

Significant Landmarks in the History of Aphasia and Its Therapy

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OBJECTIVES

The reader will be able to:

1. Understand the origins of different classifications of aphasia.
2. Compare models of aphasia that have emerged in the history of aphasia.
3. Appreciate that the history of aphasia is influenced by social and political developments in different countries.
4. Name the main protagonists in the history of aphasia.
5. Identify the main events in the history of aphasia.
6. Identify the main shifts in approach to the treatment of aphasia throughout the history of aphasia.
7. Understand where ideas about the nature of aphasia originated.

"History doesn't repeat itself. At best it sometimes rhymes."

Mark Twain (1835–1910)

Introduction

In this chapter, we explore where aphasia and attempts to treat it came from. Along the way, we can test Mark Twain's pithy aphorism. We start with a survey of how thought, language, and speech were represented in the body from ancient to modern times. The ancient Egyptians thought that the heart was the seat of the "soul" and mental life, and pre-Christian Greece and Rome developed a theory of "fluids."

Plato's view, that the mind was located in the head contrasted with Aristotle's idea that it was located in the heart. With early anatomical examinations of the brain, the ventricles of the brain, rather than the substance of the brain, was where the soul was considered to reside. This view lasted well into the Middle Ages. Not until the 15th century were basic treatments for aphasia beginning to be developed, based on the view that aphasia was a form of memory disorder. In the 18th century, Gall developed his language and speech localization theory, and Broca, Hughlings Jackson, and Bastian began to consider that recovery occurred because of some form of reorganization and treatment could be beneficial. But not until the First World War did Goldstein, Luria, and the Viennese

phoniaticians Hermann Gutzmann (1865–1922; the father of aphasia therapy) and Emil Froeschels develop the first systematic treatments.

Between the world wars, the focus shifted to North America, and a more behaviorist approach developed. Following World War II, there was a return to localization theory and an approach to treatment developed based on the Boston School and the “stimulation” approaches of Wepman and Schuell. In the latter part of the 20th century, approaches were developed based on linguistics, psycholinguistics, modular cognitive models, and psychosocial and social models.

The history of aphasia is vast, and we cannot hope to cover it completely in a single chapter. More detailed treatments are available (Eling, 1994; Tesak & Code, 2008; Howard & Hatfield, 1987).

Aphasia in the Ancient Past

An understanding of the past history of any field is essential to an appreciation of the present; the present, after all, is the realization of events in the past. St. Augustine (1,400 years before the present, henceforth BP) outlined a first understanding of what time past, time present, and time future might be. He contended that we can really know only the present because time past is only memory—even if it is recorded memory (and we know how unreliable memory can be)—and time future is, by definition, impossible to know. For the history of anything, we are particularly reliant on the written records handed down to us from the past, and writing did not develop until 5,500 years BP in the Middle East; even then, writing was limited to very few experts. But the brain had no great importance in ancient Egyptian medicine and religion. For instance, in mummification, all the organs were stored, but the brain was pulled out through the nose with a hook and discarded. This is a reflection of the cardiocentric view, where the heart was seen as the home of the soul, wherein resided a capacity for good and evil.

The oldest known reference to what we now call aphasia is in the Edwin Smith Papyrus (5000–4200 BP), a medical record of a number of cases of brain damage (Breasted, 1930). One record refers to a man who is “speechless” and states that the speechlessness is “an ailment not to be treated” but that rubbing ointment on the head and pouring a fatty liquid (possibly milk) into the ears is a beneficial therapy.

The Theory of Fluids

The causes of diseases in ancient times were thought to be due to some imbalance of the bodily fluids corresponding to the four basic elements, from which all matter was considered to be made, a view that was to persist into the 18th century. This four-element theory was developed by different philosophers within natural philosophy (e.g., Empedocles, 2504–2433 BP) in an attempt to understand nature and the essence of human nature. The four bodily fluids and their corresponding elements were yellow bile (air), blood (fire), phlegm (earth), and black bile (water). Healing involved manipulating the balance of fluids: blood-letting, starvation, fluid deprivation, heat treatment, regurgitation, fecal evacuation, and sweating. Deficits following brain injuries were interpreted as an accumulation of undesirable life fluids. Cranial drillings (trepanations) were attempts at the evacuation of undesirable fluids and in some cases may have been effective.

The Greco-Roman Period

The connection between cognitive processing and a possible localization in the structure of the human body emerged in Greco-Roman times, and the question was posed: Was the mind represented in the brain or in the heart? For Plato (2428–2347 BP), a tripartite soul corresponded to anatomically different parts of the body. Reason and mind were located in the head, but “higher” characteristics, such as pride, fear, and courage, were in the heart; the lower characteristics of lust and desire were located in the liver or the abdomen. As human speech had been associated with the rational part of the soul since Pythagoras (2580–2428 BP), this was an important step for the examination of the relationship among speech, language, and brain.

Plato’s pupil Aristotle (2384–2322 BP) had a particularly significant impact in subsequent centuries on philosophy and the development of medicine. He defined humans as speaking animals and language as innate, with the variety of languages in the world coming about through social factors. In contrast to his teacher Plato, he argued that the heart was the home of all cognitive, perceptual, and associated functions.

Ventricular Theory

Over time, the brain began to figure in Greco-Roman thought. Herophilos (2335–2280 BP), who is recognized as the “father of anatomy,” described the cortex, cerebellum, ventricles of the brain, and sensory and motor nerve trunks. It was with him that ventricular theory developed and where a

connection was made between the “psyche” (soul) and the ventricles of the brain. Ventricular theory, or cell theory, to give it its other name, dominated into the middle ages.

Galen (2130–2200 BP) was the most significant brain anatomist until the 17th century. Galen was a physician to the gladiators and so had extensive experience of wounds to the head and the brain, although the dissection of human bodies was prohibited by Rome. He dissected cows, monkeys, pigs, dogs, cats, rodents, and at least one elephant. Although working in the tradition of Aristotle, he rejected Aristotle’s theory.

The Middle Ages

The Middle Ages run from the demise of the Roman Empire (400s) to the emergence of the Renaissance (1500s). During the Middle Ages, cell theory developed from ventricular theory (see **Figure 2.1**), but the ventricles were understood as theoretical concepts, rather than as anatomical structures, and simply depicted as circles. In this model, aphasic symptoms appear to result from damage to the third cell (the

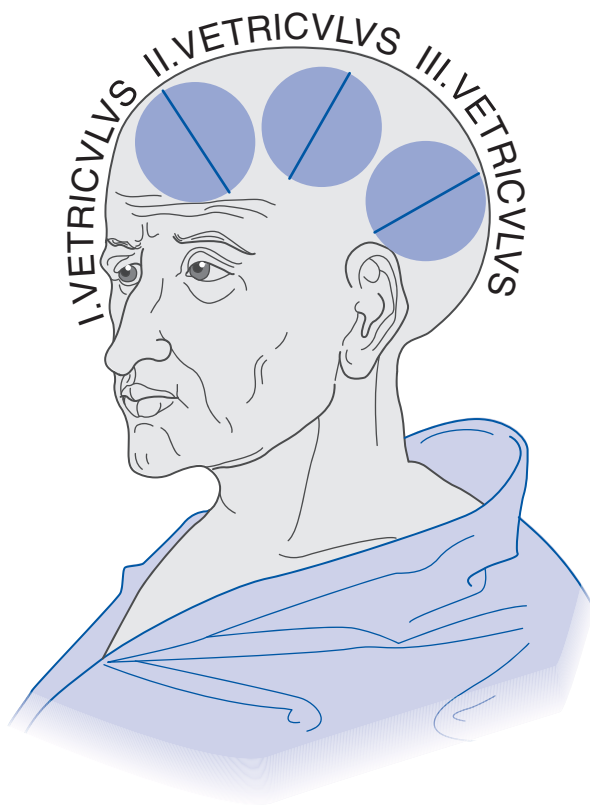


Figure 2.1 The ventricles of the brain according to medieval cell theory

Modified from Magnus, A. (1490). *Philosophia pauperum, sive Philosophia naturalis* [Poor philosophy or natural philosophy]. Georgius Arrivabenus.

fourth ventricle) and were conceptualized as memory disorders. The idea that aphasia was a memory disorder was to dominate well into the 19th century.

There are references to aphasia during this time. Antonio Guainerio (died 1440) suggested that the cause of aphasia was damage to the fourth ventricle (the third cell) and memory was impaired because the ventricle contained too much phlegm. Nicolò Massa (1489–1569) described a man who lost his speech after sustaining a head wound in battle; Massa thought that a bone splinter had been left in the brain. He located it and pulled it out, and immediately the patient called out (apparently in Latin!), “Ad Dei laudem, sum sanus!” (God be praised, I am healthy!). The Spaniard Francisco Arceo (1493–1573) described a worker who was hit on the head by a stone and was speechless for several days. Arceo remedied the fracture, and, some days later, the patient began to speak again and apparently recovered fully through spontaneous recovery.

The Renaissance to the 17th Century

The Renaissance (the “rebirth”) emerged and succeeded the darkness of the Middle Ages. It began in Italy in the 15th century, spread throughout Europe, and is associated with the beginnings of modern science and modern medicine.

From the Renaissance to the 17th century, central advances were made in anatomy and physiology of the brain, and increasing attempts were made to connect behavioral and cognitive functions to specific structures of the brain. Descriptions of aphasic symptoms became more precise, and early hypotheses on the causes began to emerge. There were major advances in the development of medicine during the Renaissance, and a number of central personalities and their insights in medicine and philosophy stand out. Leonardo da Vinci (1472–1519) made significant contributions to anatomy. Da Vinci, the exemplary Renaissance man, used empirical methods, including anatomical investigations on animal and human corpses, and produced exact anatomical sketches far superior to those of the earlier medieval tradition. For example, he noted that there was only an imprecise connection between the medieval drawings of ventricles and his own, although he did not question the belief in ventricular theory.

Two prominent Renaissance anatomists who dismissed Galenian ventricular theory were Andreas Vesalius (1514–1564) and Thomas Willis (1621–1675). Vesalius published his famous book, *On the fabric of the*

human body, in 1543; the seventh and last volume is dedicated to the brain. This book was a major advance in anatomical detail and neurology and dismissed much of Galenian anatomy. The ventricles are described in detail, but memory is not localized there: It is in the cerebellum instead.

Thomas Willis (1621–1675) gained his knowledge of the brain from his observations of patients with neurological conditions and was of great importance for the developing neuroscience of the 17th century. His great work, *Cerebri Anatome (Anatomy of the Brain & Nerves, 1664/1965)*, benefits from the anatomical drawings of the young Christopher Wren, later to design St. Paul's Cathedral and the center of London following the Great Fire of London. Willis dismissed ventricular theory, stating that mental life was essentially dependent on the cortex, thereby possibly advancing the first cortical theory of the control of muscles and reflexes (Bennett & Hacker, 2003). He also suggested that the gyri, or convolutions, of the brain are responsible for memory and will. He proposed a corporeal, or physical, soul present in humans and animals and associated it with *vital spirits*, a kind of distilled liquor that was made in the brain and circulated in the blood. For Willis, the soul was immortal, nonmaterial, and separate from the brain, with interaction between body and soul.

During the Renaissance and the following centuries, because man was thought to have been created in God's image, anatomical sectioning of the human body continued to be prohibited by the Church. The body was not to be violated by the anatomist's knife. A solution to this problem came from the philosopher René Descartes (1596–1650) in the 17th century.

Each age has its dominant technology—for us in the latter part of the 20th and early 21st centuries, it is computer technology—and we tend to use the computer metaphor to explain the workings of the mind. Mechanics and hydraulics were the most highly developed technologies in the 17th century, and Descartes described humans as machines, mechanical automatons, in his work *De Homine (On Man)*. However, this automaton was a true human because it possessed a divine soul, and, when the body died, the soul lived on. The difficult question remained as to where the soul had its home, and Descartes suggested that it was in the pineal gland, a gland the size of a pea and lying at the base of the brain but, crucially (for neuroanatomists at the time), just outside the brain proper. For Descartes, the unity between soul and body was only possible in humans, a position called *Cartesian dualism*, which is still influential in current thought. This Cartesian separation of

body and soul permitted the Church to lift its ban on anatomical sectioning, and so the basis for further advances in medicine in the 18th and 19th centuries was established.

The 18th Century Enlightenment: Reason and Nature

Isaac Newton (1642–1727) supposed, based on Aristotle's teachings, that all human bodies contain a hidden, vibrating “ether” that moved through the nerves from sensory organs to brain and then to muscles and was under the command of the will. This was Newton's vibration theory. The philosopher John Locke (1632–1704) considered the human mind a collecting point for sensory perceptions that are processed, connected, and associated with each other. David Hartley (1705–1757), most famous for his discovery of the circulation of the blood around the body, considered that the gyri were responsible for memory and the will and attempted to explain memory through association of ideas and Newton's vibration theory, which he combined in neurophysiology to produce associationism.

The idea that aphasia was an impairment of memory continued to dominate in the 17th and 18th centuries and indeed well into the 19th. For instance, Johannes Jakob Wepfer (1620–1695) described at least 13 clear cases of language disorder with brain injuries, which he attributed to memory loss. Johann Gesner (1738–1801) described his patient KD in the book *The Language Amnesia*, where he laid the foundation for the first real theory of aphasia, an impairment of memory caused by a congestion of the “nerve ducts,” and, according to Benton (1965), his was the first associationist aphasia theory. Gesner separated language from speech programming and laid the foundations for a separation of communicative competence, the latter apparently unimpaired in KD.

The 19th Century and the Birth of a Science of Aphasiology

There was probably no real “science” of aphasiology until Gesner's work but not until the 19th century did the serious systematic study of aphasia begin. The 19th century is considered to be the foundation period of the modern history of aphasia mainly

because connections were made between the symptoms of aphasia and the localization of areas of brain damage, which emerged to form the basis for the later investigations of Broca, Wernicke, and others.

Napoleon's reign in France dominated the beginning of the 19th century in Europe. At that time, the scientific climate was notably more liberal in France than in the rest of Europe. This was one reason that Franz Josef Gall (1764–1828), a brilliant and highly significant anatomist, left Austria for France. His organology (better known as *phrenology*, the term coined by his student Spurzheim) had a massive influence on ideas about aphasia, neuroanatomy, and neuropsychology, even to the present day (see **Figure 2.2**). Organology considered that the inner form of the cranium was determined by the external form of the brain and it was therefore possible to detect the strength of particular human “faculties” from the shape and size of the cranium. He wrote:

The possibility of a theory of the psychological and mental functions of the brain presupposes: . . . that the brain was the organ of all tendencies, all emotions and all faculties . . . [and] that the brain was composed of as many individual organs as there are tendencies, emotions, faculties, which essentially differ from one another. (Lesky, 1979 as cited in Tesak & Code, 2008)

With Gall, the foundations of cerebral localization of function began as a serious idea. He was a particularly skilled anatomist; he was also the first to recognize the importance of the neocortex in localization and described mental faculties (or “organs”) that were localized in specific parts of the brain. While Gall attributed no specific functions to the separate hemispheres of the brain, he did claim that the faculty for words, which was part of the faculty for language, was located in the frontal lobe, although this insight was tenuously based on an observation Gall had made of a verbally gifted school friend who could learn verbal material very well. His friend had strongly protruding eyes, suggesting to Gall that the boy's brain was particularly well developed behind the eyes, causing them to protrude; this suggested a large language organ situated in the frontal lobes. For Gall, the faculty of language was innate, independent, and autonomous of reason and intelligence, and its primary purpose was as a means of expression. More recently, this has formed the basis for the idea that cognitive functions are organized into modules, an important feature of modern cognitive neuropsychology.

The most important follower of Gall in Paris was Jean Baptiste Bouillaud (1796–1881), a founding member of the French *Société Phrénologique* who was critical of most of the fanciful claims of phrenology in general but was a passionate supporter of Gall's

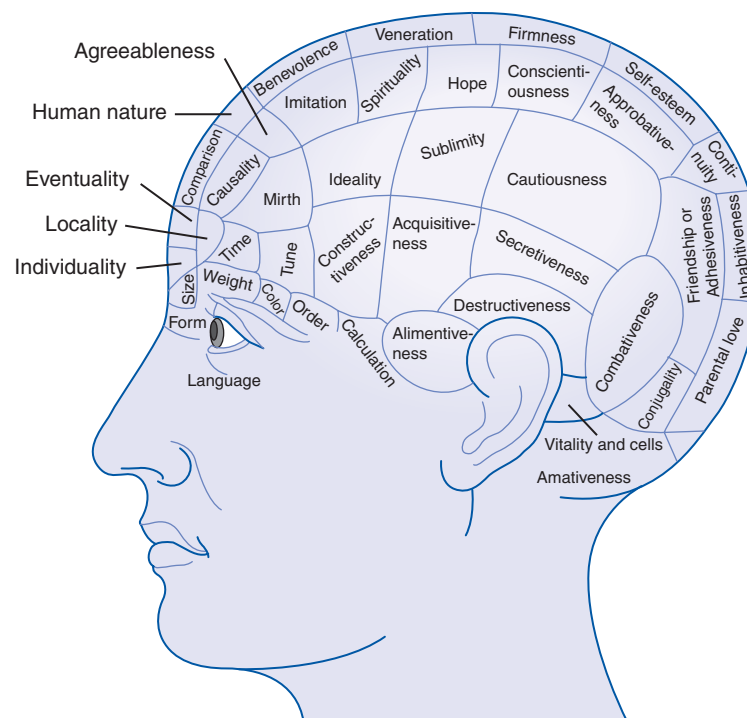


Figure 2.2 The 37 faculties, or phrenological organs, according to Johann Kaspar Spurzheim

Modified from O'Dell, E., & O'Dell, G. (1899). *Phrenology: Essays and studies*. London Phrenological Institution.

language localization theory. He published studies until the 1840s, describing more than 500 cases that he claimed supported his view that language and speech were localized in the frontal lobes. He identified the connection between the separate loss of language and speech and frontal brain damage in significant numbers of patients he described and divided the disorders, into articulation disorders (what we would now call apraxia of speech) and language disorders due to a memory problem. In the first, words are no longer correctly organized or retrievable or usable, and, in the other, the memory form of the word itself is damaged. But phrenology was scorned by most scientists at this time, and Bouillaud had few supporters. In opposition to the localizationists, like Bouillaud, were the holists, most prominent being Pierre Flourens (1794–1867) (Finger, 1994), who carried out brain ablation and stimulation experiments that would be considered primitive by today's standards. He used "spoons" for ablations and often removed large parts of the brain such that the behavioral losses following ablations were often similar. In his stimulation studies, he observed that irritation of the cortex produced no reaction at all. He concluded that the cortex is not divided into functional regions but that functions are represented throughout the brain, what we now call cortical equipotentiality. Bouillaud and other localizationists had difficulties getting their views accepted by the scientific community. From Flourens's first publications in the 1820s until the 1870s, equipotentiality was the dominating paradigm of brain physiology. However, the dispute between the localizers and the equipotentialists was not restricted to the question of localization in the brain. First, it was a question of what was the right methodology: the clinical observation/case studies of the localizers or the repeatable experiments (e.g., animal brain ablations), the approach of Flourens's followers. In addition, the two groups took different basic political and philosophical positions that influenced the neurological debate. Following the revolution of 1848 in France instigated by Napoleon III, the localizationists took the role of progressive liberals and the equipotentialists the role of conservatives. Bouillaud's son-in-law, Ernest Auburtin (1825–1893), was a significant figure in the Paris Anthropology Society and the Paris language localization debates of 1861–1866. He argued strongly for the localization of speech to the frontal lobes.

On April 4, 1861, Auburtin presented a patient, Bache, who had lost his speech but was left with the automatism "sacré nom de dieu" and was said to understand everything and to be of sound mind. He

was already very ill, and his demise was imminent. Auburtin announced that he would publicly revoke his views on localization if Bache's brain (or that of any other speech/language-disordered patient) displayed no frontal brain damage in a postmortem autopsy. It was this public announcement by Auburtin that triggered the interest of Pierre-Paul Broca (1824–1880), and Auburtin's contribution has been overshadowed by the colleague he inspired. Anthropology played an essential role in the debates on localization at this time, and it was not a coincidence that questions of language localization were under discussion in the Anthropological Society in Paris in the 1860s (Broca, whose primary interest was anthropology, was cofounder and secretary). By coincidence, on April 12, a patient named Leborgne was transferred to the clinic of Bicêtre Hospital, where Broca was working. Auburtin accompanied Broca, who had little experience of aphasia at that time, in an examination of Broca's patient. The 51-year-old man had epilepsy since his youth, loss of speech 21 years earlier, and paralyzes of the right arm for 10 years and of the leg for 4 years. Leborgne's comprehension was said to be intact, but for Broca comprehension was not part of language per se but of intelligence and memory. He had almost no speech apart from the speech automatisms *tan tan* (nonlexical) and *sacré nom de dieu* (lexical). Following Leborgne's death on April 17 and brain autopsy, Broca described Leborgne the next day (April 18) at a meeting of the Anthropology Society (Broca, 1861). Leborgne had a massive frontal lesion centered on the third frontal gyrus (see **Figure 2.3**), and Broca called Leborgne's disorder *aphemia*, meaning loss of articulate speech, a term that is still in use, although now mainly called apraxia of speech. With this, modern aphasiology and neuropsychology were born, and Broca proclaimed that the third frontal convolution was the seat for articulated language. Broca's description of Leborgne is still regarded as the most significant event in the modern history of aphasia and was taken by most as confirmation that the views of Bouillaud, Gall, and Auburtin were correct: that language and speech processing was indeed localized in this specific area of the brain. We have learned more about Leborgne the person recently, thanks to Domanski (2013). We now know that Louis Victor Leborgne was born in 1809 in Moret, France. His father was Pierre Christophe Leborgne, a teacher, who married Margueritte Savard, the daughter of a guardsman, in 1801. They had six children, including Louis Victor. The family was educated and literate; one of his nephews became an official in one of the ministries. The received opinion that Leborgne

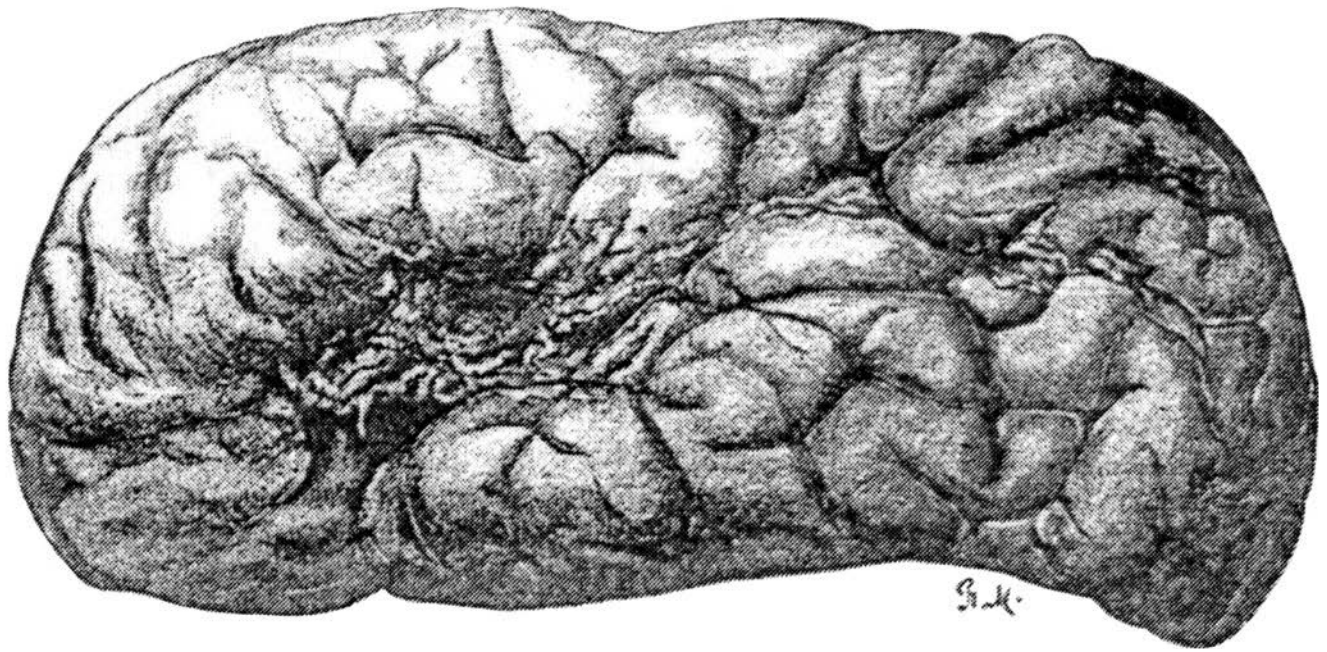


Figure 2.3 The brain of Leborgne (*tan tan*), the famous case presented by Broca in 1861

Courtesy of La Semaine Médicale.

was an uneducated illiterate from the lower social orders is clearly false, and we know that education and illiteracy are relevant to aphasia. He worked until he was 30 as a *formier*—a craftsman who produced forms for shoemakers.

Broca presented further cases of aphemia in 1863 (Broca, 1863), all of whom had damage to the left hemisphere, and for all, except one, the damage was to the third frontal gyrus. While he noted that it was strange that all the lesions were in the left hemisphere, he made no issue of the fact. The beginning of the idea that the left hemisphere was dominant for speech and language and for most other useful functions was formally crystalized in 1865 when Broca finally formulated a theory of language lateralization (Bogen, 1969)—that is, that language was represented in the left hemisphere. In 1865, he wrote his famous sentence, “We speak with the left hemisphere” (“Nous parlons avec l’hémisphère gauche”) (Broca, 1865, p. 384). He also discussed right-hemisphere compensation in the case of damage to the left (Broca, 1865, p. 384) and that people with aphemia could actually be treated under therapeutic guidance following the principles of child language acquisition. These ideas appear to be the first to propose the possibility of reorganization of the brain and language following damage (Code, 1987).

However, the position of Broca as the originator of the idea of left-hemisphere dominance remains controversial (Finger & Roe, 1996; Joynt & Benton, 1964; Schiller, 1992), with many contending that an

unknown country doctor had already made the connection between left-hemisphere damage and speech and language impairment in 1836. Marc Dax (1770–1837) had already written a paper for a regional physicians’ meeting in 1836, one year before his death but nearly 30 years before Broca’s paper wherein the connection between left-hemisphere lesions and speech disorders was clearly stated: “There now remains a very interesting problem to solve: why does it happen that changes to the left cerebral hemisphere are followed by the loss of words, but not those of the right hemisphere?” (Dax, 1865, p. 260). But Marc Dax’s work remained unpublished, and there is little evidence that he actually delivered the paper at the regional meeting, although it was submitted for publication to the *Académie de Médecine* by his son, Gustave Dax, together with his own contribution, as early as 1863, still 2 years before Broca’s 1865 paper. But the Dax contribution was not published until 1865, when Broca also argued in favor of left lateralization. This led to a bitter conflict, with Gustave Dax claiming that his father was the first to discover the role of the left hemisphere in the control of speech production (Schiller, 1992). Dax’s paper was discussed widely among the aphasiologists of Paris and its merits judged by a committee of the Academy led by Broca’s colleague Bouillaud. They took months to come to a decision, and it is suspected that this delay was to give Broca time to finish and publish his own paper (Tesak & Code, 2008). So perhaps Marc Dax is the one who should

be credited with the original finding that language is lateralized to the left, but he was just a country doctor and Broca was already famous.

Despite Broca's fame and influence, his preferred term for the disorder he had described, *aphemia*, was replaced with the term *aphasia* mainly because of an article in 1864 by prominent physician Armand Trousseau (1801–1867) with the provocative title *On aphasia, a sickness formerly wrongly referred to as aphemia*. He pointed out that the term *aphasia* from the Greek meaning “without language,” was more appropriate than *aphemia* (without speech). Trousseau believed that aphasia was a cognitive disorder that affected intellectual performance, a view also later expressed by John Hughlings Jackson. Of course, Broca's term referred to speech, as it still does today, and Trousseau's to language.

Henry Head (1926) noted that much of the great growth in German neurology and dominance in aphasiology was related to German victory in the Franco-Prussian war of 1870–1871. It was in this climate that universities in Germany and German-speaking countries became the world leaders for scientific research. A landmark development in neurology was fiber theory developed by Theodor von Meynert (1833–1892) in Vienna (Whitaker & Etlinger, 1993). Fiber theory described the important distinction between projection fibers, which connect subcortical to cortical regions, and association fibers, which connect cortical areas to one another. Thus, projection fibers communicate sensory information from the sensory organs to the cortex, and the association tracts transmit perceptions, ideas, and memory contents between areas. Von Meynert was also responsible for determining that the anterior part of the brain was responsible for motor function and the posterior part for sensory function. His work with patients with aphasia led him to describe a “sound image system.” This, and other aspects of fiber theory, form parts of the theory developed by von Meynert's student Wernicke. In 1874, the young physician Carl Wernicke (1848–1905) completed his thesis, *The Symptom-Complex of Aphasia*, where in he described cases with sensory aphasia due to lesions in the posterior left brain. With Broca's anterior production aphasia (*aphemia*) and Wernicke's posterior sensory aphasia, the basis for a fuller theory of language processing was developed. However, the impact of Wernicke's thesis went well beyond describing “sensory” aphasia, which had already been described by Bastian (Tesak & Code, 2008). Wernicke devised what today we would call information processing

components to underlie the basic operations and pathways involved in the production and reception of speech, at least at the single-word level, from the highest cognitive center to the peripheral input and output levels. The model included a sound-image system and fiber connections, explained pathologies of speech and language, and predicted forms of aphasia that had not yet been discovered. In 1885, Lichtheim took Wernicke's model and expanded and refined it to produce what we now know as the Wernicke–Lichtheim model (Figure 2.4), which was to dominate aphasia theory in most of the world well into the 20th century. Because of its obvious similarity to the outline of a house, it is sometimes called the Wernicke–Lichtheim House.

However, not everyone was seduced by the localizationist agenda. During the 1874 Berlin language debate, the localizationist Hitzig took an opposing view to that of Steinthal, who was probably the first real psycholinguist (Eling, 2006). Heymann (Chajim) Steinthal (1871) complained that the physicians' descriptions of language and aphasia were too superficial and lacked the necessary linguistic detail, a complaint that still resonates. Steinthal stated, exasperatedly, “The clinical pictures have been recorded by far too incompletely and imprecisely; our physicians have not understood what the function of language is” (1871, p. 464). In England, John Hughlings Jackson (1835–1911) was also opposed to localization and proposed that reorganization of function could take place following damage. Jackson was more than simply an antilocalizationist, however. Darwin's *On the Origin of Species* was published in 1859, and the colossal impact that his evolutionary theory had on both scientific and public opinion is legendary. Subsequently, Jackson developed his highly significant theory of the evolution and organization of the nervous system, informed by his observations of aphasia and epilepsy and extensively influenced by the evolutionary ideas of Herbert Spencer (1820–1903). Head (1926) noted that “Jackson derived all his psychological knowledge from Herbert Spencer, and adopted his phraseology almost completely (p. 31). But his work on aphasia had little impact outside Britain and remained relatively unrecognized until Head's writings led to its recognition in the early 20th century. Jackson had observed that people with aphasia can often produce complete phrases in particular contexts (e.g., curses, exclamations, and stereotypies), even when they possessed little or no spontaneous speech, and he acknowledged Baillarger's (1865) earlier distinction between *voluntary* and *involuntary* speech. Jackson (1878–1880, as cited in Taylor, 1958) hypothesized that both the ontogenic (individual development)

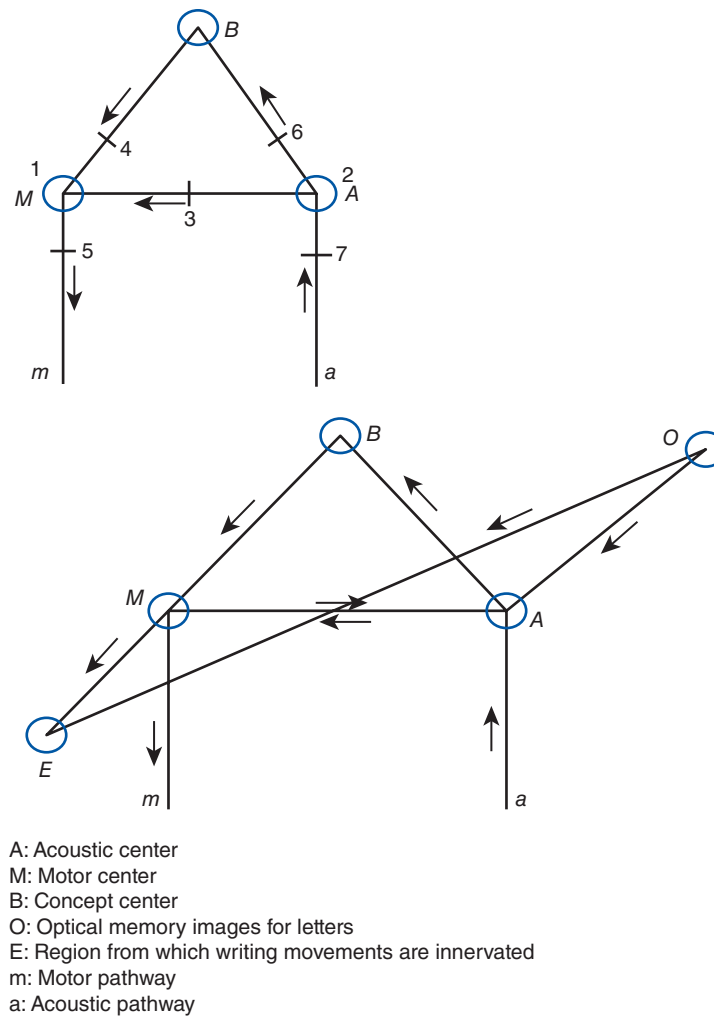


Figure 2.4 The Wernicke–Lichtheim model of language processing

Modified from Lichtheim, L. (1885). Ueber Aphasie: Aus der medicinischen Klinik in Bern [About aphasia: From the medical clinic in Bern]. *Deutsches Archiv für Klinische Medizin*, 36, 204–268.

and phylogenic (species development over time) evolution of the nervous system entailed the following: (1) a course from the most to the least organized, from the lowest, well-organized centers to the highest, least organized, centers; (2) a course from the most simple to the most complex; and (3) a course from the most automatic to the most voluntary. *Dissolution* is a term he acquired from Spencer and Jackson's model of the nervous system, and it mirrors Spencer's closely. Dissolution of the nervous system, with a loss of function, provides the inhibition of higher levels caused by brain damage, which Jackson saw as evidence of the reverse of evolution. Functions are organized hierarchically in the nervous system based on Jackson's theory at different levels of representation, from the oldest to the most recently developed in evolution and individual development, from the lowest to the highest, and from the most primitive to the most complex. Symptoms, for instance, aphasic recurrent utterances (speech automatisms), like Leborgne's tan tan, are the expression of

lower levels released from inhibition of higher levels caused by brain damage.

Many aphasiologists at this time were very interested in clinical management and treatment of aphasia—Broca and Henry Charles Bastian (1837–1915), for instance. Bastian (1898) and Henry Head developed tests for aphasia, which were used well into the second half of the 20th century.

The French suffered a military defeat at the hands of the Germans in 1870–1871, which resulted in the Germans marching into Paris. As a result, the French scientific community became closed to developments in German science and the revolution taking place in German aphasiology. French aphasiology remained staunchly devoted to Broca's mid-1860s findings (Gelfand, 1999). Jean-Martin Charcot (1825–1893) was a leading neurologist in Paris and holder of the chair for nervous diseases at the Hospice de la Salpêtrière. He was an advocate of a reactively patriotic competition with German science, and, because of him and

his students, aphasia once again became an important topic in Paris, despite the fact that there was a significant lack of enthusiasm for advances outside France since Broca. Charcot was interested in localization throughout his career, although a small, but important, part of his work was with aphasia. In a series of lectures (in 1883 and 1884), *On the different forms of aphasia* (Charcot, 1884), he developed his famous bell diagram (Figure 2.5), which was meant to allow a better understanding of normal and pathological language processing. His model contained four centers for memory images (speech, language, writing, and reading) attributed to an association center. These centers were linked to the outside world by auditory and visual routes. Charcot, in common with many of his predecessors, thus saw aphasia as a memory disorder, with memory divided into subsystems; he also believed in submemories for language, understanding,

writing, speaking, and reading, and the centers were linked to one another through many connections.

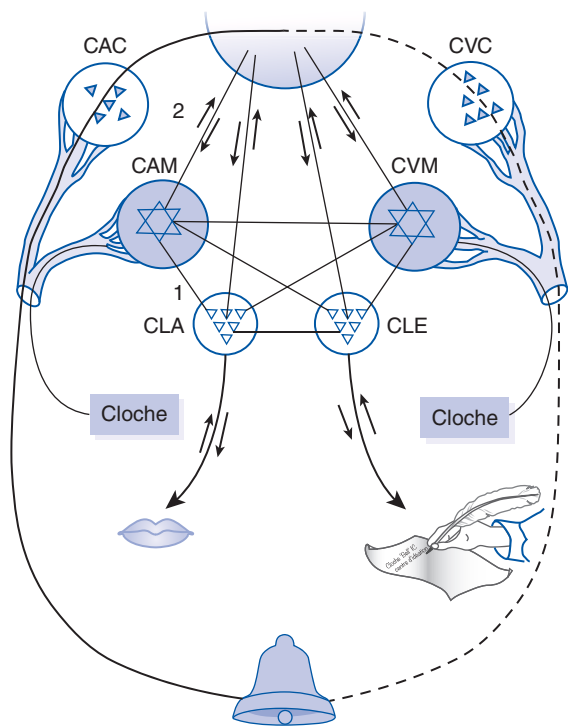
He attempted to localize aphasic disorders and went along with Broca's finding that aphemia was caused by a lesion of the third frontal gyrus, with a lesion in the second frontal gyrus as the cause of agraphia. Word deafness was caused by a lesion in the first temporal gyrus and word blindness from a lesion to the lower parietal gyrus.

Charcot's diagram became well known through the work of the young Pierre Marie (1853–1940), who joined Charcot at the Salpêtrière in 1885 and became one of his most famous students. With the work of the eminent Charcot, aphasia again became a topic of intense discussion in Paris.

In England, Hughlings Jackson published more on his evolutionary approach to aphasiology and was hardly influenced by the localization debates going on in Germany and France, although, as an editor of the new journal *Brain*, he published Lichtheim's work in English in 1885. Bateman's work, *On Aphasia, or Loss of Speech*, appeared in 1890 in its second edition, in which Charcot, Kussmaul, and others were included, although Bateman was opposed to classifications and localization. At the end of the 1800s, Bastian (1898), in England, summarized his 30 years of work on aphasia.

Another important critic of connectionism and the Wernicke–Lichtheim model was Sigmund Freud (1891/1953) in Vienna, a neurologist and aphasiologist before he founded psychoanalysis, who spent a few months with Charcot in 1885. He published his monograph on aphasia in 1891, but it was to have little impact at the time. However, it was published in an English translation in 1953, and more recently his contributions to aphasiology have been better appreciated (Buckingham, 2006). Henry Head (1926) was famously opposed to the proliferation of diagrammatic models of the representation of language in the brain and launched a bitter assault on what he called “the diagram makers.”

The Swiss Jules Joseph Dejerine (1849–1917) was Charcot's student and working in Paris, where he eventually became professeur de clinique des maladies du système nerveux in 1910. Dejerine described a classification system of aphasia, but mainly through two case descriptions of isolated writing and reading disorders his work became important. Dejerine (1891, 1892) described a 63-year-old man with word blindness (alexia) and total agraphia and a 61-year-old educated woman with word blindness without agraphia who could write spontaneously and to dictation and had no difficulties with spontaneous speaking (Hanley & Kay, 2003). Autopsies showed



- Cloche 'Bell'
- IC centre d'idéation
- Association center
- CAC centre auditif commun
- General auditory center
- CAM centre auditif des mots
- Hearing center for words
- CLA centre de langage articulé
- Center for articulated speech
- CVC centre visuel commun
- General visual center
- CVM centre visuel des mots
- Visual center for words
- CLE centre du langage écrit
- Center for writing

Figure 2.5 Charcot's “bell” model

Modified from Bernard, D. (1889). *De l'aphasie et de ses diverses formes* [Aphasia and its various forms]. Lecrosnier & Babe.

a lesion in the angular gyrus on the left for the first case and a lesion in the area that separates the general language area from the angular gyrus in the second case (Dejerine, 1892). He suspected that visual word images are stored in the angular gyrus, which he assumed is necessary for reading and writing. Thus, alexia and agraphia would result from a lesion to the angular gyrus.

Three years later, he described yet another form of alexia as it commonly occurs in motor aphasia. This “third alexia” is explained with reference to Dejerine’s language zone, containing Broca’s area, Wernicke’s area, and the angular gyrus, respectively responsible for production, auditory comprehension, and written language comprehension, and any disruption of the subcortical connecting pathways would lead to isolated phenomena. Cortical lesions of the language zone led to a disorder of “inner speech” and to disorders such as alexia in motor aphasia.

Also active in France in the later 1800s, Albert Pitres (1848–1928) is well known for his early work on *amnesic aphasia*, his term for impaired naming, and his book on aphasia in bilingual and multilingual speakers. The concept of amnesic aphasia received a great deal of discussion from the 1860s, and Pitres attempted to establish it as an independent form of aphasia (Pitres, 1898). He described amnesic aphasia as “a form of aphasia in which the language difficulties consist in having forgotten the words that are necessary to express thoughts” (Pitres, as cited in Benton, 1988, p. 210), emphasizing that pure cases are rare. Amnesic aphasia would play an important role in Geschwind’s reintroduction of the neoclassical model, developed in the 1960s in the United States, where it would reemerge as what we now call anomia (Benton, 1988).

Ribot (1881) had suggested that bilingual speakers with aphasia would recover their native language first. This idea was in general support of his theory that recent memories are more vulnerable to loss than earlier ones (Paradis, 1981). Pitres (as cited in Paradis, 1983, pp. 26–49) firmly believed that the most recently learned and familiar language is the one that will recover first, and, unlike Ribot, he based his perspective on a detailed review of the research and an analysis of eight new cases. Discussion continued for several years, with some supporting “Pitres’s rule” that the most recently used and familiar language would recover first and some “Ribot’s rule” that the first learned—the native language—would recover first. Finally, Pitres strongly opposed the idea that different languages could occupy separate locations in the brain.

Pierre Marie followed Dejerine as professor of neurology at the University of Paris and was one of the most provocative figures in the history of aphasia. Head (1926) called him “the iconoclast.” Marie was originally a localizationist, like his mentor Charcot, but in 1906 he published a paper with the title “Révision de la question sur l’aphasie: La troisième circonvolution frontale gauche ne joue aucun rôle spécial dans la fonction du langage” (“Revision of the question of aphasia: The third left frontal convolution plays no special role in the function of language”), which vehemently attacked Broca’s model of aphasia. Marie reported cases in which severe damage to this area did not result in aphasia and Broca’s aphasia could result without a lesion to the left third frontal convolution. He also stated that “l’anarthrie n’est pas de l’aphasie” (“anarthria [Marie’s term for aphemias] is not aphasia”), and he coined the famous equation, Broca’s aphasia equals Wernicke’s aphasia plus anarthria.

The Growth of Linguistic Aphasiology in the 19th and 20th Centuries

Attempts were made in the 19th and early 20th centuries to introduce linguistics as relevant in aphasiology from Steinthal, Freud, and the physician Arnold Pick. On the basis of a more exact linguistic examination, the early psycholinguist Steinthal (1871, p. 478) had described what he called *acataphasia*, which he contrasted with aphasia. He suggested that the problem in aphasia was at the lexical level (a word memory retrieval problem), whereas in *acataphasia* it is at the sentence level: an inability to make sentences, rather than poor memory for words. Forty years later, Arnold Pick (1851–1924) took up the mantle with his work on the development of *agrammatism*. Indeed, most of this pioneering work came from German-speaking Europe. Pick (1913) too believed that the developments in psychology and linguistics should form the basis for a new theory of aphasia:

Not only does the backwardness of the still authoritative psychology for aphasia theory urgently demand a revision, it is also the enormous progress that psychology itself has made. . . . [T]he situation in terms of linguistic science presents itself similarly to that of psychology . . . of which even the most recent presentations of aphasia theory have not taken notice. (p. 9)

In modern terms, Pick was advocating, as Steinthal had, a psycholinguistic perspective. In his monograph, *Agrammatic Language Disorders: Studies on the Psychological Foundation of Aphasia Theory* (1913), he developed a staged model of language production that shares many features with current models (e.g., the contemporary models of Garrett [1980] and Levelt [1989]).

In Pick's model, a mental schema develops that includes pragmatic and emotional components, which today we would call an intention to communicate, or a preverbal message. Subsequently, a sentence schema is activated, which takes place before word choice. The choice of a word, Pick stated, is determined only by the position it takes in the sentence, so it must occur following sentence formulation. Likewise, word ordering and intonation precede word choice. Then, grammatical and lexical words are built into the sentence schema; thus, the specification of grammatical words (function words and inflections) precedes the specification of content words.

Agrammatism for Pick was the core aphasic symptom, and he described separate forms associated with impairments to the different stages of production. To explain function word omissions in telegraphic speech, Pick supposed that the individual employs an economy of effort in the context of a severely impaired system—the word is omitted because it is the semantically least useful in the sentence. He also discussed in detail the idea of “emergency language,” a form of adaptation of the system to brain damage: “the whole mental language apparatus accommodates itself . . . extraordinarily fast with the situation created by the illnesses” (Pick, 1913, p. 156). Similar views would later also be developed by Isserlin (1922).

In 1914, Karl Kleist (1878–1960) described an impairment he called paragrammatism, a second word order disorder distinct from agrammatism. Kleist stated:

So far we have only spoken of agrammatism. We retain the term agrammatism for one of these two . . . word order disorders. The basic trait of agrammatism is the simplification and coarsening of word sequences. Complicated compound sentences (subordination of clauses) are not built. The patients only speak in small, primitive mini-sentences, if they continue to create sentences at all. All less necessary words, especially pronouns and particles, are reduced or eliminated . . . Conjugation thereby also degenerates . . . But also the

changes occurring in the words themselves, through conjugation, declination, and comparison (flexions in the narrower sense), are more or less omitted. (pp. 11–12)

In contrast to this pattern, in paragrammatism:

[T]he ability to create word orders is not abolished, but phrases and sentences are often wrongly chosen and thereby amalgamate and contaminate each other Phrases and sentence constructions are not completed The spoken expression is not simplified overall; instead, also conditioned by a strong over-production of word sequences, it swells to confused sentence monsters. (p. 12)

Kleist considered a mixed agrammatic-paragrammatic symptom pattern to be the rule, and pure cases to be rare. He was very clear with regard to the anatomical basis (Kleist, 1914, p. 12): “We will not go wrong if, contrary to frontal agrammatism, we localize paragrammatism in the temporal lobe or its immediate neighbourhood.”

Later, Kleist (1916, p. 170) modified his position and concluded that the cause of agrammatism was “a loss or lowering of excitability of sentence and phrase formulae,” which approximately corresponds to Pick's sentence schemata, and in paragrammatism, “sentence and phrase formulae . . . are aroused incorrectly.” So, for Kleist (1916, p. 198), paragrammatism is caused “by an incorrect arousal of acoustic sentence formulae.” Kleist was another of Wernicke's many assistants, and Wernicke had a significant influence on him. Kleist was also an ultra-localizationist, and his brain map went beyond even the phrenological maps of Spurzheim in its detail.

Russian linguist Roman Jakobson (1896–1980) is sometimes considered the first to strongly apply linguistics in aphasiology, although, as noted above, Steinthal may be more worthy. Jakobson was a founding member of the Linguistic Circle of Prague established in 1926. When the Nazis entered Czechoslovakia, Jakobson fled, first to Denmark, Norway, and Sweden and then to the United States in 1941, where he eventually became professor at Harvard and the Massachusetts Institute of Technology. In his 1941 monograph, *Child Language, Aphasia, and Phonological Universals* (English translation, 1968), Jakobson describes parallels between language acquisition and aphasia and proposed a regression hypothesis, which states that we can observe the same processes in both developing child speech and the impairments

of speakers with aphasia, but in reverse: “The dissolution of the linguistic sound system in aphasics provides an exact mirror-image of the phonological development in child language” (Jakobson, 1968, p. 60), and “the order in which speech sounds are restored in the aphasic during the process of recovery corresponds directly to the development of child language” (p. 64).

For Jakobson, there was no doubt that aphasia should be understood in terms of linguistic theories and aphasia could test the validity of linguistic theories. Jakobson (1964) also attempted to contrast Luria’s six aphasia types (described below) in terms of three linguistic dichotomies: encoding (combination and contiguity) impairments versus decoding (selection and similarity) impairments, limitation impairments versus disintegration, and sequence (syntagmatic and successivity) versus concurrence (paradigmatic and simultaneity). For instance, an encoding impairment, like Luria’s dynamic aphasia or efferent motor aphasia, is characterized by problems with combination, whereas decoding impairments, like sensory or semantic aphasia, entail impairments in selection. Jakobson is admired as a pioneer of linguistic aphasiology, but his views had little mainstream impact and played little part in contemporary linguistic aphasiology.

Not until the 1960s, when generative transformational grammar emerged, did a broad linguistic aphasiology develop. Chomsky’s ideas were to have a revolutionary impact in linguistics, cognitive psychology, and philosophy. Noam Chomsky (born 1928) introduced transformational generative grammar (TG) at the turn of the 1950s and 1960s (Chomsky, 1957b, 1965), and linguistic science materialized as a dynamic enterprise. Chomsky (1957a) famously wrote a scathing critique of the behaviorist B. F. Skinner’s book *Verbal Behavior* in which Skinner claimed that language development is accountable in terms of stimulus-response learning. Chomsky dismissed the behaviorist account. For generative linguistics, children learn a set of rules and have an innate capacity for language acquisition; while learning is involved in language acquisition, they do not learn a set of utterances through imitation and reinforcement.

Chomsky proposed a partition between linguistic *competence* and linguistic *performance*. Competence is the abstract system of mental representations and processes that constitutes the basis of language, and performance is the actual realization of language through use. An important feature of TG is the powerful idea of a universal grammar shared by all languages.

Chomsky regarded linguistics as a branch of cognitive psychology. A theory of a language is a

psychological model of a part of the mind and subject to scientific laws. Psycholinguistics advanced and the development of experimental investigations of language processing grew, and these emerged as a dynamic interchange on how the psychological reality of linguistic constructs might be tested (see, for instance, Miller, 1964). A view was also developing that aphasia could be relevant for linguistics and psycholinguistics and vice versa. Linguistics has methods for describing aphasic language and might provide details to inform treatment planning, and aphasic data can act as “external” evidence for linguistic and psycholinguistic hypotheses. The separation of abstract phonological and concrete phonetic components in speech production has been a theoretical position since the origins of phonology and phonetics as disciplines, and dozens of studies have demonstrated that the distinction accounts well for separate phonological and apraxic speech errors occurring in different people with aphasia. A frequently observable double dissociation has been described between problems with referential, or modalizing, language that is differentially impaired across the broad range of aphasic types. This evidence supports a model of language that posits a referential and a modalizing, form of language, which is taken to reflect certain linguistic and cognitive distinctions that cannot be accounted for by structurally motivated linguistic models (Nespoulous et al., 1998).

Another theory of language that was to become relevant in aphasiology from the 1970s is systemic functional linguistics, developed by M. A. K. Halliday (1961, 1985). At the heart of Halliday’s model is the recognition that language has a fundamental social function as well as a cognitive/referential one. Language can be conversational and used to develop, cement, and maintain relationships using different registers and styles, depending on whether the relationship is with a boss, loved ones, or friends and paralinguistic features, such as facial expression, body language, and gesture, are essential components of everyday communication. Systemic linguistics provided methods of analysis for all components of language and several social contexts. This “functional” appreciation of language has been fully incorporated into contemporary psycholinguistic models (e.g., Tomasello, 2014).

Aphasiology in the 20th Century

The devastation of war brings advances in science and technology, and aphasia and neuropsychology are no exceptions. The massive numbers of brain-injured

soldiers of World War I resulted in new approaches to rehabilitation, many pioneered by Kurt Goldstein (1878–1965), who is often considered the major opponent to the classical localizationist approach (Geschwind, 1965). He took a holistic view of aphasia through his organismic approach and was deeply concerned with rehabilitation and the psychosocial impact of aphasia. World War I saw the development of aphasia therapy from what Howard and Hatfield (1987) called the “speech gymnastics” of the Viennese phoniatricians Hermann Gutzmann (1865–1922), known as “the father of aphasia therapy,” and Emil Froeschels (1884–1973). They applied the techniques they knew from voice therapy, articulatory drills, and primary school teaching techniques. In Britain, treatment of aphasia also was mainly developed by elocutionists and voice teachers. Bastian was an exception and introduced the still-influential division between *compensation* for lost functions and *restitution* of functions (Bastian, 1898). He described therapy for aphasia based on the potential of reorganization of the right hemisphere through functional compensation, which he distinguished from functional restitution. These processes have become axiomatic in neuropsychology and have a significant impact on how we plan and carry out therapy.

During World War II, A. R. Luria (1902–1977) in Russia collected a mass of data from brain-injured soldiers and developed a functional systems approach to the brain and language, resulting in a new perspective on the organization of cognition and language and a new classification of aphasia. Treatment involved the reorganization of function, where intact functional subsystems could be used to compensate for impaired ones, in speech, language, reading, and writing. Luria’s clinical approach had a major impact in Eastern Europe but also in the United Kingdom and Australia. He was influenced by the pioneering work of fellow Russian psychologists Pavlov and Vygotsky and has been called the “last giant” in the history of aphasia.

The essential foundations of Luria’s approach are easily accessible in *The Working Brain* (1973) and in Kagan and Saling (1992). His important early work is *Traumatic Aphasia*, based on data gathered from World War II, and the English translation appeared in 1970. His general neuropsychology was extensively developed in *Higher Cortical Functions in Man* (1980), and a special issue devoted to Luria’s contribution to aphasia appeared in *Aphasiology*, edited by Kaczmarek (1995).

Luria attempted to create a synthesis of the localizationist approach, as represented by Wernicke or Kleist, with the holistic approach. To Luria, neither

approach seemed to be altogether appropriate to understand the functioning of the human brain. Central to his approach is the notion of a functional system. Every single mental function (e.g., thinking, writing, and arithmetic) should be understood not as a single, simple function “but as a complete functional system, embodying many components belonging to different levels of . . . motor and nervous apparatus” (Luria, 1973, p. 27). Therefore, “there can of course be no question of the localization of complex functional systems in limited areas of the brain or of its cortex” (Luria, 1973, p. 30).

Mental activity is a complex functional system “involving the participation of a group of concertedly working areas of the cortex” (Luria, 1973, p. 35). In addition, functional systems are characterized by the variability and mobility of the participating mechanisms. If we consider writing, for instance, then this can also be achieved using the feet or the mouth if circumstances require. For this reason, too, rigid allocation of functions to specific brain areas cannot be assumed.

For Luria, language was also a functional system, and his classification of aphasia resulted from localized injuries and their relationship to the respective components of language processing. He outlined a classification that, while using different terminology, is not dissimilar to classifications that others have produced. However, the underlying causes of symptoms can be different for Luria. In what follows, I have inserted Benson and Geschwind’s (1971) equivalent “neoclassical” forms. Luria described dynamic aphasia (also called frontal aphasia), which is caused by a lesion of the left prefrontal lobe anterior to the premotor areas. The main features are an apparent lack of a will to speak and a disturbance of inner speech. The individual can no longer make predicative statements or propositions, and production is limited to empty phrases. They can understand quite well and can also name and repeat, although they initiate little speech without external stimulation. On the neoclassical model, this is transcortical motor aphasia.

Luria described two separate forms of motor aphasia. A lesion of the inferior frontal areas of the left premotor zone, which corresponds to Broca’s area, leads to efferent (kinetic) motor aphasia. Individual sounds are not problematic, but the problems occur when the patient has to switch from one articulation to another. The individual has a problem with the production of linear schemes, which also has effects in other domains, so writing is also impaired in a similar fashion. In later stages of the condition, agrammatism emerges. Neoclassically, this is Broca’s aphasia. The

second motor aphasia, afferent (kinesthetic) motor aphasia, is characterized by problems finding the positions of the articulators necessary for speech, and in milder forms there is confusion between similar phonemes. Phonemic confusions also occur in reading and writing. The lesion is in the inferior region of the left post-central parietal cortex, which, among other things, leads to the impaired interpretation of kinesthetic feedback. The neoclassical model calls this form conduction aphasia.

Sensory aphasia is caused by a lesion of the superior and posterior regions of the temporal lobe, which approximately corresponds to Wernicke's area, and indeed on the neoclassical model it would be called Wernicke's aphasia. Luria localized phonemic analysis in the secondary auditory cortex, and, while the individuals have intact hearing, they cannot discriminate between, analyze, or synthesize similar phonemes, which leads to comprehension difficulties at the lexical level. Paraphasias and writing problems arise from impaired "phonemic hearing."

An injury to the middle gyrus of the temporal lobe is the underlying cause in acoustico-mnemonic aphasia, which causes an impairment of verbal memory and the preservation of repetition, comprehension, and fluent speech but with paraphasic errors—a transcortical sensory aphasia in neoclassical terms. Finally, in semantic aphasia, patients can understand the meaning of individual words, but they cannot grasp the meaning of the construction as a whole; there is also an impairment of what Luria called logico-grammatical operations with a disturbance of simultaneous (and spatial) synthesis that affects not only linguistic but also spatial and praxic systems, acalculia, and other problems can co-occur. The lesion covers most of the posterior left hemisphere in the parieto-temporo-occipital region. Benson and Geschwind (1971) consider this form of aphasia equivalent to anomia.

On the face of it, Luria's model seems similar to other major classifications, but Luria has clearly different views on the individual processes (analysis, synthesis, and integration) engaged in language; his is a process model. Additionally, the possibility of aphasic symptoms being connected at different linguistic levels on the basis of abstract principles is implied—for instance, the disturbance of the linear scheme, which shows itself in sound production, sentence production, and writing. Importantly, Luria's process model provides routes for the formulation of strategies for rehabilitation because the model is flexible and dynamic in contrast to the static classical model and the brain is conceptualized overall as a dynamic and interactive system. While Luria

claimed not to be a localizationist, but emphasized localizable "functional systems," his model helped to reintroduce localization and provide it with a more dynamic and multidimensional perspective, rather than the two-dimensional connectionist view of the old or neoclassical model.

A historically significant study of the effectiveness of aphasia therapy was conducted in Edinburgh by psychologist Oliver Zangwill and speech therapist Edna Butfield and published in 1946 (Butfield & Zangwill, 1946). Howard and Hatfield (1987) suggested that the paper "was the first published attempt to evaluate the efficacy of therapy properly, and to assess also the significance of specific factors, such as the form of aphasia and its aetiology" (p. 51). The short paper described therapy for 66 cases of aphasia between the ages of 20 and 40 years, divided into a group that received treatment within 6 months of the onset (Group 1) and a group whose treatment began after 6 months (Group 2). The study examines the effects of spontaneous recovery in the second group. Treatment was mainly based on Goldstein's methods, and the amount varied between 5 and 290 sessions per individual. Progress was measured fairly grossly in ratings of much improved, improved, or unchanged. "Speech" was judged to be much improved in one-half of Group 1 and one-third of Group 2, but improvement in the other modalities did not appear to be significant to the authors. Improvement did not appear to be related to spontaneous recovery.

The New World Takes the Lead

The decline in the massive influence of German aphasiology, neurology, and science in general was strongly related to the defeat of Germany in World War I and the shift in the focus of intellectual life to the English-speaking world, and with Weisenburg and McBride (1935) there was a shift in focus across the Atlantic and a new, behavioral, psychometric, anticlassification, and antilocalizationist approach to aphasia developed in the United States. This was spearheaded by particular attention to assessment and rehabilitation. Many classifications of aphasia had developed in the previous century, but Weisenburg and McBride's own was the simple dichotomy of expressive or receptive aphasia (and mixed expressive-receptive).

The educational psychologist L. Granich (1947) developed therapy for 300 war veterans in Atlantic City Hospital, New Jersey, including 100 with aphasia and related disorders. Granich's therapy was also

much influenced by Goldstein's work, and he was not concerned with standardized testing or aphasic syndromes. He used drilling and believed in the beneficial effects of hard work by patients and in the value of the strategies that patients produced themselves, although his approach was mostly uneven and patchy (Howard & Hatfield, 1987).

Between 1940 and 1960, Joseph Wepman (1907–1985) and Hildred Schuell (1907–1970) developed assessment and treatment approaches for different aphasia types based heavily on significant auditory stimulation and repetition. For them, the person with aphasia had not lost language functions, but they had become inaccessible. Language *competence* survived; it was language *performance* that was impaired and could be regained with the right kind of stimulation. Therapy essentially entailed facilitating and stimulating language use. Improvement, if it occurred, came because the patient facilitated and integrated what they already knew and did not learn new vocabulary or grammatical forms.

The principles of stimulation and repetition remain important ones in present-day approaches to therapy. Both Wepman and Schuell developed test batteries: Wepman developed the Language Modalities Test for Aphasia (LMTA) with Jones (Wepman & Jones, 1961). Schuell saw aphasia as a single unitary condition that could, however, occur with additional complications and symptoms, and she attached great value to a detailed assessment in all modalities reflected in the Minnesota Test for Differential Diagnosis of Aphasia (MTDDA) (Schuell, 1955; Schuell et al., 1964) developed with detailed psychometric evaluation. This battery supported much clinical assessment for rehabilitation in the English-speaking world well into the latter 20th century.

Neoclassicism and the Return to Localization

Boston neurologist Norman Geschwind (1926–1984) is mainly responsible for the return of language localization as what is called neoconnectionism or neoclassicism. Geschwind resurrected the Wernicke–Lichtheim notion that certain areas of the left hemisphere have a narrowly specialized function in language processing, among them especially Broca's and Wernicke's areas (Geschwind, 1974); the connection between Broca's area and Wernicke's area via the arcuate fasciculus; and the angular gyrus mediating between visual and auditory information, which is important for written speech and naming. Geschwind (1974) described language processing as

a form of information processing. Visual information proceeds to the angular gyrus via the primary visual cortex, where the visual form is associated with a corresponding auditory pattern. When the word is required for speech, a representation is passed on to Broca's area via the arcuate fasciculus, where its production is implemented by the motor cortex. Neoclassicism dominated world aphasiology from the 1960s until the 1980s and still has a significant influence.

Wernicke's classification was repackaged as the Boston classification and became internationally known. Beside considerable research activity in Boston, the influence of Boston was bolstered by the Boston Diagnostic Aphasia Examination (BDAE) developed by Harold Goodglass (1920–2002) and Edith Kaplan (Goodglass & Kaplan, 1972). It became one of the most popular and widely used aphasia batteries ever produced, has been translated many times, and still appears to be a widely used clinical assessment in English-speaking countries (Katz et al., 2000). The main functions are the classification of aphasia into (neo)classical types on the basis of functional profiles that emerge from testing and the localization of damage on the basis of this classification. Brain imaging was in its infancy when the BDAE was developed, and localization of structural lesions from impaired functions was an important goal of aphasiological and neuropsychological testing. However, the ability of the BDAE to localize damage on the basis of aphasia classification was unreliable, at best, and the advent of brain imaging methods made the goal mostly obsolete.

Cognitive Neuropsychology

New approaches were developing that would have a significant impact on how researchers and clinicians approached aphasia. These approaches were emerging from the growth of experimental psycholinguistics and developments in information-processing approaches to cognitive functioning. The cognitive neuropsychological model that was developed in the early 1980s pioneered a shift away from grouping and classifying aphasia. Instead, it advocated the development of single-case designs for therapy research (Coltheart, 1983; McReynolds & Kearns, 1983), and good success with well-selected individuals began to be demonstrated.

The development of the cognitive neuropsychological model emerged from the coming together of psycholinguistics, single-case methods, the information-processing model, and a theory-driven

and hypothesis-testing approach to investigation. This approach was claimed to be preferable to the comparison of mixed groups categorized according to the classical syndromes. Utilizing Jerry Fodor's (1983) ideas on *modularity*, an idea inspired by Gall's faculties, the model assumed that components of cognition are organized in modules that are domain specific (computations performed by a module are specific to that module only), associated with circumscribed brain structures, genetically determined and computationally autonomous, and independent of other cognitive processes. The model became well known for its box-and-arrow diagrams to conceptualize processing; the diagrams were used to represent the stages and routes involved in activities, such as reading single words aloud, writing single words to dictation, and naming objects. The model can identify what is impaired and retained by detailed hypothesis-driven testing using psycholinguistically controlled tests. It shares some features with the Wernicke–Lichtheim model, not least its focus on single-word processing. Graves (1997) traced the evolution of the traditional Wernicke–Lichtheim model through the subsequent modeling of Dejerine (1892), Liepmann (1920), and Geschwind (1965) to the contemporary models of Marshall and Newcombe (1973) and Ellis and Young (1988). The model informs modern cognitive neuroscience and has had a substantial impact on approaches to assessment and treatment of aphasia.

Microgenetic Theory

While clearly dominant, the cognitive neuropsychological paradigm was not the only theoretical approach to emerge in the second half of the 20th century. Microgenetic theory also developed, although it has not had wide impact. The word *microgenesis* was first introduced in English by Heinz Werner (1956), who adapted the German *Aktualgenese* in an article called “Microgenesis and aphasia,” though Arnold Pick (1913) had explored the microgenetic idea in aphasia earlier. Jason Brown (1979, 1988) developed microgenetic theory further in recent decades. The theory is in the tradition of Jackson's evolutionary levels of neural representation, although distinct from it. “The idea of microgenesis developed in the Würzburg school of psychology . . . but the term was coined from the German *Aktualgenese* . . . for the microtemporal unfolding of object representations, conceived as a more or less instantaneous recapitulation in cognition of patterns laid down in phylo-ontogeny” (Brown, 1988, p. 3).

For microgenesis, the basic assumption is that mental representations, actions, and affects emerge from a prehistory that shapes their major structure, where there is an “unfolding” in microtime (seconds or fractions of seconds) that leads to an idea or an action that unfolds from deep to surface structure. We are aware of the surface events—ideas, actions—but not the deep prehistory. Measured in millions of years, the temporal unfolding process is evolutionary phylogenesis; measured over a lifetime, it is ontogenesis; and when over a second or less, the process is one of microgenesis, a kind of instantaneous evolution.

Although microgenetic theory is in the tradition of Hughlings Jackson, explanations for the emergence of aphasic and other symptoms differs (Brown, 1988). For Hughlings Jackson, the earlier stages in evolution and individual development were released or disinhibited from the control of higher levels; in microgenesis, disinhibition appears to have less relevance. A symptom represents not only the result of a released lower, more primitive level but also a natural part of the prehistory of the surface behavior. For instance, the uncontrollable pathological laughing or crying that is a common symptom of pseudobulbar palsy is, on the Jacksonian model, a disinhibited primitive reaction that is out of higher control due to the upper motor neuron lesion, whereas in microgenetic theory they are always there in the deep structure of the nervous system and part of the prehistory of the normal response that is shaped into a normal response by later stages in the unfolding of the response. Therefore, in microgenetic theory, symptoms are *errors* but not *deficits*, and they are viewed as achievements of the cognitive processes underlying them. The significant claim is that a symptom represents a normal part of normal processing revealed by pathology (Brown, 1988).

The Treatment of Aphasia in the Latter 20th Century

Many treatments and therapies developed from often opposing theoretical approaches during the latter half of the 20th century. It became increasingly clear that an aphasic language disability can result in significant emotional and psychosocial impact, can have a fundamental influence on relationships, and can set up sociocommunicative barriers within the person's community.

In the second half of the 20th century, treatment approaches and methods developed from a range of sources. There were principled treatments based on theoretical positions as well as more symptomatic treatments aimed at reducing or eliminating specific aphasic features. In the 1970s, Frederick Darley (1918–1999) and his students emphasized the importance of the intensity, duration, and timing of therapy input (Darley, 1972). Data began to emerge on the best candidates for treatment; thus, the age, educational background, time since onset of the damage, and severity of the aphasia began to emerge as important prognostic variables. A range of group-based randomized clinical trials (RCTs) were conducted in the late 20th century but proved very difficult to design and carry out mainly because of the heterogeneous nature of aphasia and the failure to specify and systematize therapy appropriately.

Howard and Hatfield (1987) classified most approaches into several main methodologies. There are didactic methods, which aim to reteach language utilizing traditional and intuitive educational methods from child and foreign-language teaching. In common with didactic methods are established behavioral techniques, such as repetition, imitation, modeling, prompting, and cuing. They are utilized in some hierarchically organized therapy approaches for apraxia of speech, and contemporary computer-based methods use systematic behavioral methods (see chapters in Code & Muller, 1995, and Helm-Estabrooks & Albert, 1991). Treatments inspired by the Boston model were developed, mainly by Nancy Helm-Estabrooks and Martin Albert and colleagues (for review, see Helm-Estabrooks & Albert, 1991). Many of these approaches were designed for specific types of aphasia or impairment, such as perseveration, and use systematic behavioral training hierarchies organized into steps and levels, such as Melodic Intonation Therapy (MIT), which aims to reestablish some speech by reorganizing the speech production process using melodic intonation, and Visual Action Therapy (VAT) for Broca's or global impairments.

Schuell's language stimulation was a part of many treatments and universally utilized. Luria's (1970) functional systems model formed the basis for approaches to the reorganization of function. Intact functional subsystems could substitute for impaired subsystems. For example, Luria suggested that letters made of sandpaper could aid a reading impairment via the tactile system, and drawn "articulograms" of the lips producing particular combinations of speech sounds were developed for severe apraxia of speech,

where the speaker uses his or her intact visual route to the speech production system.

The systematic nature of the cognitive neuropsychological approach had attractive features for clinical work with aphasia and subsequently other aspects of impaired cognition and began to have a significant impact on aphasia therapy. The model came with a model of assessment for treatment and an emphasis on the individual and their problems. Howard and Patterson (1990) outlined three strategies for therapy that could work with the model: reteaching of the missing information or missing rules or procedures based on detailed testing, teaching a different way to do the same task, and facilitating the use of impaired access routes. While these broad strategies for treatment are not new, the model's main contribution has been in systematizing assessment, allowing a clearer identification of the location of impairments within a hypothetical model. A recent book (Whitworth et al., 2013) focuses on the therapeutic application of clinical research findings from cognitive neuropsychological research. It clearly and transparently presents excellent examples, making it highly accessible.

The development of a cognitive neuropsychology-inspired single-case approach was much aided by the failure of RCTs to demonstrate that treatment was efficacious or effective. A similar disenchantment with medical-model, classification-based treatments was at least a partial cause for a parallel shift to more everyday functional communication at this time. Martha Taylor Sarno (1969) and Audrey Holland (1980) were important in developing functional approaches to assessment and treatment. Approaches like Promoting Aphasics Communicative Effectiveness (PACE; Davis & Wilcox, 1985) emphasized successful communication, not precise oral naming or correct syntax. The main features of the approach are that the therapist and patient participate equally as sender and receiver of messages; interactions entail the exchange of new information; the person with aphasia chooses the modality or methods of communication; feedback is based on the person with aphasia's success in communicating the message; and it encourages writing, gesturing, drawing, and pointing.

Reorganizational approaches were developed based on surviving right-hemisphere (RH) processing in the 1980s and 1990s. These include MIT, which claims to utilize intact RH musical processing. Artificial languages made up of visual arbitrary shapes or symbols were devised from work with chimpanzees, and remarkable success was reported with globally

impaired patients, being able to use the systems propositionally. There were also attempts to directly influence cognitive processing in the RH and stimulate latent RH language processes using lateralization techniques, such as dichotic listening and hemi-field viewing, although it was never clear that improvements observed were due to increased RH involvement (for review, see Code, 1987). In the 1980s, treatments began to be developed that were delivered by microcomputers using mainly behavioral methods (see the collection led by Katz, 1987). Intense stimulation, feedback on performance, and control of the pace and level of difficulty by the user appeared to be clear advantages.

Also, during the early 1980s, the relevance of the psychosocial impact of aphasia began to be better recognized, although Goldstein had pioneered its importance before World War II. Most of our happiness and sadness come from our interactions with others. How we perceive our interactions with others is what determines the quality of our life experience—our psychosocial well-being. Our psychosocial life is grounded in our emotional experience within a social context. The psychosocial impact of aphasia on people with aphasia and their families began to be increasingly acknowledged, and approaches to improving psychosocial state began to be developed (see the collection of papers in Code, 1999, and Code et al., 1999). In 1980, the World Health Organization (WHO) introduced the terms *impairment*, *disability*, and *handicap* to describe and categorize disease. In this latter part of the 20th century, the disability movement was successful in introducing a social model that contrasted significantly with the medical model's perspective of illness, and the social disability and social exclusion that accompany aphasia became increasingly acknowledged.

The more recent draft of the International Classification of Impairments, Disabilities, and Health (WHO, 2001) proposed three dimensions: *impairment*, a loss or abnormality of body structure or of physiological or psychological function; *activity limitation*, where the extent of functioning at the level of the person is reduced or limited. Activities may be limited in nature, duration, and quality. The term *disability* was replaced by *activity limitation*. Participation is the nature and extent of a person's involvement in life situations in relation to impairments, activities, health conditions, and contextual factors. Handicap was replaced by *participation restriction*.

This approach sees the problem lying not in the individual's impairments but rather in society's failure to accommodate their different needs, which lead to

people with disabilities facing increased social barriers and oppression (Jordan, 1998). The main objective of the social approach to aphasic disability is to increase successful participation in authentic communication events, focus on communication at the level of conversation, provide communicative support systems within the speaker's own community, and increase communicative confidence and empower speakers with aphasia (Simmons-Mackie, 1998).

In recent years, evidence-based practice (EBP) has emerged as a concept; it is essentially a principled and systematic approach to evaluating the relative strengths of a treatment for an individual. It combines clinical expertise, best current evidence, and client values with the aim of providing the highest-quality service reflecting the needs and choices of the individual (Sackett et al., 2000). This process of evaluation is aided in practice with the range of systematic reviews of therapy trials available, and there are a range of useful resources that can help with what could be time consuming for a busy clinician. Both the American Speech and Hearing Association (ASHA) and Academy of Neurogenic Communication Disorders and Sciences (ANCDS) provide detailed evaluations of evidence for the effectiveness of aphasia treatment that are freely available online (<http://www.asha.org>; <http://www.ancds.org/evidence-based-practice-guidelines>). SpeechBite is a free web resource that enables searching for approaches to therapy across the specialties of speech and language therapy and pathology including aphasia and related conditions (<http://www.speechbite.com/>). It provides an online database established to gain fast access to evaluated, relevant, evidence-based research for clinical decision making, contains references to more than 3,000 journal articles, and provides methodological reliability ratings to help identify the research quality of therapy trials (Murray et al., 2013). The Aphasia Software Finder, developed at Frenchay Hospital, Bristol, United Kingdom, and funded by the Tavistock Trust, provides an online service for people with aphasia and their families, as well as professionals, for locating relevant computer treatment software packages and also provides evaluation (<http://www.aphasiatavistocktrust.org/aphasia/default/software.asp>) (Further detailed discussion of EBP can be found in Chapter 7.)

To end this brief sketch of the history of aphasia and its treatment, we might ask whether things got any better for people with aphasia in the 20th century. At the turn of the century, Katz et al. (2000) conducted an international survey across the English-speaking world, with data collected from clinical

aphasia departments in the United States, Canada, Australia, and the United Kingdom. Findings revealed that the mean amount of therapy per week received at the acute stage was just 30 minutes for Australia and the United Kingdom. For North America, the mean was 60 minutes per week but with a range of 16 to 20 sessions (the North American data included the Veteran's Administration hospital system). The figures for the United Kingdom and Australia in particular suggest that people with aphasia, even in the acute stage, can expect no more than 2.5 hours of therapy spread over 5 weeks. The amount of therapy someone with more long-term aphasia can expect is even less (see the collection of studies of the treatment of chronic aphasia edited by Code, 2010).

Yet there is evidence that intensive therapy, even relatively short in duration, can improve outcome, especially, but not exclusively, in the early stages of recovery. Bhogal et al. (2003) conducted an analysis of the large group trials that have been completed over the years that have examined the effectiveness of aphasia treatment. They found a significant treatment effect in studies that provided 8.8 hours of weekly therapy for 11.2 weeks; studies that did not show a significant treatment effect provided less than 2 hours for 23 weeks. The implication of these results seems clear: Intensive therapy over a relatively short duration can be more effective and cost effective than nonintensive therapy over twice the duration (for a thorough discussion of therapy intensity, see Patterson et al., 2018).

Methods of treatment have improved considerably over the centuries, and a great deal of research into rehabilitation demonstrates that it can be effective. People with aphasia do receive treatment, in the developed world at least, but the gap between what we know about the effectiveness of treatment and the

service we provide to people with aphasia does not appear to be narrowing.

What could a future history of aphasia look like? As noted elsewhere (Tesak & Code, 2008), predicting the future may well be imprudent given the very unpredictable nature of future events, especially since the global financial crisis of 2007–2008, a worldwide economic crisis that negatively impacted financial support for health and social services in many of the world's economies. At the time of this writing, the impact of the 2020 worldwide COVID-19 pandemic is unknown, but the damage to the world's economies will be colossal. However, trends in health care and public health suggest that the incidence of stroke in the 40-to 60-year-old age range will decrease, at least in the developed world, as improved medical interventions result in an increase in survival from stroke and improved awareness of the importance of diet, exercise, and lifestyle makes an impact. But people are living longer, and this brings with it an increase in the incidence of progressive neurological conditions, including progressive aphasia. So aphasia will be with us for many years yet, and its management will continue to be a significant concern for the foreseeable future.

What might be the nature of this management of aphasia? Predictions suggest that pharmaceutical and neurophysiological interventions will emerge but will be coupled with behavioral assessment and treatment carried out by trained and experienced clinicians (Small, 2000, 2004).

Broca, Wernicke, Hughlings Jackson, and their contemporaries might be surprised and rather disappointed that aphasia still constitutes a significant problem for many in the early 21st century, but current developments in treatment and management should provide some optimism for the future.

WRAP-UP

Study Questions

1. When in the history of aphasia did thinkers associate damage to the brain with impairments in speech and language? Describe the main forms of aphasia identified by the Wernicke–Lichtheim model.
2. What were the main trends that caused a shift of focus in aphasia research from Europe to North America?
3. What single event is often suggested to have heralded the beginnings of modern aphasiology?

4. Why was Gall's organology (Spurzheim's phrenology) so revolutionary, and in which ways is it an inadequate theory of the relationship between brain structure and brain function?
5. Who developed the so-called speech-gymnastics approaches to aphasia treatment?
6. Writers in previous times have described aphasia as a memory disorder. Why? Does the idea that various aphasic impairments may be caused by some impairment in memory have relevance today?
7. In what ways did Arnold Pick describe and distinguish agrammatism from paragrammatism?
8. Who has been called the father of aphasia therapy?
9. Stimulation plays a particularly significant role in the history of the treatment of aphasia. With whom is the idea associated?
10. Who developed a more systematic and psychometric approach to testing for aphasia?

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