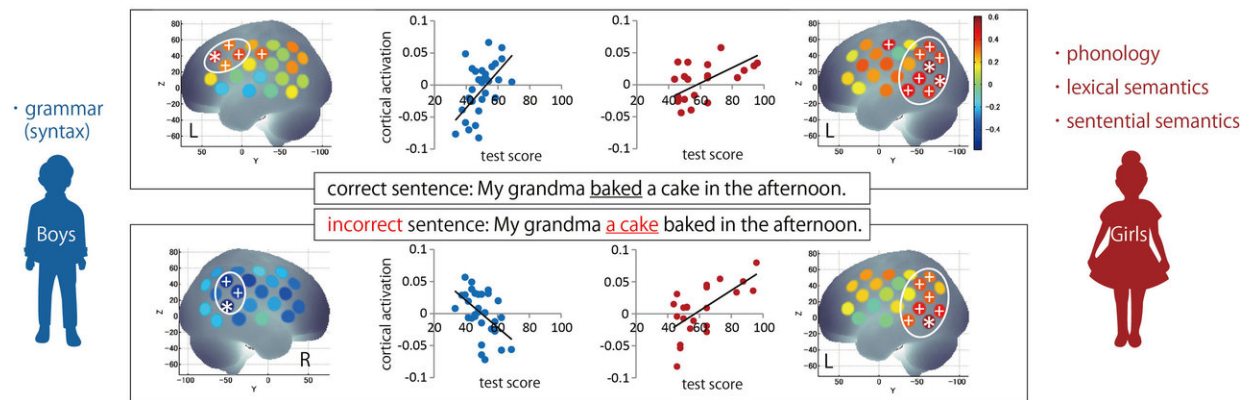


Different neural strategies for junior high school male and female English learners

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Adolescent male and female brains respond differently to English sentences. (left, boys; right, girls) (top, correct sentence; bottom, incorrect sentence) Colors represent correlation between test scores and neural activity. Warm colors show positive correlation, cool colors show negative correlation. Regions marked with * and + show statistically significant correlation. Points from the region of interest (circled) are used to plot neural activity vs. test scores. (Top) Boys show increased activation with proficiency in the front left of the brain, girls show increased activation in the back left. (Bottom) Boys show decreased activation with proficiency in the back right of the brain; girls show increased activation at the back left. Credit: Fumitaka Homae

Researchers from Tokyo Metropolitan University studied the neural response of Japanese junior high school students learning English as a second language while listening to English sentences. More proficient

boys showed more activation in parts of the brain associated with grammatical rules (syntax); girls used a wider range of language information, including speech sounds (phonology) and meaning of words and sentences (semantics). These discoveries may help optimize how boys and girls are taught English.

Children learn their native [language](#) with enviable ease and speed, but learning a second language is a far more varied process; though there has been much research into how the [brain](#) deals with new languages, we still don't know how variations in gender, age etc. specifically affect how we learn a new tongue.

A team led by Prof. Fumitaka Homae studied a rarely targeted population for this subject: Japanese junior [high school students](#) learning English as a second language in a school environment. The majority of work into the neuroscience behind learning a second language is based on immigrant populations in the United States, and children in the multi-lingual environment of Europe.

The boys and girls were given a standardized English test and a test of working memory, temporary storage used to organize, manipulate and analyze newly arrived information. They then listened to English sentences, including some with grammatical errors; observations of brain activity were taken using functional near-infrared spectroscopy (fNIRS) and event-related potential (ERP) measurements. fNIRS reveals which parts of the brain are active; ERP gives us an idea of how brain activity varies with time.

The results revealed a surprising disparity in how boys and girls deal with sentences. The girls performed better on the tests, and had more working memory. However, boys showed no correlation between working memory and performance, while girls did. Looking at [brain activity](#), fNIRS revealed that boys showed increased activation with

proficiency in the front of the brain when they heard a correct [sentence](#), while girls showed more at the back. The front is linked with "syntactic" processing i.e. rule-based understanding of sentences; the back is associated with a wider range of language processing. Interestingly, boys displayed an overall decreased response for incorrect sentences; girls showed the exact opposite.

ERPs also showed disparities, with boys exhibiting a strong response to incorrect sentences from an early time, a phase thought to be associated with "syntactic" processing. Girls only showed a difference between correct and incorrect sentences at later times.

The emerging picture is of two different strategies to cope with a second language. Boys leverage efficient processing and rule-based "implicit" thinking; girls draw on a wider range of linguistic information, achieving "explicit" comprehension of sentences. A cursory look at test scores may have simply pointed to girls being "better" at learning English, but the mechanisms tell a far more interesting story.

A clearer picture of how boys and girls learn a second language (in this case, English) has the potential to revolutionize teaching in schools, building methods and syllabi to address directly strengths and weaknesses for both boys and [girls](#).

More information: Lisa Sugiura et al, Explicit Performance in Girls and Implicit Processing in Boys: A Simultaneous fNIRS–ERP Study on Second Language Syntactic Learning in Young Adolescents, *Frontiers in Human Neuroscience* (2018). [DOI: 10.3389/fnhum.2018.00062](https://doi.org/10.3389/fnhum.2018.00062)

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