Excerpts from Haskins Lab Pamphlet 2020

The Science of the Spoken and Written Word.

Talking and understanding what others say comes naturally to every healthy child. Children rapidly learn to speak and understand others, and can do so with no formal training. Literacy is a very different matter. Many individuals as well as entire societies do not read or write. Although most people take language for granted, understanding the nature of speech and its relationship to literacy is anything but simple. How do we acquire, produce, and understand speech, which is our birthright by biological evolution? How do we achieve literacy, which is a cultural artifact? What bridges these dual domains of language? Exploring such questions opens a window on the inner workings of the mind.

Answering these fascinating questions is of more than scientific interest to those who cannot take language for granted. 1

Disorders, disease, and trauma impair some people's ability to speak and/or understand the speech of others. Disabilities and inadequate education prevent many more from learning to read and write. The science of the spoken and the written word promises to help these people participate more fully in their humanity and our society.

Haskins Laboratories has been at the forefront of this research for seventy years. It is the nation's leading independent, multidisciplinary community of scientists studying speech, language, and reading. Its theoretical and technological breakthroughs are continually advancing the science of the spoken and the written word, and the practical applications of its discoveries are improving human communication.

Birds, bees, and even poorly educated fleas communicate with each other by song, flight-dance, or the twitch of antennae, but only humans possess the gift and the power of language. Speaking comes almost as naturally to us as breathing. Indeed, that's in part what it is: modulating the air we exhale from our lungs with our larynx, palate, jaw, tongue, and lips to form vowels and consonants. Speech is so integral to our identity that it may have emerged simultaneously with the origin of *Homo sapiens* some 200,000 years ago or even earlier, when an upright ancestor emitted a sound more potentially meaningful than a chimpanzee's grunt.

Healthy infants typically start babbling at six to eight months and begin to utter words at twelve to fifteen months, sentences a few months later. In a child's third year, these sentences become fluent. Six-year-olds know an average of 13,000 words. By the time we graduate from high school, our vocabularies have burgeoned to approximately 60,000 words.

As inevitably as we acquire our native language, we lose the capacity to master another one easily. By the age of ten to twelve months, infants' ability to distinguish some sounds that are not salient in the language spoken around them begins to diminish. A Japanese baby, for instance, no longer registers the difference between English's "l"s and "r"s. By puberty, our brains have lost the plasticity that would enable us to speak a foreign language without a telltale accent.

Where in the cerebral cortex is our language facility concentrated? A critical region for language is clustered around the Sylvian fissure in the left hemisphere of most people's brains (including those of a majority of left-handed people), which is why most of us perceive speech a few milliseconds earlier and more accurately

through our right ear (which is connected to the left hemisphere), while many people hear music more acutely through their left ear.

Functional Magnetic Resonance Imaging (fMRI) usually reveals a flush of activity in the left hemisphere when people read or converse. One of the fascinations of speech for many scientists (and non-scientists as well) is that it opens a window on what goes on inside our heads.

“Personally,” wrote Noam Chomsky, the father of modern linguistics,“I am primarily intrigued by the possibility of learning something, from the study of language, that will bring to light inherent properties of the human mind.”

The basic building blocks of speech are phonemes. The ”b,” short “a,” and “g” that form the word “bag,” for example, are phonemes. A change in a phoneme can create a meaning change (“rag,” “bog,” “bat”). English consists of about four dozen such phonemes. In contrast, the American Indian language Mura has 11 phonemes. The click language XuÚ! has 141.

It has proven very difficult to reduce phonemes to acoustic properties, as evidenced by the difficulty that computer scientists have experienced in creating useful speech recognition systems. Moreover, there is evidence that phonemes consist of more than sounds. If you listen through headphones to a voice saying “ba” as you watch a video of a face saying “da,” the visual information trumps the acoustic information and you hear “da.” This phenomenon is called the “McGurk effect” after one of its discoverers, Harry McGurk.

Words are even more confounding than the syllables that compose them. Harvard psychologist and bestselling author Steven Pinker writes, “In the speech sound wave, one word runs into the next

seamlessly; there are no little silences between spoken words the way there are white spaces between written words."

Research conducted at Haskins Laboratories over seventy years has convinced scientists in many disciplines to consider the sounds and words that constitute speech not as discrete, disembodied acoustical entities

but, rather, as physical events or gestures, the overlapping actions of our larynx, palate, tongue, jaw, and lips. Speech is a complex neurological and physiological system. Understanding the system of speech can help us synthesize, recognize, and improve it.

Writing makes speech visible. Although it is based on the spoken word, it consists of symbols rather than actions. Many of these symbols originated in pictographs. Turn the letter "A" upside down and you can still make out an ox head; it takes a little more imagination to discern the tent flap in a "D." But the letters in written languages became symbols of sounds: phonemes in English and Finnish, entire syllables in Mayan and Japanese, a combination of both in Korean.

The written word appeared much later than the spoken word. The earliest known script, the cuneiform that the Sumerians incised on clay tablets, is only 4,000 to 5,000 years old. Borrowing characters from the Phoenicians, the ancient Greeks created the first fully alphabetic system of writing, memorialized in the very word, "alphabet" (alpha, beta...).

The relatively recent invention of written languages and the abundance of non-literate societies and individuals indicate that reading is not a biological, evolutionary imperative, like speech, but a cultural acquisition. We don't go to school to learn to talk,

but some kind of education is necessary to grasp that the letters in our alphabet approximate phonemes and that b-a-g spells “bag.” Some people do not learn this lesson easily because they suffer from dyslexia or other learning disabilities, poor teaching, or both.

At Haskins Laboratories, psychology, physiology, linguistics, neuroscience, cognitive science, and computer science are illuminating the connections (and disconnections) between the spoken and the written word.

Sophisticated behavioral research, imaging technologies that peer inside the brain, and computer models that simulate mental and physiological activities are enabling researchers to make spectacular advances in the science of the spoken and the written word. Haskins Laboratories is on the forefront of this exciting field, deepening our understanding of humanity and civilization and helping people to participate more fully in both.

TEACHING READING IS ROCKET SCIENCE

One of her mentors at Haskins, the late Dr. Isabelle Liberman, “cared passionately about reading instruction and remedi- ation,” Dr. Brady explains. “She wanted research to impinge on practice. In turn, I have long felt a dual responsibility to conduct research on reading and to see that insights from research reach the classroom.” For Dr. Brady there was also a “personal hook.” Her younger brother, who eventually became an engineer without attending college, is dyslexic. “I watched him have a difficult time in school learning to read, and spelling is still a challenge.”

Early Reading Success helped teachers develop students’ ability to recognize that spoken words consist of phonemic segments and to

identify the phonemes in spoken words and syllables. Such phoneme awareness is necessary for understanding what the letters in the alphabet stand for and is an essential component of preparation for learning to read. In its very first year, Early Reading Success raised from 30 to 50 percent the proportion of children in participating schools who entered first grade meeting the benchmark for requisite early reading skills. “One of the things we have to overcome is low expectations for poor children,” Dr. Brady says. “Another is the belief that kindergarten should not have academic goals; it is critical to give students the foundation they need for learning to read.”

The concept of phoneme awareness, pioneered at Haskins, is a major contribution to education. Dr. Reid Lyon at the National Institute of Child Health and Human Development calls the discovery of phoneme awareness “a national and even international accomplishment that has literally saved children’s lives.”

The Haskins reading program is educating the scientists involved as well as teachers and schoolchildren. “Working with our team of mentors in the schools, our understanding of what teaching reading requires keeps growing,” says Dr. Brady, who believes it is more complex than most advocates of whole language instruction on the one hand or of traditional phonics on the other hand realize. “Our approach entails phoneme awareness, phonics, fluency, vocabulary development, and comprehension. Teaching reading is rocket science,” she says, quoting a colleague, Dr. Louisa Moats. “Every year I’m learning more about reading development and teaching reading. This shapes research questions. The cross-talk between research and teaching benefits both sides.”

Building on ERS, Dr. Brady, together with Dr. Margie Gillis, has undertaken a larger project Mastering Reading Instruction. Funded

by the U.S. Department of Education's Institute of Education Science, they are carefully comparing methods of professional development to determine the key elements for training first-grade teachers to be expert at teaching children to read. "Given the low reading achievement of more than a third of the elementary students in the U.S.," Dr. Brady says, "it is crucial to determine how to give teachers the knowledge and skills they need to help all children learn to read adequately.

The discovery of phoneme awareness is 'a national and even international accomplishment that has literally saved children's lives.'

"I make my pilgrimage to Haskins at least twice a year," says Dr. Ram Frost, who comes all the way from Jerusalem, where he is a Professor of Psychology at Hebrew University and heads the Laboratory for Verbal Information Processing.

As a postdoctoral fellow at Haskins Laboratories, the Israeli scientist conducted landmark research in how the disparate writing systems of English, Hebrew, and Serbo-Croatian affect the way people read and write. His findings suggested that reading English, whose letters represent phonemes, Hebrew, whose letters typically represent syllables but seldom specify vowels, and Serbo-Croatian, which is highly unusual because many speakers use both the Cyrillic and Roman alphabets, requires different cognitive strategies and therefore different instructional methods. Now Dr. Frost is extendinghis investigations to Arabic, as well.

Dr. Frost considers his laboratory "an auxiliary lab of Haskins in some senses," and it facilitates Haskins scientists' research in Semitic languages such as Hebrew and Arabic. "Haskins people

travel to other labs around the world to do research," he says. "The exchange is bidirectional, and this multinational web is unique to Haskins."

Don't just take Dr. Frost's word for this. Gordon Ramsay, a British electronic engineer and computer scientist, came to Haskins as a Research Associate after working at l'Institut de la Communication Parlée in Grenoble, France. "There's a constant flow of people coming through Haskins," says Ramsay, "and they travel enormous distances to come here. People don't do that at other labs. Haskins has an enormous amount of intellectual credit abroad. For me, coming here is wonderful because I think it's the best lab in the world."

Dr. Frost's work is a prime example of Haskins's international impact. Deploring the "total chaos in reading results" in Israeli schools, he fought "a lonely fight" against the Ministry of Education that he eventually won. Parliament formed a committee on which he served, and subsequently he headed a task force that revised all the materials for reading instructions in primary schools. "In two years the entire system of teaching reading in Israel has changed," he says. "I managed to import to Israel the revolution we saw in America." In this revolution as in so much else, Haskins Laboratories has played an influential role.

Googel it

Wikipedia

https://en.wikipedia.org/wiki/Haskins_Laboratories