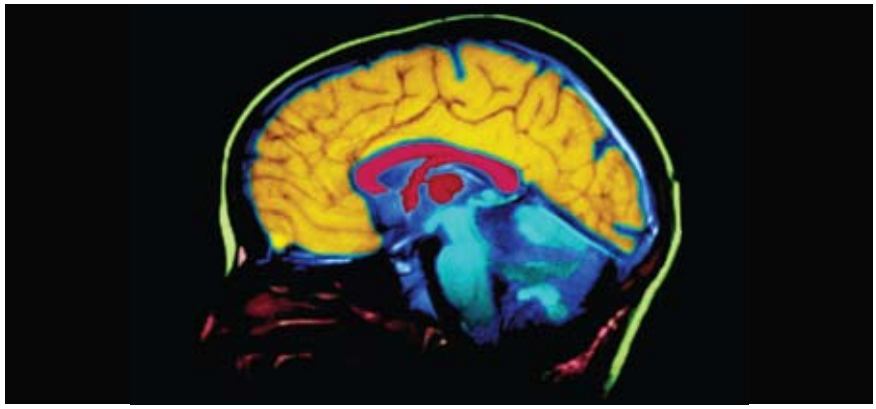
Speak Up! Mini Cases in Language

By Antoinette R. Miller



This is a series of short cases useful for a variety of courses, including physiological psychology, neuroscience, cognitive psychology, cognitive science, and cognitive neuropsychology/neuroscience. Each of these cases depicts a breakdown in language that may be traced to damage in an area or areas that are related to language processing, and each is based on an actual case or cases reported in the literature. These cases were originally written for use in a problem-based learning format, but they may also be used as individual assignments.

Please note: These cases focus on disruptions of spoken communication and reading. Additional disruptions of writing may also occur with damage to the brain areas associated with language (particularly Broca's area).

Objectives

After completing the cases, students will

- know and understand the cortical areas associated with language, including the specific brain areas, their functions, and some conditions that may arise when damage or dysfunction occurs;
- be familiar with the aspects of one or more language disorders; and
- be able to work with other students to identify the relevant details in an ambiguous and ill-defined problem and research the important aspects.

Blocks of analysis

There are a variety of cortical brain areas that are involved in the production and comprehension of language. The primary areas include the following:

- Broca's area, located in the posterior frontal lobe (left hemisphere) and responsible for the production of language and also some basic grammatical processing;
- Wernicke's area, located in the temporo-parietal junction (left hemisphere) and responsible for the comprehension of language;
- angular gyrus, located in the parietal lobe, a convergence zone involved in reading; and
- arcuate fasciculus, a band of fibers that connects the Broca's and Wernicke's areas.

The classic Wernicke-Geschwind (W-G) model of language postulates that these areas interact, as shown in Figure 1, to comprehend and produce spoken language and to read and pronounce written language. There is recent research that disputes the modular nature of this process, but for the purposes of this case, the W-G model is sufficient.

It should be noted that the language "loop" is found on the left hemisphere in the great majority of the population. Many language dysfunctions involve either the production or the comprehension of language and can involve either spoken or written language.

Classroom management

These cases may be used either to introduce concepts of language and language processing (problem-based learning) or as a capstone (case study) exercise following a lecture in the cortical areas involved in language production and comprehension. They were deliberately written with the minimum of background information on the brain areas involved in language and with enough "symptoms" to allow students to identify one or more potential conditions that may be exhibited in the cases.

Depending on the format of the class, there are several potential ways to introduce and distribute the cases. In a pure problem-based learning format, it would be possible for the students to be given the cases with no introductory lecture. In the case of a more "traditional" lecture-based course, they may be introduced by a general lecture that outlines the basic functions of the various brain areas described in the Blocks of Analysis section and some discussion of some of the potential language difficulties that may arise when these areas are damaged, if desired.

Following is one suggested sequence of case introduction and

administration using small groups of four to six students.

Day 1—Introductory lecture

The instructor may present a brief lecture on the aspects of language and the brain areas involved and also on some of the general language difficulties that may arise from damage to these areas. This information is outlined in the Blocks of Analysis section, and a good overview can also be found at *http://thebrain.mcgill.ca/flash/d/d_10/d_10_cr/d_10_cr_lan/d_10_cr_lan.html.*

Day 2—Case distribution

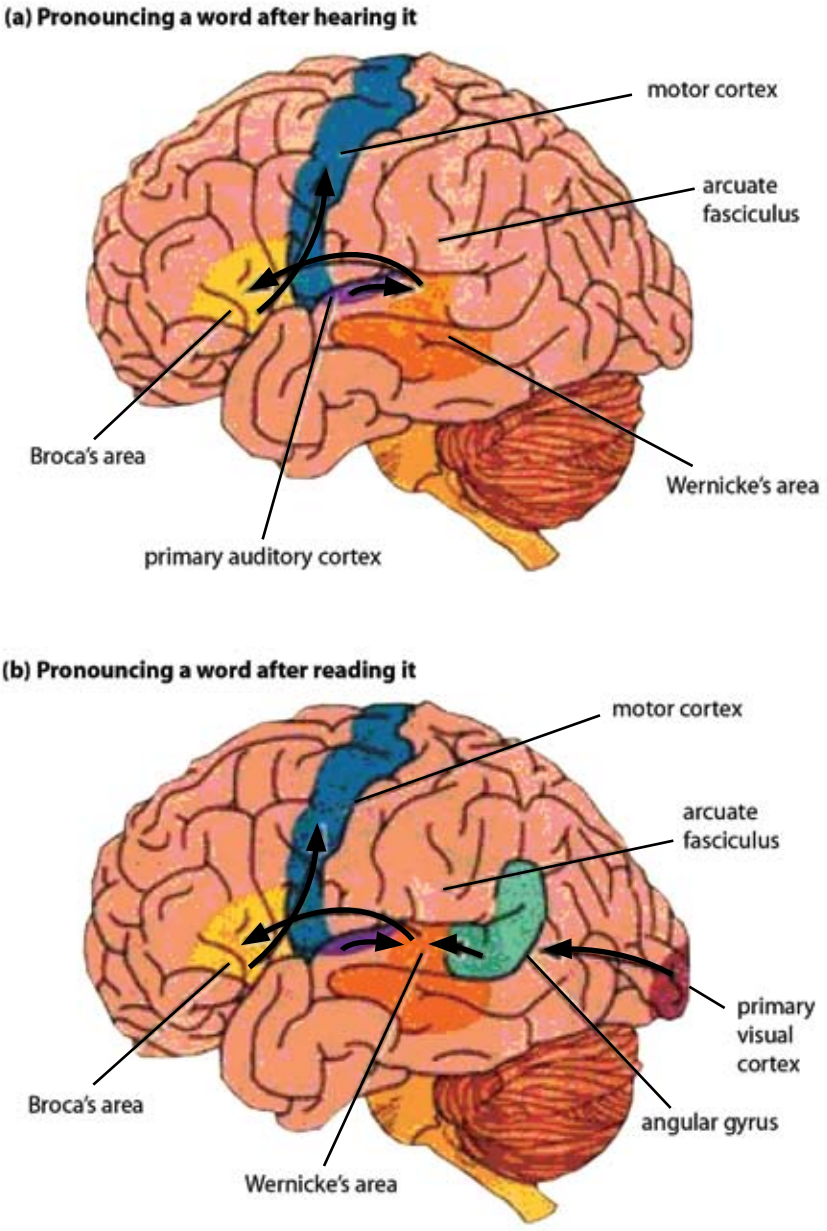
During the next class period, give each group of students a different case with instructions to answer these questions and remind them to document their sources:

- What condition or conditions (there may be more than one possibility) are being described in this case?
- What brain area or area(s) may be involved (be sure to consider which language functions are compromised too, and be SPECIFIC as to which hemisphere)? How should they function normally? What could be causing this dysfunction?
- What do the patient's symptoms tell you about his language abilities and how they may be impaired?

The instructor may act as a floating facilitator (checking in with each group at the onset to clarify terms or the wording of their cases and then later on to provide any necessary nudges. The instructor may also require a representative of each group to turn in a written account of the findings at the end of the period.

FIGURE 1

Brain areas associated with language comprehension and production.
From *The Brain From Top to Bottom: From Thought to Language* (*http://thebrain.mcgill.ca/flash/i/i_10/i_10_cr/i_10_cr_lan/i_10_cr_lan.html*).



After the completion of this class period, the instructor may choose to make the entire case set available to the class by electronic or print means. This can be done immediately at the end of the Day 2 class meeting.

Day 3—Report-out session

During the next class period, a member of each group makes a verbal report to the rest of the class about what the group has discovered thus far. These reports may include a short

synopsis of the case and answers to the probing questions provided at the end of each one. Generally, about 10 minutes for each group may be sufficient (these are meant to be brief reports), but more time may be required if there are several groups.

Day 4—Case write-ups due

Students submit their individual write-ups of their group's case. This write-up may be in American Psychological Association format (or the preferred format of the course's core discipline) and should include the following information:

- a brief recounting of the case and the relevant points (one to two paragraphs),
- answers to the questions included with each case, and
- additional information on the condition or related conditions.

The Cases

Case 1: William

William is a right-handed man in his late 60s who has been noticing a progressive difficulty in recognizing spoken words (this actually began nearly 10 years ago). He has a decade-long history of hypertension, although his doctors had thought this was well-controlled with medication.

As his difficulties progressed, he also began experiencing problems with speaking (mild, but still noticeable). When his daughter spoke to him, William often showed difficulty in understanding what she said, although when she wrote him notes, he understood those perfectly well. Interestingly enough, he has had no problem with recognizing environmental (nonspeech) sounds and has been able to carry on his work as a farmer with no difficulty.

When William was finally brought to his doctor, a neurological exam revealed few abnormalities. He had no paresis and normal muscle tone in his extremities. However, when he spoke, William always seemed to be shouting, and he had no evidence of a hearing deficit.

William was referred for a full neuropsychological evaluation, and the team also noted that his voice was abnormally loud, explosive, and quite dysprosodic. He continued to show difficulty in understanding words that were said to him, and so he was unable to complete any repetition tasks. He still read quite well, although when he read aloud his voice was still quite loud and his tone was odd.

While William was being evaluated, he often mixed up his words or substituted nonsense syllables—without being aware of it. This happened more often when he was asked to name objects, rather than in spontaneous conversation. However, his doctors noted that evaluation was difficult; often William was unable to repeat instructions because of his inability to understand what was being said to him. When instructions were written down for him, however, William did not exhibit as many of these problems. Also, his writing was quite fluent and contained few of these substitution or other errors.

Case 2: Louis

Louis is a right-handed man in his midfifties who has recently suffered from a cerebrovascular accident (CVA). This has left him with a right-sided hemiparesis (weakness) and significant language issues. In particular, Louis's right arm and hand were too weak to grasp anything.

During the first week after his CVA, Louis was unable to utter more than single words. This was incredibly frustrating for him, but he was able to communicate using Scrabble tiles (he could spell out nongrammatical and misspelled sentences of three or four words). He appeared to understand what was being said to him, and his communications did answer inquiries, although they were very sparse and lacking in "smoothness" (he often sounded like Tarzan when he spoke).

Over the next few weeks, his speech improved slightly, although it was still clearly very difficult for him. He was able to articulate short sentences with few function words, but his prosody was lacking. When Louis spoke, he sounded like a robot (lacking in emotional tone) no matter what he said. He could, however, repeat simple sentences spoken to him.

Case 3: Sherman

Sherman is a right-handed man in his midfifties. He suffered a head injury 30 years ago that had caused a variety of problems, including posttraumatic amnesia and residual right-sided hemiparesis (weakness) for about two weeks. However, he eventually recovered his mobility.

More recently, Sherman began experiencing somewhat severe seizures that were fairly well-controlled by Phenobarbital. However, in the past few years Sherman has been neglectful in taking his medication, and his seizures have worsened significantly. He's continued experiencing right-sided hemiparesis that has progressively increased, and his face has begun to droop.

Along with these seizures, Sherman has been experiencing difficulties with reading. Prior to his seizures Sherman was an avid reader, but his recent difficulties have removed much of the pleasure for him. Sherman finds that he has no problem with high-frequency words such as *and, it,* and *boy* (he can still read them with relatively little difficulty). However, when

he encounters irregular words, especially low-frequency words such as *colonel* and *thyme*, he can't read them well and instead sounds them out letter by letter ("thymee" and "culoneel").

Case 4: Gerald

Gerald is a 60-year-old, right-handed male who has suffered a medial cerebral artery infarction, which had initially resulted in a severe expressive aphasia and right-sided hemiparesis (weakness). After one year of speech therapy, his articulation improved, although it was still somewhat labored. In addition to this, he was severely impaired in his ability to name objects. When confronted with pictures, he was only able to name 47 out of 114 pictures. However, he was significantly better at reading words and sentences aloud. He showed no signs of paraphasia (inappropriate word substitutions), and his writing was only mildly impaired. Here is an example of a conversation between Gerald and his doctor:

Doctor [Holding up a coffee cup]: Can you tell me what this is?
Gerald: Oh boy, you know . . . isn't that funny, oh I know, it's one of those things . . . geez . . . it's something that you hold, right? . . . uhmm . . . it holds stuff.
Doctor [Now showing a pencil]: How about this?
Gerald: Um . . . ok . . . I know what that is . . . isn't it something you use to . . . you know . . . oh darn it . . . you use it to write, I think . . . it's one of those things that . . . ugh! . . . I must be getting old.

Case 5: Bob

Bob is a 33-year-old, right-handed man who was recently found sprawled on the floor by his wife. When he woke, he was dragging his right leg, had a right facial droop, and didn't appear to understand anything said to him. After being rushed to the ER, the doctors diagnosed a dense right hemiparesis (weakness). Doctors also noticed that although his speech was rapid and fluent, he was quite unintelligible. He showed no slurring or stilting of his speech, and his overall articulation was fine. Bob had absolutely no trouble getting words out; the problem was that once they were out they made no sense.

During Bob's neuropsychological assessment, his doctor asked him to repeat sentences such as "will you answer the telephone?" More often than not, he would answer the questions ("yes I will" or "no, it's on the ground") rather than repeat the sentence. His spontaneous speech was filled with neologisms (made-up words) and jargon. In fact, one of his doctors commented that Bob's speech was reminiscent of the "Jabberwocky" poem by Lewis Carroll (i.e., "Twas brillig, and the slithy toves. . . . Did gyre and gimble in the wabe"). Bob was also unable to comprehend written text or write coherently (his written work read much like his spoken words sounded—fluent but empty). And for all intents and purposes, Bob seemed completely unaware of his condition.

Case 6: Paddy

Paddy is a right-handed man in his fifties who has recently suffered a stroke in his left hemisphere, in the area of his posterior middle cerebral artery. Damage was restricted to the posterior part of his left hemisphere. After his initial recovery, his language was assessed and found to have a variety of issues. When speaking spontaneously, his speech contained a fair number of paraphasias, and although he was unable to repeat anything said to him, he was able to signify his comprehension by other means (pointing, gestures). Paddy clearly could tell something was wrong with his speech; when asked a question he would keep "talking around the answer," in some cases finally hitting upon the correct word or phrase almost by accident. ■

Note: The teaching notes, answer key, and sources for the originating case material can be found at the National Center for Case Study Teaching in Science at *http://ublib.buffalo.edu/libraries/projects/cases/case.html.*

Resources

Print

Any neuroscience, neuropsychology, or biological psychology textbook.

Garrett, B. 2009. *Brain and behavior: An introduction to biological psychology*. 2nd ed. Los Angeles: Sage Publishers.

Kolb, B., and I.Q. Whishaw. 2006. *An introduction to brain and behavior*. 2nd ed. New York: Worth Publishers.

Kolb, B., and I.Q. Whishaw. 2008. *Fundamentals of human neuropsychology*. 6th ed. New York: Worth Publishers.

Online

Advances in Clinical Neuroscience and Rehabilitation Online Archives—*www.acnr.co.uk/index.shtml*

The Brain From Top to Bottom: From Thought to Language—*http://thebrain.mcgill.ca/flash/a/a_10/a_10_cr/a_10_cr_lan/a_10_cr_lan.html*

National Aphasia Association—*www.aphasia.org/*

Society for Neuroscience: Brain Facts—*www.sfn.org/index.aspx?pagename=brainFacts*

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