Man's important contribution to thought, as a consequence of the combination of commonly accepted knowledge, plus certain ideas or discoveries of other men, plus one or two coincidences of the kind of insight that brings thitherto unrelated ideas into useful connection, is largely to reduce greatness to a link in a complex causal chain. When the whole story is told of an invention or a discovery or the founding of a school, when as much attention is given to the antecedents as to the consequences of the great event, its greatness seems to diminish, its importance becomes less as it spreads over a broader range of activities and a longer span of time.

The case with Fechner goes about like this. The times were ready for scientists to get hold of mind by measuring it. Sensory thresholds had been determined as much as a hundred years before Fechner. The physiologists were already experimenting with sensation—Johannes Müller with specific nerve energies in 1826, Ernst Heinrich Weber with tactual sensibility in 1834. To contemporaneous thought Herbart had contributed the notion of the measurement of ideas, while denying the possibility of experimenting on them; and he had made Leibnitz's concept of the threshold well known. Lotze published his *Medical Psychology: The Physiology of the Mind* the year after Fechner's *Zend-Avesta*. It was in this setting that Fechner had on 22 October 1850 his important insight about measuring sensation and relating the measures of sensation to the measures of their stimuli.

Fechner's claim to originality of epoch-making magnitude lies in this insight. His claim to honor lies in his careful and laborious work through the decade of the 1850's, and the crucial character of the *Elemente* when it finally came out in 1860. He is credited with having given experimental psychology the three fundamental psychophysical methods still in constant use today, but actually the method of limits goes back to 1700 and may be said to have been formalized by Delezenne in 1827, whereas the method of constant stimuli was first used by Vierordt in 1852. Only the method of average error belongs to Fechner, and that only half, for he and his brother-in-law, A. W. Volkmann, developed it in the 1850's. What Fechner did in the *Elemente* was to present the case for sensory measurement and write the systematic handbook for psychophysics, a new field of scientific endeavor. In this sense he founded psychophysics as a field that is ancillary to the establishment of the philosophy of panpsychism.

It is conceivable that the *Elemente* might have fallen flat, as the laborious production of a queer old mystic in Leipzig who went to endless pains to prove a point that most wise men do not believe. The times, however, were ripe for psychophysics. Immediately the methods began to be used, and new facts began to accumulate, while the argument waxed about Fechner's

interpretation of what it is that the methods do, about whether sensation had actually been measured after all.

In general, the greatness of Great Men is a subjective addition to history which posterity adds in order to understand history. History is continuous and sleek. Great Men are the handles that you put on its smooth sides. You have to simplify natural events in order to understand them, and science itself is forced to generalize in the interest of economy of thinking. Just so the history of science singles out events, schools, trends, and discoveries and eponymizes them, that is to say, it names them for a central figure. Fechner has become the name for a change in the newly developing scientific psychology, for the gradual acceptance of the belief that the fleeting and evanescent mind—consciousness—can be measured. That had to happen before anything else could take place in respect of scales and measurement in the psychological sphere.

William James admired Fechner, the philosopher, but deplored Fechner, the psychophysicist. Almost everyone knows how he said, "But it would be terrible if even such a dear old man as this could saddle our science forever with his patient whimsies, and, in a world so full of more nutritious objects of attention, compel all future students to plough through the difficulties, not only of his own works, but of the still drier ones written in his refutation . . . The only amusing part of it is that Fechner's critics should always feel bound, after smiting his theories hip and thigh and leaving not a stick of them standing, to wind up by saying that nevertheless to him belongs the *imperishable glory*, of first forming them and thereby turning psychology into an *exact science*." Well, say I, isn't that sort of glory as nearly imperishable as one could expect ever to get? But then, of course, James did not agree with Tolstoy. He thought that there are Great Men.

Only this year Henri Piéron has expressed a thought quite similar to James' except that Piéron and James are on opposite sides of the Fechner fence. Piéron wrote in concluding a centennial article about the importance of Fechner's psychophysics: "And thus the shade of Fechner does not cease in our day to hover over many American laboratories of experimental psychology which without doubt never hear tell of Fechner except when Stevens declares that nothing of Fechner's work remains." That is hardly fair to us Americans. Stevens' students hear about Fechner, and scattered over America are a small coterie of psychologists who seldom miss noting the date when 22 October comes around.

And now here are we celebrating the centenary of the *Elemente*. In complimenting Fechner we compliment ourselves, of course. A centenary is virtually a religious rite. We could not be pleasing Fechner now, even if he had justified his contribution to psychophysics by eventually finding himself immortal. What we need for our own use are symbols of our faith, our faith in science and measurement and quantification. It is right to hang Fechner's

picture on the wall. It is a symbol of what we will to have important. It is right to be glad when your son is born on 22 October. It is right to atomize the smooth flow of History by the eponymy of great names. The scientist may be a determinist in his model-making, but as an active scholar and experimenter he needs more motivation than simple description and the generalization of observation can provide. He needs humor and reverence, as well as a little distortion of the complacency of history, to keep his prime-mover going, and what good is the scientific machine without a prime-mover?

It was given to Fechner to have the idea of measuring sensation independently of the measure of its material stimulus. In his own opinion he succeeded. Posterity doubts the validity of his procedure or even condemns it. Yet, if posterity has something better, it grew out of what Fechner provided. All honor then to the man who, resolved to achieve one goal, actually reached another, who because of his patient insistence remains the central figure at the absolute threshold at which measurement entered psychology. It may be said that he gave to sensations their magnitudes.

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