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Developmental steps in theory of mind of typical Chinese children and Chinese children with autism spectrum disorder

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ABSTRACT

This study investigated the developmental sequence of theory of mind (ToM) of 76 typical preschool children and 34 children with autism spectrum disorder (ASD) using the five-task scale of ToM. Results showed that the developmental sequence of typical children in the five ToM tasks differed from that of children with ASD. Specifically, typical children had the following sequence for the five tasks from the easiest to the hardest: diverse desire, knowledge access, diverse belief, content false belief, and hidden emotion tasks. Children with ASD had a significantly poorer performance on ToM tasks than typical children and had a varied sequence for diverse belief and knowledge. The developmental sequence of ToM of both Chinese typical children and children with ASD is different from those of children from other countries as presented by previous studies. The present study provides substantial evidence supporting the cultural and atypical developmental influence on ToM development.

1. Introduction

1.1. Development of theory of mind in typical children and children with autism spectrum disorder

Theory of mind (ToM) refers to the ability to infer mental states (e.g., desire, emotion, belief, and intention) and use these inferences to understand and predict one's own behavior and those of others (Wellman and Gelman, 1992). ToM is strongly associated with one's social, affective, and communicative relationships with others (Birch & Bloom, 2007; Feng, Lo, Tsai, & Cartledge, 2008).

The ability of typical children to understand and use ToM emerges at an extremely early age and continues to improve throughout childhood (Wellman, 2011). In their infancy, these children particularly understand intentional actions and show desire to interact with adults (Girli & Tekin, 2010). At the age of 2, typical children begin to use mental state words that represent emotions, desires, and beliefs in their communication (Bartsch & Wellman, 1995; Bretherton & Beeghly 1982; Brown & Dunn, 1991). At the age of 3, they begin to understand the principle of "seeing leads to knowing" and can distinguish their beliefs from those of others (Howlin, Baron-Cohen, & Hadwin, 1999; Pratt & Bryant, 1990; Wellman and Bartsch, 1988). From 4 to 5 years, a child begins to acquire false beliefs (FB), which is a significant milestone in ToM development (Wellman,

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Cross, & Watson, 2001). Understanding FB indicates one's awareness of the representational and internal attributions of mental states (Wimmer & Perner, 1983). In the same age bracket, children begin to understand the representational and internal attributions of pretense (Wellman, 2011), deception (Wellman, 2011), lies (Peterson & Siegal, 2002), appearances versus reality (Flavell, Flavell, & Green, 1987), and the case in which someone's external expressions or actions may not directly display their own internal feelings (Harris, Donnelly, Guz, & Pitt-Watson, 1986). Older typical children increasingly develop advanced ToM as exemplified by 6- to 8-year-old children acquiring second-order FB and irony (Perner & Wimmer, 1985; Winner & Leekam, 1991) and by the ability of 9- to 11-year-old children to understand faux pas (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001).

However, considerable evidence shows that children and even adolescents with autism spectrum disorder (ASD) continuously fail in ToM tasks or have poor ToM skills, which indicates the atypical ToM development among children with ASD (Baron-Cohen, 2001, 1987, 1992; Baron-Cohen & Goodhart, 1994; Peterson, Garnett, Kelly, & Attwood, 2009; Roeyers and Demurie, 2013). However, whether the atypical development follows a delayed or deviant development model is still being argued (Hoogenhout & Malcolm-Smith, 2014). The delayed development model suggests that the development of ToM skills in ASD in follows the same order as that in typical development but at a later chronological and mental age (Hoogenhout & Malcolm-Smith, 2014). For example, autistic children with a mental age of at least 11 years have an 80% chance of passing a standard FB test (Happe', 1995); moreover, high-functioning autistic children have similar developmental sequence and rate of ToM development, although they show significantly lower onset compared with typical children (Hoogenhout & Malcolm-Smith, 2014). However, a latter study showed that the developmental sequence is not strictly examined, which significantly weakens the conclusion. According to another model, the deviant developmental model, the ToM of ASD develops in a different sequence or never reaches the level seen in typical development (Hoogenhout & Malcolm-Smith, 2014). Statistical analysis showed that compared with typical children, those with ASD versus have a specific developmental sequence in the scale of ToM (Peterson, Wellman, & Liu, 2005; Peterson, Wellman, & Slaughter, 2012). However, the specific developmental sequence has been only confirmed in Australian children with ASD; whether the sequence is universal in children with ASD from other cultures is unclear. Taken together, more evidence is needed to clarify the underlining mechanism of the atypical ToM development of children with ASD.

1.2. Cultural influence on the development of ToM

Cross-cultural differences in the pace of ToM development have been identified worldwide through comparison: East Asia (e.g., Korea, Japan, mainland China, and Hong Kong) versus North America (Chen & Lin, 1994; Liu, Wellman, Tardif, & Sabbagh, 2008; Naito, 2003; Oh & Lewis, 2008; Zhang et al., 2010), Iran versus Australia or North America (Shahaeian et al., 2014a; Shahaeian, Nielsen, Peterson, & Slaughter, 2014; Shahaeian, Peterson, Slaughter, & Wellman, 2011), Indonesia versus Australia (Kuntoro, Saraswati, Peterson, & Slaughter, 2013), and Cameroon versus Germany (Chasiotis, Kiessling, Hofer, & Campos, 2006), among others. The sociocultural influences on ToM development are specified not only through behavioral performance but also through neural processes. The ToM reasoning-related activity of the right temporal-parietal junction and inferior frontal gyrus has been shown to depend on cultural and linguistic backgrounds (Kobayashi, Glover, & Temple, 2007).

Recently, cultural difference has also been observed in the performance of children on the scale of ToM (five-task version). This scale is a reliable test that assesses multiple milestones in ToM development (Peterson et al., 2012; Wellman, Fang, & Peterson, 2011; Wellman & Liu, 2004; Shahaeian et al., 2011). This scale includes five tasks: (1) diverse desires (different people want different things), (2) diverse beliefs (different people hold diverse beliefs about the same thing), (3) knowledge access (not seeing leads to not knowing), (4) FBs (content FB task), and (5) hidden emotions (people feel an emotion but display a different one) (Wellman & Liu, 2004). Evidence has shown that children with North American, Australian, German, and Indonesian cultural backgrounds acquire diverse desire, diverse belief, knowledge access, content FB, and hidden emotion, in that sequence (Kristen, Thoermer, Hofer, Aschersleben, & Sodian, 2006; Kuntoro et al., 2013; Peterson et al., 2005; Wellman & Liu, 2004). By contrast, children exposed to Chinese and Iranian cultures develop knowledge before diverse beliefs (Shahaeian et al., 2011; Wellman, Fang, Liu, Zhu, & Liu, 2006; Wellman et al., 2011). This sequential disparity has been related to individualistic versus collectivist cultural environments (Greenfield, Keller, Fuligni, & Maynard, 2003; Shahaeian et al., 2011). Moreover, except for the mainstream culture context, the micro-culture context also influences ToM development. As shown by Kuntoro et al. (2013), different micro-cultural contexts where children grow in two groups result in slower mastery of some ToM concepts (knowledge access and hidden emotion) by Indonesian pemulung children compared with middle-class children.

Although previous studies have generally shown the cross-cultural variation in ToM development, these studies examined only the case of typical children; hence, their findings are not generalizable and are confined only to the typical development of ToM. As such, this research gap is yet to be filled. The following question needs to be addressed: does cultural environment also influence the ToM development of children with ASD?

1.3. Present study

To clarify the underlying mechanism of atypical ToM development and to reveal whether the cultural influence on ToM development would be exhibited by children with ASD, this study investigates the ToM developmental trajectory and