Symptoms previously considered 'defective' in patients with language disorder may actually be adaptive

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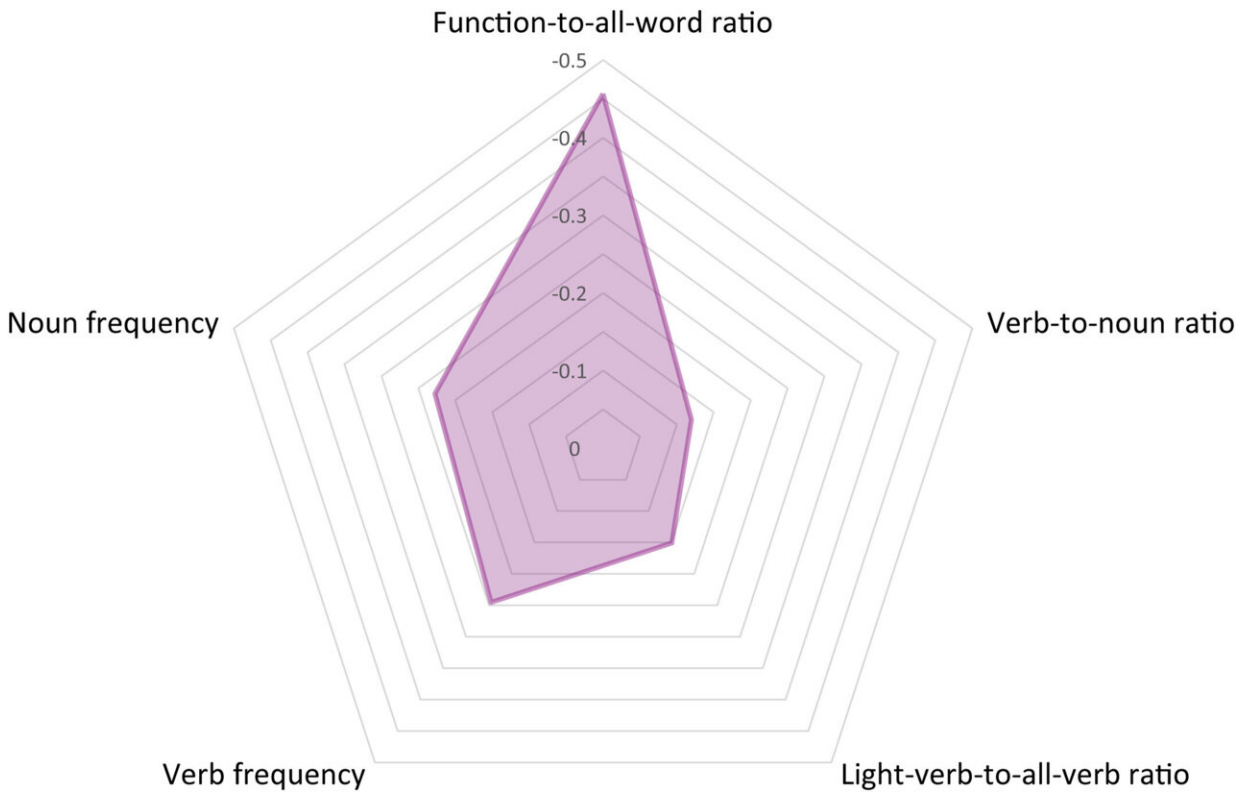

The radar chart shows the absolute value of the coefficient of the repeated measures correlation between surprisal and various word-level features at the sentence level in the written and spoken samples of nonfluent primary progressive aphasia patients. Credit: *Annals of Neurology* (2023). DOI: 10.1002/ana.26744

Individuals with a language disorder called non-fluent aphasia—which may result from a stroke, head injury, or neurodegeneration find it difficult to speak in complex sentences, and they have various word-level abnormalities, including using fewer verbs and fewer function words such as pronouns and prepositions.

Experts have presumed that these symptoms result from a brain deficit in language processing, but a new study led by investigators at Massachusetts General Hospital (MGH) refutes this theory. The findings, which are published in the *Annals of Neurology*, suggest that the features of non-fluent aphasia are part of a compensation strategy to sustain sentence information.

After experiencing a brain injury or lesion, an individual may develop symptoms that are directly caused by the injury itself or are the result of the brain's adaptive response to deficits from the injury. Differentiating adaptive from defective symptoms can help clinicians avoid targeting the wrong symptoms in rehabilitative care and better understand the mechanisms behind a patient's condition.

To determine the basis of the symptoms of non-fluent aphasia, investigators analyzed spoken and written samples from individuals with and without the condition. Participants were asked to look at a drawing of a family at a picnic and describe it using as many complete sentences as possible.

Using methods including artificial intelligence, the researchers found that because patients with non-fluent aphasia have difficulty using complex sentences, they compensate by choosing semantically richer and more informative words in their structurally simple sentences to sustain sentence information.

"This research offers a foundational shift in how we interpret symptoms

of non-fluent aphasia," says lead author Neguine Rezaii, MD, an assistant in Neurology at MGH and an instructor in Neurology at Harvard Medical School.

The work also indicates a need for revisions in the treatment of non-fluent aphasia to place the focus on promoting the use of informative words.

"The goal would be to strengthen the same adaptive strategy patients are already using," says Rezaai. "Artificial intelligence can help identify most informative words given the preceding context. These word suggestions might help patients be even more informative and also gain more confidence in their word selection."

More information: Neguine Rezaii et al, Measuring Sentence Information via Surprisal: Theoretical and Clinical Implications in Nonfluent Aphasia, *Annals of Neurology* (2023). DOI: 10.1002/ana.26744

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