

American Sign Language: 'It's not mouth stuff - it's brain stuff.'

by Richard Wolkomir

The understanding of sign language has progressed significantly since the 1950s. Teacher Bill Stokoe was instrumental in helping sign language be recognized as a genuine natural language with a grammar, rather than just a set pattern of hand signals. Sign language research is discussed.

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In a darkened laboratory at the Salk Institute in San Diego, a deaf woman is signing. Tiny lights attached to her sleeves and fingers trace the motions of her hands, while two special video cameras whirl.

Computers will process her hands' videotaped arabesques and pirouettes into mathematically precise three-dimensional images. Neurologists and linguists will study these stunning patterns for insight into how the human brain produces language.

Sign has become a scientific hot button. Only in the past 20 years have linguists realized that signed languages are unique--a speech of the hand. They offer a new way to probe how the brain generates and understands language, and throw new light on an old scientific controversy: whether language, complete with grammar, is innate in our species, or whether it is a learned behavior. The current interest in sign language has roots in the pioneering work of one renegade teacher at Gallaudet University in Washington, D.C., the world's only liberal arts university for deaf people.

When Bill Stokoe went to Gallaudet to teach English, the school enrolled him in a course in signing. But Stokoe noticed something odd: among themselves, students signed differently from his classroom teacher.

"Hand talk": a genuine language

Stokoe had been taught a sort of gestural code, each movement of the hands representing a word in English. At the time, American Sign Language (ASL) was thought to be no more than a form of pidgin English. But Stokoe believed the "hand talk" his students used looked richer. He wondered: Might deaf people actually have a genuine language? And could that language be unlike any other on Earth? It was 1955, when even deaf people dismissed their signing as "slang." Stokoe's idea was academic heresy.

It is 37 years later. Stokoe--now devoting his time to writing and editing books and journals and to producing video materials on ASL and the deaf culture--is having lunch at a cafe near the Gallaudet campus and explaining how he started a revolution. For decades educators fought

his idea that signed languages are natural languages like English, French and Japanese. They assumed language must be based on speech, the modulation of sound. But sign language is based on the movement of hands, the modulation of space. "What I said," Stokoe explains, "is that language is not mouth stuff--it's brain stuff."

It has been a long road, from the mouth to the brain. Linguists have had to redefine language. Deaf people's self-esteem has been at stake, and so has the ticklish issue of their education.

"My own contribution was to turn around the thinking of academics," says Stokoe. "When I came to Gallaudet, the teachers were trained with two books, and the jokers who wrote them gave only a paragraph to sign language, calling it a vague system of gestures that looked like the ideas they were supposed to represent."

Deaf education in the '50s irked him. "I didn't like to see how the hearing teachers treated their deaf pupils--their expectations were low," he says. "I was amazed at how many of my students were brilliant." Meanwhile, he was reading the work of anthropological linguists like George Trager and Henry Lee Smith jr. "They said you couldn't study language without studying the culture, and when I had been at Gallaudet a short time, I realized that deaf people had a culture of their own."

When Stokoe analyzed his students' signing, he found it was like spoken languages, which combine bits of sound--each meaningless by itself--into meaningful words. Signers, following similar rules, combine individually meaningless hand and body movements into words. They choose from a palette of hand shapes, such as a fist or a pointing index finger. They also choose where to make a sign; for example, on the face or on the chest. They choose how to orient the hand and arm. And each sign has a movement--it might begin at the cheek and finish at the chin. A shaped hand executing a particular motion creates a word. A common underlying structure of both spoken and signed language is thus at the level of the smallest units that are linked to form words.

Stokoe explained his findings on the structure of ASL in a book published in 1960. "The faculty then had a special meeting and I got up and said my piece," he says. "Nobody threw eggs or old vegetables, but I was

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bombarded by hostility." Later, the university's president told Stokoe his research was "causing too much trouble" because his insistence that ASL was indeed a language threatened the English-based system for teaching the deaf. But Stokoe persisted. Five years later he came out with the first dictionary of American Sign Language based on linguistic principles. And he's been slowly winning converts ever since.

"Wherever we've found deaf people, there's sign"

Just as no one can pinpoint the origins of spoken language in prehistory, the roots of sign language remain hidden from view. What linguists do know is that sign languages have sprung up independently in many different places. Signing probably began with simple gestures, but then evolved into a true language with structured grammar. "In every place we've ever found deaf people, there's sign," says anthropological linguist Bob Johnson. But it's not the same language. "I went to a Mayan village where, out of 400 people, 13 were deaf, and they had their own Mayan Sign--I'd guess it's been maintained for thousands of years." Today at least 50 native sign languages are "spoken" worldwide, all mutually incomprehensible, from British and Israeli Sign to Chinese Sign.

Not until the 1700s, in France, did people who could hear pay serious attention to deaf people and their language. Religion had something to do with it. "They believed that without speech you couldn't go to heaven," says Johnson.

For the Abbe de l'Epee, a French priest born into a wealthy family in 1712, the issue was his own soul: he feared he would lose it unless he overcame the stigma of his privileged youth by devoting himself to the poor. In his history of the deaf, *When The Mind Hears*, Northeastern University psychologist Harlan Lane notes that, in his 50s, de l'Epee met two deaf girls on one of his forays into the Paris slums and decided to dedicate himself to their education.

The priest's problem was abstraction: he could show the girls a piece of bread and the printed French word for "bread." But how could he show them "God" or "goodness"? He decided to learn their sign language as a teaching medium. However, he attempted to impose French grammar onto the signs.

"Methodical signing," as de l'Epee called his invention, was an ugly hybrid. But he did teach his pupils to read French, opening the door to education, and today he is a hero to deaf people. As his pupils and disciples proliferated, satellite schools sprouted throughout Europe. De l'Epee died happily destitute in 1789 surrounded by his students in his Paris school, which became the National

Institution for Deaf-Mutes under the new republic.

Other teachers kept de l'Epee's school alive. And one graduate, Laurent Clerc, brought the French method of teaching in sign to the United States. It was the early 1800s; in Hartford, Connecticut, the Rev. Thomas Hopkins Gallaudet was watching children at play. He noticed that one girl, Alice Cogswell, did not join in. She was deaf. Her father, a surgeon, persuaded Gallaudet to find a European teacher and create the first permanent school for the deaf in the United States. Gallaudet then traveled to England, where the "oral" method was supreme, the idea being to teach deaf children to speak. The method was almost cruel, since children born deaf--they heard no voices, including their own--could have no concept of speech. It rarely worked. Besides, the teachers said their method was "secret." And so Gallaudet visited the Institution for Deaf-Mutes in Paris and persuaded Laurent Clerc to come home with him.

During their 52-days voyage across the Atlantic, Gallaudet helped Clerc improve his English, and Clerc taught him French Sign Language. On April 15, 1817, in Hartford, they established a school that became the American School for the Deaf. Teaching in French Sign Language and a version of de l'Epee's methodical sign, Clerc trained many students who became teachers, too, and helped spread the language across the country. Clerc's French Sign was to mingle with various "home" signs that had sprung up in other places. On Martha's Vineyard, Massachusetts, for example, a large portion of the population was genetically deaf, and virtually all the islanders used an indigenous sign language, the hearing switching back and forth between speech and sign with bilingual ease. Eventually, pure French Sign would blend with such local argots and evolve into today's American Sign Language.

After Clerc died, in 1869, much of the work done since the time of de l'Epee to teach the deaf in their own language crumbled under the weight of Victorian intolerance. Anti-Signers argued that ASL let the deaf "talk" only to the deaf; they must learn to speak and to lip-read. Pro-Signers pointed out that, through sign, the deaf learned to read and write English. The Pros also noted that lipreading is a skill that few master. (Studies estimate that 93 percent of deaf schoolchildren who were either born deaf or lost their hearing in early childhood can lip-read only one in ten everyday sentences in English.) And Pros argue correctly that the arduous hours required to teach a deaf child to mimic speech should be spent on real education.

"Oralists" like Horace Mann lobbied to stop schools from teaching in ASL, then the method of instruction in all schools for the deaf. None was more fervent than

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Alexander Graham Bell, inventor of the telephone and husband of a woman who denied her own deafness. The president of the National Association of the Deaf called Bell the "most to be feared enemy of the American deaf." In 1880, at an international meeting of educators of the deaf in Milan, where deaf teachers were absent, the use of sign language in schools was proscribed.

After that, as deaf people see it, came the Dark Ages. Retired Gallaudet sociolinguist Barbara Kannapell, who is cofounder of Deafpride, a Washington, D.C. advocacy group, is the deaf daughter of deaf parents from Kentucky. Starting at age 4, she attended an "oral" school, where signing was outlawed. "Whenever the teacher turned her back to work on the blackboard, we'd sign," signs Kannapell. "If the teacher caught us using sign language, she'd use a ruler on our hands."

Kannapell has tried to see oralism from the viewpoint of hearing parents of deaf children. "They'll do anything to make their child like themselves," she signs. "But, from a deaf adult's perspective, I want them to learn sign, to communicate with their child."

In the 1970s, a new federal law mandated "mainstreaming." That law was good for parents, because they could keep children home instead of sending them off to special boarding schools, but many public schools didn't know what to do with deaf kids," signs Kannapell. "Many of these children think they're the only deaf kids in the world."

Gallaudet's admissions director, James Tucker, an exuberant 32-year-old, is a product of the '70s mainstreaming. "I'd sit in the back, doing work the teacher gave me and minding my own business," he signs. "Did I like it? Hell no! I was lonely-for years I thought I was an introvert." Deaf children have a right to learn ASL and to live in an ASL-speaking community, he asserts. "We learn sign for obvious reasons-our eyes aren't broken," he signs. Tucker adds: "Deaf culture is a group of people sharing similar values, outlook and frustrations, and the main thing, of course, is sharing the same language."

Today, most teachers of deaf pupils are "hearies" who speak as they sign. "Simultaneous Communication," as it is called, is really signed English and not ASL. "It looks grotesque to the eye," signs Tucker, adding that it makes signs too "marked," a linguistic term meaning equally stressed. Hand movements can be exaggerated or poorly executed. As Tucker puts it: "We have zealous educators trying to impose weird hand shapes." Moreover, since the languages have entirely different sentence structures, the effect can be bewildering. It's like having Japanese spoken to English-speaking students with an interpreter shouting occasional English words at them.

The silent world of sign

New scientific findings support the efforts of linguists such as Bob Johnson, who are calling for an education system for deaf students based on ASL, starting in infancy. Research by Helen Neville, at the Salk Institute, shows that children must learn a language-any language-during their first five years or so, before the brain's neural connections are locked in place, or risk permanent linguistic impairment. "What suffers is the ability to learn grammar," she says. As children mature, their brain organization becomes increasingly rigid. By puberty, it is largely complete. This spells trouble because most deaf youngsters learn language late: their parents are hearing and do not know ASL, and the children have little or no contact with deaf people when young.

Bob Johnson notes that more than 90 percent of all deaf children have hearing parents. Unlike deaf children of deaf parents, who get ASL instruction early, they learn a language late and lag educationally. "The average deaf 12th-grader reads at the 4th-grade level," says Johnson. He believes deaf children should start learning ASL in the crib, with schools teaching in ASL. English, he argues, should be a second language, for reading and writing: "All evidence says they'll learn English better." It's been an uphill battle. Of the several hundred school programs for the deaf in this country, only six are moving toward ASL-based instruction. And the vast majority of deaf students are still in mainstream schools where there are few teachers who are fluent in ASL.

Meanwhile, researchers are finding that ASL is a living language, still evolving. Sociolinguist James Woodward from Memphis, who has a black belt in karate, had planned to study Chinese dialects but switched to sign when he came to Gallaudet in 1969. "I spent every night for two years at the Rathskeller, a student hangout, learning by observing," he says. "I began to see great variation in the way people signed."

Woodward later concentrated on regional, social and ethnic dialects of ASL. Visiting deaf homes and social clubs in the South, he found that Southerners use older forms of ASL signs than Northerners do. Southern blacks use even more of the older signs. "From them, we can learn the history of the language," he says.

Over time, signs tend to change. For instance, "home" originally was the sign for "eat" (touching the mouth) combined with the sign for "sleep" (the palm pillowing the cheek). Now it has evolved into two taps on the cheek. Also, signs formerly made at the center of the face migrate toward its perimeter. One reason is that it is easier to see both signs and changes in facial expressions in this way,

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since deaf people focus on a signer's face-which provides crucial linguistic information-taking in the hands with peripheral vision.

Signers use certain facial expressions as grammatical markers. These linguistic expressions range from pursed lips to the expression that results from enunciating the sound "th." Linguist Scott Liddell, at Gallaudet, has noted that certain hand movements translate as "Bill drove to John's." If the signer tilts his head forward and raises his eyebrows while signing, he makes the sentence a question: "Did Bill drive to John's?" If he also makes the "th" expression as he signs, he modifies the verb with an adverb: "Did Bill drive to John's inattentively?"

Sociolinguists have investigated why this unique language was for so long virtually a secret. Partly, Woodward thinks, it was because deaf people wanted it that way. He says that when deaf people sign to the hearing, they switch to English-like signing. "It allows hearing people to be identified as outsiders and to be treated carefully before allowing any interaction that could have a negative effect on the deaf community," he says. By keeping ASL to themselves, deaf people-whom Woodward regards as an ethnic group-maintain "social identity and group solidarity."

A key language ingredient: grammar

The "secret" nature of ASL is changing rapidly as it is being examined under the scientific microscope. At the Salk Institute, a futuristic complex of concrete labs poised on a San Diego cliff above the Pacific, pioneer ASL investigator Ursula Bellugi directs the Laboratory for Cognitive Neuroscience, where researchers use ASL to probe the brain's capacity for language. It was here that Bellugi and associates found that ASL has a key language ingredient: a grammar to regulate its flow. For example, in a conversation a signer might make the sign for "Joe" at an arbitrary spot in space. Now that spot stands for "Joe." By pointing to it, the signer creates the pronoun "he" or "him," meaning "Joe." A sign moving toward the spot means something done to "him." A sign moving away from the spot means an action by Joe, something "he" did.

In the 1970s, Bellugi's team concentrated on several key questions that have been of central concern ever since MIT professor Noam Chomsky's groundbreaking work of the 1950s. Is language capability innate, as Chomsky and his followers believe? Or is it acquired from our environment? The question gets to the basics of humanity since our language capacity is part of our unique endowment as a species. And language lets us accumulate lore and pass it on to succeeding generations. Bellugi's team reasoned that if ASL is a true language, unconnected to speech, then our penchant for language

must be built in at birth, whether we express it with our tongue or hands. As Bellugi (above) puts it: "It had to keep asking myself, 'What does it mean to be a language?'"

A key issue was "iconicity." Linguistics has long held that one of the properties of all natural languages is that their words are arbitrary. In English, to illustrate, there is no relation between the sound of the word "cat" and a cat itself, and onomatopoeic words like "slurp" are few and far between. Similarly, if ASL follows the same principles, its words should not be pictures or mime. But ASL does have many words with transparent meanings. In ASL, "tree" is an arm upright from the elbow, representing a trunk, with the fingers spread to show the crown. In Danish Sign, the signer's two hands outline a tree in the air. Sign languages are rife with pantomimes. But Bellugi wondered: Do deaf people perceive such signs as iconic as they communicate in ASL?

One day a deaf mother visited the lab with her deaf daughter, not yet 2. At that age, hearing children fumble pronouns, which is why parents say, "Mommy is getting Tammy juice." The deaf child, equally confused by pronouns, signed "you" when she meant "I." But the sign for such pronouns is purely iconic: the signer points an index finger at his or her own torso to signify "I" or at the listener to signify "you." The mother corrected the child by turning her hand so that she pointed at herself. Nothing could be clearer. Yet, as the child chattered on, she continued to point to her mother when she meant "I."

Bellugi's work revealed that deaf toddlers have no trouble pointing. But a pointing finger in ASL is linguistic, not gestural. Deaf toddlers in the "don't-understand-pronouns" stage do not see a pointing finger. They see a confusing, abstract word. ASL's roots may be mimetic, but embedded in the flow of language-the signs lose their iconicity.

By the 1980s, most linguists had accepted sign languages as natural languages on an equal footing with English, Italian, Hindi and others of the world. Signed languages like ASL, were as powerful, subtle and intricately structured as spoken ones.

The parallels become especially striking in wordplay and poetry. Signers' creativity combine hand shapes and movements to create puns and other humorous alterations of words. A typical pun in sign goes like this: a fist near the forehead and a flip of the index finger upward means that one understands. But if the little finger is flipped, it's a joke meaning one understands a little. Clayton Valli at Gallaudet has made an extensive study of poetry in ASL. He finds that maintenance or repetition of hand shape provides rhyming, while meter occurs in the timing and type of movement. Research with the American Theater of

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the Deaf reveals a variety of individual techniques and styles. Some performers create designs in space with a freer movement of the arms than in ordinary signing. With others, rhythm and tempo are more important than spatial considerations. Hands may be alternated so that there is a balance and symmetry in the structure. Or signs may be made to flow into one another, creating a lyricism in the passage. The possibilities for this new art form in sign seem bounded only by the imagination within the community itself.

The special nature of sign language provides unprecedented opportunities to observe how the brain is organized to generate and understand language. Spoken languages are produced by largely unobservable movements of the vocal apparatus and received through the brain's auditory system. Signed languages, by contrast, are delivered through highly visible movements of the arms, hands and face, and are received through the brain's visual system. Engagement of these different brain systems in language use makes it possible to test different ideas about the biological basis of language.

The prevailing view of neurologists is that the brain's left hemisphere is the seat of language, while the right controls our perception of visual space. But since signed languages are expressed spatially, it was unclear where they might be centered.

To find out, Bellugi and her colleagues studied lifelong deaf signers who had suffered brain damage as adults. When the damage had occurred in their left hemisphere, the signers could shrug, point, shake their heads and make other gestures, but they lost the ability to sign. As happens with hearing people who suffer left-hemisphere damage, some of them lost words while others lost the ability to organize grammatical sentences, depending on precisely where the damage had occurred.

Conversely, signers with right-hemisphere damage signed as well as ever, but spatial arrangements confused them. One of Bellugi's right-hemisphere subjects could no longer perceive things to her left. Asked to describe a room, she reported all the furnishings as being on the right, leaving the room's left side a void. Yet she signed perfectly, including signs formed on the left side. She had lost her sense of topographic space, a right-hemisphere function, but her control of linguistic space, centered in the left hemisphere, was intact. All of these findings support the conclusion that language, whether visual or spoken, is under the control of the left hemisphere.

One of the Salk group's current efforts is to see if learning language in a particular modality changes the brain's ability to perform other kinds of tasks. Researchers

showed children a moving light tracing a pattern in space, and then asked them to draw what they saw. "Deaf kids were way ahead of hearing kids," says Bellugi. Other tests, she adds, back up the finding that learning sign language improves the mind's ability to grasp patterns in space.

Thinking and dreaming in signs

Salk linguist Karen Emmorey says the lab also has found that deaf people are better at generating and manipulating mental images. "We found a striking difference in ability to generate mental images and to tell if one object is the same as another but rotated in space, or is a mirror image of the first," she says, noting that signers seem to be better at discriminating between faces, too. As she puts it: "The question is, does the language you know affect your other cognitive abilities?"

Freda Norman, formerly an actress with the National Theater of the Deaf and now a Salk research associate, puts it like this: "English is very linear, but ASL lets you see everything at the same time."

"The deaf think in signs," says Bellugi. "They dream in signs. And little children sign to themselves."

At McGill University in Montreal, psychologist Laura Ann Petitto recently found that deaf babies of deaf parents babble in sign. Hearing infants create nonsense sounds like "babababa," first attempts at language. So do deaf babies, but with their hands. Petitto watched deaf infants moving their hands and fingers in systematic ways that hearing children not exposed to sign never do. The movements, she says, were their way of exploring the linguistic units that will be the building blocks of language-their language.

Deaf children today face a brighter future than the generation of deaf children before them. Instruction in ASL, particularly in residential schools, should accelerate. New technologies, such as the TDD (Telecommunications Device for the Deaf) for communicating over telephones, relay services and video programs for language instruction, and the recent Americans with Disabilities Act all point the way to a more supportive environment. Deaf people are moving into professional jobs, such as law and accounting, and more recently into computer-related work. But it is not surprising that outside of their work, they prefer one another's company. Life can be especially rewarding for those within the ASL community. Here they form their own literary clubs, bowling leagues and gourmet groups.

As the Salk laboratory's Freda Norman signs: "I love to read books, but ASL is my first language." She adds, smiling: "Sometimes I forget that the hearing are different."