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Individual differences in children's pronoun processing during reading: Detection of incongruence is associated with higher reading fluency and more regressions

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ABSTRACT

In two eye tracking experiments, we tested fourth graders' and adults' sensitivity to gender feature mismatches during reading of pronouns and their susceptibility to interference of feature-matching entities in the sentence. In Experiment 1, we showed children and adults two-phrase sentences such as "Leon{m}/Lisa{f} shooed away the sparrow{m}/the seagull{f} and then he{m} ate the tasty sandwich." Eye tracking measures showed no qualitative differences between children's and adults' processing of the pronouns. Both age groups showed longer gaze durations on subject mismatching than on matching pronouns, and there was no evidence of interference of a gender-matching object. Strikingly, in contrast to the adults, not all fourth graders reported detection of the subject gender mismatch. In Experiment 2, we replicated earlier results with a larger sample of children ($N = 75$) and found that only half of the fourth graders detected the gender mismatch during reading. The detectors' reading pattern at the pronoun differed from that of the non-detectors. Children who reported detection of the mismatch showed a reading pattern more similar to the adults. Children who did not report detection of the mismatch had comparably slower gaze durations and were less likely to make regressions directly at the pronoun. We conclude that children

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who read more fluently use their available processing resources to immediately repair grammatical inconsistencies encountered in a text.

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Introduction

Reading is a complex task that involves not only word decoding but also linking pieces of information across longer text passages. Proficient readers use coherence markers to integrate new information into the current situation model (Zwaan & Radvansky, 1998). Pronouns and other anaphora are important markers for coherence because they link entities across sentences and, thus, serve as a cue for the way in which phrases are interconnected (Ariel, 2004). Online processing and integration of pronouns, therefore, is important for situation model building and ultimately for text comprehension (Garnham, Oakhill, & Johnson-Laird, 1982). However, pronouns are semantically underspecified because they carry only number and gender information. Therefore, they often have to be inferred based on the sentence context (Kehler, 2002; Kehler, Kertz, Rohde, & Elman, 2008).

In the current study, we investigated whether the online processing of pronominal gender information is a possible source of reading difficulty for children. In Experiment 1, we tested adults' and children's sensitivity to gender feature mismatches on the pronoun and their susceptibility to interference effects when a gender-matching object is present. In Experiment 2, we compared the online pronoun processing of children who reported detection of the gender mismatch with that of children who did not report detection. We were interested in the eye movement patterns associated with the report of mismatch detection and inter-individual differences that may contribute to successful mismatch detection in children.

Online pronoun resolution in proficient readers

Proficient readers infer the antecedent of a pronoun online by combining lexical information (e.g., gender of the pronoun) and contextual information (e.g., verb meaning, disambiguating sentence information). In a self-paced reading experiment, Garnham and Oakhill (1985) showed that adults need more time for the integration of a subclause when there is no gender cue on the pronoun and the antecedent needs to be inferred entirely from context. This shows that readers use the gender cue on the pronoun for resolution online during reading. Gender mismatches of pronoun and antecedent, therefore, should disrupt the reading process. In a self-paced reading study with proficient readers, Carreiras, Garnham, Oakhill, and Cain (1996) found longer reading times for the last sentence of a story when it contained a mismatching pronoun for the stereotypical gender of a referent (i.e., female for nurse, male for doctor). They concluded that adults use gender information as soon as it becomes available, and their results show that adult readers form expectations for the gender of a pronoun, such that gender mismatches result in longer processing times. In a study with a stronger manipulation, Rigalleau, Caplan, and Baudiffier (2004) presented adults with sentences such as “Wendy complimented Nancy because she/*he made an effort” and found that reading times on the subordinate clause were significantly longer when the pronoun did not match the two antecedents. Their results also show that the gender feature is a strong determinant for the identification of an antecedent. When there is no available gender-matching antecedent, processing of the pronoun is made difficult to a point where a proficient reader does not engage in resolution at all even if enough context information is available to infer the correct antecedent. In the experiment by Rigalleau et al., however, response accuracy on the comprehension questions of the gender-mismatch sentences was equal to that of the gender-match sentences. However, response latencies were significantly longer for the mismatch sentences. This suggests that although readers understood the sentences despite the

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