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TEXT 01

COMMUNICATION
AMONG BACTERIA

Do bacteria have a language? Do they communicate with each other? Stephen Anderson, a professor of linguistics at Yale University, thinks so. One of his many research interests is the communication abilities of nonhuman animals, an interest that led him to write *Dr. Dolittle's Delusion*. Remember the story of Dr. Dolittle, who could talk to the animals? Well, in this book, Anderson examines a variety of animal communication systems and concludes that animals communicate like humans. In the excerpt below, he explains how bacteria communicate with other bacteria. How does this support or challenge your thinking about whether human language makes us different?

Communication is virtually universal among living things. Even bacteria communicate. Some classes of bacteria secrete distinctive organic molecules, for which they have specialized receptors. This apparatus allows the bacteria to detect the presence of others of the same species, a system known in the literature as quorum sensing. "Bacteria, it turns out, are like bullies who will not fight unless they are backed up by their gang. An attack by a small number of bacteria would only alert the host's immune system to knock them out. So bacteria try to stay under the radar until their numbers are enough to fight the immune system." The molecules secreted by one bacterium serve to communicate its presence to the others.

Source: Stephen Anderson, *Dr. Dolittle's Delusion: Animals and the Uniqueness of Human Language* (New Haven: Yale UP, 2004) 16, 20. Quotation from Andrew Pollock, "Drug Makers Listen In While Bacteria Talk," *New York Times*, February 27, 2001.

TEXT 02

HONEYBEE COMMUNICATION

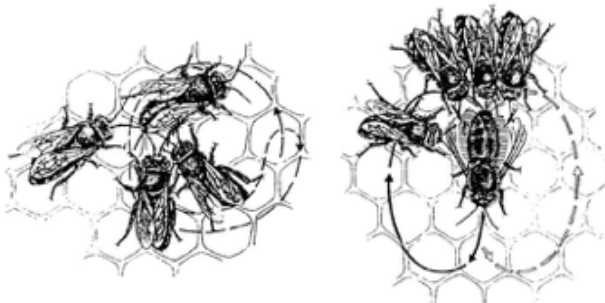
Did you know that bees communicate the location of pollen to other bees in the hive by dancing? By orienting their dance in relation to the position of the Sun, and by calibrating the amount of the dance's movement, bees that have found this basic necessity can tell the rest of the hive exactly where it is. This should be seen and so we provide this link to a three-minute video.

<http://www.youtube.com/watch?v=4NtegAOQpSs&feature=fvwrel>

The system of communication bees use was discovered over 70 years ago by Karl von Frisch, an Austrian zoologist. He saw that honeybees use two different dances — a circle dance and tail-wagging dance — to tell other bees where to find food. His discovery of bee “language” is one of the great achievements in biology in the 20th century. Von Frisch opened our eyes to the sophistication and complexity of animal communication. In 1973 he won the Nobel Prize for his contributions to science.

Von Frisch included the pictures below in his Nobel Prize speech.

If pollen is close to the hive, the bees move in a circle (shown on the left, below), which von Frisch called the round dance. And if the pollen is farther away, they use what he called the tail-wagging dance, moving in a figure eight and wagging their tails (shown on the right, below).



A. Round Dance

B. Tail-wagging dance

The tail-wagging dance tells how far and also in what direction the food is from the hive. The dance consists of two loops with a straight run in the middle. The direction of the straight run indicates the direction of the food in relation to the Sun. The distance is communicated by the duration of the straight run and the number of tail-wags.

If food lies in the same direction as the Sun, the foraging bee dances straight up the wall of the hive (like the figure below, left). If it lies in the opposite direction of the Sun, the bee dances straight down.

If food lies to the left of the Sun's position, the bee dances at the appropriate angle to the left (below, right). What is quite amazing is that the dance is done in the dark hive and, of course, the angle of the Sun is constantly changing.



Source: Information taken from Karl von Frisch, “Decoding the Language of the Bee: Nobel Lecture, December 12, 1973,” in *Nobel Lectures, Physiology or Medicine 1971–1980*, ed. Jon Lindsten (Singapore: World Scientific Publishing Co., 1992), 78, 79.

TEXT 03

BIRD CALLS AND SONGS

We all know birds call out and sing lovely songs. However, do their calls or songs mean anything to other birds? Do bird calls or songs communicate anything to other birds?

Edward Vajda, a professor Russian language and linguistics at Western Washington University, has created this handout on bird communication to help his linguistics students understand how animal communication compares with human language. How does this information help you with your investigation?

Birds have two types of sound signals: calls and songs.

Bird calls consist of one or more short notes. These calls seem to be instinctive responses to danger, nesting, flocking, and a few other basic situations.

The English sparrow has three flight calls. One call is used just before takeoff. Another call is used during flight. And one call is used just before landing at a nesting site.

Sparrows have two types of danger calls. One call is used to announce that a predator is nearby, like an owl in a tree. The other call is used to announce that a predator is soaring overhead. These calls seem intended to coordinate group activity in specific situations. The meanings of these signs constitute a small, finite set that can't be increased. And bird calls cannot be done differently to produce variations of meaning.

Bird songs are used primarily by males to attract mates or to establish territory. Bird songs are limited to these and only these functions. Bird songs are longer than bird calls. But, like calls, they can't be varied and cannot be rearranged to produce new songs.

Source: Adapted from a document created by Edward Vajda, *Animal Systems of Communication II*, Course Materials: Linguistics 201, Western Washington University. Accessed 9 July 2012. http://pandora.cii.wvu.edu/vajda/ling201/test1materials/animal_communication.htm.

TEXT 04

THE CASE OF ALEX THE PARROT

The case of Alex the Parrot provides one of our most interesting cases of animal communication. Most parrots can make sounds that resemble words or sentences to us,

but there is little evidence that these mean for the bird what they mean for us. However, Alex seemed to be different. Alex used many words for colors, object, numbers, and shapes to communicate with people. A psychologist named Irene Pepperberg worked with Alex until he died at age 31 in 2007. Many newspapers covered Alex's death in an obituary, just as they do with famous people. We took the following information about Alex from an obituary that appeared in the magazine *The Economist*.



The last time Irene Pepperberg saw Alex she said goodnight as usual. "You be good," said Alex. "I love you." "I love you, too." "You'll be in tomorrow?" "Yes, I'll be in tomorrow." But Alex died in his cage that night, bringing to an end a life spent learning complex tasks that, it had been originally thought, only primates could master.

Alex, unlike any chimpanzee, learned to speak words easily. The question was, was Alex merely parroting Dr. Pepperberg? Do parrots actually understand what they are saying?

Dr. Pepperberg thought so. Using a training technique now employed on children, Dr. Pepperberg and her collaborators at the University of Arizona began teaching Alex how to describe things, how to make his desires known, and even how to ask questions.

By the end, said Dr. Pepperberg, Alex had the intelligence of a 5-year-old child and had not reached his full potential. He had a vocabulary of 150 words. He knew the names of 50 objects. He could describe their colors, their shapes, and the materials they were made from. He could answer questions about objects' properties. He could ask for things — and would reject an offered item and ask again if it was not what he wanted. He understood, and could discuss, the concepts of "bigger," "smaller," "same," and "different." And he could count up to six, including the number zero. He even knew when and how to apologize if he annoyed Dr. Pepperberg or her collaborators.

There are still a few researchers who think Alex's skills were the result of rote learning rather than abstract thought. Alex, though, convinced many people that birds as well as mammals can evolve complex and sophisticated cognition, and communicate the results to others

Source: Obituary: "Alex the African Grey," *The Economist* September 20, 2007. <http://www.economist.com/node/9828615>

TEXT 05

CHIMPANZEE
COMMUNICATION

Many people think that chimpanzees are the animals most likely to have a system of communication like that of humans. Do they? Jane Goodall has studied chimpanzees at the Gombe Stream National Reservation in Tanzania for more than 40 years. Her numerous books and articles on chimpanzee behavior have revolutionized the human understanding of chimps and forced scholars to rethink many long-held views on the uniqueness of humans in the animal world. In the excerpt below she talks about chimpanzee communication.

Sometimes, when watching chimpanzees, I have felt that, because they have no human-like language, they are trapped within themselves. Their calls, postures and gestures, together, add up to a rich repertoire, a complex and sophisticated method of communication. But it is non-verbal. How much more might they accomplish if they could talk to each other. It is true that they can be taught to use the signs or symbols of a human-type language. And they have cognitive skills to combine these signs or symbols into meaningful sentences. Mentally, at least, it would seem that chimpanzees stand at the threshold of language acquisition. But those forces that were at work when humans began to speak have obviously played no role in shaping chimpanzee intellect in this direction.

Source: Jane Goodall, *Through a Window: My Thirty Years with the Chimpanzees of Gombe* (Boston: Houghton Mifflin, 1990) 208.

TEXT 06

LANGUAGE DEVELOPMENT IN CHIMPANZEES AND HUMAN CHILDREN

In the Planet of the Apes movies, apes and chimpanzees can talk. In the real world, apes and chimps can't talk. They have thinner tongues and a higher vocal box than people, which makes it hard for them to pronounce vowel sounds. However, people have still tried to teach chimps language, typically using sign language that doesn't require any sounds. Below is a chart of some of the most important attempts to teach chimps language, followed by a chart on typical language growth in human children.

Language Development of Some Famous Chimpanzees and Apes

Name	Details	Language Development
Washoe	<ul style="list-style-type: none"> Chimpanzee Born in 1965 Died in 2007 	<ul style="list-style-type: none"> Learned about 250 American Sign Language signs. Made simple sentences, such as "Gimmie sweet" and "You me go out hurry" Some researchers claimed Washoe had learned to "talk" to people using these sentences Others claimed Washoe was signing only to get rewards and was not really talking to people
Nim Chimpsky	<ul style="list-style-type: none"> Born in 1973 Died in 2000 <i>Project Nim</i> is a movie about Nim. 	<ul style="list-style-type: none"> Learned 125 ASI signs His trainers concluded that he did not learn language, but only imitated their signs to get rewards
Chantek	<ul style="list-style-type: none"> Orangutan Born in 1977 Now lives at Zoo Atlanta 	<ul style="list-style-type: none"> Learned 150 ASL signs Understands spoken English and ASL Recognizes himself in a mirror
Koko	<ul style="list-style-type: none"> Gorilla Born July 4, 1971 Now lives at the Gorilla Foundation in Hawaii. 	<ul style="list-style-type: none"> Learned about 1,000 ASL signs Understands about 2,000 spoken English words According to the Gorilla Foundation, Koko's IQ is somewhere between 70 and 95 (the average human IQ is 100)
Kanzi	<ul style="list-style-type: none"> Bonobo Born 1989 Lives at Great Ape Trust in Iowa Has appeared on TV including <i>The Oprah Winfrey Show</i> 	<ul style="list-style-type: none"> Understands spoken English and can use different combinations of close to 400 symbols, called lexigrams, to communicate Follows rules of grammar to make sentences An accomplished maker of stone tools

Source: Modified from <http://blogs.smithsonianmag.com/science/2011/08/six-talking-apes/> Guy Deutscher, *The Unfolding of Language: An Evolutionary Tour of Mankind's Greatest Invention* (New York: Henry Holt and Co., 2005) Kindle edition.

Typical Language Development of Human Children

By age 1	<ul style="list-style-type: none"> • Understands 20–50 words • Can speak about 3–50 words besides “mama” and “dada” • Understands simple instructions • Recognizes symbols for objects, such as cars, cats, and dogs
By age 2	<ul style="list-style-type: none"> • 150–300-word vocabulary • Makes 2-word sentences such as “daddy bye-bye.” • Uses words such as “more” • Can points to toes, eyes, nose • Learns a few new words each week
By age 3	<ul style="list-style-type: none"> • 900–1,000-word vocabulary • Creates 2–3-word sentences such as “Mommy go” • Uses possessives and the plural form of nouns • Carries on conversation with other children, adults, and him/herself • Asks questions such as “What’s that?” • Understands simple time concepts, such as “last night” and “tomorrow”
By age 4	<ul style="list-style-type: none"> • 1,500-word vocabulary • Creates sentences of 4–5 words • Can retell stories and recent past events • Understands words like “yesterday,” “summer,” “lunchtime,” “tonight,” “little,” and “big” • Knows own last name, name of street he/she lives on • Can use words to “make believe”
By age 5	<ul style="list-style-type: none"> • 2,000-word vocabulary • Uses past tense correctly • Can talk about feelings • Follows three-step commands • Can play simple games with rules • Asks many questions, such as “Who?” and “Why?”
By age 6	<ul style="list-style-type: none"> • Can use over 2,300 words • Can understand 20,000–24,000 words • Makes 5–6-word sentences • Knows spatial relations, such as “on top,” “behind,” “far,” and “near” • Identifies coins, such as pennies, nickels, and dimes • Understands concepts such as “same” and “different” and “left” and “right” • Uses complex and compound sentences, such as “Let’s go to the store after we eat”

Sources:

Nicole Lilenthal, *Typical Speech and Language Development* (Speech-Language Pathology Information, 2008). <http://www.speechpathologyguru.com/typical-speech-and-language-development-a11/>

Stephen A. Stahl, *Vocabulary Development* (Brookline, MA: Brookline Books, 1999).

Nicole Sax and Erin Weston, *Language Development Milestones*, master’s dissertation, University of Alberta, 2007. <http://www.rehabmed.ualberta.ca/spa/phonology/milestones.pdf>

TEXT 07

KANZI'S SYSTEM OF COMMUNICATION

Kanzi, a bonobo chimpanzee, has become quite famous. He has appeared on television and been on the cover of many magazines because of his ability to communicate. This article about him was written by Paul Raffaele for *Smithsonian* magazine in 2006.

Raffaele is a journalist who has covered much of the world for the Smithsonian Museum and Reader's Digest. He has written two books about his adventures: *The Last Tribes on Earth: Journeys Among the World's Most Threatened Cultures* and *Among the Cannibals: Adventures on the Trail of Man's Darkest Ritual*.

I traveled to Iowa, to meet Kanzi, a 26-year-old male bonobo reputedly able to converse with humans. When Kanzi was an infant, American psychologist Sue Savage-Rumbaugh tried to teach his mother to communicate using a keyboard labeled with geometric symbols. Kanzi's mother never really got the hang of it, but Kanzi picked up the language. First Kanzi used 6 symbols, then 18, finally 348. The symbols refer to familiar objects (yogurt, key, tummy, bowl), favored activities (chase, tickle), and even some concepts considered fairly abstract (now, bad). Kanzi learned to combine these symbols in regular ways. Once, Savage-Rumbaugh said, on a trip to the woods Kanzi touched the symbols for marshmallow and fire. Given matches and marshmallows, Kanzi snapped twigs for a fire, lit them with the matches, and toasted the marshmallows on a stick.

Savage-Rumbaugh claims that Kanzi knows the meaning of up to 3,000 spoken English words. She says Kanzi also understands words that aren't a part of his keyboard vocabulary; she says he can respond appropriately to commands such as "put the soap in the water" or "carry the TV outdoors."

About a year ago, Kanzi and his sister, mother, nephew, and four other bonobos moved into a \$10 million, 18-room house and laboratory complex at the Great Ape Trust near Des Moines. Kanzi and the other bonobos spend evenings sprawled on the floor, snacking on M&M's, blueberries, onions, and celery, as they choose DVDs to watch. Their favorites DVDs star apes and other creatures friendly with humans.

Savage-Rumbaugh has been testing the bonobos' ability to express their thoughts vocally. In one experiment, she placed Kanzi and his sister in separate rooms where they could hear but not see each other. Savage-Rumbaugh explained to Kanzi that he would be given yogurt. He was then asked to communicate this information to his sister. Kanzi vocalized, then his sister vocalized in return and selected "yogurt" on the keyboard in front of her.

With these and other ape-language experiments, says Savage-Rumbaugh, the mythology of human uniqueness is coming under challenge. If apes can learn language, which we once thought unique to humans, then it suggests that ability is not innate in just us.

But many people argue that these bonobos are simply very skilled at getting what they want and their abilities do not constitute language. "I do not believe that there has ever been an example anywhere of a nonhuman expressing an opinion, or asking a question. Not ever," says Geoffrey Pullum, a language specialist at the University of California at Santa Cruz. "It would be wonderful if animals could say things about the world, as opposed to just signaling a direct emotional state or need. But they just don't."

Source: Modified from Paul Raffaele, "Speaking Bonobo," *Smithsonian* magazine, November 2006. <http://www.smithsonianmag.com/science-nature/speakingbonobo.html>

TEXT 08

THE FLEXIBILITY OF HUMAN LANGUAGE

Human languages are flexible. With our words we can make an almost limitless number of sentences. And people seem to make new words when the old ones won't do. In what follows, Stephen Pinker, a professor of psychology at Harvard University and author of many books on language, writes about the number of sentences possible in English. We also provide a few examples of "new words" added in 2012 and 2011 to the Merriam-Webster's Collegiate Dictionary.

Go into the Library of Congress and pick a sentence at random from any book. Chances are you would fail to find an exact repetition no matter how long you continued to search. Estimates of the number of sentences that an ordinary person is capable of producing are breathtaking. If a speaker is interrupted at a random point in a sentence, there are on average about ten different words that could be inserted at that point to continue the sentence in a grammatical and meaningful way. Let's assume that a person is capable of producing sentences up to twenty words long. Therefore the number of sentences that a speaker can deal with in principle is at least 10²⁰ (a one with twenty zeroes after it, or a hundred million trillion). At a rate of five seconds a sentence, a person would need a childhood of about a hundred trillion years (with no time for eating or sleeping) to memorize them all.

New Words Added to the Merriam-Webster's Collegiate Dictionary in 2011 & 2012

2012		2011	
aha moment	gassed	Americana	helicopter parent
bucket list	gastropub	boomerang child	m-commerce
cloud computing	man cave	bromance	robocall
earworm	mash-up	continuous positive	social media
energy drink game changer	systemic risk	airway pressure	tweet
	underwater	crowdsourcing	walk-off
		fist bump	

Sources:

Adapted with minor modifications from Stephen Pinker, *The Language Instinct* (New York: William Morrow and Co., 1994) 85–86.

<http://www.merriam-webster.com/info/newwords11.htm>

<http://www.merriam-webster.com/info/newwords12.htm>

TEXT 09

HUMAN LANGUAGE IS DIFFERENT FROM ANIMAL COMMUNICATION

Is human language different? James R. Hurford thinks so. He was a professor of general linguistics at the University of Edinburgh in Scotland. He is the author of several important books on linguistics and how language has evolved. In this excerpt, he argues that there is a difference between system of communication and human language. Do you agree with him? Do any of the documents support his claims? Do any challenge his claims?

Human language is different from animal communication systems in at least two ways. Human languages contain tens of thousands of arbitrary learned symbols, mainly words. No other animal communication system involves learning all the symbols in each individual's lifetime, and certainly not in such vast numbers.

Human language also has complex syntax. The meanings of our sentences are composed from the meanings of the parts (that is words). This is obvious to us but no other animal communication system (with honeybees as an exception) puts messages together in this way.

It does not make sense to confuse language with communication. Almost all species communicate in some way, but this does not mean they have language. To apply the term "language" to the communication of honeybees, or of monkeys, or whales, is to miss an important difference.

Human vocabularies are completely learned, in the early lifetimes of individuals. The calls of monkeys or of chickens seem to be innate.

None of this conflicts with the well-known fact that animals are able to learn small sets of signs. The most celebrated trained apes, Kanzi and Nim, have been able to acquire vocabularies of several hundred items. Pets can be trained to respond to human words. Yet, humans learn tens of thousands of words within a few years, at some times up to about 20 new items per day.

Source: Modified from: James R. Hurford, "Human Uniqueness, Learned Symbols and Recursive Thought," *European Review* 12, no. 4 (2004): 551–65.