Language use is simpler than previously thought

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(Phys.org)—For more than 50 years, language scientists have assumed that sentence structure is fundamentally hierarchical, made up of small parts in turn made of smaller parts, like Russian nesting dolls.

A new Cornell study suggests language use is simpler than they had thought.

Co-author Morten Christiansen, Cornell professor of psychology and co-director of the Cornell Cognitive Science Program, and his colleagues say that language is actually based on simpler sequential structures, like clusters of beads on a string.

"What we're suggesting is that the language system deals with words by grouping them into little clumps that are then associated with meaning," he said.

Sentences are made up of such word clumps, or "constructions," that are understood when arranged in a particular order. For example, the word sequence "bread and butter" might be represented as a construction, whereas the reverse sequence of words ("butter and bread") would likely not.

The sequence concept has simplicity on its side; language is naturally sequential, given the temporal cues that help us understand and be understood as we use language. Moreover, the hierarchy concept doesn't take into account the many other cues that help convey meaning, such as

the setting and knowing what was said before and the speaker's intention.

The researchers drew on evidence in language-related fields from psycholinguistics to cognitive neuroscience. For example, research in evolutionary biology indicates that humans acquired language (and animals did not) because we have evolved abilities in a number of areas, such as being able to correctly guess others' intentions and learn a large number of sounds that we then relate to meaning to create words. In contrast, the hierarchy concept suggests humans have language thanks only to highly specialized "hardware" in the brain, which neuroscientists have yet to find.

Research in cognitive neuroscience shows that the same set of brain regions seem to be involved in both sequential learning and language, suggesting that language is processed sequentially. And several recent psycholinguistic studies have shown that how well adults and children perform on a sequence learning task strongly predicts how well they can process the deluge of words that come at us in rapid succession when we're listening to someone speak. "The better you are at dealing with sequences, the easier it is for you to comprehend language," Christiansen said.

The study by Christiansen and his colleagues has important implications for several language-related fields. From an evolutionary perspective, it could help close what has been seen as a large gap between the communications systems of humans and other nonhuman primates. "This research allows us a better understanding of our place in nature, in that we can tie our language ability, our communication abilities, more closely to what we can see in other species. It could have a big impact in terms of allowing us to think in more humble terms about the origin of language in humans," Christiansen said.

The research could also affect natural language processing, the area of

computer science that deals with human language, by encouraging scholars to focus on sequential structure when trying to create humanlike speech and other types of language processing, Christiansen said. He pointed out that machines already successfully perform such tasks as translation and speech recognition thanks to algorithms based on sequential structures.

The study, "How hierarchical is [language](#) use?" was published Sept. 12 in the *Proceedings of the Royal Society B: Biological Sciences.*

More information: The study, "How hierarchical is language use?" was published Sept. 12 in the Proceedings of the Royal Society B: Biological Sciences ([bit.ly/RUGa7E](#)).

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