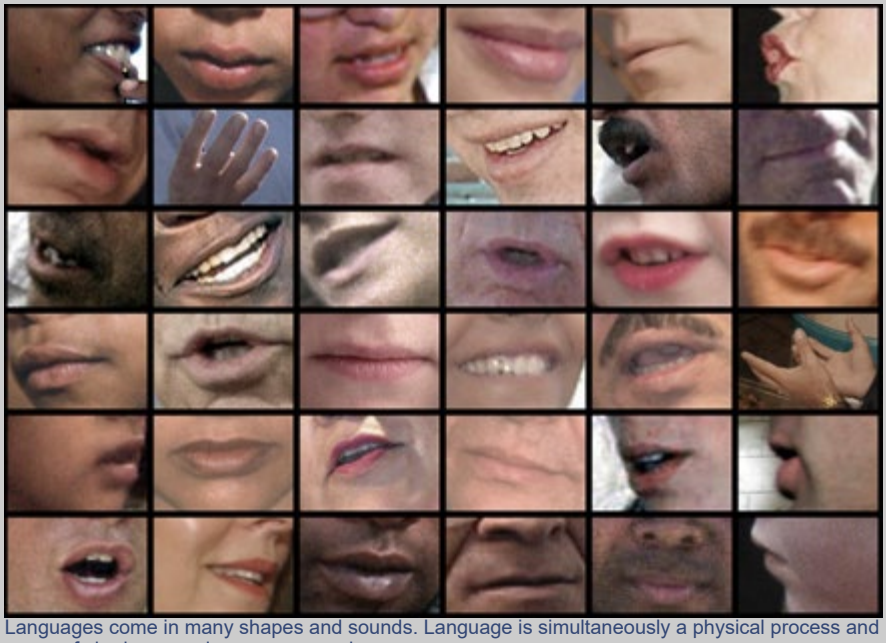
Introduction

Language is common to all humans; we seem to be "hard-wired" for it. Many social scientists and philosophers say it's this ability to use language symbolically that makes us "human."

Though it may be a universal human attribute, language is hardly simple. For decades, linguists' main task was to track and record languages. But, like so many areas of science, the field of linguistics has evolved dramatically over the past 50 years or so.



Languages come in many shapes and sounds. Language is simultaneously a physical process and a way of sharing meaning among people.

Credit: Design by Alex Jeon, National Science Foundation

Today's science of linguistics explores:

- the sounds of speech and how different sounds function in a language
- the psychological processes involved in the use of language
- how children acquire language capabilities
- social and cultural factors in language use, variation and change
- the acoustics of speech and the physiological and psychological aspects involved in producing and understanding it
- the biological basis of language in the brain

This special report touches on nearly all of these areas by answering questions such as: How does language develop and change? Can the language apparatus be "seen" in the brain? Does it matter if a language disappears? What exactly is a dialect? How can sign language help us to understand languages in general?

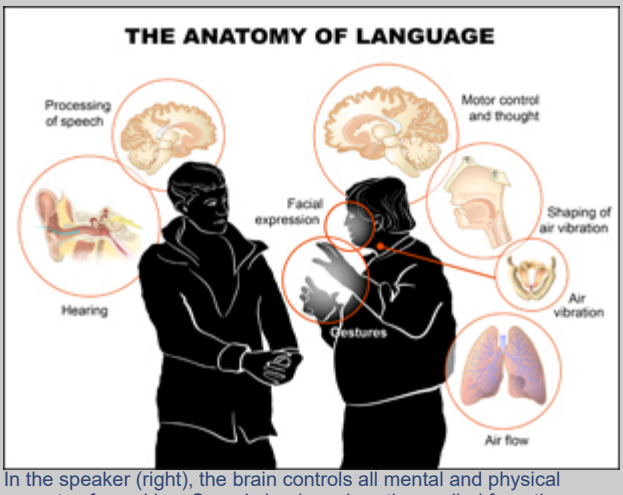
Answers to these and other questions have implications for neuroscience, psychology, sociology, biology and more.

More Special Reports ***Next: Speech is Physical and Mental***

Speech is Physical and Mental

Humans are equipped with sophisticated machinery for producing and hearing speech. Speech is a physical activity involving both gestures (in the case of signed languages) and anatomical components such as the diaphragm, ears, vocal cords and such (in the case of oral languages). It is also a mental activity, involving the brain in all its complexity, such as the ability to decode, interpret and perceive. Researchers study all aspects of language and its perception—from the generation of speech sounds and their acoustical properties to how language gets processed by the brain.

Click on illustrations for more detail.



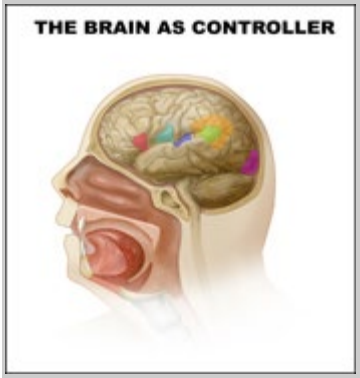
In the speaker (right), the brain controls all mental and physical aspects of speaking. Sounds begin as breath expelled from the lungs. On its journey to the mouth, the air vibrates as it is forced through the vocal cords. The mouth, nose and tongue modify this vibrating air to form sound waves. Facial expressions and gestures also play a role in communication. In the listener (left), sound waves enter the ear and are then analyzed into words by the brain.

Credit: Zina Deretsky, National Science Foundation

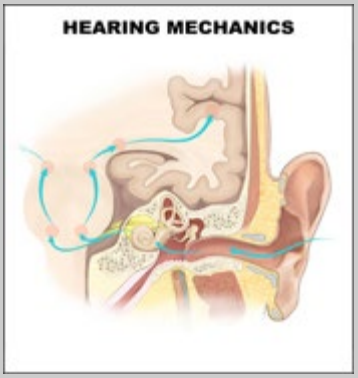
The physical and mental aspects of speech are closely intertwined. In an environment full of sounds, the brain manages to discern and make sense of speech. Yet researchers are finding that our experiences with language can also alter the brain and shape how it functions. In fact, the first language we learn influences our perception of everything we hear later.

Today, researchers are uncovering new aspects of the physical and mental basis of language.

Click on illustrations for more detail.



The brain acts as "command central" for language and communication, controlling both physical and mental components of speech.



On the receiving end of language, sound patterns entering the ear are amplified, sorted, decoded and finally recognized and processed as words.

On the production end of language, the brain triggers action by the diaphragm, lungs, vocal cords, nose lips and tongue which all work together to form words.

Credit: Zina Deretsky, National Science Foundation

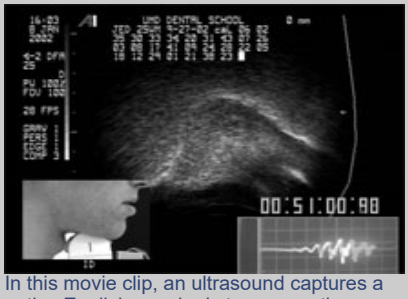
Speech is Physical and Mental >> Exploring The Interface

Researchers are exploring a range of topics at the physical/mental interface of speech, including:

- How are speech signals processed in the brain?
- How does our native language shape the way we perceive speech and limit the range of sounds we can hear and reproduce?
- Why do native speakers pronounce words differently from non-native speakers?

Speech Perception

Speech perception is one of our most valuable social skills. It is also a remarkably flexible process, as demonstrated by our ability to understand speakers in noisy environments and language spoken with a wide variety of accents. Both of these factors affect the speech signals our brain must decode. Exactly how does the human brain process language and does that process differ from how it handles other sounds? NSF-supported researcher Josef Rauschecker of Georgetown University strives to answer those and related questions.



In this movie clip, an ultrasound captures a native English speaker's tongue motions as he pronounces the nonsense word "zgomu." Because "zg" sequences are not permitted in English, he doesn't master the proper coordination to pronounce the unfamiliar sound sequence properly. Instead, he inserts a vowel-like sound between the z and g, forming "zegomu." Ultrasound shows improper tongue motions frequently cause this type of mispronunciation.

Credit: Lisa Davidson. This movie was recorded in the lab of Dr. Maureen Stone at the University of Maryland, Baltimore.

View Video
Requires Real Player

In previous research, Rauschecker discovered that separate areas in primate brains control the processing of different sounds. For example, a particular region handles sounds used for communication. To determine whether human brains function similarly, Rauschecker is using non-invasive magnetic resonance imaging (MRI) techniques to observe which parts of volunteers' brains are stimulated by speech. MRI measures increases or decreases in brain blood flow, which indicates changes in brain activity. Through this work, he has located areas of the brain that are stimulated by language as opposed to experimental control sounds with similar complexity. His work reveals new details about the organization of the brain's hearing and language processing regions.

Cues From Foreign Words

Few people master the accent and pronunciation of foreign words—often despite years of input and training. Why do foreign language learners and those who "borrow" phrases from foreign languages pronounce words differently from native speakers? NSF-sponsored researcher Lisa Davidson of New York University thinks language-specific differences in the timing patterns of speech production are part of the answer.

To pronounce words properly, speakers must learn the timing of speech in a particular language—including the duration of consonant and vowel sounds and coordination between adjacent sounds. Some mispronunciations likely involve perception. A person's brain is "tuned" to recognize the familiar—in this case, the subtleties and patterns of their native language. Non-native speakers often can't hear or will misinterpret the differences between sounds in foreign languages.

Click here for audio

In this sound file, a native English speaker repeats words produced by a Slovak speaker. She cannot accurately reproduce words containing non-native consonant sequences such as /vd/ and /zn/ ("vdalay" and "znasho"). However, she has no trouble pronouncing the middle word "zegano" because a vowel sound follows the first z. This pattern is acceptable in English.

Credit: Lisa Davidson, New York University.

For example, non-native combinations such as the /vl/ of "Vlasic" present a substantial challenge for native English speakers. Because the /vl/ sequence isn't found at the beginnings

of words in English, they might compensate by dropping a consonant or inserting a vowel sound between the first two letters, pronouncing the word as "Velasic". In other cases, according to Davidson, non-native speakers know how a foreign word should be pronounced, but can't achieve the proper timing and coordination to do so because they haven't mastered the tongue motions used by native speakers. She has verified this by comparing the tongue motions of native and foreign language speakers using ultrasound. Davidson is interested in learning how speakers incorporate "borrowed" foreign words into their own language. She is investigating how mispronounced words get passed on through generations, and how this influences language change.

More Special Reports ***Next: Language Learning***

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Text Only Version

Linguists disagree on whether nature or nurture is most important in language learning. Some say children are born with a kind of "universal grammar," and others emphasize that adults play a major role. But they all agree that language acquisition is a complex process.

Credit: Art Explosion

Nicaraguan Sign Language: A Case for Innateness

Language Learning

Almost all human beings acquire a language (and sometimes more than one), to the level of native competency, before age 5. How do children accomplish this remarkable feat in such a short amount of time? Which aspects of language acquisition are biologically programmed into the human brain and which are based on experience? Do adults learn language differently from children? Researchers have long debated the answers to these questions, but there is one thing they agree on: language acquisition is a complex process.

Most researchers agree that children acquire language through interplay of biology and environmental factors. A challenge for linguists is to figure out how nature and nurture come together to influence language learning.

Emphasis on Nature

Some researchers theorize that children are born with an innate biological "device" for understanding the principles and organization common to all languages. According to this theory, the brain's "language module" gets programmed to follow the specific grammar of the language a child is exposed to early in life. Yet the language rules and grammar children use in their speech often exceed the input to which they are exposed. What accounts for this discrepancy?

That is where the *theory of universal grammar* comes in. This theory posits that all languages have the same basic structural foundation. While children are not genetically "hard-wired" to speak a particular language like Dutch or Japanese, universal grammar lets them learn the rules and patterns of these languages—including those they were never explicitly taught. Some linguists believe that universal grammar and its interaction with the rest of the brain is the design mechanism that allows children to become fluent in any language during the first few years of life. In fact, childhood may be a critical period for the acquisition of language capabilities. Some scientists claim that if a person does not acquire any language before the teen-aged years, they will never do so in a functional sense. Children may also have a heightened ability, compared to adults, to learn second languages--especially in natural settings. Adults, however, may have some advantages in the conscious study of a second language in a classroom setting.

Emphasis on Experience and Usage

Not all linguists believe that the innate capacities

No Nonsense: Babies Recognize Syllables

Babies are born into a world buzzing with new noises. How do they interpret sounds and make sense of what they hear? University of Wisconsin, Madison, researcher Jenny Saffran strives to answer these types of questions by studying the learning abilities "that babies bring to the table" for language acquisition. "Studying learning gives us the chance to see the links between nature and nurture," says Saffran.

One thing babies must learn about language is where words begin and end in a fluid stream of speech. This isn't an easy task because the spaces we perceive between words in sentences are obvious only if we are familiar with the language being spoken. It is difficult to recognize word boundaries in foreign speech. Yet according to Saffran, by seven or eight months of age, babies can pluck words out of sentences.

In her studies, Saffran introduced babies to a simple nonsense language of made-up, two-syllable words spoken in a stream of monotone speech. There are no pauses between the "words," but the syllables are presented in a particular order. If the babies recognize the pattern, they can use it to identify word boundaries in subsequent experiments. To test this, Saffran plays new strings of speech where only some parts fit the previous pattern, then records how long the babies pay attention to the familiar versus novel "words." Since babies consistently pay attention to unfamiliar sounds for longer periods than to familiar ones, a difference in attention times indicates what the babies learned from their initial exposure to the nonsense language.

Saffran's research suggests babies readily identify patterns in speech and can even evaluate the statistical probability that a string of sounds represents a word. Her research reveals the sophisticated learning

and Critical Age

Evidence supporting the innateness of language and the concept of a "critical age" for language acquisition emerged among Nicaragua's deaf community in the 1980's.

Until this time, Nicaragua lacked a formal sign language or education system for the hearing impaired. Deaf children relied on rudimentary, idiosyncratic gestures to communicate with their immediate families. Yet, when hundreds of previously isolated deaf students entered schools for the first time, they quickly developed a distinct and sophisticated communication system known as Nicaraguan Sign Language (NSL).

The emergence of NSL provided researchers with a rare opportunity to watch a new language develop—complete with an extensive vocabulary and grammar rules. Some linguists cite it as the most compelling evidence in support of the theory that humans are innately endowed with the capacity to acquire language, even when the input is sub-optimal. However, it also supports the concept of a "critical age" window for optimal language acquisition. While children rapidly developed a full use of sign language that extended beyond vocabulary to include grammar, deaf adults did not.

For more information on sign languages, see: Sign Language.

Yuri Mejia, a student at the Escuelita de Bluefields school, signing her name in Nicaraguan sign language.

Credit: Christina Gomez-Mira, courtesy of Nicaraguan Sign Language Projects, Inc.

are most important in language learning. Some researchers place greater emphasis on the influence of *usage and experience* in language acquisition. They argue that adults play an important role in language acquisition by speaking to children—often in a slow, grammatical and repetitious way. In turn, children discern patterns in the language and experiment with speech gradually—uttering single words at first and eventually stringing them together to construct abstract expressions. At first glance, this may seem reminiscent of how language is traditionally taught in classrooms. But most scientists think children and adults learn language differently.

While they may not do it as quickly and easily as children seem to, adults *can* learn to speak new languages proficiently. However, few would be mistaken for a native speaker of the non-native tongue. Childhood may be a critical period for mastering certain aspects of language such as proper pronunciation. What factors account for the different language learning capabilities of adults and children? Researchers suggest accumulated experience and knowledge could change the brain over time, altering the way language information is organized and/or processed.

Why Further Study is Needed

While our understanding of language acquisition is incomplete, this pursuit is well worth the effort, according to NSF program officer Joan Maling.

"We still don't understand how a child learns its first language, why some children have language disorders or how children and adults learn a second language," she says. "And we still don't understand what happens when a stroke or a disease such as Alzheimer's seems to wipe out a person's knowledge of language."

Unraveling the process of language acquisition promises not only to help scientists answer these questions, but to explain fundamental features of learning and the human brain.

capabilities involved in language acquisition and demonstrates how these skills evolve as an infant matures.

For details about Saffran's research and experimental methods, click here.

Click here for audio

Example of nonsense speech used in a 1996 study by Saffran, Aslin and Newport.

Credit: Audio generated by Jenny Saffran at the Department of Brain and Cognitive Sciences, University of Rochester.

Researcher Jenny Saffran prepares a young subject for an infant auditory test at the Waisman Center's Infant Learning Laboratory at the University of Wisconsin, Madison. Sounds are projected from hidden speakers while flashing lights direct the infant's attention. Each session is recorded by video and transmitted by monitor to researchers outside the room.

Credit: Jeff Miller, University of Wisconsin, Madison

By Nicole Mahoney

More Special Reports

Next: Language Change

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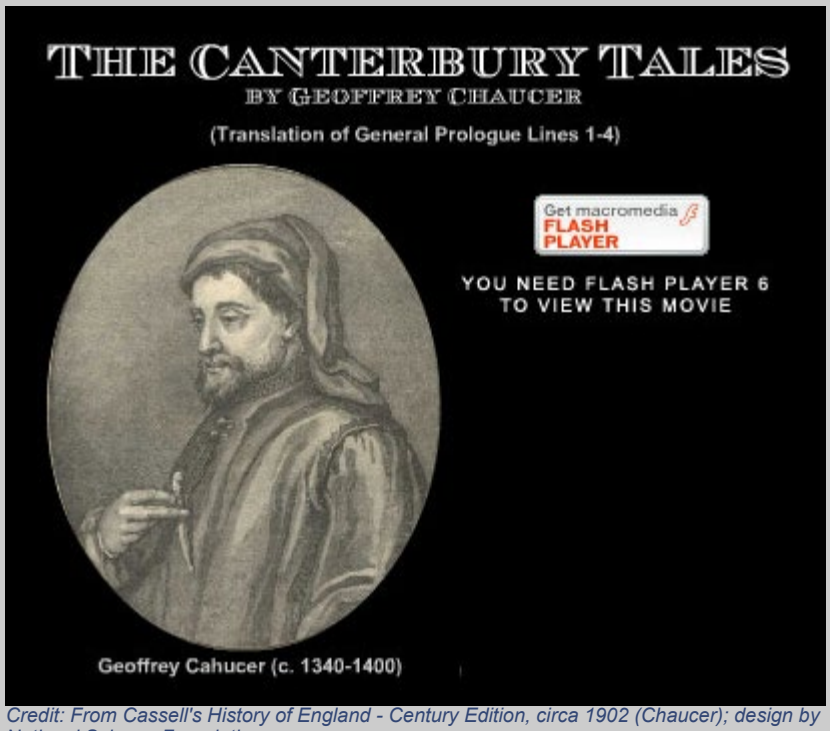
Language Change

In some ways, it is surprising that languages change. After all, they are passed down through the generations reliably enough for parents and children to communicate with each other. Yet linguists find that all languages change over time—albeit at different rates. For example, while Japanese has changed relatively little over 1,000 years, English evolved rapidly in just a few centuries. Many present-day speakers find Shakespeare's sixteenth century texts difficult and Chaucer's fourteenth century Canterbury Tales nearly impossible to read.



Credit: From Cassell's History of England - Century Edition, circa 1902 (Chaucer); design by National Science Foundation;
Translation by Joan Maling, National Science Foundation

Why They Change

Languages change for a variety of reasons. Large-scale shifts often occur in response to social, economic and political pressures. History records many examples of language change fueled by invasions, colonization and migration. Even without these kinds of influences, a language can change dramatically if enough users alter the way they speak it.

Frequently, the needs of speakers drive language change. New technologies, industries, products and experiences simply require new words. Plastic, cell phones and the Internet didn't exist in Shakespeare's time, for example. By using new and emerging terms, we all drive language change. But the unique way that individuals speak also fuels language change. That's because no two individuals use a language in exactly the same way. The vocabulary and phrases people use depend on where they live, their age, education level, social status and other factors. Through our interactions, we pick up new words and sayings and integrate them into our speech. Teens and young adults for example, often use different words and phrases from their parents. Some of them spread through the population and slowly change the language.

No two individuals use a language in exactly the same way. The vocabulary and phrases people use are linked to where they live, their age, education level, social status and sometimes to their membership in a particular group or community.

Credit: Art Explosion (left and middle); Digital Vision (right)

Types of Change

Three main aspects of language change over time: vocabulary, sentence structure and pronunciations. Vocabulary can change quickly as new words are borrowed from other languages, or as words get combined or shortened. Some words are even created by mistake. As noted in the Linguistic Society of America's publication *Is English Changing?*, *pea* is one such example. Up until about 400 years ago, *pease* referred to either a single pea or many peas. At some point, people mistakenly assumed that the word *pease* was the plural form of pea, and a new word was born. While vocabulary can change quickly, sentence structure—the order of words in a sentence—changes more slowly. Yet it's clear that today's English speakers construct sentences very differently from Chaucer and Shakespeare's contemporaries (see illustration above). Changes in sound are somewhat harder to document, but at least as interesting. For example, during the so-called "Great Vowel Shift" 500 years ago, English speakers modified their vowel pronunciation dramatically. This shift represents the biggest difference between the pronunciations of so called Middle and Modern English (see audio clips in "Paths of Change")

Agents of Change

Before a language can change, speakers must adopt new words, sentence structures and sounds, spread them through the community and transmit them to the next generation. According to many linguists—including David Lightfoot, NSF assistant director for social, behavioral and economic sciences—children serve as agents for language change when, in the process of learning the language of previous generations, they internalize it differently and propagate a different variation of that language.

Linguists study language change by addressing questions such as these:

- Can we trace the evolutionary path of a language?
- How do language changes spread through communities?
- How do historical circumstances influence language change?
- What is the relationship between language learning and change?

By Nicole Mahoney

More Special Reports ***Next: Paths of Change***

Language Change >> Paths of Change

NSF researcher Anthony Kroch of the University of Pennsylvania is trying to understand how language change spreads through populations. With collaborator Beatrice Santorini, he is compiling an electronic collection of Modern English texts covering the time period from 1700 to 1914 (the beginning of World War I). The completed "corpus," as it is known, will complement three others created independently over the past decade by researchers from the University of Pennsylvania and the University of York, England. The existing works—which span 900 years of English history—contain more than 4.5 million words of text carefully tagged and annotated for linguistic features. The publicly available collection gives researchers a standardized, searchable document to track changes in the English language over time. It helps them explore language shifts in a historical context and examine the link between language learning and change. Mathematicians are using the data to create computer models that explain how changes diffuse through populations. Kroch is currently working with researchers in Canada and Brazil to create standardized, historical corpora of French and Portuguese.

	Middle English:	Mid-Shift:	Present-Day English:
Child	Click here for audio	Click here for audio	Click here for audio
Loud	Click here for audio	Click here for audio	Click here for audio
Good	Click here for audio	Click here for audio	Click here for audio
To	Click here for audio	No Mid-Shift Version Available	Click here for audio

During the Great Vowel Shift (GVS) of the 15 th century, English speakers changed the way they pronounced certain vowels. As with many large-scale language changes, the GVS occurred gradually, over about a century. These shifts in vowel pronunciation mark the biggest differences between Middle English and contemporary English. The sound clips above trace vowel pronunciation from Middle to present-day English.

Credit: Melinda J. Menzer, Furman University

Linguist Donald Ringe of the University of Pennsylvania and computer scientist Tandy Warnow of the University of Texas at Austin teamed up in 1993 to build statistical models that help explain how languages evolve. In some ways, language change parallels biological evolution. Many of today's languages descended from others—for example, Latin is the "ancestor" of French, Spanish and Italian. And languages, like species, diverge over time after communities separate. Biologists and linguists both use trees as models to represent evolutionary origins and branch points. But languages don't always change in a tree-like manner. Ringe and Warnow are developing new algorithms and computational methods for tracing the history of languages in a more precise way. Today, their research group includes statistician Steve Evans, from the University of California at Berkeley, and computer scientist Luay Nakhleh from Rice University. The team's software and tools will help researchers from a variety of fields, including anthropologists studying human migration patterns.

By Nicole Mahoney

More Special Reports ***Next: Endangered Languages***

Endangered Languages

As "globalization" increases, so does the loss of human languages. People find it easier to conduct business and communicate with those outside their own culture if they speak more widely used languages like Chinese, Hindi, English, Spanish or Russian. Children are not being educated in languages spoken by a limited number of people. As fewer people use local languages, they gradually die out.

Globalization and other factors speed language loss. Globalization is endangering languages, as people prefer to conduct business and communicate in widely used tongues like English, Chinese and Hindi. Public education, the Internet and print and television media also speed the rate of language loss.

Credit: Nicolle Rager Fuller, National Science Foundation

Ouma Katrina Esau, a N|u speaker (left), talks into a head-mounted microphone while holding an ultrasound probe in place. Linguist Johanna Brugman of Cornell University (right) monitors the video feed on an ultrasound laptop while adjusting the probe for a better image of Esau's tongue as translator Willem Damarah looks on. The tongue of a N|u speaker makes movements not found in most languages. The ultrasound video helps explain the role of tongue movement in language.

Why It Matters

At least 3,000 of the world's 6,000-7,000 languages (about 50 percent) are about to be lost. Why should we care? Here are several reasons.

- The enormous variety of these languages represents a vast, largely unmapped terrain on which linguists, cognitive scientists and philosophers can chart the full *capabilities—and limits—of the human mind*.
- Each endangered language embodies *unique local knowledge* of the cultures and natural systems in the region in which it is spoken.
- These languages are among our few sources of evidence for *understanding human history*.

Other Implications

Those who primarily speak one of the world's major languages may find it hard to understand what losing one's language can mean--and may even feel that the world would be better off if everyone spoke the same language. In fact, the requirement to speak one language is often associated with violence. Repressive governments forbid certain languages and cultural customs as a form of control. And conquered people resist assimilation by speaking their own

This represents a creative use of a tool designed for a different purpose. Originally created for medical use, to help pediatricians "look" at young hearts, the probe now helps linguists "look" at the tongue movements of rare languages.

Credit: Bonny Sands, Northern Arizona University

languages and practicing their own customs.

On the positive side, one language can enrich another—for example, by providing words and concepts not available in the other language. Most languages (including English) have borrowed words of all kinds. Learning another language often brings an appreciation of other cultures and people.

The study of endangered languages also has implications for cognitive science because languages help illuminate how the brain functions and how we learn. "We want to know what the diversity of languages tells us about the ways the brain stores and communicates experience," says Peg Barratt, NSF division director for behavioral and cognitive sciences. "Our focus is not just on recording examples of languages that are soon to disappear, but on understanding the grammars, vocabularies and structures of these languages."

Preserving While Documenting

Documentation is the key to preserving endangered languages. Linguists are trying to document as many as they can by describing grammars and structural features, by recording spoken language and by using computers to store this information for study by scholars. Many endangered languages are only spoken; no written texts exist. So it is important to act quickly in order to capture them before they go extinct.

To help preserve endangered languages, **E-MELD** (Electronic Metastructure for Endangered Language Data) aims to boost documentation by:

- duplicating and digitizing high-quality recordings in an archival form;
- emphasizing self-documenting and software-independent data;
- giving linguists a toolkit to analyze and compare languages;
- developing a General Ontology for Linguistic Description (GOLD) to allow interoperability of archives, and comparability of data and analysis.

In another kind of archiving, Joel Sherzer, Anthony Woodbury and Mark McFarland (University of Texas at Austin) are ensuring that Latin America's endangered languages are documented through The Archive of the Indigenous Languages of Latin America (AILLA). This Web-accessible database of audio and textual data features naturally–occurring discourse such as narratives, ceremonies, speeches, songs, poems and conversation. Using their Web browsers, scholars, students and indigenous people can access the database, search and browse the contents and download files using free software.

Documentation is the right thing to do for both cultural and scientific reasons. According to NSF program director Joan Maling, we must explore as many different languages as we can to fully understand this uniquely human capacity—"Language" with a capital L. "Just as biologists can learn only from looking at many different organisms, so linguists and language scientists can learn only from studying many different human languages," she says. "Preserving linguistic diversity through documentation is critical to the scientific study of language."

Related Links:

"Endangered Languages" - WAMU Interview with David Lightfoot, NSF Assistant Director for Social, Behavioral and Economic Sciences, March 7, 2007

"The Rosetta Project" -An online digital library of reference materials for all documented human languages

Wikepedia Definition

By Elizabeth Malone

More Special Reports ***Next: Dialects***

Dialects

What They Are

Vestor and Dorothy Mcgaha of Haywood County, North Carolina, explain some unique phrases of Appalachian English.

Credit: Neal Hutcheson

Different language communities have certain ways of talking that set them apart from others. Those differences may be thought of as dialects —not just accents (the way words are pronounced) but also grammar, vocabulary, syntax and common expressions. Often a group that is somewhat isolated regionally or socially from other groups will develop a characteristic dialect.

Many people wonder, "What's the difference between a language and a dialect?" There are no universally accepted criteria for distinguishing them, and the difference is often a matter of degree rather than of kind. The Dictionary of Linguistics defines dialect as a variety of a language used by people from a particular geographic area. Many historical linguists view every speech form as a dialect of the older medium from which it was developed; for example, modern Romance languages such as French and Italian developed from dialects of Latin. Other linguists point out the role of historical and political developments in the formation of a dialect

Regardless how one defines them, dialects are fascinating and relevant to the general study of language differences.

Why They Matter

Research in dialects helps scientists understand the fundamental principles that underlie language differences, language innovation and language variation in time and space. The research also helps the public understand language diversity and offers a new perspective on national debates associated with various dialects – for example, should people be encouraged to eliminate "nonstandard" ways of speaking?

Walt Wolfram of North Carolina State University helped launch the national awareness about the role of dialects in American society and education. Now he is conducting research on several dialects in North Carolina, including the Ocracoke brogue and African American Appalachian dialects.

For more about Wolfram and his research, see:
http://www.ncsu.edu/linguistics/bios/wolfram.htm
http://www.uga.edu/lsava/Wolfram/Wolfram.html

Researchers Walt Wolfram and Natalie Schilling-Estes interview Ocracoke resident Rex O'Neal about the changes taking place on the island over the past several generations.

Credit: Herman Lankford

Related Links:

Dictionary of American Regional English

PBS program "Do You Speak American?"

A National Map of the Regional Dialects of American English

Ernest Woods of Haywood County, North Carolina, stresses a point about Appalachian speech.

Credit: Neal Hutcheson

By Elizabeth Malone

Sign Languages

What They Are

Spelling NSF in sign language.

Credit: Photodisc

Sign (or signed) languages are principally used among members of what linguists call the "culturally deaf" communities. They rely on hand signs, facial expressions, body positions, motions and other physical signs (perhaps including mouthing the words) in order to communicate. By comparison, spoken language relies mostly on sounds on words.

Why They Matter

Why is the study of sign language important to linguistics? In general, it helps us understand the very nature of human language. Because they are so different from spoken languages, sign languages demonstrate at least two important properties of language.

- All languages share certain characteristics; for example, a hierarchy of morphemes (meaningful units of language, such as the final "s" that identifies plural words in in English), words, phrases, sentences and so on.
- All humans have the capacity to communicate via language.

Comparing signed to spoken languages is also instructive. In general, the grammar of sign languages—for example their allowable word orders—do not match those of neighboring spoken languages because of their independent development. However, contrary to what was (and is still sometimes) believed, sign languages share the richness and capacity of spoken languages. The late William Stokoe of Gallaudet College (later Gallaudet University) showed that American Sign Language meets the criteria to be classified a fully developed language, and changed conventional theory.

Because of the differences (as well as similarities), the study of sign languages is essential to understanding both the shared and the varied aspects of human language. It is also significant for developing second language programs that train sign language interpreters, and for instructors in deaf education programs.

Related Links:

Commentary on Stokoe

ASL Browser

By Elizabeth Malone

More Special Reports ***Next: Examples***

Sign Language >> Examples

Nicaraguan Sign Language

Nicaraguan Sign Language (NSL) arose in the early 1980s when hundreds of previously isolated deaf individuals were brought together in schools for the first time—the result of an educational reform movement dedicated to providing literacy training and a fourth-grade education to everyone. For virtually the first time, it became possible to directly observe the emergence of a new language.

Yuri Mejia, a student at the Escuelita de Bluefields school, signing “turtle” in Nicaraguan Sign Language.

Credit: Christina Gomez-Mira; courtesy of Nicaraguan Sign Language Projects, Inc.

A New Language Develops

This case is particularly interesting because this language arose not as the result of language contact or the creolization (merging) of previously existing languages, but rather from the merging of idiosyncratic gesture systems (called "home signs") that were used for communication within the immediate family by the first generation of deaf children to enter the schools. Home signers quickly began to share their idiosyncratic systems. Young children exposed to a mix of gesturing began to produce a communication form radically different from their input. The new form was more fluid, more complex and wholly language-like.

Yuri Mejia, a student at the Escuelita de Bluefields school, signing “friend” in Nicaraguan Sign Language.

Credit: Christina Gomez-Mira; courtesy of Nicaraguan Sign Language Projects, Inc.

With no coexisting signed languages and limited access to Spanish as a result of low literacy and the inability to hear, the only possible source of this highly complex linguistic structure is the human brains of those very young first language learners.

Over the course of 17 years, NSF-supported researcher Judy Kegl of the University of Southern Maine has generated an extensive archive of Nicaraguan Sign Language—including vocabulary and sentence structure. Her work has prompted a study of the entire population of signers in the region that will address questions about factors in sign fluency such as age and exposure to signing, the issue of critical mass (i.e., "How many gesturers does it take to make a language?”) and the process by which a language emerges.

Yuri Mejia, a student at the Escuelita de Bluefields, signing “drive” in Nicaraguan Sign Language..

Credit: Christina Gomez-Mira; courtesy of Nicaraguan Sign Language Projects, Inc.

American Sign Language

American Sign Language (ASL) has been a focus of NSF-sponsored research. For example, Ronnie B. Wilbur and Avinash C. Kak of Purdue University use a novel approach to the problem of automatic recognition, and eventually automatic translation, of ASL. The approach takes advantage of the fact that signs are composed of components (handshape, location, orientation, movement), in much the same way that words are composed of consonants and vowels.

The Wilbur-Kak project uniquely integrates several areas of basic research: linguistic research

on the structure of signs in ASL, psycholinguistic research on human perception of ASL and advanced techniques from statistical pattern recognition and computer vision. The long-term goal is an advanced machine translation device that would help signers interact with speakers in practical settings such as the workplace and classrooms.

Other ASL Projects

Sociolinguistics – Ceil Lucas of Gallaudet University is analyzing sociolinguistic variation in ASL. She is examining videotapes of conversational ASL as produced by deaf signers from different parts of the U.S. Studies of sociolinguistic variation are important because they inform our understanding of the fundamental nature of language and of how languages change.

Psycholinguistics - Karen Emmorey of San Diego State University is conducting the first experiments using head-mounted eye tracking technology to study the eye behaviors of ASL signers —including native signers and late learners. She will compare the eye gaze and eye movements of deaf and hearing subjects as they produce and perceive ASL.

Tactile ASL – Karen Petronio of Eastern Kentucky University is examining Tactile American Sign Language, a variety of ASL used primarily by deaf-blind adults who were born deaf and with a hereditary condition that causes a slow loss of vision. They used 'visual' ASL as their primary means of communication until loss of vision required them to switch to tactile.

Irish Sign Language

Barbara LeMaster of California State University, Long Beach conducts research on a rare and dying form of gendered Irish Sign Language (ISL) used in Dublin, Ireland. In one segment of the Dublin deaf community, the native vocabularies for women and men are so different that they can impair communication on the most mundane topics. For example, men and women have different signs for everyday terms, such as 'cat,' 'Monday,' 'night' and 'red.' These varieties emerged from sex-segregated education at two residential schools for the deaf in Dublin.

Researchers want to document these differences for several reasons.

- No documented language, whether spoken or signed, has as extreme gender differences as this one.
- Unlike other gender different situations, these gender varieties are the product of language socialization experiences that completely segregated females and males—as though deaf girls and boys grew up on separate islands.
- This research provides foundational data for the future production of a dictionary of gendered ISL, and for any current and future work tracking the dissemination of these gendered signs, and their meanings, over time.

By Elizabeth Malone

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National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA Tel:

(703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749