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"I know something you don't know": Discourse and social context effects on the N400 in adolescents

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ABSTRACT

Adolescence is a time of great cognitive and social development. Despite this, relatively few studies to date have investigated how perspective taking affects on-line language comprehension in adolescents. In the current study, we addressed this gap in the literature, making use of a Joint Comprehension Task in which two individuals with differing background knowledge jointly attend to linguistic stimuli. Using event-related potentials, we investigated adolescents' electrophysiological responses to (a) semantically anomalous sentence stimuli in discourse context and (b) semantically plausible sentence stimuli that the participants believe another individual finds semantically implausible. Our results demonstrate that a robust "N400 effect" (i.e., a well-established event-related potential, known to be sensitive to lexical-semantic integration difficulties) is elicited by semantically anomalous sentences; this N400 effect is subsequently attenuated by discourse context. Lastly, a "social N400 effect" is elicited by sentences that are semantically plausible for the participants if they believe that another individual finds the sentences implausible. The results suggest that adolescents integrate the perspective of others during on-line language comprehension via simulation; that is, adolescents use their own language processing system to interpret language input from the perspective of other jointly attending individuals.

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Introduction

Adolescence is a time of great cognitive and social development, yet there remains a paucity of research on the cognitive mechanisms that support specific social cognitive functions during this developmental period. In the current study, we investigated how the social environment interacts with language comprehension in adolescent participants. Specifically, we investigated whether adolescent participants' comprehension of language stimuli is affected by joint comprehension, that is, the process of attending to language stimuli while in the presence of other co-attending individuals.

In adult participants, background information about interlocutors (i.e., individuals engaged in conversation) affects language comprehension. For example, social inferences drawn from cues encoded in speech signals provide information about a speaker's identity, age, sex, class, and regional origins. This information has a profound influence on how spoken words and sentences are interpreted. For example, the utterance "I have a large tattoo on my back" elicits electrophysiological markers of semantic incongruity if the utterance is made with an upper-class accent (Van Berkum, van den Brink, Tesink, Kos, & Hagoort, 2008) despite the fact that the linguistic utterance alone is not semantically anomalous. Similarly, information about what a speaker can or cannot know based on his or her background knowledge affects listeners' interpretation of ambiguous utterances (Brown-Schmidt, 2009; Hanna, Tanenhaus, & Trueswell, 2003; Keysar, Barr, Balin, & Brauner, 2000). There is general consensus in the adult literature that information about others affects language comprehension, although considerable debate persists about when and how social information influences language comprehension (Barr & Keysar, 2006; Brennan, Galati, & Kuhlen, 2010; Brown-Schmidt & Hanna, 2011). The limited research done with adolescents in similar scenarios suggests that while adolescents are sensitive to the perspective of others during language comprehension, their ability to integrate this information on-line continues to improve throughout late adolescence (Dumontheil, Apperly, & Blakemore, 2010).

Most research on the role of social cognition in language processing has focused on how interactions between speaker and listener are modulated by various types of information. Recently, we demonstrated that background information about other co-listeners, or other co-recipients of language input, also affects language processing (Rueschemeyer, Gardner, & Stoner, 2015). During joint comprehension, two individuals simultaneously process language input in the presence of one another. Real-world examples may include two friends jointly listening to a third friend at a dinner party and two individuals simultaneously reading a tweet or an e-mail. Such joint comprehension scenarios are interesting because although listeners are privy to the same input, they may interpret that input differently. For example, ambiguous words may be processed differently by two listeners, or differing background knowledge may lead one listener to parse a sentence differently than another listener. Making predictions about the interpretation of other listeners has potential benefits for communication; if a listener can understand why other listeners are confused, appropriate additional information can be provided to make sure that a consistent message has been communicated to everyone. Therefore, listeners who are sensitive to potential discrepancies provide an interesting testing ground because they simultaneously parse the intended meaning of the speaker and understand how the same linguistic input has been parsed by other listeners.

We have suggested previously that simulating language comprehension from another listener's perspective is a key mechanism in joint comprehension (Rueschemeyer et al., 2015). Specifically, we used event-related potentials (ERPs) to measure participants' on-line parsing of sentence stimuli that they judged to be semantically plausible if they were seated next to an individual who they believed would judge the same sentence to be semantically implausible. The results showed that an electrophysiological marker of semantic integration difficulty, an "N400 effect," was elicited in these situations, but only in the presence of the naive other listener. When the other listener was removed from the experimental setup, no N400 effect was elicited by identical sentence stimuli. The "social N400 effect" elicited by perceiving another individual's misunderstanding did not differ significantly in latency or topography from that observed when participants were presented with sentences that they judged to be semantically anomalous. These results suggest that tracking another individual's