Learning complex sequences of tones is related to syntactic processing of natural language.

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**Introduction** Sequential learning (SL) is a cognitive process allowing people to perceive and learn environmental patterns. We have previously shown that SL of simple sequences of 2 items (a predictor and a target) is related to syntactic processing of natural language (Singh et al., 2014). The aim of the present research is to extend this finding to more complex sequences.

**Method** We explored this relationship with a visual and an auditory SL task wherein a sequence of two items (instead of only one in Singh et al., 2014) predicted the probability of occurrence of a target. These SL tasks were presented to 13 adults (11 females, 18-40 years), who also completed a measure of syntactic processing of natural language: the Grammaticality Judgment subtest of the Comprehensive Assessment of Spoken Language (CASL). We performed mixed-measures ANOVAs on individual mean response times (RT) as well as single-trial analyses using a correlational approach and a linear mixed model.

**Results** showed an interaction between target predictability (high vs. low, indicating SL), Grammaticality (high vs low performers), and Modality (Visual vs. Auditory) [Mixed-measure ANOVAs: $F(1,11)=7.69, p=.018$; Linear mixed model: $F(4,2102)=36.0, p<.001$]. Sidak corrected pairwise comparisons indicated a significant predictability effect in the group of low performers with the auditory SL task only [Mixed-measure ANOVAs: $p=.071$; Linear mixed model: $p=.011$]. RT effects (RT to low minus high predictability conditions) were correlated with the raw score of Grammaticality [Spearman’s rho =.171, $p=.007$, N=247, two-tailed].

**Conclusion** The consistency of these results together with Singh et al. (2014) indicate a robust relationship between syntactic processing of natural language and SL independently of sequence complexity.


**Keyword** implicit learning; statistical learning; grammar, syntax, melody