Learning Structural Biases of Novel Verbs: An ERP Study
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A wealth of findings suggests that frequency-based accessibility of structural alternatives for particular verbs (verb bias) plays an important role in sentence comprehension [1, 2, 3]. In the language acquisition and artificial language learning literatures, behavioral evidence indicates that both children and adults learn the combinatorial facts about a particular verb from linguistic input [4, 5], but little is known about brain activity during such learning.

The current experiment investigated continuous electrophysiological activity underlying the learning process of new frequency-sensitive verb bias, to explore how the human language system adapts to new statistical linguistic information. EEG was recorded while participants read sentences containing novel verbs in rapid serial visual presentation (500 msec SOA). All of the training sentences provided strong semantic context promoting either modifier or instrument interpretation of a prepositional phrase following the novel verb, as in sentences (1) and (2).

(1) Instrument-ambiguous /-unambiguous: The farmer dakked the corn with /using the tractor...
(2) Modifier-ambiguous /-unambiguous: The gladiator norged the lion with /that has the mane...

In instrument-training sentences (1), tractor has to be an instrument for an unknown action dakking, while in modifier-training sentences (2), mane is clearly a property of the lion rather than an instrument used in the unknown action norging. Half of the training sentences included ambiguous with phrases, while the other half substituted the unambiguous using or that has in place of with. Each participant completed a brief training session with 64 sentences evenly distributed in four conditions across two blocks. Each novel verb was presented in only one of the four training structures.

Electrophysiological evidence suggests learning over the time course of verb bias training. In the disambiguating noun region, mean N400 amplitude elicited by instrument nouns (e.g. tractor) was reliably smaller than that elicited by modifier nouns (e.g. mane, Fig-1).

Post-hoc analysis revealed that this attachment effect came mainly from the conditions containing the ambiguous with phrases, rather than from the unambiguous conditions containing using and that has (Fig-2). N400 reduction in instrument-ambiguous training trials may reflect the fit of the noun’s meaning with the instrument role predicted for it based on the newly learned verb bias. In the unambiguous conditions, however, no such difference was observed, perhaps because readers did not have to learn verb-specific information since disambiguation was supplied by using and that has.

Individual differences in familial left handedness appear to predict different learning strategies. For sentences containing ambiguous with phrases, individuals without left-handed relatives showed an attachment effect that changed from N400 in the first block to P600 in
the second block (Fig-3A & B). In contrast, no P600 effect was observed in individuals with left-handed relatives. These results suggest that at least for some subjects, learning verb bias involves a transition from semantic to syntactic processing.

The results suggest experience-dependent plasticity in the language system, which continuously collects statistical information from linguistic input. Future experiments using sentences that contradict the trained biases will provide additional evidence addressing when and how people use newly learned verb bias during comprehension.

**Reference:**