Left brain may serve as language director

The left half, or hemisphere, of the brain possesses unique features that enable humans, at least right-handed ones, to understand language, according to a report in the March 6 SCIENCE.

The new findings, which apply to both spoken and signed language, may help resolve the current debate over the nature of the left hemisphere's role in language, assert neuropsychologist David P. Corina of the University of Southern California in Los Angeles and his colleagues at the Salk Institute for Biological Studies in La Jolla, Calif.

Some investigators, including Corina's group, theorize that the left hemisphere deals specifically with the grammar and syntax of human language; others argue that the left side governs signed and spoken language by controlling the muscles employed in speaking and making signs, including such nonlinguistic gestures as waving good-bye; and a third proposal holds that the left hemisphere directs the expression and comprehension of symbols in general, not just those found in language.

In one study, Corina and his co-workers recruited 16 right-handed, hearing adults fluent in the use of American Sign Language. Each participant repeated a list of common, one-handed signs and English words, presented on videotape and audiotape, respectively. Signs and words appeared at a rate of one per second. During two trials, volunteers tapped a telegraph key as quickly as possible, alternating right and left index fingers. A computer hooked up to the telegraph key recorded the number of taps in each 30-second trial. The researchers also measured each volunteer's "baseline" tapping rate for each hand in the absence of a competing task.

Repetition of both words and signs caused a significantly greater drop in right-handed tapping than left-handed tapping. This suggests greater involvement of the left hemisphere, which regulates movement on the right side of the body, in both spoken and manual language, the researchers argue. Left-brain responsibility for handling two attention-demanding tasks at once inevitably disrupts performance on at least one of the tasks, they say.

The investigators repeated the experiment with 48 right-handed, hearing adults who spoke English but had no experience with any sign language. Participants repeated common words and two types of manual gestures — symbolic gestures, such as waving good-bye or giving the thumbs-up sign, and arbitrary gestures with no meaning. Only word repetition produced a marked drop in right-handed tapping, the scientists note.

A third experiment consisted of 12 right-handed, deaf adults fluent in American Sign Language. Each repeated a list of common signs, symbolic gestures and arbitrary gestures. Only the repetition of sign language generated substantially fewer right-handed taps.

The discovery that only tasks with linguistic meaning disrupt right-handed tapping indicates that the left hemisphere handles specific characteristics of language, rather than muscle movements or symbolic abilities involved in language, Corina's group contends.

Further support for this theory comes from the researchers' observations of W.L., a deaf individual who suffered stroke-induced left-hemisphere damage. Like other right-handed signers with left-brain injuries, the patient lost virtually all ability to use sign language (SN: 7/18/87, p.40). However, W.L. spontaneously substituted pantomime gestures for signs, providing evidence that the left hemisphere offers specific directions for language use.

Laboratory and clinical studies of the left hemisphere's role in language focus on right-handers because left-handers display less predictable hemispheric specializations for a variety of abilities. Both sides of the brain may play a part in regulating language use and comprehension among some left-handed persons, studies suggest. *— B. Bower*

Drafting dolphins ride the wakes with ease

Williams/NATURE

After surfacing for a breath, this dolphin sinks about one-half meter and lets the wake of a boat ease the job of high-speed swimming.

As a swimming instructor, Terrie M. Williams found the awkwardness of the human body in water quite frustrating. So when she became a wildlife physiologist, she decided to study just how efficient marine mammals are in their aquatic endeavors. And when she looked at the vital signs of dolphins trained to swim alongside a moving boat, she discovered that they owe their smooth technique not only to their streamlined shape but also to where they swim.

For fast speeds, the animals shift positions to take advantage of the physics of the water, moving along with no apparent effort, Williams and her colleagues report in the Feb. 27 NATURE.

Working at the Naval Oceans Systems Center Hawaii Laboratory in Kailua, the researchers equipped two bottlenose dolphins with harnesses that monitored the heart rates of the free-swimming animals. The team also measured the lactic acid buildup in the animals' blood and counted how often the dolphins surfaced to breathe.

Traveling at 2 meters per second, the dolphins used about 1.3 joules of energy per kilogram of body weight; their hearts beat about 76 times a minute. That makes them twice as energy efficient as seals and sea lions and about 10 times as efficient as humans, Williams says.

When the boat sped up to 3 meters per second, the dolphins seemed to strain a little, but they still swam out to the side as trained. However, at 4 meters per second, "there was nothing we could do to make them stay in position," Williams told SCIENCE NEWS. Instead, the dolphins would drift back to a particular spot in the boat's wake, where differences in water pressure made swimming easier. Then they traveled — without seeming to flick their tails at all — about one-half meter under the surface, coming up only for a breath. "They got a real advantage just by knowing enough to ride that pressure wave," she adds.

These surfing dolphins breathed 5.5 times per minute, compared with 8.8 times for dolphins traveling at the same speed but without the aid of a wake. The lactic acid levels of the faster-breathing animals shot up to three times those of their wave-riding counterparts. Thus, like bike riders who "draft" by pulling up close behind another cyclist or a vehicle, these animals can sustain high speeds with less effort. By using the water to their advantage, they move twice as fast for only 13 percent more energy, says Williams.

Scientists and seafarers have long wondered why dolphins sometimes travel in the bow waves of ships or in the wakes of small boats or larger marine mammals with seemingly little effort. The new results demonstrate that this behavior is not playful but energy efficient, Williams says. *— E. Pennisi*