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Good Theory Gone Bad

by Ryan Bonn

(Chemistry 1552)

First proposed in the late 18th century by Austrian physician Dr. Franz Joseph Gall and his assistant Johann Gaspar Spurzheim, Phrenology was poised to radically change the way the brain was looked at and understood. Although met with initial criticism from others in the scientific community, phrenology quickly became very popular and influential in both England and the United States from 1810 to around 1840. In his own words Dr. Gall explains his endeavor as to “ascertain the functions of the brain in general, and those of its different parts in particular; to show that it is possible to ascertain different dispositions and inclinations by the elevations and depressions upon the head; and to present in a clear light the most important consequences which result therefrom to medicine, morality, education, and legislation a word, to the science of human nature.” (Gall, 1798) In layman’s terms, Dr. Gall believed that he had discovered a way to explain human nature (personality, motivation, thinking of an individual) by simply measuring an individual’s head. Through the process called cranioscopy, a term first created by Gall, he would be able to infer personality traits based off the measurements and characteristics of the external anatomy of the skull.

To explain this theory, Gall created five tenets for which his system would work. The first was that the brain was the organ that controlled the mind. The second was that within the mind there consisted separate and distinct thoughts and reason that reflected personality traits. For example, according to Gall the mind held both thoughts of compassion and violence. These thoughts were separated and regulated within the mind. The third tenet was that since the mind had distinct compartments for varying thoughts and actions, then so too did the brain. Therefore, the organ as a whole could be categorically mapped out with each section assigned to control a certain trait. The fourth tenet stated that the size of each section was directly correlated to the power that trait had within the mind. From this, Gall believed that as the compartments developed together, they formed the overall shape of the brain. The last tenet concluded that since the skull was formed to contour the shape of the brain, the skull could be used as a guide to read an individual’s psychological ability and predispositions.

All of these tenets are outlined in the first comprehensive book of findings published by Gall and Spurzheim in 1815 titled, *Outlines of the Physiognomical System Indicating the Dispositions and Manifestations of the Mind*. Within this all-encompassing doctrine Gall and Spurzheim split their contents into seven distinct chapters: previous history surrounding their discovery, the methods in which they ascertained the organs of the mind, the 38 separate and distinct organs, the pathognomy of natural language, the overarching psychology of human nature, inferences that can be drawn from their work, and lastly the practical considerations that their work will have on such things as education, criminal legislation and the deranged. While the book is quite lengthy at 323 pages, unsurprisingly, much of the content and supporting evidence is non-scientific but rather anecdotal. For instance, one of the main tenets of phrenology is that the examination of the skull gives great insight into the shape of the brain due to the fact that the brain determines the physical characteristics of the anatomy of the skull. This major tenet is explained not by scientific evidence but by the biased logical reasoning of the authors themselves. “Like all other parts of our body, the brain and skull are submitted to this [change of] decomposition and composition; and according to the natural law established between the skull and brain, the brain at all ages commands the directions, in which the bony mass is deposited in order to form the skull. If the whole brain or some parts increase or

decrease, the ossification of the skull follows always the size and form of the brain.” (Gall & Spurzheim, 1815) After establishing support for their theory that the skull is shaped to contour that of the brain, Gall and Spurzheim explained that in order to correctly identify protrusions resulting from more developed organs, the authors had to become experts in the external anatomy of the average human skull. A skill that the authors said took years of practice with craniometry. With this knowledge, the authors then spent years measuring and examining the skulls of various individuals and assigning traits that the authors observed qualitatively based off the individual’s personality and background. One such example would be the lack of development of what the authors called the organ of philoprogenitiveness. According to the authors, the development of this organ was indicative of strong parental affection. Gall first discovered this organ while attending to an ill woman who was a mother of five children. Gall observed that this woman was very affectionate to her children, he also noticed a relatively large protuberance on the back of the woman’s head corresponding to what he believed to be an overly developed region near the occipital lobe and cerebellum. He hypothesized that the woman’s affection and unusual anatomy was not a coincidence and that that area must be specialized for parental love. Gall decided to test this hypothesis by performing a craniotomy on mothers who were in jail for committing infanticide. He discovered that twenty-five of the twenty-nine mothers tested had relatively small protuberances indicative of an underdeveloped organ of philoprogenitiveness. Gall concluded that, “the want of this organ does not indeed excite a mother to destroy her child, but a mother destitute of this propensity is less able to resist those external circumstances which provoke her to commit this crime. Such a mother will not resist as strongly as she would have done if her mind had been influenced by the powerful energy of philoprogenitiveness.” (Gall & Spurzheim, 1815) This is just one of the many organs Gall and Spurzheim identified using anecdotal evidence and so called analysis of small sample sizes.

In essence, Gall and Spurzheim used bumps and indentations along an individual’s skull to determine whether that individual was predisposed to such things as crime or obedience. Although this method and resulting “diagnosis” were found to be absurd and phrenology as a whole reduced to a pseudoscience, some of the very tenets it was based on were confirmed to be true. Tenets such as localization and specialization of areas of the brain now form the basis of modern-day neurology and neuroanatomy. In fact, one of the first studies that confirmed the localization and specialization of the brain also discredited the other tenets presented by Gall and Spurzheim. Paul Broca, a French physician, first published his discovery of what is now known as verbal aphasia in 1861. He reported the discovery of a lesion located in the middle of the left frontal lobe of one of his patients during his autopsy. The patient had severe problems with his speech, only being able to repeat the same syllable over and over again. However, the rest of the patient’s faculties were still there, only his speech had been affected. This led Broca to the hypothesis that that specific region in the brain was responsible for speech and that “in this present case, the lesion of the frontal lobe was the cause of the loss of speech.” (Broca, 1861/translation 2003) This realization confirmed Gall’s hypothesis that different brain regions had specialization, however it discredited Gall’s craniotomy approach. Here was an example of a brain injury that was affecting specific brain function but had no indentations or protuberances on the skull at all. Thirteenth years later, a German physician by the name of Carl Wernicke published his discovery of what’s known as sensory aphasia. Distinct from Broca’s aphasia, sensory or “Wernicke’s aphasia” did not involve the left frontal lobe or the production of speech but rather an area on the left temporal lobe and the understanding and processing of language. The discovery of Wernicke’s area discredited Gall and Spurzheim to an even greater degree. Instead of language being constrained to just one region in the brain, the neural process of language was now divided by two distinct specialized regions. Since then, many more discoveries of specialization in the brain have occurred as well as new ways to look at the brain. The emergence of high quality structural magnetic resonance imaging has allowed researchers to re-examine the tenets of phrenology. One such study that assesses the validity of phrenology by using modern scientific

advancements is *An empirical, 21st century evaluation of phrenology*. Published in May of 2018, researchers at Oxford University used data from 5,724 subjects to determine if there was any statistical support to the basis of phrenology. The researchers used multiple questionnaires and cognitive tests to determine traits and lifestyles similar to those proposed by Gall and Spurzheim. They also cross analyzed these traits with a structural MRI of that individual's brain to look for any statistical correlation. The researchers succinctly concluded that, "the phrenological analyses produced no statistically significant or meaningful effects." (Jones, Alfaro-Almagro & Jbabdi, 2018) In the end, phrenology laid the foundation for much of the localization and specialization found in neuroscience today, however the reasoning and application behind its basis was biased and simply inaccurate. It truly was a good theory that turned bad.

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