Strange Science

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CHAPTER 5

Reading through Deafness

Francis Galton and the Strange Science of Psychophysics

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One of the strangest Victorian sciences originated in the work of Gustav Theodor Fechner, a German experimental psychologist who believed that the relationship between "body and soul" could be studied with mathematical precision.[1] Rather than accept that an insuperable barrier distinguishes that which is "mental, psychological, or belonging to the soul" from that which is "bodily, corporeal, physical, or material," Fechner sought to study human beings from a "single point of view."[2] In his monumental book *Elemente der Psychophysik* (1860), he argued that scientists could move beyond the mind-body distinction by studying sensory experience, which involves the physical stimulation of nerves and the mental recognition of the feeling produced by that stimulation. Having coined the term *Psychophysik* (translated into English as *psychophysics*) to describe this new line of scientific inquiry, Fechner designed rigorous experiments that would allow him to exploit its full potential.[3] In these experiments, which he describes at length in *Elemente*, he increased the intensity of a stimulus in small increments and then recorded the subject's perception of those increases in numerical terms. By comparing the two figures, Fechner determined the mathematical relationship—

which he referred to as the "psycho-physical law"—between physical stimulation and psychological experience of a sensation.[4]

Fechner's development of psychophysics had dramatic and enduring effects on the field of psychology in the late nineteenth century. Soon after *Elemente der Psychophysik* appeared in 1860, German psychologists Wilhelm Wundt and Hermann Ebbinghaus incorporated Fechner's theories and psychophysical experiments into their research on sensation. And although *Elemente* was not translated into English until 1966, the book made a powerful impression on scientists around the world as reviews and excerpts circulated in British, French, and American periodicals during the early 1870s. By 1875, Francis Galton praised Fechner's book for "lay[ing] the foundations of a new science" and noted that psychophysics was "beginning to attract serious attention in Belgium, France, America and England."[5] By the time William James published his *Principles of Psychology* in 1890, *Elemente der Psychophysik* had made its mark on the field of psychology. As James observed, "Fechner's book was the starting point of a new department of literature, which it would be perhaps impossible to match for the qualities of thoroughness and subtlety."[6] Although James went on to criticize Fechner's "peculiarly fragile" methods in *Principles*, psychophysics did not linger long on the periphery of mainstream science.[7] During the early twentieth century, Fechner's once-strange science gained a stronghold in psychology and remains an important field in the discipline today.[8] Finally, Fechner's innovative way of thinking about the mind-body problem inspired twentieth-century scientists and philosophers including Sigmund Freud, Henri Bergson, Alfred Whitehead, Ernst Mach, and Ilya Prigogine—all of whom acknowledged his profound influence on their work.[9]

Critical accounts of Fechner's legacy have painted a nefarious picture of his influence on scientific and cultural history in Europe, particularly in the nineteenth century. Jonathan Crary has argued, for example, that Fechner's quantification of sensation "render[ed] a perceiver manageable, predictable, productive" and made the human body "compatible with arrangements of power."[10] In making these claims, Crary draws on Michel Foucault's theory of biopolitics, which describes the nineteenth century as the historical moment in which life (*bios*) and its processes are incorporated "into the order of knowledge and power, into the sphere of political techniques."[11] Although Crary's valuable study covers extensive ground, it passes over the work of Francis Galton, who did more than any other nineteenth-century scientist to usher Britain into a new biopolitical age using Fechner's theories and experimental techniques.

This chapter begins by establishing Galton's significance in the history of nineteenth-century biopolitics, which depended upon his knowledge of and experiments in psychophysics. As I demonstrate, Galton used Fechner's work to design new instruments that could measure the relative sensitivity of an entire population, making the bodies and sensory processes of people knowable, comparable, and "compatible with arrangements of power." Indeed, Galton's collection of biological data, which included intimate details about the sensory capacities of thousands of people, solidified his eugenic interests and his belief that blindness, deafness, and other disabilities would weaken the national "stock." After discussing the ominous implications of Galton's early work in psychophysics, however, I trace the surprising turns his research took when he began to lose his hearing. As Galton reached the point of near-deafness during the 1890s, I argue, he turned his attention to a subject in Fechner's *Elemente* that he had never explored before: the shadowy world of "below-threshold stimuli."[12] These stimuli acted upon the nerves, as Fechner observed, but failed to reach the threshold required to produce a complete sensation. Inspired by Fechner's theory of below-threshold stimuli, Galton speculated that faint sensations—such as barely audible sounds—could be supplemented by the imagination, and he turned to the poetry of Wordsworth and Tennyson to substantiate his speculations. In so doing, Galton simultaneously opened new lines of scientific inquiry and shed new light on the sensory poetics of Wordsworth and Tennyson.

In this chapter, I consider how Galton's experience of deafness altered his interpretation of literature, science, and the body. He began to reconceive the body's sensory thresholds as something other than hard limits that mark the fixed range of a person's ability; he began to see them as boundaries to be surpassed by the powers of imagination. At the same time, his personal struggle with deafness rerouted his psychophysical research away from eugenics and toward more productive and positive ends. And finally, I show how Galton's experience of hearing loss inspired new interpretations of familiar poems that affirmed the vital powers of imagination. Of course, these revelations neither overshadow nor mitigate Galton's eugenic fantasies or his belief that congenital deafness was dangerously dysgenic. Rather, they prove that deafness could be a source of insight, ingenuity, and creative interpretation rather than a disabling and degenerative condition that endangered national welfare—even for Galton, who spent most of his life trying to prove otherwise.

Fechner's Elemente *in England*

In 1872, twelve years after *Elemente der Psychophysik* first appeared in Germany, the English psychologist James Sully introduced Gustav Fechner's book to the British public in an extensive article in the *Westminster Review* entitled "Recent Experiments with the Senses."[13] Along with Fechner's *Elemente*, Sully discussed the work of Helmholtz, Volkmann, and Wundt, all of whom researched the "phenomena of sensation," or what Sully called the "borderland of Physiology and Psychology."[14] Sully noted that sensation eluded objective inquiry because it was an "individual and subjective" experience.[15] But he observed that Fechner and other German scientists managed to mitigate the "oscillation of individual feeling" by "varying the experiments" and by "taking different states of the same individual, as well as many different individuals" into consideration.[16] This was a crucial point for British scientists who valued objectivity and understood it to be the guiding principle of scientific inquiry, as George Levine, Lorraine Daston, Peter Galison, and others have demonstrated.[17]

From the moment Fechner's work appeared before British readers, then, it was framed as an innovative empirical science that took subjective experience into account. It offered a reliable way to remake specific aspects of interiority available for objective study, a desire that many Victorian scientists shared. As William A. Cohen has observed, "Much of Victorian mental science focuses on differentiating interior from exterior states and on the links between physical and immaterial components of human psychology."[18] Moreover, Fechner's work dovetailed with the physiological psychology that Alexander Bain, William Carpenter, and Thomas Laycock had been writing about since the 1850s. Thus when Francis Galton praised the "new science" of psychophysics in an 1875 letter to a friend, he remarked that although the book was fifteen years old, "the reading world is only now prepared to recognize its merits."[19] Thus he declared that he would be "heartily glad if an English publisher were to bring his work out in translation, believing that it would interest many scientific men and introduce a new and much needed branch of scientific investigation into England."[20] Although Galton's wish would not be fulfilled for almost a hundred years, he gauged the book's value and significance accurately—it did interest a number of scientists, including George Henry Lewes, Henry Maudsley, and others.

By his own account, Galton was most impressed by the central aim of Fechner's book, which was "to show that one fundamental law connects the amount of *sensation* (in the widest sense of the word) with the

magnitude of the *exciting cause*," and he concluded that the experiments Fechner used to discern that fundamental law were "most delicate and ingenious."[21] Indeed, his meticulous experiments revealed that physical stimuli must reach a "threshold" (die *Schwelle)* to register on a person's consciousness. Then, building on the work of Ernst Weber, a German physician who described the minimum recognizable difference between two stimuli as the "just-noticeable difference" (JND), Fechner conducted further experiments that involved slowly increasing the intensity of a stimulus (the heaviness of a weight, for example) and asking the subject to continuously evaluate whether or not he or she perceived any differences. After collecting and analyzing the data, Fechner refined Weber's hypothesis by noting that the intensity of a stimulus must increase exponentially for a person to perceive an increase in its intensity. He then developed a logarithm to describe the exponential relationship between stimulus and perception.[22] The Weber-Fechner formula, as it is now known, expresses the "fundamental law" that "connect[s] the amount of *sensation* . . . with the magnitude of the *exciting cause*," and it is this law that so impressed Galton.

While Galton, Sully, and other British scientists marveled at Fechner's work and the formula he derived through rigorous experimentation, other Victorian writers were exasperated by his attempt to describe the relationship between sensation and stimulus in mathematical terms. In *Studies in the History of the Renaissance* (1873), for example, Walter Pater wrote fondly of Renaissance science, which was "all divination, clairvoyance, unsubjected to our exact modern formulas, seeking in an instant of vision to concentrate a thousand experiences."[23] Pater was likely referring to the Weber-Fechner formula, which Sully had introduced to British audiences in the pages of the *Westminster Review* just one year before Pater's book appeared in print. And indeed, Fechner did measure and quantify the "thousand experiences" that constitute a sensation, yielding a totalizing formula that described precisely how sensory experience corresponded to physical stimuli. Given Pater's devotion to the British aesthetic movement, he would have been even more distraught if he had lived to see the rise of experimental aesthetics in the twentieth century, which made ample use of the Weber-Fechner formula to calculate the optimal stimulatory intensities for aesthetic experience.

Fechner's quantification of sensory experience had more pernicious effects on the English populace than Pater intuited, however. As Jonathan Crary argues in *Techniques of the Observer*, the circulation of Fechner's work in the nineteenth century marked the moment when the human

subject, "through knowledge of the body and its modes of functioning, was made compatible with arrangements of power." Bringing Foucault's writing on biopolitics to bear on his analysis of nineteenth-century visual technologies, Crary insists that Fechner's "arithmetical homogenization" of the senses "render[ed] a perceiver manageable, predictable, productive."[24] In this model, qualitative differences in perception are obliterated and only quantitative distinctions among perceptual capacities are available for appraisal. Fechner's work formalized the plurality of human difference into rigid hierarchies by translating it into quantified bundles, Crary argues, and enforced a more rigorous distinction between humans and nonhumans (only the former can describe, and therefore quantify, the intensity of their sensations).

Crary analyzes the effects of Fechner's quantification of sensory perception and makes an especially important argument about the new technologies that used psychophysics to make the human body more fully available to market capitalism. Moreover, Crary understands how psychophysics contributed to the production of subjects who have become complicit in the surveillance of their own senses. And yet he does not consider how the concepts in *Elemente* arrived in England or how British scientists like Francis Galton translated Fechner's vision into a biopolitical reality. As Thomas Lemke points out, the "objects of biopolitics" are the biological features of individual people "measured and aggregated on the level of populations," and the collation of data about such features makes it possible to define norms, establish standards, and determine average values."[25] By designing instruments that could measure the sensory capacities of the English populous, Galton used psychophysics to gather data about and produce a statistical map of the sensory capacities of a large population of living bodies. But Galton did far more than make those bodies available to market capitalism or even governmental power, as Crary argues. Rather, Galton offered a statistical representation of their sensory capacities to justify his eugenic theory and make it seem scientifically legitimate.

Galton and Fechner

Psychophysics was especially appealing to Galton, an "apostle of quantification" who became increasingly interested in statistical analysis.[26] After learning of Fechner's ingenious experiments in James Sully's essay in the *Westminster Review* and reading *Elemente* on his own, Galton began to

devise ways of making psychophysics "suitable for other applications."[27] According to his biographer, Karl Pearson, Galton's "mind was turning from physical to psychical anthropometry" in 1877 when he gave an address to the Department of Anthropology of the British Association for the Advancement of Science (BAAS).[28] At the very beginning of the speech, Galton made a special point of describing the new lines of inquiry that Fechner's work in psychophysics made possible:

> What . . . I especially wish to point out is, that it has of late years become possible to pursue an inquiry into certain fundamental qualities of the mind by the aid of exact measurements. Most of you are aware of the recent progress of what has been termed Psycho-physics, or the science of subjecting mental processes to physical measurements and to physical laws. I do not now propose to speak of the laws that have been deduced, such as that which is known by the name of Fechner . . . ; but I will briefly allude to a few instances of measurement of mental processes. . . . They will show, what I desire to lay stress upon, that the very foundations of the differences between the mental qualities of man and man admit to being gauged.[29]

Galton tried to impress upon his audience what he believed to be true: that Fechner's pioneering experiments made it possible to take "exact measurements" of a person's mental qualities and to compare those of one man to another to gauge their relative strengths and weaknesses. And although Galton emphasized the measurement of "mental processes" in his first public address on the new science of psychophysics, he integrated Fechner's work into other areas of research, including his work on composite photographs and, as we shall see, his study of sensation.[30]

Shortly after he delivered his 1877 address, Galton began to prepare the ground for his own psychophysical research into the sensory capacities of large populations, which would occupy him over the next decade. Using Fechner's theory of sensory thresholds, he designed a series of instruments and devices that could measure the power of a person's senses, thereby allowing Galton to compare them to the power of another. One of the most important instruments he devised was a small whistle that could ascertain the "upper limits of audible sound in different persons."[31] According to Galton, he conducted "amusing experiment[s]" on "some rather elderly and self-satisfied personages," which revealed "a remarkable falling off in the power of hearing high notes as age

advanced."[32] The instrument (now referred to as the Galton whistle) was instrumental in the diagnosis of presbycusis, the loss of hearing in old age, which was precisely the condition that resulted in his profound deafness in the final years of his life.[33]

Throughout the 1880s, Galton used Fechner's theory to design various instruments that would gather sensory data from broad swaths of the English population. As a result of Galton's efforts, psychophysics became an essential part of the broad, scientific effort to collect biological data about the bodies of the English citizenry. In 1880, Galton was appointed chairman of the Anthropometric Committee of the BAAS, which was to orchestrate "The Systematic Examination of Heights, Weights, &c., of Human Beings in the British Empire."[34] Although the committee had collected scores of measurements from different areas in Britain—not quite from the whole empire, as they promised—Galton wanted a more expansive set of measurements, along with fingerprints and photographs of those who were measured. By the time the Anthropometric Committee disbanded in 1885, Galton had opened his own anthropometrics laboratory at the International Health Exhibition in London. Tucked away among the many exhibits at the "Heatheries" was Galton's laboratory, "a compartment only 6 feet wide and 36 feet long, [in which] about ninety persons were measured daily in an elaborate manner."[35] The laboratory was fitted with a new set of instruments intended to measure "keenness of sight; colour sense; judgment of eye; hearing; highest audible note; breathing power; strength of pull and squeeze; swiftness of blow; span of arms; height, standing and sitting; and weight."[36]

When the exhibition closed down a year after it opened, Galton was permitted to move his laboratory to the Science Museum at South Kensington, where it would remain active for another six years. Over the years, he had collected measurements of the sizes, strengths, and perceptual capacities of 9,337 people.[37] In Galton's laboratories, the general public gave their bodies over to measurement, treating the instruments as entertainments in a health exhibition. While they enjoyed pleasurable games or interesting activities the scientist had constructed for them, they unwittingly participated in a large-scale collection of their biological data. Galton would spend years converting the data into a statistical snapshot of a whole population—a graph of intensities, a schematization of the formerly intangible, inaccessible qualities and capacities of British bodies. Galton's anthropometric laboratories carried out one of the first technologically sophisticated and centrally organized attempts to collect vital information about the sensory and physical capacities of the British

public and render that information in statistical terms. His laboratories accordingly became a crucial component of Victorian biopolitics, which Foucault describes as the "numerous and diverse techniques for achieving the subjugation of bodies and the control of populations."[38]

Galton's massive collection of data at the Anthropometrics Laboratory allowed him to generate theories about sensation, which he presented in *Inquiries into Human Faculty* (1883). Using Fechner's language, he concluded that "morbidly sensitive persons" were "induced by lower stimuli than . . . the healthy, but the number of just perceptible grades of sensation between them is not necessarily different."[39] Here he reaches the surprising conclusion that the "women of delicate nerves" who suffer from pathological supersensitivity do not have "acute powers of discrimination." He also makes the counterintuitive claim that men, as a rule, "have more delicate powers of discrimination than women."[40] Women lose on both ends of Galton's sensory study: they are too sensitive to be rational, but not sensitive enough to be discriminating. He grouped workers, "idiots," "savages," and the blind together with women, arguing that they were all less sensitive and discriminating than English gentlemen. And to make matter worse, Galton claimed that his experiments confirmed what he expected to find: that the most sensitive people were also "intellectually ablest" and, as he would later argue, the best suited for reproduction.[41]

During this phase of his career, Galton used psychophysics for more ominous purposes than the comparatively benign collection of biological data for governance or management of a large population: he used the science to statistically justify his theory of eugenics. Anticipating his later work in eugenics, Galton began to express in *Inquiries* his concern about the health of "Our human civilised stock," insisting that it is "far more weakly through congenital imperfection than that of any other species of animals."[42] The sources of such imperfection, according to Galton, are the "weakly and misshapen individuals" one encounters on the street. To ensure that his readers grasp the threat that disability poses, he reminds them that "the worst cases are out of sight" and argues that "we should parade before our mind's eye the inmates of the lunatic, idiot, and pauper asylums, the prisoners, the patients in hospitals, the sufferers at home, the crippled, and the congenitally blind."[43] Disabled bodies serve as props in Galton's early rhetoric on eugenics; they are not people to him, but empty signs of the degeneration that would certainly come if marriage and reproduction were not managed with extreme care.

Galton and the Auditory Imagination

In *Inquiries into Human Faculty*, Galton's derision of physical disability emphasizes blindness, but he soon turned his attention to deafness.[44] In an 1885 essay entitled "Hereditary Deafness," which appeared just three years after *Inquiries*, he expressed his serious concerns about the "deaf-mute" communities forming in the United States, which he had read about in an article by Alexander Graham Bell.[45] Galton shared Bell's fears about evolutionary futurity and believed that deaf communities were forming a "marked and degenerate variety of mankind" perpetuated by intermarriage. He insisted that "strong social, and possibly legislative, agencies" would arise to prevent any marital "unions" that were likely to produce "heredity effects harmful to the nation."[46] He also argued that "gesture-languages"—or signing—should be suppressed and that "the philanthropic custom of massing the deaf and dumb together in separate societies, and of making their life as happy as possible in those societies" should be discouraged.[47]

As Galton's hearing began to decline in the 1890s, however, the tone of his writing about the deaf softened considerably. In 1907, at the age of eighty-five, a nearly deaf Galton replied to a letter from Charles Darwin's son, George, soliciting donations for the blind: "I fully sympathise," Galton responded, "and gladly send £2 to help it. But my strongest sympathy is with the deaf. Had I a fairy godmother," he continued, "I would petition that every experimental physicist should be made as deaf as I am, until they had discovered a good ear trumpet, and then that as many fairy-gifts should be heaped on the discoverer as should exceed all he could desire, as well as the thanks and gratitude of all whom he had relieved!"[48] In part, Galton perceived his deafness as a disabling condition, a burden to be relieved by a mechanical device, the "ear trumpet" he desired. But when Galton wished that "every experimental physicist" could be as deaf as he was, he suggested that deafness could be productive and enabling—not because it would cultivate sympathy in the able-bodied, but because it would supply meaningful motives for new scientific inquiry. For Galton, deafness was both a troublesome burden and an affirming potentiality, especially for scientists working on technologies that amplify the senses.

In an 1893 lecture at the Royal Institution, which announced its debt to Fechner in its title, "The Just-Perceptible Difference," Galton began to describe what he called the "auditory imagination"—a faculty that we all develop when we read silently. In fact, he defined reading as "the audi-

tory presentation of the words that are perused by the eye."[49] Without this faculty, he claimed, "It would be . . . impossible to realise the sonorous flow of the passages, whether in prose or poetry, that are read only with the eyes." By virtue of his deafness, Galton had become quite adept at 'realizing the sonorous flow' of prose and poetry, of 'listening' to words printed in text by translating them into imagined sound. In fact, he described his deafness as the enabling experience—one of "two helpful conditions"—that permitted him to "measure the force" of his own auditory imagination; the other is printed copies of the public lectures he attended, which were sometimes distributed in advance.[50] At these lectures, he made a habit of comparing his "capabilities of following the reader when [he is] using [his eyes], and when he is not"—and he found self-reflexive practice to be "a never-flagging source of diversion." Galton took pleasure in exploring the "potency" of his auditory imagination and in hearing through means other than his physiological ear. And his pleasure and his ability to 'follow the lecturer' dissipated when he ceased to experiment in this way: "Should I raise my eyes from the copy," he wrote, "nothing whatever . . . can be understood, the overtones by which words are distinguished being too faint to be heard."[51] In these fascinating experiments, Galton inverted the structuring phonocentrism that, according to Jacques Derrida, privileges the speaking voice over the written word. In deafness, he had become adept at 'hearing' texts and listening with faculties other than those associated with the ear. Moreover, he claimed that we "all . . . cultivate this form of auditory imagination . . . when we are listening to the words of a reader while our eyes are simultaneously perusing a copy of the book from which he is reading."[52]

To develop his theory of the universal auditory imagination, Galton turned to Fechner's psychophysics, but approached it from a more intriguing angle this time: rather than devising instruments that could pinpoint sensory thresholds with accuracy, he began to wonder about the ghostly stimuli that fell below the threshold of perception. George Henry Lewes wrote of these stimuli eloquently in the second volume of *Problems of Life and Mind* (1879), using Fechner's threshold theory to explain how they can affect the nervous system without registering as a complete sensation:

> There can be no sensation without adequate stimulation, and no stimulation without external stimulus. But the contact of a stimulus with a sensitive surface does not suffice for Sensation: it must have a certain energy to disturb the neural equilibrium, and produce an

> excitation; further, that excitation must reach a certain level of relative intensity to produce a change in the state of consciousness.[53]

In this passage, Lewes illuminates Fechner's most profound, but often overlooked, insight: that not all stimuli result in a complete sensation. As Lewes explains, only those that have "a certain energy" may "disturb neural equilibrium" enough to "produce an excitation," and even then, the excitation had to be intense enough to "produce a change in consciousness." What about the stimuli that excite the nervous system, but do not produce any change in consciousness? According to Fechner's theory, these stimuli either dissolve into unconsciousness or, as Nicholas Dames puts it, remain below threshold until they could "accumulate sufficiently" and "burst suddenly upon the consciousness."[54]

Galton took a profound interest in these kinds of stimuli as his hearing faded, so much so that in his 1893 lecture on the auditory imagination, he explained that he wanted nothing more than to move "beyond . . . the frontier of the mysterious region of mental operations which are not vivid enough to rise above the threshold of consciousness."[55] He would not accept that a weak stimulus must remain below the threshold of consciousness, as it would in a person whose hearing capacity had diminished. Rather, he insisted that the imagination could help these below-threshold stimuli rise to consciousness: the imagination, he explained, "originate[s] . . . what may be termed *incomplete* sensations" and "[when] one of these concurs with a real sensation of the same kind, it would swell its volume."[56]

Galton and the Poets

To develop the idea that the imagination could produce "faint sensations" that supplemented the body's physiological circuitry and help bring weak stimuli to threshold, he turned to Wordsworth and Tennyson. Like many Victorian scientists who, according to Gillian Beer, "habitually seamed their sentences with literary allusion and incorporated literature into the argumentative structures of their work," Galton carefully selected the lines that could illustrate, exemplify, or prove his point about sensation.[57] Moreover, he believed that poetry was the appropriate place to search for evidence that the imagination could supplement physical sensation, since "the force of the imagination may endure with extraordinary power and be cherished by persons of poetic temperament." He

therefore turned to Wordsworth's "Ode: Intimations of Immortality," seizing on the famous lines in stanza 9 that, according to Galton, "long puzzled his readers":

> Not for these I raise
> The song of thanks and praise,
> But for those obstinate questionings
> Of sense and outward things,
> Fallings from us, vanishings, &c.[58]

Galton overlooks many of the nuances of this passage, disregarding the speaker's dim recollections of childhood and the celestial plenitude he has lost, and reads it instead as an allegory about sensory thresholds. He arrives at this interpretation by referring, in perfect literary-critical fashion, to Wordsworth's marginal notes: "The explanation," Galton tells us,

> is now to be found in a note by Wordsworth himself, prefixed to the ode in Knight's edition. Wordsworth there writes—"I was often unable to think of external things as having external existence, and I communed with all I saw as something not apart from, but inherent in, my own immaterial nature. Many times while going to school have I grasped at a wall or tree to recal [*sic*] myself from this abyss of idealism to the reality. At that time I was afraid of such processes. In later times I have deplored, as we all have reason to do, a subjugation of an opposite character, and have rejoiced over the remembrances, as is expressed in the lines 'Obstinate questionings,' &c."[59]

Galton uses biographical detail and marginal notes to reconstruct the poet's experience and make sense of the lines that Helen Vendler insists are the "heart of the poem."[60] As Vendler argues, the lines about misgivings and questionings figure criticality as compensation for the lost splendor of childhood. And while these are "unpleasant experiences, inexplicable disorientations in a shadowy universe," she argues, they are nonetheless the foundation on which we build "our later trust" in the inward reality of feeling and intellect.[61]

For Galton, however, the poet's "obstinate questionings" of "sense and outward things" refer not to the gift of criticality, but to the specific disbelief that perception is merely the act of sensing the object world. In Wordsworth, he finds proof that sensation is not always the result of a physical encounter, a contact between the sensing body and the external

world. He finds an opportunity to read against physical reality and identify an alternate route to sensation that does not involve the physiological circuits ordinarily associated with sensory perception. Wordsworth's inability to "think of external things as having external existence," and his idea that what he communed with was "inherent" in his own "immaterial nature," both support the theory that sensations can originate within the mind. Moreover, they suggest to Galton that the mind can supply a stimulus that augments or supersedes physical stimuli—"external things"—and that perception requires no object, so long as one's powers of imagination are intact.

Galton's literal reading of the Immortality Ode, and his insistence on pairing it with Wordsworth's anecdotal account of an unusual sensory experience, is an example of what Brian Massumi describes as interdisciplinary "poaching." Poaching happens, according to Massumi, when "a concept [is] severed from the system of connections from which it is drawn and plopped into a new and open environment where it suffers an exemplary kind of creative violence."[62] Galton's quotation of Wordsworth's Ode is creative violence, par excellence, because it violates the poem's rhythms, disrupts its flows, and forces unwelcome breaks; it even places a rude ampersand where Wordsworth's lines continue on: "Blank misgivings of a Creature / Moving about in worlds not realised." But, as Massumi points out, this act of creative violence "is only half the story. . . . When you uproot a concept from its network of systemic connections with other concepts you still have its *connectibility* . . . the concept carries a certain residue of activity from its former role."[63] Whenever a concept is poached, Massumi tells us, it carries its affects from the original environment; the poem's affects carry over. In this case, the poem's oscillation between overwrought lament over "The things which I have seen I now can see no more" and sober discovery of a nourishing criticality fuse into Galton's writing about hearing loss and his development of coping mechanisms and new routes to a different kind of fulfillment.

Following his discussion of Wordsworth, Galton turns to Tennyson's "The Holy Grail," a poem about the Knights of the Round Table and their search for a divine and ever-disappearing object. Tennyson famously referred to "The Holy Grail" as "one of the most imaginative of [his] poems" and claimed that it "expressed . . . [his] strong feeling as to the Reality of the Unseen." This Idyll is told in flashback by Percivale in old age to his fellow monk, Ambrosius. Percivale explains that his sister, a Holy Nun, first beheld the Grail and that a vision of the covered Grail appeared before the knights, too, while Arthur was away tending to the

needs of the secular world. Percivale, inspired by his sister's fervency, swears that he will quest for it a year and a day, and Galahad, Lancelot, Gawain, and Bors follow suit. When Arthur returns, he is dismayed and makes predictions about the knights who embark on the quest to see the Grail. Ultimately, the knights experience only what they are capable of experiencing: they, according to Arthur, "have seen according to their sight"—which suggests that one's capacity to apprehend an ideal is relative; that is, visions are only as powerful or as real as one's beliefs, dispositions, and faith.

Galton was interested in a passage that appears at the very end of the poem, after King Arthur has heard each of the knights describe his visionary experience of the Grail, or lack thereof. Galton includes these in his 1893 lecture:

> Let visions of the night or of the day
> Come, as they will; and many a time they come
> Until this earth he walks on seems not earth,
> This light that strikes his eyeball is not light,
> The air that smites his forehead is not air,
> But vision, &c.[64]

Arthur's speech is tangled and complicated, and its possible meanings would require a separate essay. But Galton was not interested in the meaning of Arthur's speech within its own textual environment; instead, he was intrigued by the idea, hinted at in the passage, that sensation does not necessarily originate in contact between the external world and the physiological senses. The paradoxical idea that the "light that strikes the eyeball is not light" becomes a meaningful sign for Galton; extracted from its own internal semantic and symbolic network and resituated in his lecture, it becomes evidence that the mind and the material world collude to produce sensations.

Again, Galton violates the aesthetic integrity of the poem, cutting off the final lines of the passage, which Tennyson referred to as "the (spiritually) central lines of the Idylls."[65] But he does so to find a new meaning in it—a meaning that speaks to his experience of deafness and his ongoing search for a theory of supplemental sensations that originate in the mind or cross over from other senses rather than traveling the ordinary neurophysiological routes. And again, Galton reads the poem alongside an anecdote that Tennyson's friend and cofounder of the Metaphysical Society, James Knowles, published in an essay on the late poet in

1892: "Sometimes," Tennyson reportedly said to Knowles, "as I sit alone in this great room I get carried away, out of sense and body, and rapt into mere existence, till the accidental touch or movement of one of my own fingers is like a great shock and blow, and brings the body back with a terrible start."[66] The image of a rapturously disembodied Tennyson was both striking and provocative to Galton, who avoided the common interpretation of these incidents as trance states or as seizures. Rather, he took it as evidence that "the imagination is sufficiently intense to mimic a real sensation."[67]

Conclusion

Although Galton's commitment to eugenics never waned, his latter-day experiments with psychophysics helped to defamiliarize what Lennard Davis describes as "one of the foundational ableist myths of our society"—that speaking and hearing are "the norm."[68] During the 1880s, Galton used Fechner's work to statistically define that norm by collecting biological data from thousands of visitors who passed through his Anthropometrics Laboratory. But he later used different aspects of the science to discover a way around the standard auditory mechanisms of other, less traveled routes of sensory experience. For Galton, those less traveled routes involved supplementation with other senses (reading along while listening) or with the purely creative powers of imagination, at least during the 1890s. But one tantalizing account suggests that he may have purchased an electronic hearing aid at the very end of his life. In January 1911, a close friend of Galton's wrote to the *Times* to share details about the belated scientist's private life and character with the public. He begins with a story about Galton's debilitating deafness and the new device he acquired to alleviate the condition:

> His first sore trial was his deafness, which cut him off from scientific gatherings where at one time he was a familiar figure. This defect he remedied with the help of an electrical instrument very much in the form of a camera. I well remember going to see him a day or two after this new acquisition. Pointing to it as it stood on the table by his side, he said:—"That is my ear. If you will speak to it without raising your voice I shall hear all you say." The experiment was successful and he talked gaily on De Quetelet's letters and digressions from curve of frequency.[69]

Galton seems to have embraced the electronic hearing aid, which restored his hearing by amplifying the physical stimulus so that it reached the requisite threshold. The writer describes the instrument as "remedy" for Galton's deafness, a stubborn "defect" that closed him off from the public life he once enjoyed as a prominent and prolific scientist. And yet, as I have shown, Galton's response to deafness suggests that his loss of hearing was profoundly enabling and productive. Forced to relinquish the soundscapes he had always known, Galton sought to perceive the world in new ways and supplemented what he heard with input from other senses; he moved beyond the biopolitical impulses that guided his earlier work on psychophysics and entertained creative new ideas about below-threshold stimuli; he developed provocative readings of poems by Wordsworth and Tennyson in his quest to prove to himself and to the public that below-threshold stimuli could be supplemented and brought to sensorial fruition; and he even wished that other scientists might be as deaf as he because he saw that deafness was neither a punishment nor a defect, but a powerful source of motivation and an impetus to reconceive literature, science, and the body in ways he never would have bothered to imagine before.

Notes

1. Gustav Theodor Fechner, *Elements of Psychophysics*, trans. Helmut E. Adler, vol. 1 (New York: Holt, Rinehart, and Winston, 1966), 1. Unless otherwise noted, all references to Fechner's *Elements* will refer to this edition. The original book, *Elemente der Psychophysik* (Leipzig: Breitkopf and Hartel, 1860), appeared in two volumes in German. Only the first volume has been translated into English.

2. Ibid., 5. According to Michael Heidelberger, Fechner does not fall into the trap of naïve materialism; rather, he argues, Fechner's materialism is nonreductive "because it describes life and consciousness as having an independent, original nature that cannot be further reduced to physical phenomena." See Michael Heidelberger, *Nature from Within: Gustav Theodor Fechner and His Psychophysical Worldview* (Pittsburgh: University of Pittsburgh Press, 2004), 73.

3. Fechner, *Elements of Psychophysics*, 1. The *OED* dates the first usage of "psychophysics" in English to a July 1875 issue of the *North American Review*. This attribution is inaccurate, however. The first usage of the term appeared in Emil Du Bois-Reymond's essay "The Limits of Our Knowledge of Nature," *Popular Science Monthly*, May 1874, 27. The first usage in British sources appears to be a selection of "Critical Notices" by R. Flint in *Mind* 1 (1876): 117; the same volume featured an article on Fechner and other psychologists by James Sully, who first introduced *Elemente der Psychophysik* to the English-speaking world in a review essay entitled "Recent Experiments with the Senses," *Westminster Review* 98 (July 1872): 165–98. Sully never used the word "psychophysics" in his 1872 review; he referred instead to the "psycho-physical law" that Fechner proposed.

4. Sully, "Recent Experiments," 178.

5. Galton to Mrs. Hertz, June 4, 1875, in Karl Pearson, *The Life, Letters and Labours of Francis Galton*, vol. 3B: *Characterization, Especially by Letters, & Index* (Cambridge: Cambridge University Press, 1914–30), 464.

6. William James, *The Principles of Psychology* (New York: Henry Holt, 1890), 1:534.

7. Ibid., 546. James insisted that Fechner's psychophysical experiments were "peculiarly fragile" because they depended on the idiosyncratic judgments of test subjects and on psychologists' accounts of those judgments.

8. George A. Gescheider, *Psychophysics: The Fundamentals*, 3rd ed. (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), ix.

9. Jay Hetrick, "Aisthesis in Radical Empiricism: Gustav Fechner's Psychophysics and Experimental Aesthetics," *Proceedings of the European Society for Aesthetics* 3 (2011): 140.

10. Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge: MIT Press, 1992), 147.

11. Michel Foucault, *The History of Sexuality*, vol. 1: *An Introduction*, trans. Robert Hurley (New York: Vintage Books, 1978), 141–42.

12. Nicholas Dames discusses Fechner's theory of below-threshold stimuli and its relevance to nineteenth-century reading practices in *The Physiology of the Novel*, but Galton's interest in these stimuli pertained to auditory experience rather than reading. It is no surprise, then, that Galton does not appear in Dames's study. For his discussion of below-threshold stimuli, see Nicholas Dames, *The Physiology of the Novel: Reading, Neural Science, and the Form of Victorian Fiction* (Oxford: Oxford University Press, 2007), 201–2.

13. David Burbridge, "Galton's 100: An Exploration of Francis Galton's Imagery Studies," *British Journal for the History of Science* 27, no. 4 (1994): 445 n. 18. Burbridge notes that Sully's book *Sensation and Intuition* (1874) also helped distribute Fechner's work to British audiences.

14. Sully, "Recent Experiments," 165.

15. Ibid., 167.

16. Ibid.

17. George Levine, *Dying to Know: Scientific Epistemology and Narrative in Victorian England* (Chicago: University of Chicago Press, 2002); Lorraine J. Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007).

18. William A. Cohen, *Embodied: Victorian Literature and the Senses* (Minneapolis: University of Minnesota Press, 2008), 5.

19. Galton to Mrs. Hertz, in *Characterization*, 464.

20. Ibid.

21. Ibid.

22. Nicholas Dames offers a helpful definition and discussion of the Weber-Fechner formula; see *Physiology of the Novel*, 179–82.

23. Walter Pater, *The Renaissance: Studies in Art and Poetry. The 1893 Text*, ed. Donald L. Hill (Berkeley: University of California Press, 1980), 83.

24. Crary, *Techniques of the Observer*, 147.

25. Thomas Lemke, *Biopolitics: An Advanced Introduction*, trans. Eric Frederick Trump (New York: New York University Press, 2011), 5.

26. Stephen Jay Gould, *The Mismeasure of Man: The Definitive Refutation to the Argument of "The Bell Curve"* (New York: Norton, 1981), 107.

27. Galton to Mrs. Hertz, in *Characterization*, 464.

28. Karl Pearson, *The Life, Letters and Labours of Francis Galton*, vol. 2: *Researches of Middle Life* (Cambridge: Cambridge University Press, 1924), 228.

29. Francis Galton, "Address to the Department of Anthropology," in Section II, "Notices and Abstracts," *Report of the Forty-Seventh Meeting of the British Association for the Advancement of Science; Held at Plymouth in August 1877* (London: John Murray, 1878), 95.

30. For excellent work on Galton's use of Fechner's theory of JNDs in his writing on composite photography, see Allan Sekula, "The Body and the Archive," *October* 39 (Winter 1986): 51; and Frans Lundgren, "The Politics of Participation: Francis Galton's Anthropometric Laboratory and the Making of Civic Selves," *British Journal for the History of Science* 46, no. 3 (2013): 461.

31. Francis Galton, *Inquiries into Human Faculty and Its Development* (London: Macmillan, 1883), 26.

32. Ibid.

33. Ironically, Galton made these comments on deafness in 1883, just a few years before his own hearing began to rapidly deteriorate.

34. Francis Galton, "Report of the Anthropometric Committee," in Section I, "Reports on the State of Science," *Report of the Fiftieth Meeting of the British Association for the Advancement of Science; Held at Swansea in August and September 1880* (London: John Murray, 1880), 120.

35. Francis Galton, "On the Anthropometric Laboratory at the Late International Health Exhibition," *Journal of the Anthropological Institute of Great Britain and Ireland* 14 (1885): 206.

36. Ibid., 205.

37. Francis Galton, "Some Results of the Anthropometric Laboratory," *Journal of the Anthropological Institute* 14 (1885): 275.

38. Foucault, *The History of Sexuality*, 140.

39. Galton, *Inquiries into Human Faculty*, 20.

40. Ibid.

41. Ibid.

42. Ibid., 16.

43. Ibid.

44. For a comprehensive discussion of Galton's views on deaf communities, see Jennifer Esmail, "A Deaf Variety of the Human Race?" in *Reading Victorian Deafness: Signs and Sounds in Victorian Literature and Culture* (Athens: Ohio University Press, 2013), 133–62.

45. In his contribution to this collection, James Emmott discusses Alexander Melville Bell's work on Visible Speech, which he used to help deaf children vocalize. Emmott observes that although Bell's approach was utopian in many ways, his son, Alexander Graham Bell, took a dark turn toward eugenics in his aggressive support of the oralist movement.

46. Sir Francis Galton, "Hereditary Deafness," *Nature* 31 (January 1885): 270.

47. Ibid.

48. Galton letter to George Darwin, November 2, 1907, in *Characterization*, 584.

49. Francis Galton, "The Just-Perceptible Difference," *Notices of the Proceedings at the Meetings of the Members of the Royal Institution of Great Britain, with Abstracts of the Discourses Delivered at The Evening Meetings*, XIV, 1893–1895 (London: William Clowes and Sons, 1896), 18.

50. Ibid.

51. Ibid., 19.

52. Ibid., 18.

53. George Henry Lewes, *Problems of Life and Mind*, vol. 2: *Mind as a Function of the Organism*, 3rd series (London: Trübner, 1879), 364.

54. Dames, *Physiology of the Novel*, 181.

55. Galton, "The Just-Perceptible Difference," 13.

56. Ibid., 17.

57. Gillian Beer, *Open Fields: Science in Cultural Encounter* (New York: Oxford University Press, 1996), 174.

58. Galton, "The Just-Perceptible Difference," 16.

59. Ibid.

60. Helen Vendler, "Lionel Trilling and the *Immortality Ode*," *Salmagundi* 41 (1978): 81.

61. Ibid., 83.

62. Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation* (Durham, NC: Duke University Press, 2002), 20.

63. Ibid.

64. Galton, "The Just-Perceptible Difference," 16.

65. Alfred, Lord Tennyson, *Idylls of the King* (New York: Penguin, 1983), 90.

66. Galton, "The Just-Perceptible Difference," 17.

67. Ibid.

68. Lennard Davis, *Enforcing Normalcy: Disability, Deafness and the Body* (London: Verso, 1995), 15, quoted in Esmail, *Reading Victorian Deafness*, 7.

69. Montague Crackanthorpe, "Sir Francis Galton," *The Times*, January 25, 1911. The device Crackanthorpe is referring to may be the Acousticon, an early electrical hearing aid. This device was developed at the turn of the century by Miller Reese Hutchison, an American inventor and electrical engineer whose earlier invention—the Akouphone (1895)—is widely regarded as the world's first electrical hearing aid. In 1902, Hutchison traveled to London to demonstrate how his new Acousticon worked. According to an account of his visit, he showed the device at Buckingham Palace and at various institutions; Queen Alexandra was so impressed that she awarded him the gold medal for his invention. For this account, see A. L. Griffith, "The Acousticon," *The World To-Day* 5, no. 1 (July 1903): 855. As a Fellow of the Royal Society, Galton certainly would have been aware of Hutchison's demonstrations, especially since they piqued the interest of the queen and won her enthusiastic approval.