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Atypical understanding of mental terms in Chinese-speaking children with autism spectrum disorder

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ABSTRACT

The present study investigated how Chinese children with autism spectrum disorder (ASD) understand mental terms, especially their knowledge of verb factivity. We examined these children's ability to understand mental terms representing true belief (i.e., *zhi1dao4*, *know*) and false belief (i.e., *yi3wei2*, *thought*) and compared their ability with that of typically developing (TD) children matched with age, and TD children matched with verbal mental age (VMA). Children were asked to participate in a game to find a toy according to the experimenter's testimony, which involved these mental terms. Results showed that all children from these three groups understood *zhi1dao4* better than *yi3wei2*. Particularly, children with ASD performed statistically significantly worse in understanding mental terms than their age-matched TD children, but not differently from VMA-matched TD children. The understanding of mental verbs was correlated with the language ability of children with ASD, and with age, language ability and executive function of TD children. After controlling for the effects of age, general language ability, and executive functions, the group difference of mental verb understanding still existed.

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1. Introduction

Human languages provide tools for their speakers to communicate mental states. These tools, often referred to as mental terms, provide linguistic labels for the conceptual categories for mental experiences (e.g., Tardif & Wellman, 2000). Mental terms, in many languages, are often used to lead embedded propositions which represent the content of the mental states (de Villiers & Pyers, 2002). Therefore, the meaning of a mental term determines how the subsequent clause is interpreted. The verb factivity of mental terms, defined as the degree of the mental verbs presuppose the veracity of their clauses, and determines the interpretations of the clauses, that is, the likelihood of a belief being true (Cheung, Chen, & Yeung, 2009; Lee, Olson, & Torrance, 1999; Scoville & Gordon, 1980). Strong factive verbs affirm the following clause, and non-factive verbs negate their clauses (Cheung et al., 2009; Scoville & Gordon, 1980). For example, in the sentence "I know that there is a marble in the box," *know* has a high verb factivity, so the clause "there is a marble in the box" is more likely to be true; while in the sentence "I thought that there was a marble in the box", *thought* has a low verb factivity, so its clause is less likely to be true. Knowledge about verb factivity, especially the understanding of nonfactive verbs, uniquely correlates with children's understanding of people's false belief (Cheung et al., 2009; Lee et al., 1999; Papafragou, Cassidy, & Gleitman, 2007).

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1.1. Acquisition of mental terms

The acquisition of mental terms is relatively late compared to other semantic categories among typically developing (TD) children. From 2.5 years of age, mental-state terms such as *think*, *know* and *remember* start to appear in English-speaking children's spontaneous speech (Limber, 1973; Shatz, Wellman, & Silber, 1983). Two- and three-year-old children begin to acquire mental terms to firstly refer to perception, emotion, and desire (e.g., *see*, *hear*, *happy*, *love*, *want*), and then to knowledge and beliefs (e.g., *know*, *think*, *believe*; Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982). Three- and four-year-old children can comprehend the subtle differences of implications of *think* and *know* by giving different answers to the questions, using *think* and *know* to ask about people's false belief (Johnson & Maratsos, 1977). By age 4, English-speaking children could distinguish *know* from *think* and *guess* in terms of their relative certainty (Moore, Bryant, & Furrow, 1989). Acquisition of these mental terms, as well as general language ability, reflects children's development of theory of mind (ToM) (e.g., Astington & Baird, 2005; Milligan, Astington, & Dack, 2007).

1.2. Understanding Chinese mental terms

A meta-analysis showed parallel developmental trajectories of ToM understanding for children in China and North America (Liu, Wellman, Tardif, & Sabbagh, 2008). Verb factivity is marked in the Chinese language through different mental terms (e.g., *xiang3* meaning *think*, *yi3wei2* meaning *thought*). Verb factivity plays an important role in Chinese-speaking children's false belief understanding (Cheung et al., 2009; Lee et al., 1999; Tardif, Wellman, & Cheung, 2004). Lee and colleagues (1999) investigated the effects of Chinese mental verbs (*xiang3*, *think*; *yi3wei2*, *thought*; and *dang4*, *falsely think*), on Chinese-speaking children's understanding of false belief. They found that children performed better in false belief questions using *yi3wei2*, or *dang4*, than those using *xiang3*. Linguistic representation of a belief has the potential to influence children's understanding of a statement being either true or false and this has been supported by evidence with children speaking English and other languages. For instance, studies have been conducted to explore the relations between understanding of false beliefs and mental verbs in Cantonese, a dialect used in South China (mainly in Guangdong and Hong Kong). Tardif and colleagues (2004) examined whether types of Cantonese verbs used in the verbal cues of the false belief task affected Cantonese-speaking children's performance. Cantonese represents beliefs in two ways: either neutral belief (i.e., *nam5*, *think*) or explicitly false (i.e., *ji5wai4*, *thought*). Results showed that children questioned with explicitly false belief words had an advantage in the performance of false belief tasks over children questioned with neutral belief words. This finding implied that children's ToM performance is partially mediated by their linguistic ToM. Cheung and colleagues (2009) further examined Cantonese-speaking children's understanding of some strong factive and non-factive Cantonese mental terms and their performance in false belief tasks. Results showed that understanding of mental terms, especially strong nonfactive Cantonese mental terms (i.e., *ji5wai4*, *thought*), predicted false belief understanding, after controlling for non-verbal IQ and general language ability.

1.3. Understanding mental terms in ASD

Although extensive research has suggested that children with autism spectrum disorder (ASD) are impaired in ToM understanding (e.g., Baron-Cohen, 2000; Baron-Cohen, Leslie, & Frith, 1985), little is known about their understanding of mental terms, a highly relevant ability to their ToM capacity (Ziatas, Durkin, & Pratt, 1998). Tager-Flusberg (1992) analyzed the spontaneous speech samples of children with ASD and Down syndrome by coding utterances including lexical terms for desire, perception, emotion and cognition. Results showed that children with ASD were as capable as children with Down syndrome of talking about desire, perception and emotion, but their speech included fewer utterances to call for attention and to refer to cognitive mental states. In a study by Ziatas et al. (1998), participants were asked to find a hidden candy according to a puppet's verbal cues involving mental terms *know*, *think* or *guess* ("I know/think/guess it is in the blue box"). Results showed that compared to TD children, children with ASD showed specific impairment understanding mental terms in this task.

1.4. The present study

Understanding verb factivity of Chinese mental terms is important for Chinese children to understand others' true or false beliefs. Studies on the Chinese mental terms in ASD not only contribute to our knowledge about the atypical language development in children with ASD, but also provide further evidence for the ToM deficits in children with ASD.

The objectives of this study were (1) to compare the understanding of Chinese (Mandarin) mental terms in Mandarin-speaking children with ASD and TD children matched with age and verbal mental age (VMA); (2) to examine whether the deficit in understanding Chinese mental terms in children with ASD was due to their limited general language ability or executive function. We sought to achieve these objectives through the following research questions:

- (a) Could children with ASD tell the subtle differences between mental terms in terms of verb factivity like the TD children matched with age and VMA respectively?

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