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An Analysis of the History of Neuroimaging

The brain has always been and remains one of the greatest mysteries of the world. “Innovations in physics and computing technology over the past two decades have provided a powerful means of exploring the overall structure and function of the brain using a range of computerized brain imagining technologies” (Gordon, 1999). However, the earlier methodologies used to study the brain has not always been accurate, let alone ethical. A variety of techniques have been utilized to study the brain directly and indirectly through the process of brain imaging, or otherwise referred to as neuroimaging, and the related technology is increasingly being innovated.

One of the original methods utilized in analyzing the brain was phrenology, “a faculty psychology, [and] theory of brain and science of character reading, what the nineteenth-century phrenologist called ‘the only true science of mind’” (Wyhe, 2000). Phrenology was initially developed by physician Franz Joseph Gall in 18th-century Vienna, and while “very popular in Europe, it found its most devoted audience in the united States” (Janik, 2014). Phrenology’s popularity peaked from the 1820s to the 1840s, and it was seen as a legitimate method for ensuring character references and determining if any mental distresses were related to brain damage. The “belief that the protuberances on the skull provided an accurate index of talents and abilities was particularly urged to be applied to education and criminal reform” (Wyhe, 2000). Unfortunately, “phrenologists were less similar to doctors and more akin to visiting so-called psychics, clairvoyants, or astrologers today” (Wyhe, 2000). Currently, phrenology is considered a pseudoscience regardless of its previous long standing in the field of medicine and brain imaging.

With phrenology fading out of popularity, the next neuroimaging technique to rise was called the human circulation balance. The human circulation balance was invented by physiologist, Angelo Mosso in 1882 and was capable of non-invasively measuring the redistribution of blood during cognitive, emotional and intellectual activity. It was devised to observe the brain, although it did not resemble modern-day brain scanners. The human circulation balance operated on a simplistic, yet relatively untested, idea at the time that the brain requires increased amounts of blood when it is working at increasingly difficult tasks. During the procedure, “Mosso would have volunteers lie down on a long wooden plank, carefully balanced on a fulcrum, like a seesaw. He calibrated for anything that might throw off the balance, like the rise and fall of the volunteer’s breathing” (Benderev, 2014). Once secure, Mosso would ring a bell, which he reasoned would result in the volunteer’s brain attempting to process the sound. This would “require more blood making the brain weigh more and in extension, tipping the scale toward the head’s side” (Benderev, 2014). These processes continued into the 1900s where it was believed that the balance “would soon fully explain the physiology of the human brain” and show the amount of brain energy used under certain stimuli (Benderev, 2014).

Also in the late 1880s, Wilhelm Conrad Rontgen revolutionized neural imaging when he discovered the X-ray. “This new discovery provided physicians with the ability to study the inside of a living subject for the first time without resorting to intrusive surgical techniques. Images were and still are to this day, acquired by passing a beam of X-rays through an object, such as the brain or an organ, and onto a photographic film on the opposite side” (Ombao, 2017). The discovery of the X-ray eventually prompted numerous other neuroimaging techniques such as ventriculography, pneumoencephalography, and cerebral angiography. Unfortunately, X-rays “have inherent limitations in their ability to study basic anatomical structures, such as the fact that they simply provide two-dimensional projections of a three-dimensional object. These shortcomings eventually led to the advent of more advanced imagining modalities” in the late 1900s that fully utilized computer technology (Ombao, 2017).

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