

SECTION

I

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# APHASIA



**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.

# Significant Landmarks in the History of Aphasia and Its Therapy

Chris Code

**INTRODUCTION**

In this chapter, we explore where aphasia and attempts to treat it came from. We start with a survey of how thought, language, and speech are 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 in pre-Christian Greece and Rome a theory of *fluids* developed. 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 anatomic examinations of the brain, the soul was considered to reside in the ventricles of the brain rather than in the substance of the brain. This view lasted well into the Middle Ages. It was not until the 15th century that basic treatments for aphasia began to develop 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 it was not until the First World War that Goldstein, Luria, and the Viennese phoniatricians Hermann Gutzmann (1865–1922) (the father of aphasia therapy) and Emil Froeschels developed 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, such as Eling's (1994) reader, Tesak and Code (2008), and Howard and Hatfield (1987) for a history focusing on treatment of aphasia.

## APHASIA IN THE ANCIENT PAST

An understanding of the history of any field is essential to an appreciation of the present: the present, after all, is the realization of events in the past. Saint Augustine (1400 years before present, henceforth BP) outlined a first understanding of what time past, time present, and time future might be. He contended that we can only really know 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 any subject, we are reliant on the written records handed down, and writing did not develop until 5500 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 viewed 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 and 4200 years 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 the rubbing of ointment on the head and pouring a fatty liquid (possibly milk) into the ears is a beneficial therapy.

## The Theory of Fluids

In ancient times, the causes of diseases were thought to be the result of some imbalance of the bodily fluids that corresponded 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 are yellow bile (air), blood (fire), phlegm (earth), and black bile (water).

Healing involved manipulating the balance of fluids: bloodletting, 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 sometimes 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. Because 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 between speech, language, and brain.

Plato's pupil Aristotle (2384–2322 BP) had a particularly significant impact on philosophy and the development of medicine in subsequent centuries. In contrast to his teacher Plato, he argued that the heart was the home of all cognitive, perceptual, and associated functions.

## Ventricular Theory

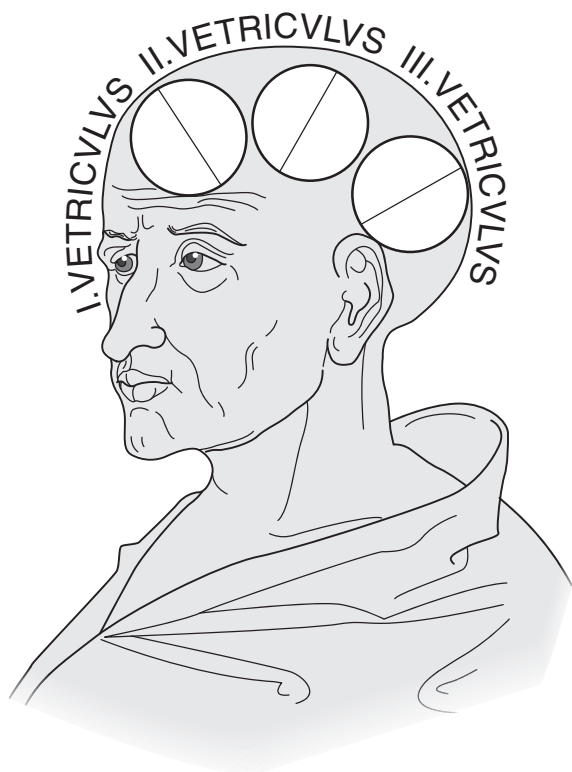
The brain began to figure in Greco-Roman thought. Herophilus (2335–2280 BP), who is recognized as the father of anatomy, described the cortex, the cerebellum, the ventricles of the brain, and the sensory and motor nerve trunks. With him, ventricular theory developed and a connection was made between the psyche (soul) and the ventricles of the brain. Ventricular theory, or cell theory, 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 with wounds to the head and the brain. Rome prohibited the dissection of human bodies, but 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 span from the demise of the Roman Empire (400s) to the emergence of the Renaissance (1500s). During the Middle Ages, cell theory or ventricular theory developed (see Figure 1-1), but the ventricles were understood as theoretical concepts rather than as anatomic structures and simply were depicted as circles. On the model, aphasic symptoms appear to result from damage to the third cell (the fourth ventricle) and were conceptualized as memory disorders. The idea that aphasia was a memory disorder dominated well into the 19th century.

There are some 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 following a battle head wound and surmised that a bone splinter remained in the brain. He located it and pulled it out, and immediately the



**Figure 1-1** The ventricles of the brain according to medieval cell theory.

Source: Modified from *Philosophia pauperum sive philosophia naturalis*, 1490.

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 hit on the head by a stone who was speechless for several days. Arceo remedied the fracture and some days later the patient began to speak again and apparently recovered spontaneously.

## 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 and spread throughout Europe. It 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 increasingly 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 causes began to emerge. During the Renaissance, major advances in the development of medicine were made, and a number of important personalities and their insights in medicine and philosophy stand out. Leonardo da Vinci (1472–1519) made significant contributions to the study of anatomy. Da Vinci, the exemplary Renaissance man, used empirical methods, including sections on animal and human corpses, to produce exact anatomic 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 Galen’s ventricular theory were Andreas Vesalius (1514–1564) and Thomas Willis (1621–1675). Andreas Vesalius published his famous and beautiful 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 anatomic detail and neurology and it dismisses much of Galenian anatomy. The ventricles are described in detail, but memory is not localized there. It is in the cerebellum instead.

Thomas Willis gained his knowledge of the brain from his observations of patients with neurologic conditions. Willis was greatly important in developing neuroscience in the 17th century. His work *Cerebri Anatome (Anatomy of the Brain and Nerves, 1664)* benefits from the anatomic

drawings of the young Christopher Wren, who later designed 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 advancing probably 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 the will. He proposed a corporeal or physical soul present in humans and animals and associated 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, the Church continued to prohibit anatomic sectioning of the human body: 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—in the latter part of the 20th and early 21st centuries it is computer technology, and we tend to use the computer technology metaphor to explain the workings of the mind, among other things. In the 17th century, mechanics and hydraulics were the most highly developed technologies, and Descartes described humans as machines, mechanical automata, in his work *De Homine (On Man)*. However, this automaton was a true human because it possessed a divine soul. When the body died, the soul could live on. The difficult question was where the soul resided. Descartes suggested that it was in the pineal gland, a gland the size of a pea 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 is only possible in humans, a position called Cartesian dualism, still influential in current thought. This Cartesian separation of body and soul permitted the Church to lift its ban on anatomic sectioning, so the basis for further advances in medicine in the 18th and 19th centuries was established.

## THE 18TH-CENTURY ENLIGHTENMENT: REASON AND NATURE

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Isaac Newton (1642–1727) supposed, based on Aristotle's teachings, that all human bodies contain a hidden, vibrating “ether” that moves through the

nerves from sensory organs to the brain and then to the muscles. This ether 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 the gyri 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*.

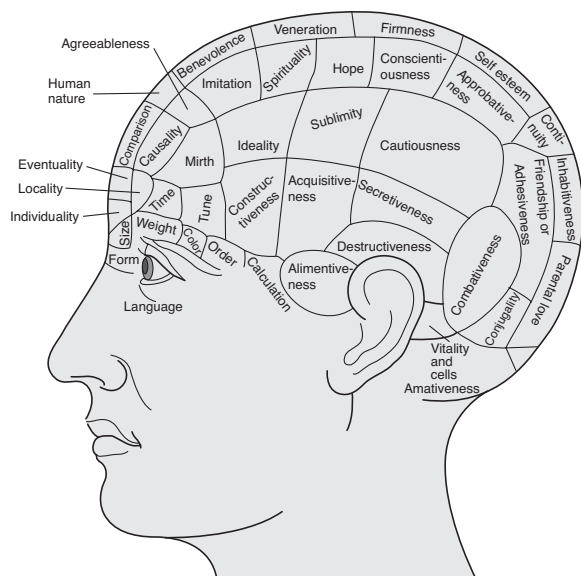
The idea that aphasia was an impairment of memory continued to dominate in the 17th and 18th centuries, and indeed well into the 19th. For instance, Johannes Jakob Wepfer (1620–1695) described at least 13 clear cases of language disorder with brain injuries, which he attributed to memory loss. Johann 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

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There was no real science of aphasiology until Gesner's work, and it was not until the 19th century that serious systematic study of aphasia began. The 19th century is considered to be the foundation of the 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



**Figure 1-2** The 37 faculties, or phrenological organs, according to Johann Kaspar Spurzheim.

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

aphasia, neuroanatomy, and neuropsychology, even to the present day (see Figure 1-2). Organology considers that the inner form of the cranium is determined by the external form of the brain and that it is 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. (Gall, 1798, translated from Lesky, 1970, p. 73)*

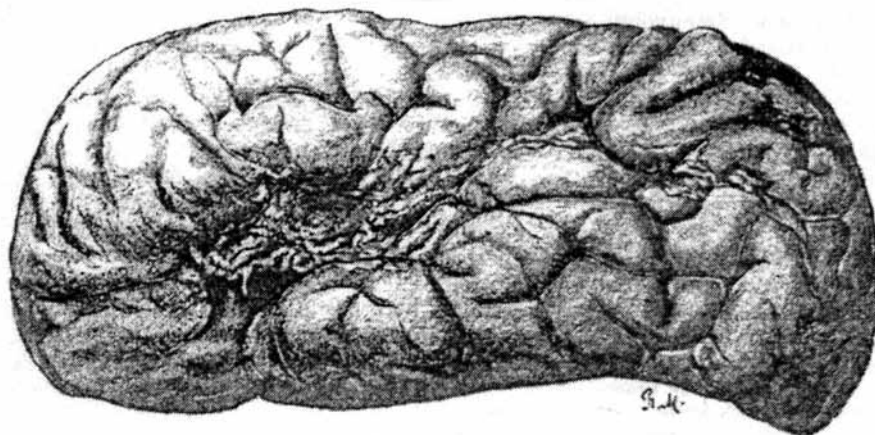
With Gall, the foundations of cerebral localization of function became a serious idea. He was a particularly skilled anatomist, the first to recognize the importance of the neocortex in localization, and described mental faculties (or “organs”) that were localized in specific parts of the brain. Although 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, even though this insight was tenuously based on an observation Gall made of a linguistically gifted school

friend who could learn verbal material very well. The boy also had strongly protruding eyes, suggesting to Gall that his brain was particularly well developed behind the eyes, causing them to protrude and suggesting 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.

In Paris, Jean Baptiste Bouillaud (1796–1881) was an important follower of Gall. He identified the connection between the separate loss of language and speech and frontal brain damage in significant numbers of patients. Some seem to have had what we would now call apraxia of speech.

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, primitive by today’s standards. He used spoons for ablations and often removed large parts of the brain so that the behavioral losses following ablations were similar between cases. 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 own views accepted by the scientific community. Bouillaud’s son-in-law, Ernest Auburtin (1825–1893), was a significant figure in the Paris Anthropology Society and in the Paris Language Localization Debates of 1861–1866, and he argued strongly for the localization of speech to the frontal lobes. His contribution has been overshadowed by the colleague he inspired, Paul Broca (1824–1880), who was secretary to the society. Auburtin accompanied Broca, who had little experience with aphasia, in an examination of Broca’s patient Leborgne (Tan Tan). Following Leborgne’s death and brain autopsy, Broca described Leborgne at a subsequent meeting of the Anthropology Society in 1861 (Broca, 1861). Leborgne had a massive frontal lesion centered on the third frontal gyrus (see Figure 1-3) with good comprehension, almost no speech apart from the speech automatisms *tan tan* and *Sacré Nom de Dieu*. Broca called this disorder *aphemia*, meaning loss of articulate speech, a term that is still in use although now the term apraxia of speech is mainly used.



**Figure I-3** The brain of Leborgne (Tan Tan), the famous case presented by Broca in 1861.

Source: From Marie, P. (1906). *Essai de critique historique sur la genèse de la doctrine de Broca*. *Sem. Med.* 26, 565–571.

With this, modern aphasiology and neuropsychology were born, and Broca proclaimed that the third frontal convolution was the seat for articulated language. The description of Leborgne by Broca 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 and that language and speech processing were indeed localized in this specific area of the brain.

In 1863, Broca presented further cases of aphemia (Broca, 1863), each of whom had damage to the left hemisphere, and for all except one the damage was to the third frontal convolution. Although he noted that it was strange that the lesions were all in the left hemisphere, he made no issue of the fact. The beginnings of the idea that the left hemisphere was dominant for speech and language, and for most other useful functions, was formally crystallized in 1865, when Broca finally formulated a theory of language lateralization (Bogen, 1969), that is, that language is 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. 389) and that people with aphemia could actually be treated following the principles of child language acquisition under

therapeutic guidance. He seems 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, 1836–1865, p. 260). Marc Dax’s work remained unpublished, although it was submitted for publication to the *Académie de Médecine* by his son Gustave Dax as early as 1863—still 2 years before Broca’s 1865 paper. But the Dax contribution was not published until 1865, the year 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). Marc Dax 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 described, *aphemia*, was replaced with the term *aphasia*, mainly because of an 1864 article by prominent physician Armand Trousseau (1801–1867) provocatively titled “On Aphasia, a Sickness Formerly Wrongly Referred to as Aphemia.” Trousseau points out that the term *aphasia*, from the Greek meaning “without language,” is more appropriate than *aphemia* (without speech). Trousseau believed that aphasia was a cognitive disorder that affects intellectual performance, a view also later expressed by John Hughlings Jackson. Of course, Broca's term refers to speech, as it still does today, and Trousseau's to language.

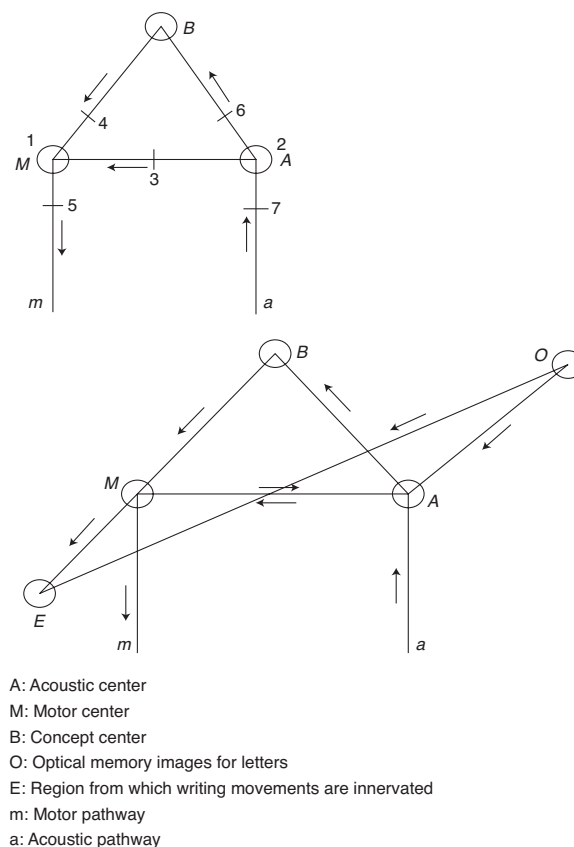
Henry Head (1926) notes that much of the great growth in German neurology and dominance in aphasiology was related to German victory in the Franco-Prussian War of 1870–1871. It was in this climate that universities in Germany and German-speaking countries became world leaders in scientific research. A landmark in neurology was fiber theory, developed by Theodor von Meynert (1833–1892) in Vienna (Whitaker & Etlinger, 1993). Fiber theory describes 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 aphasic patients led him to describe a “sound image system.” This and other aspects of fiber theory form parts of the theory developed by Wernicke.

In 1874, the young physician Carl Wernicke (1848–1905) completed his thesis *The Symptom-Complex of Aphasia*, in which he describes cases with sensory aphasia caused by lesions in the posterior left brain. With the anterior production aphasia of Broca (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. Wernicke surmised that information processing components 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 includes a sound image system and fiber connections, explains pathologies of speech and language, and predicts 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 1-4). This theory dominated 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 Steinthal, who was probably the first real psycholinguist



**Figure 1-4** The Wernicke-Lichtheim models of language processing.

Source: From Lichtheim, L. (1885) ‘Ueber Aphasie: Aus der medicinischen Klinik in Bern.’ *Deutsches Archiv für Klinische Medizin*. 36, 204–268.

(Eling, 2006). Heymann (Chajim) Steintal (1871) complained that the physicians' descriptions of language and aphasia were too superficial and lacked the necessary linguistic detail, a complaint that still resonates. He 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" (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. Hughlings Jackson was more than simply an anti-localizationist, however. Darwin's *Origin of Species* was published in 1859 and the impact his evolutionary theory had on both scientific and public opinion is famous. Subsequently, Jackson developed his highly prominent 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) notes, "Jackson derived all his psychological knowledge from Herbert Spencer, and adopted his phraseology almost completely" (p. 31). But Jackson's 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. Hughlings Jackson (1878–1880, reproduced in Taylor, 1958) hypothesized that both the ontogenic (individual development) and phylogenic (species development over time) evolution of the nervous system entailed: (1) a course from the most to the least organized, from the lowest, well-organized centers up 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 borrowed from Spencer. Dissolution of the nervous system with a loss of function provides evidence of the reverse of evolution. Functions, according to Jackson, are organized hierarchically in the nervous system 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 speech automatisms, are the expression of lower levels released from the 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.

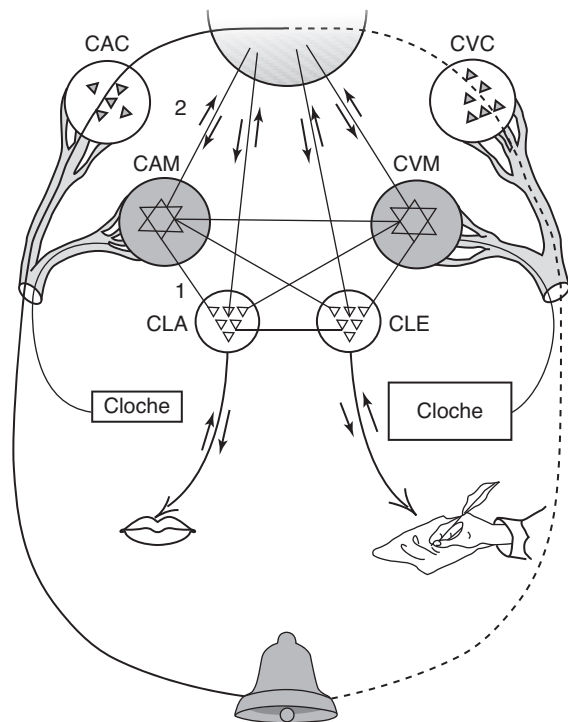
Bastian (1898) and Henry Head developed a way of testing aphasia, and their tests were used well into the second half of the 20th century.

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 rather 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. Because of Charcot 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 1-5), which was meant to allow a better understanding of normal and pathologic language processing. His model contained four centers for memory images (speech, language, writing, 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, for understanding, writing, speaking, and reading, and the centers were linked to one another through many connections.

Charcot attempted to localize aphasic disorders and went along with Broca's finding that motor aphasia 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



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 I-5 Charcot's 'Bell' model.

Source: Modified from Bernard, D., 1889. *De l'aphasie et de ses diverses formes* (2nd Edition). Paris: Lecrosnier & Babe.

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, Freud spent a few months with Charcot in 1885 but was to become far more famous for his work in psychoanalysis. He published his monograph on aphasia in 1891, but it had little impact at the time. However, it was published in English translation in 1953, and more recently his contribution to aphasiology has 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 also working in Paris, and a student of Charcot, where he eventually became *Professeur de clinique des maladies du système nerveux* in 1910. Dejerine developed a classification system of aphasia, but it was mainly through two case descriptions of isolated writing and reading disorders that his work became important. Dejerine (1891) described a 63-year-old man with word blindness (alexia) and total agraphia (Dejerine, 1892) and a 61-year-old educated woman with word blindness without agraphia but who could write spontaneously and to dictation, and had no difficulties with spontaneous speaking (Hanley & Kay, 2003). Autopsies showed 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). Dejerine suspected that visual word images are stored in the angular gyrus, which he assumed is necessary for reading and for writing. Thus, alexia and agraphia would result from a lesion to the angular gyrus.

Three years later, he described a further 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. Any disruption of the subcortical connecting pathways would lead to isolated phenomena. Cortical lesions of the language zone lead to a disorder of "inner speech" and such disorders 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 in 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 quoted in Benton, 1988, p. 210), emphasizing that pure cases are rather 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) suggested that bilingual aphasic speakers would recover their native language first. This idea was in general support of his theory that recent memories are more vulnerable to loss than are earlier ones (Paradis, 1981). Pitres (1895) firmly believed that the most recently learned and most familiar language is the one that would 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 some 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 native language would recover first (see Paradis, 1983, for relevant papers translated into English). 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*) that vehemently attacked Broca’s model of aphasia. Marie reported cases where severe damage to this area did not result in aphasia, and where Broca’s aphasia could result without a lesion to the left third frontal convolution. He also stated, “*L’anarthrie n’est pas de l’aphasie*” (“anarthria [Marie’s term for aphemia] is not aphasia”), and he coined the famous equation: Broca’s aphasia = Wernicke’s aphasia + anarthria. Although Marie was an apparently unpleasant man, contemporary research generally tends to support his findings.

## THE GROWTH OF LINGUISTIC APHASIOLOGY IN THE 19TH AND 20TH CENTURIES

In the 19th and early 20th centuries, Steinthal, Freud, and physician Arnold Pick attempted to introduce linguistics as relevant in aphasiology. On the basis of a more exact linguistic examination, the early psycholinguist Steinthal (1871) 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* the problem 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) also 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. . . . The 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 that 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, where 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 the deficit of function word omission, Pick supposed

that the individual employs an economy of effort in the context of a severely impaired system. He also discussed the idea of “emergency language” in detail, 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). Later Isserlin (1922) would develop similar views.

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

*the 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. (Kleist, 1914, pp. 11–12)*

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 anatomic basis (Kleist, 1914): “We will not go wrong if, contrary to frontal agrammatism, we localize paragrammatism in the temporal lobe or its immediate neighbourhood” (p. 12).

Later Kleist (1916) modified his position and concluded that the cause of agrammatism was “a loss or lowering of excitability of sentence and phrase formulae” (p. 170) that approximately corresponds to Pick’s sentence schemata, and in paragrammatism “sentence and phrase formulae . . . are aroused incorrectly” (p. 170). So, for Kleist (1916), paragrammatism is caused “by an incorrect arousal of acoustic sentence formulae” (p. 198). Kleist was another of Wernicke’s many assistants, and Wernicke had a significant influence on him. Kleist was also the 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 previously, Steintal may be more worthy. Jakobson was a founding member of the Prague Circle or School of Phonology, 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 a professor at Harvard and the Massachusetts Institute of Technology (MIT). In his 1941 monograph *Child Language, Aphasia, and Phonological Universals* (English translation, 1968), Jakobson describes parallels between language acquisition and aphasia and proposes a *regression hypothesis* that states that we can observe the same processes both in developing child speech and in the impairments of aphasic speakers, but in reverse.

*The dissolution of the linguistic sound system in aphasics provides an exact mirror-image of the phonological development in child language. . . . The order in which speech sounds are restored in the aphasic during the process of recovery corresponds directly to the development of child language. (Jakobson, 1968, pp. 60, 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 later) in terms of three linguistic dichotomies: encoding (combination, contiguity) impairments versus decoding (selection, similarity) impairments, limitation impairments versus disintegration, and sequence (syntagmatic, successivity) versus concurrence (paradigmatic, simultaneity). For instance, an encoding impairment, such as Luria’s dynamic aphasia or efferent motor aphasia, is characterized by problems with combination, whereas decoding impairments, such as 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 play little part in contemporary linguistic aphasiology.

It was not until the 1960s when generative transformational grammar emerged that a broad linguistic aphasiology developed. Chomsky’s ideas were to have a revolutionary impact in linguistics, cognitive psychology, and philosophy. Noam Chomsky (born 1928) introduced *transformational generative grammar* (TG) in 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 he claims 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. 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). There was also a view developing that aphasia could be relevant to 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. For example, the breakdown in phonological structure seen in some forms of aphasia has been used to test various phonological models. Ball, Code, Tree, Dawe, and Kay (2004) used data from progressive apraxia of speech to compare cognitive, gestural, and sonority models of syllable production breakdown and were able to show that although a sonority model accounted well for some observed data, the gestural phonology model accounted better for most of the data.

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 phonologic and apraxic speech errors occurring in different aphasic people. 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 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, Code, Virbel, & Lecours, 1998).

Another theory of language from the 1970s that was to become relevant in aphasiology 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 function to develop, cement, and maintain relationships using different registers and styles depending on whether the relationship is with a boss, a loved one, or a friend. 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.

## APHASIOLOGY IN THE 20TH CENTURY

The devastation of war brings advances in science and technology, and the fields of aphasiology 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) call the “speech gymnastics” of the Viennese phoniatrians Hermann Gutzmann (1865–1922)—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. In Britain, too, treatment of aphasia was mainly developed by elocutionists and voice teachers. Bastian was an exception and introduced the 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 (see Chapter 3, this volume).

In Russia during World War II, A. R. Luria (1902–1977) 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 Great Britain 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). Luria's important early work is *Traumatic Aphasia*, which is based on data gathered from World War II; the English translation appeared in 1970. He developed his general neuropsychology extensively in *Higher Cortical Functions in Man* (1980). 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 localizer approach, as represented by Wernicke or Kleist, and 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 (such as thinking, writing, 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, 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, on the surface and while using different terminology, is not dissimilar to classifications that others have

produced. However, the underlying causes of symptoms can be different for Luria. Benson and Geschwind's (1971) equivalent "neoclassical" forms are provided in the following discussion. 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 aphasic person can no longer make predicative statements or propositions, and production is limited to empty phrases. The patient understands quite well and can also name and repeat, although individuals initiate little speech without external stimulation. In 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. In the neoclassical model, 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 postcentral 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 is called Wernicke's aphasia. Luria localized phonemic analysis in the secondary auditory cortex, and although the individual has intact hearing, he or she 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 affecting word repetition—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. They experience 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, integration) engaged in language; his is a *process model*. Additionally, his model implies the possibility of aphasic symptoms being connected at different linguistic levels on the basis of abstract principles; for instance, the disturbance of the linear scheme, which shows itself in sound production, sentence production, and in 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 because the model conceptualizes the brain overall as a dynamic and interactive system.

Although 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.

In Edinburgh, psychologist Oliver Zangwill and speech therapist Edna Butfield conducted a historically significant study of the effectiveness of aphasia therapy and published it in 1946 (Butfield & Zangwill, 1946). Howard and Hatfield (1987) suggest 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 describes therapy for 66 cases of aphasia between the ages of 20 and 40 years. Patients were divided into a group that received treatment within 6 months of the onset and a group whose treatment began after 6 months. 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 sessions and 290 per individual. Progress was measured fairly grossly in ratings of much improved, improved, or unchanged. Speech was judged to be *much improved* in 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. With Weisenburg and McBride (1935), there was a shift in focus across the Atlantic and a new, behavioral, psychometric, anticlassification, and antilocationalist approach to aphasia developed in America. 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 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 patients with aphasia and related disorders. Granich's therapy was also much influenced by Goldstein's work, and Granich 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 (born 1907) 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 aphasic person has not lost language functions; language functions have become inaccessible. Language *competence* survived, but language *performance* 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 he or she 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, Jenkins, & Jiménez-Pabón, 1964) developed with detailed psychometric evaluation. This battery supported much clinical assessment for rehabilitation in the English-speaking world well into the later 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 for naming. Geschwind (1974) describes 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. Besides 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 probably has become the most popular and widely used aphasia battery ever produced, has been translated many times, and still appears to dominate 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 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.

### THE TREATMENT OF APHASIA IN THE LATER 20TH CENTURY

During the latter half of the 20th century, many treatments and therapies developed from often opposing theoretical approaches. In this time period, 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 aphasic person’s community.

Treatment approaches and methods developed from a range of sources. There were principled treatments based on theoretical positions and 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, the duration, and the timing of therapy input (Darley, 1972). Data began to emerge on the best candidates for treatment; thus, the age, the educational background, the time since onset of the damage, and the severity of the aphasia became important prognostic variables. A range of group-based randomized clinical trials (RCTs) were conducted, but proved very difficult to design and carry out mainly because of the heterogeneous nature of aphasia and the failure of the researchers to specify and systematize therapy appropriately.

Howard and Hatfield (1987) classify 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, that are used in some hierarchically organized therapy approaches for apraxia of speech. Contemporary computer-based methods use systematic behavioral methods (see chapters in Code & Müller, 1995, and Helm-Estabrooks & Albert 1991). Nancy Helm-Estabrooks and Martin Albert and colleagues mainly developed treatments inspired by the Boston model (for review, see Helm-Estabrooks & Albert, 1991). Many of these approaches were designed for specific types of aphasia or impairment type, such as perseveration, and use systematic behavioral training hierarchies organized into steps and levels.

For example, Melodic Intonation Therapy (MIT) aims to reestablish some speech in patients by reorganization of the speech production process using melodic intonation, and Visual Action Therapy (VAT) is used 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 instance, Luria suggested that letters made of sandpaper could aid a reading impairment via the tactile system. Drawn "articulograms" of the lips producing particular combinations of speech sounds were developed for severe apraxia of speech, in which the speaker uses the intact visual route to the speech production system.

The cognitive neuropsychological model developed in the early 1980s pioneered a shift away from grouping and classifying aphasia. It advocated the development of single-case designs for therapy research (Colheart, 1983) and began to demonstrate good success with well-selected individuals. The development of the cognitive neuropsychological model emerged from the coming together of psycholinguistics, single-case methods and the information processing model, and a theory-driven and hypothesis-testing approach to investigation. This approach was 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 used to conceptualize processing and 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 what is 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) has 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 systematic nature of the cognitive neuropsychological approach had attractive features for clinical work with aphasia, and subsequently other aspects of impaired cognition, and this model began to have a significant impact on aphasia therapy. It includes a model of assessment for treatment and an emphasis on the individual patient and his or her problems. Howard and Patterson (1990) outline three strategies for therapy that could work with the model: reteaching of the missing information, 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. Although 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.

The development of a cognitive neuropsychologically 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 such as 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 aphasic person chooses the modality or methods of communication; feedback is based on the aphasic person's success in communicating the message; and the approach encourages writing, gesture, drawing, and pointing.

In the 1980s and 1990s, reorganizational approaches were developed based on surviving right hemisphere (RH) processing. These include MIT, which claims to use 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 the result of increased RH involvement (for review, see Code, 1987). In the 1980s, treatments were developed that were delivered by microcomputers using mainly behavioral methods (see the collection led by Katz, 1987). Intense stimulation and feedback on performance and control of the pace and level of difficulty by the user appeared to be clear advantages.

During the early 1980s, too, 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 people's happiness and sadness comes from interactions with others. How individuals perceive their interactions with others is what determines the quality of their life experience, their psychosocial well-being. Psychosocial life is grounded in emotional experience within a social context. The psychosocial impact of aphasia on aphasic people and on 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, Hemsley, & Herrmann, 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 (World Health Organization, 2001) proposes the following three dimensions: *impairment* is a loss or abnormality of body structure or of a physiologic or psychological function. An *activity limitation* is when 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 with *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 with *participation restriction*. However, it may be some time before these rather awkward terms replace the familiar *impairment*, *disability*, and *handicap* in general use.

This approach views the problem as society's failure to accommodate the different needs of persons with impairments, which leads to people with disabilities facing increased social barriers and oppression

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

Has the situation for people with aphasia in the 20th century changed for the better? 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 in Australia and the United Kingdom. In North America, the mean amount of therapy per week was 60 minutes but with a range of 16 to 20 sessions (the North American data included the Veterans Administration Hospitals system). The figures for the United Kingdom and Australia in particular suggest that aphasic people, even in the acute stage, can expect no more than 2½ 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, Teasell, and Speechley (2003) analyzed the large group trials that have been completed over the years that examine 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 more cost-effective, than is nonintensive therapy over twice the duration.

Methods of treatment have improved considerably over the centuries, and a great deal of research in rehabilitation demonstrates that it can be effective, as chapters in this volume describe. In modern times, people with aphasia do receive treatment for their impairments and their disabilities, but the gap between what we know about the effectiveness of treatment and the service we provide to aphasic people does not appear to be narrowing.

## Study Questions

1. When in the history of aphasia did thinkers associate damage to the brain with impairments in speech and language?
2. Describe the main forms of aphasia identified by the Wernicke–Lichtheim model.
3. What were the main trends that caused a shift of focus in aphasia research from Europe to North America?
4. What single event is often suggested to have heralded the beginnings of modern aphasiology?
5. 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?
6. Who developed the so-called speech gymnastics approaches to aphasia treatment?
7. Writers in previous times have described aphasia as a memory disorder. Why, and does the idea that various aphasic impairments may be caused by some impairment in memory have relevance today?
8. In what ways did Arnold Pick describe and distinguish *agrammatism* from *paragrammatism*?
9. Who has been called the father of aphasia therapy?
10. Stimulation plays a particularly significant role in the history of the treatment of aphasia. With whom did the idea originate?
11. Who developed a more systematic and psychometric approach to testing for aphasia?

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