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## The contribution of theory of mind, counterfactual reasoning, and executive function to pre-readers' language comprehension and later reading awareness and comprehension in elementary school



Nicole R. Guajardo\*, Kelly B. Cartwright

*Department of Psychology, Christopher Newport University, Newport News, VA 23606, USA*

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### ABSTRACT

The current longitudinal study examined the roles of theory of mind, counterfactual reasoning, and executive function in children's pre-reading skills, reading awareness, and reading comprehension. It is the first to examine this set of variables with preschool and school-aged children. A sample of 31 children completed language comprehension, working memory, cognitive flexibility, first-order false belief, and counterfactual reasoning measures when they were 3 to 5 years of age and completed second-order false belief, cognitive flexibility, reading comprehension, and reading awareness measures at 6 to 9 years of age. Results indicated that false belief understanding contributed to phrase and sentence comprehension and reading awareness, whereas cognitive flexibility and counterfactual reasoning accounted for unique variance in reading comprehension. Implications of the results for the development of reading skill are discussed.

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\* Corresponding author.

E-mail address: [nguajard@cnu.edu](mailto:nguajard@cnu.edu) (N.R. Guajardo).

## Introduction

Skilled reading comprehension requires awareness of one's own reading processes (see [Cartwright, 2009](#); [Cartwright, 2010](#), and [Pressley, 2002](#), for reviews) and the ability to generate inferences to support understanding ([Elbro & Buch-Iversen, 2013](#); [Oakhill & Cain, 2012](#)). For successful comprehension, readers must consider both their own thinking and characters' mental states, such as emotions, intentions, and beliefs, to make inferences about reasons for characters' actions ([Shanahan & Shanahan, 1997](#)). Indeed, children with poor metacognitive skills exhibit lower reading comprehension ([Paris & Jacobs, 1984](#)), and elementary school students often struggle with understanding characters' internal mental motivations and focus instead on characters' actions without making inferences for why those actions occur ([McConaughy, Fitzhenry-Coor, & Howell, 1983](#); [Shannon, Kameenui, & Baumann, 1988](#)). Not surprisingly, poor comprehenders are less adept at generating inferences from text to support reading comprehension ([Cain & Oakhill, 1999](#); [Laing & Kamhi, 2002](#); [Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007](#)). These kinds of inferences often require levels of social cognition, such as theory of mind and counterfactual reasoning, that may vary in children.

Theory of mind involves attributing mental states to others, understanding humans in terms of mental states, and being aware of one's own and others' thoughts ([Astington, Harris, & Olson, 1988](#); [Wellman, Cross, & Watson, 2000](#)). Thus, it is likely that theory of mind understanding would facilitate the development of reading comprehension. The primary purpose of the current study was to examine whether theory of mind, specifically false belief understanding, in preschool and middle childhood would predict preschool language comprehension and elementary school reading comprehension and metacognitive awareness of reading processes. We also examined whether counterfactual thinking, which involves comparing an actual outcome with possible alternative outcomes ([Kahneman & Miller, 1986](#); [Kahneman & Tversky, 1982](#)), predicted later reading comprehension. Finally, we explored the role of these variables beyond executive function, a well-established contributor to reading comprehension (e.g., [Borella, Carretti, & Pelegrina, 2010](#); [Cartwright, 2012](#); [Cartwright, 2015a](#); [Locascio, Mahone, Eason, & Cutting, 2010](#)).

### *Reading comprehension*

Work with early narrative comprehension has set a foundation for hypothesizing a relationship between theory of mind understanding and reading comprehension. [Feldman, Bruner, Renderer, and Spitzer \(1990\)](#) proposed two landscapes within a story: landscape of consciousness and landscape of action. Reading comprehension relies on one's abilities to make inferences from a story regarding both landscapes. For full comprehension, readers must be able to understand the events in the story as well as the characters' thoughts, perceptions, and motives that explain those events ([Emery, 1996](#)). Evidence for the importance of such mental state inferences is found even with pre-readers. As young as 4 years, the ability to infer character goals, actions that achieve those goals, and character mental states (including thoughts and perceptions) predicts story comprehension ([Tompkins, Guo, & Justice, 2013](#)).

The importance of these inferences sets the foundation for a hypothesized role of theory of mind, particularly false belief understanding, in reading comprehension. Indeed, previous work has demonstrated a link between false belief understanding and comprehension of the landscape of consciousness within stories with pre-readers. [Pelletier and Astington \(2004\)](#) found that kindergarteners who understood false belief were more likely to integrate the landscapes of action and consciousness when they retold a story. They proposed that children must be able to infer mental states and their connections with behavior before they can understand the dual nature of stories and retell aspects of stories on both planes. Similarly, [Riggio and Cassidy \(2009\)](#) demonstrated that preschoolers' false belief performance predicted their ability to explicitly articulate a false belief in a story. Children who failed false belief tasks focused only on the landscape of action. Thus, children who were able to attribute mental states to characters understood the story at a higher level ([Riggio & Cassidy, 2009](#)).

Work with elementary school-aged readers also has shown the importance of being able to infer mental states for comprehension. Recognizing that even some elementary school-aged children

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