Contribution ID: **40**   Type: **Talk**

Disentangling Hierarchical and Sequential Computations during Sentence Processing

Sequence processing in humans is thought to rely on two distinct mechanisms: the computation of transition probabilities between adjacent elements and the extraction of larger hierarchical structures. Previous studies indicate that both mechanisms contribute to auditory sequence processing, but whether language processing involves one or the other remains debated. To address this issue, we designed a linguistic version of the local-global auditory test, which contrasts sequential versus hierarchical violations of expectations in sentences, and we searched for violation responses in both human magnetoencephalography and computational models. We found that in models, both mechanisms coexist, whereas humans only show hierarchical structure effects. Our results suggest that human sentence processing is dominated by structure-based computations and robust to sequential effects. They point to major differences between language processing in humans versus neural models and, within humans, between the processing of linguistic sentences versus non-linguistic sequences.

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Session Classification: Reading

Track Classification: Predictive Processes and Statistical Learning