Language experience accounts for individual differences in syntactic processing: Evidence from multi-level modeling

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Syntax; Comprehension; Individual differences; Language experience; Moving window; American English

Individual differences in online syntactic processing [1,2] and offline comprehension [3] have been reported, but their existence and source remain debated [4,5]. Theories have alternately attributed such differences to language experience [4,6], working memory [1], phonological processing [4], and executive conflict resolution [2]. Teasing apart these influences has been challenging for several reasons. First, these abilities frequently correlate. If only one construct is tested, it is possible its apparent effects actually reflect another construct with which it correlates. Second, many studies used only one measure of each construct, which likely introduced variance unrelated to the construct of interest: e.g., a Stroop task might reflect differences in executive attention but also in lexical access. Finally, the failure of a construct to predict syntactic processing cannot be easily interpreted if it is unknown whether the construct was reliably measured to begin with.

We investigated individual differences in syntactic processing using multi-level models, which can test how participant-level variables (e.g., language experience) interact with trial-level variables (syntax). To better assess which abilities affect syntactic processing, we (a) investigated multiple constructs, (b) measured each using multiple tasks, and (c) assessed measurement reliability through intra- and inter-task correlations.

English monolinguals (N=63) completed self-paced reading and a battery of tasks measuring language experience (vocabulary and self-reported reading frequency), phonological processing (two pseudoword repetition tasks), executive attention (antisaccade and Stroop tasks), and working memory (reading, listening, and operation spans). Tasks within each construct were z-scored and combined. We tested whether these factors predicted three measures of online and offline syntactic processing.

Resolution of direct object/sentential complement ambiguities was predicted exclusively by language experience: language experience increased sensitivity to verb bias statistics in online reading (t=2.60, p<.01).

Preference for low versus high attachments of ambiguous relative clauses, assessed by comprehension questions, was predicted by two variables. Higher working memory predicted low attachment preference (z=4.60, p<.0001), consistent with past results [3], but so did language experience, independently of working memory (z=4.70, p<.0001). We suggest this experience effect reflects learning of the English low-attachment preference.

Reading of object-extracted relative clauses (ORCs) was slower than reading of subject-extracted relative clauses (SRCs), t=2.48, pMCMC<.01, but no individual differences modulated this difference. Correlations between even- and odd-numbered items revealed little consistency (r=.09, p=.47) in which participants showed greater ORC minus SRC differences. Either individuals differ little in their difficulty with ORCs, or the reading-time measure was insufficiently reliable to detect such differences.

These results suggest language experience plays a critical role in online and offline syntactic processing. No other construct predicted online syntactic processing, and only one (working memory) predicted offline comprehension. Crucially, the null effect of other constructs cannot be attributed to a failure to reliably assess them. The tasks within each construct correlated (all ps<.05), suggesting stable measures; they just did not predict syntactic processing. These results are congruent with findings that lab-provided distributional experience alters syntactic processing [7,8] and demonstrate that a priori individual differences in syntactic processing may reflect differential exposure to language input.

References