

Evidence for Competition Resolution Difficulties During Complex Sentence Processing in Adults With Developmental Language Disorder

Stewart M. McCauley¹, Zara Harmon², Si On Yoon³, Philip Combiths¹, J. Bruce Tomblin¹, & Kristi Hendrickson¹

¹ Department of Communication Sciences and Disorders, University of Iowa

² Max Planck Institute for Psycholinguistics

³ Department of Communicative Sciences and Disorders, New York University

While recent years have seen a growing emphasis on developmental language disorder (DLD) in developmental psycholinguistics, the language abilities of adults with a history of DLD remain severely understudied. Here, we report findings on complex sentence processing in adult English speakers with and without DLD. Eye-tracking data was recorded while participants took part in a visual world paradigm experiment depicted in Fig. 1^[cf. 1]. The experiment focused on object-relative clause (OR) sentences (e.g., *Last week, the reporter^[NP1] [that the senator^[NP2] attacked] admitted^[main verb] the error*). Successful comprehension is presumed to require resolution of NP1/NP2 interference to achieve syntactic reactivation of NP1 upon encountering the main verb^[2]. We hypothesized that adults with DLD would struggle with OR comprehension. Further, following previous research suggesting that children with DLD may struggle with competition resolution^[3], we predicted that adults with DLD, upon hearing the main verb, would show more sustained competition between the head noun (NP1) and the subject of the relative clause (NP2) than adults with typical language development (TLD), manifesting as delayed post-verb fixations to NP1. Participants ($N_{DLD}=14$; $N_{TLD}=16$; ages 34-35) were re-recruited from a previous longitudinal study of child language^[4].

Comprehension question accuracy revealed significant comprehension difficulties for adults w/ DLD (DLD: 64.2%; TLD: 86.1%). Fixation proportions (see Fig. 2) revealed two key patterns: 1) adults w/ DLD show initial delay in fixating to NP2, which resolves with more exposure to OR sentences; 2) post-verb, adults w/ DLD re-fixate to NP2 after fixating to NP1. Linear growth curve analysis (GCA) of the initial (pre-verb) fixations to NP2 (600ms window) was consistent with the first key pattern; main effects: *Group* (DLD vs. TLD; $\beta=-1.91, t=-2.60$), *TrialNumber* ($\beta=-0.05, t=-2.66$); interactions: *Group* Trial Number* ($\beta=0.06, t=2.77$); *Time* Trial Number* ($\beta=0.08, t=2.0$); *Group* Time* Trial Number* ($\beta=-0.10, t=-2.00$); all $p<0.05$. The *Group* Time* TrialNumber* interaction demonstrates a learned recovery from delayed fixation to NP2 for adults w/ DLD during the experiment. Interactions within a GCA of the post-verb window (adding quadratic and cubic time terms to capture non-linearity) was consistent with the U-shape in NP2 fixations seen for adults w/ DLD (all $p<0.05$): *Group* CubicTime* ($\beta=2.9, t=2.4$); *Group* TrialNumber* ($\beta=-0.03, t=-2.76$). A *Group* Time* TrialNumber* interaction was marginal ($\beta=-0.08, t=-1.94, p=0.052$).

The first key pattern described—a learning effect—is consistent with findings showing a processing boost in less experienced readers following brief, repeated exposure to ORs^[5], suggesting that adults w/ DLD may lack adequate experience with ORs. Regarding NP1/NP2 competition during the post-verb window, analyses did not support the expected pattern of fixation to NP1 being delayed in adults w/ DLD. However, the overarching hypothesis of greater competition between NP1 and NP2 is consistent with the late re-fixation to NP2. Importantly, this

pattern mirrors eye-tracking data showing that children with DLD vacillate between competing lexical items in the late stages of word processing despite accurate early fixations^[6-7]. We will seek to illuminate the extent to which our findings—and the OR comprehension difficulties more generally—derive from relative inexperience with OR sentences vs. more general processing mechanisms tied to inhibition and competition resolution.

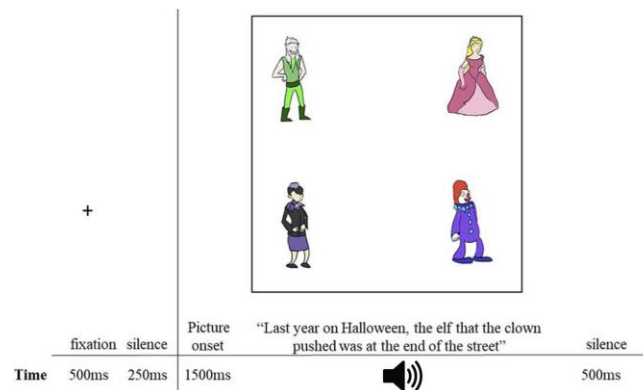


Fig. 1: Visual world paradigm experiment featuring 20 OR sentences following the above example pattern, 20 filler sentences, and comprehension questions. Stimuli adapted from Baker and Love [1].

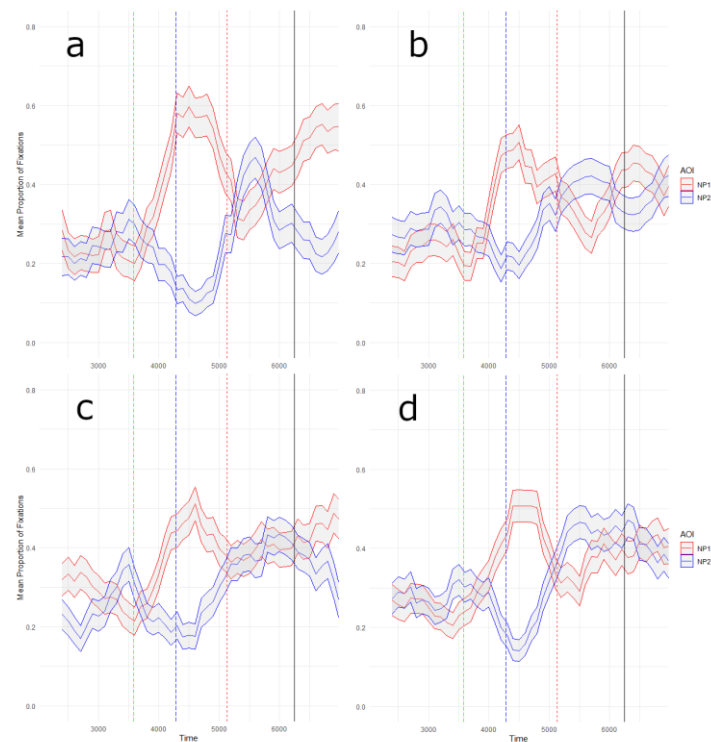


Fig. 2: Fixations to NP1 and NP2 for the first vs. second trial block of the experiment. Dotted lines represent mean onset times for NP1, NP2, main verb. Solid line represents sentence end. a) First half, adults w/ DLD; b) Second half, adults w/ DLD; c) First half, adults w/ TLD; d) Second half, adults w/ TLD

References: [1] Baker & Love (2022). Time as a parameter for lexical and syntactic processing: an eye-tracking-while-listening investigation. *Lang. Cogn. Neurosci.* [2] Gordon, Hendrick, & Johnson (2001). Memory interference during language processing. *JEP: LMC*. [3] McMurray, Klein-Packard, & Tomblin (2019). A real-time mechanism underlying lexical deficits in DLD. *Cognition*. [4] Tomblin & Nippold (2014). *Understanding individual differences in language development across the school years*. Psych. Press. [5] Wells et al. (2009). Experience and sentence processing: Statistical learning and relative clause comprehension. *Cogn. Psych.* [6] Mainela-Arnold, Evans, & Coady (2008). Lexical representations in children with SLI. *JSLHR*. [7] McMurray, Munson & Tomblin (2014). Individual differences in language ability are related to variation in word recognition, not speech perception. *JSLHR*.