

The Sounds of Language



When sounds don't compute

"Benji" (not his real name) was born healthy, active and, in his own way charismatic. But somewhere along the way, he began slipping into a fog. The world didn't make sense to him. He did not learn to talk until age 3. At 5 and 6, when most kids are talking fluently, he'd forget common words or get lost in the middle of a sentence. Reading, writing, spelling, even understanding verbal instructions were abnormally difficult.

By age 7, Benji, who had normal hearing, was diagnosed with something called "auditory processing deficit." According to Cathie Pauly, a Middleton, Wis., speech pathologist, this disability prevents children from processing sounds -- speech and non-speech -- the way they were designed to



process them." The deficit causes people to confuse related sounds, like "t" and "d." And, she says, it affects the interpretation of all sounds. "Once they hear a sound, they don't assign a meaning to it."

The auditory processing deficit is one of many learning disabilities that affect millions of American children. In 1996, an estimated 2.6 million kids -- more than 4 percent of the school-age population -- were in publicly-funded learning disability programs at a cost of more than \$8 billion. Probably the most common learning disability is dyslexia, a difficulty sounding out letters and reading words.

Although Benji now had a label for his problem, it did not point toward a cure. Then, in September, 1997, Benji's parents read about a computerized language program that promised results nothing short of breathtaking (see "Giving Language Skills a Boost" in the [bibliography](#)).

Too fast for comfort

The researchers who put the program together think the auditory processing deficit is rooted in an abnormal slowness in interpreting phonemes, the most basic sounds of speech. (The first phoneme in "bat," for example, is the "b" sound. The phoneme is pronounced quickly, without a vowel sound).

In the rapid-fire communication of speech, sounds like "b" or "p" occur in just one to five hundredths of a second. Most people have no trouble hearing and identifying these sounds, but not kids like Benji.

According to many language experts, the inability to interpret phonemes erodes the very foundation of language. They say the low-level processing deficit undermines higher functions like speaking, reading and remembering words.

Think of a computer that could mis-read every third letter entered from the keyboard -- sooner or later it would get profoundly confused.

Eventually, the language problem can be compounded by behavioral problems. Feeling "dumb," the kids often act dumb or worse. Indeed, according to Pauly, 70 to 80 percent of prison inmates have some form of language disability.

The computer program in question grew out of the work of Paula Tallal, a neuroscientist and clinical psychologist who studies language at Rutgers University. She wondered whether children with the auditory deficit could interpret sounds that were slowed down. By the early 1990s, she had begun tinkering with computerized speech processing. In 1993, she linked up with Michael Merzenich, a University of California at San Francisco neuroscientist who studies the ominously-titled field of brain plasticity.

Brain plasticity?

You read that right, but it's not an effort to make replacement anatomical parts, but to study how the brain adapts and learns. Brain plasticity describes the ability of the brain to change through experience.

Together, Tallal and Merzenich invented Fast ForWord, a set of video games that runs on PCs or Macs. To earn points, the headphone-wearing child must distinguish "baa" from "paa," for example. After playing for 100 minutes, the home computer sends data via the Internet to the program's manufacturer, Scientific Learning Corp. in California, so the language pathologist can track the child's progress.

Meanwhile, the home computer processes the results and adjusts its playing level so the child is still challenged the next day. Gradually, the problematic sounds occur as quickly as they do in normal speech.

The 4- to 8-week training session is under the supervision of a trained audiologist or special education teacher, and it's not cheap -- Benji's parents paid almost \$1,850.

With that kind of money at stake, people want results. According to Barney, Benji's dad, "I thought this sounded too good to be true. And things that sound that way usually are too good to be true. But this ended up being much better than it sounded."

First of all, Benji's scores soared on the Test of Language Development, a standard assessment of the fundamentals of language. Before the 6-week program, all 11 scores were below average, yet two months later, only one was still below average. Second, Benji, who could never exceed 30 percent on a spelling test, was suddenly hitting 80 percent and above. Reading seemed easier, and he could respond to his father's requests to "Go downstairs and get the big hammer from the workbench."

But most important, Benji could suddenly talk about his world. Before, after a fracas on the playground, he could not explain what had happened. He only vaguely recalled homework assignments, and could never recite a school rule correctly.

The rapid results (see the Scientific Learning [web site](#) for details) have surprised some academics who study language development and sparked skepticism in others. Some experts, including Lila Gleitman of the University of Pennsylvania, even deny the very existence of the auditory processing deficit syndrome. Since children can distinguish "baa" from "paa" as young as one month, she calls the notion "garbage."



The American Speech-Language-Hearing Association, a professional organization representing speech pathologists, would not comment until it completes a position on Fast ForWord, according to Mona Thomas, who works in the organization's clinical department.

But Sally Shaywitz, who co-directs the Yale Center for the Study of Learning and Attention, thinks phoneme problems cut to the very heart of language. Dyslexia, a group of disorders that prevent smart people from reading normally, "reflects a difficulty within the language system and it affects a very specific component of the language system -- and that component has to do with how our brains process the sounds of language," she recently told Reuters.

And Pauly, who works with about four children each month, says they've all gained significant language abilities, and adds that that improvement continues after the program ends. Indeed, Benji, who only recently learned to tell a two-sentence story, was just selected to present his storytelling skills to a teacher continuing education session.

Nonetheless, she finds schools reluctant to adopt Fast ForWord, perhaps because they doubt that the program works, or from a feeling that they lack the personnel or computers. "They feel that if one child does it, there will be lots of other children clamoring for it."

If Benji's success is representative, there will indeed be such a clamor. Just two weeks after starting the program, the nine-year-old summed up his progress this way. "Everybody sounds **strange**. I can understand their words."