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Eye movements reveal differences in children's referential processing during narrative comprehension



Jan A.A. Engelen^{a,*}, Samantha Bouwmeester^a, Anique B.H. de Bruin^b, Rolf A. Zwaan^a

^a Institute of Psychology, Erasmus University Rotterdam, 3000 DR Rotterdam, The Netherlands

^b Department of Educational Development and Research, Maastricht University, 6211 LM Maastricht, The Netherlands

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ABSTRACT

Children differ in their ability to build referentially coherent discourse representations. Using a visual world paradigm, we investigated how these differences might emerge during the online processing of spoken discourse. We recorded eye movements of 69 children (6–11 years of age) as they listened to a 7-min story and concurrently viewed a display containing line drawings of the protagonists. Throughout the story, the protagonists were referenced by either a name (e.g., *rabbit*) or an anaphoric pronoun (e.g., *he*). Results showed that the probability of on-target fixations increased after children heard a proper name, but not after they heard an anaphoric pronoun. However, differences in the probability of on-target fixation at word onset indicate that the referents of anaphoric pronouns were anticipated by good comprehenders, but less so by poor comprehenders. These findings suggest that comprehension outcomes are related to the online processing of discourse-level cues that regulate the accessibility of entities.

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Introduction

When comprehending a story, it is important to keep track of who does what to whom. Many narrative texts, however, are not entirely explicit about this. Take the sequence “John decided to call Bill.

* Corresponding author.

E-mail address: engelen@fsw.eur.nl (J.A.A. Engelen).

He still owed him a favor.” Interpretations of John owing Bill and Bill owing John are both plausible. Because for sequences like this there is a statistical tendency for the grammatical subject of the second clause to refer back to the first-mentioned entity of the first clause (Gernsbacher & Hargreaves, 1988), most listeners will go with the former interpretation. This discourse-level cue to reference requires extensive exposure to be learned. Children at 5 years of age use the gender of pronouns (Arnold, Brown-Schmidt, & Trueswell, 2007) and the semantics of verbs (Pyykkönen, Matthews, & Järvikivi, 2010) to guide referential choice, but they do not yet show a first-mention bias in either offline or online tasks (Arnold et al., 2007). Given this protracted developmental trajectory, there may be much interindividual variation in the ease with which children process anaphoric pronouns (i.e., pronouns that refer to an entity introduced earlier in the discourse, called an antecedent) during the next years of life. Indeed, Yuill and Oakhill (1988) cited two studies reporting 77% correct resolution in normal 9-year-old readers (Bormuth, Manning, Carr, & Pearson, 1970) and 57% in poor readers after training in anaphor resolution (Dommes, Gersten, & Carnine, 1984), whereas their own data showed performance of 91% for 8-year-old good readers and 66% for poor readers even when the pronoun and antecedent were close together in the text.

In this study, we explored this state of affairs as a source of differential comprehension outcomes in school-aged children. To what extent does understanding a story depend on accurate online referential processing? This question fits in with the increasing tendency to define skilled and struggling developing comprehenders not only by their offline performance on a particular task but also by the online processes that lead up to it (Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007). Although various frameworks of text comprehension underline the importance of referential coherence (e.g., Gernsbacher, 1990; Myers, O'Brien, Albrecht, & Mason, 1994; Sanford & Garrod, 1981; van den Broek, Young, Tzeng, & Linderholm, 1999; Zwaan & Radvansky, 1998), online referential processing has not been specifically related to understanding of extensive discourse.

In the remainder of the Introduction, we discuss what it means to successfully comprehend discourse and how readers construct referential coherence. We pay specific attention to the notion that although different types of referring expressions may be referentially equivalent, they have different functions in organizing the flow of information within the discourse. We then place these aspects in a developmental context and propose a novel application of the visual world paradigm to investigate them in a way that is temporally sensitive and unobtrusive to the comprehension process.

Referential coherence and discourse comprehension

Narrative comprehension is widely assumed to entail the construction of a situation model, an integrated representation of the events described by the text (Johnson-Laird, 1983; van Dijk & Kintsch, 1983). Narratives typically revolve around a limited number of characters, whose goals and plans are the driving force behind the events that take place. For that reason, protagonists have been called the “meat” of situation models (Zwaan & Radvansky, 1998). When a protagonist is first introduced in a story, usually by a name, comprehenders set up a mental representation. As subsequent events unfold, a major task for the listener or reader is to identify who a given sentence is about and to connect the incoming information with what he or she already knows about this character (Morrow, 1985). To determine whether incoming information coheres with previously comprehended information, readers and listeners use various linguistic cues (Givón, 1992). According to Gernsbacher (1997), these cues lie on a continuum from explicit to implicit. Whereas a repeated name or a noun with a definite article (e.g., *John, the old man*) can be mapped onto the existing representation of a discourse entity in a relatively straightforward manner, a pronoun (e.g., *he*) has no meaning outside the scope of its immediate context and requires knowledge-driven inferential processing. There is evidence that resolving anaphoric pronouns that require an inference is problematic for children as old as 5 years (e.g., Wykes, 1981; Wykes, 1983). In an acting-out task, children made more mistakes in reproducing the second sentence of a pair when it contained pronouns (e.g., “Jane needed Susan’s pencil. She gave it to her”) than when it contained nouns and proper names (e.g., “Susan gave the pencil to Jane”). In this case, surface-level cues, such as grammatical subjecthood and order of mention, are not diagnostic, and applying knowledge about how events in the world are related is the only way to arrive at the correct interpretation.

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