Chapter 5
Eye Tracking and Spoken Language Comprehension

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ABSTRACT

Constructing a more precise and deeper understanding of how listeners, and particularly young children, comprehend spoken language is a primary focus for both psycholinguists and educators alike. This chapter highlights how, over the course of the past 20 years, eye tracking has become a crucial and widely used methodology to gain insight into online spoken language comprehension. We address how various eye-tracking paradigms have informed current theories of language comprehension across the processing stream, focusing on lexical discrimination, syntactic analysis, and pragmatic inferences. Additionally, this chapter aims to bridge the gap between psycholinguistic research and educational topics, such as how early linguistic experiences influence later educational outcomes and ways in which eye-tracking methods can provide additional insight into the language processing of children with developmental disorders.

INTRODUCTION

Early developmental research in spoken language comprehension has largely focused on establishing differences between child and adult language abilities; what can adults understand that children cannot? However, for both researchers and educators alike, the central questions lie not just in identifying such differences, but in explaining them. What are the mechanisms that allow adults to succeed where children fail, and how do these mechanisms develop? The difficulty of these questions lies in the nature of language comprehension. Understanding a spoken sentence requires integration of multiple levels of linguistic

representation: from phonetic parsing, to identifying lexical entries, determining syntactic structure and semantic relationships, and incorporating discourse context. What's more, adults are able to accomplish this feat seemingly instantaneously, as a sentence unfolds. The advent of eye-tracking methodologies, which use gaze fixations within a visual display as a signal of lexical activation (Allopenna, Magnuson, & Tanenhaus, 1998; Tanenhaus, Spivey-Knowltown, Eberhard, & Sedivy, 1995; Trueswell, Sekerina, Hill, & Logrip, 1999), has allowed researchers to break into the moment-by-moment progression of sentence interpretation, providing a window into the nature of the underlying processing mechanisms.

More recently, these methodologies have been adapted for use with children. Studying children's sentence processing not only provides insight into language acquisition, but also constrains theories of adult language competence. By uncovering how children interpret sentences and the types of errors they make, we can determine the types of information children can and cannot use to understand what they are hearing. Eye-tracking studies have helped to identify the properties of the language system that emerge early in development and track later developing skills as they come online. In the current chapter, we will outline the progress made in the field of psycholinguistics towards specifying the building blocks of the linguistic system, and how it may constrain theories of its underlying structure.

The study of language development also informs educational practices and initiatives for both typically and atypically developing populations. Understanding which sources of information the child language system can use at a particular age can help tailor interventions to be more targeted and effective. Furthermore, a better of understanding of typical language acquisition is necessary to identify where and how breakdowns occur in children with various language deficits. This is imperative in order to create appropriate tools to address the difficulties that such children face. The present chapter aims to outline how progress might be made towards this goal.

BACKGROUND

Cooper (1974) was the first researcher to use an eye-tracking paradigm to explore the relationship between spoken language and eye movements within a constructed visual scene. In his seminal paper, Cooper recorded participants' eye movements to a 3x3 grid containing pictures of different objects as they listened to pre-recorded stories about the displayed items. He found that upon hearing the word for a displayed object, participants rapidly moved their eyes to the corresponding picture. In fact, participants directed their gaze to the correct referent even before the whole word was spoken (Cooper, 1974). The pattern of data suggested that direction of gaze was closely tied to the unfolding linguistic information.

There are two main advantages to using eye-tracking paradigms in psycholinguistic research. First, eye-tracking paradigms allow for a continuous, moment-to-moment measure of spoken language comprehension, whereas offline judgment tasks show only the final interpretation. The fine-grained temporal resolution in these tasks allows for researches to analyze language comprehension on the scale of milliseconds (Allopenna, Magnuson, & Tanenhaus, 1998; Dahan, Magnuson, & Tanenhaus, 2001; Dahan, Magnuson, Tanenhaus, & Hogan, 2001). This is a critical feature because language processing, in both adults and children, is incredibly rapid and incremental; a sentence, and each individual word within it, is processed as it unfolds and before all of the information is available (Snedeker, 2009). Second, eye-tracking paradigms are ideal for use with young children, allowing for researchers to explore previously untestable hypotheses about language acquisition and development. Prior to eye-tracking paradigms,

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