

**STORYBOOK NARRATIVES IN MANDARIN-SPEAKING  
PRE-ADOLESCENTS WITH AND WITHOUT AUTISM  
SPECTRUM DISORDER: INTERNAL STATE LANGUAGE  
AND THEORY OF MIND ABILITIES\***

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**ABSTRACT**

This study investigated the ability of Mandarin-speaking pre-adolescents with autism spectrum disorder (ASD) to use internal state language (ISL) in narratives. The data consist of narratives from pre-adolescents with ASD and typically developing controls, matched on gender, language and cognitive abilities. The narratives were elicited using *Frog, where are you?* Participants' use of ISL was assessed by focusing on lexical expressions referring to emotion, desire, cognition and perception. In addition, the Chinese Theory of Mind Tasks were administered to measure participants' theory-of-mind (ToM) abilities. The results reveal no group differences in basic narrative measures or in ToM performance. The two groups of participants were comparable in their overall use of ISL and in reference to individual category of internal states. In addition, our results displayed no association between the use of ISL and ToM abilities. The importance of the matching variables and the limitation of the ToM test batteries were discussed.

Key words: autism spectrum disorder, internal state, theory of mind, Mandarin-speaking pre-adolescent

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\* This research was supported by the Ministry of Science and Technology. I am grateful to the two anonymous reviewers for their insightful comments. An earlier version of this paper was presented at the 24th Annual Conference of the International Association of Chinese Linguistics (IACL-24) in Peking, 2016. The usual disclaimers apply.

## 1. INTRODUCTION

As one of the earliest and the most widely used form of organizing human experience (Bruner, 1990), narratives provide a rich context for social interactions. Given this, assessment of narrative production has been regarded as an important means not only to examine the connection between social cognition and language (Lorusso et al., 2007; Norbury, Gemmell and Paul, 2014), but also to explore the social-cognitive abilities in individuals with autism spectrum disorder (ASD), characterized by deficits in social communication and interaction (American Psychiatric Association [APA], 2013; for a review, see Stirling, Douglas, Leekam and Carey, 2014).

Investigations of narratives and ASD have found comparable performance in basic narrative measures such as story length and syntactic complexity between ASD and comparison groups (Colle, Baron-Cohen, Wheelwright and van der Lely, 2008; Diehl, Bennetto and Young, 2006; Sah and Tornng, 2015); however, differences in other aspects of narratives have been reported. For instance, individuals with ASD show limited use of causal language (Losh and Capps, 2003), have difficulties maintaining topics and integrating narrative events (Jolliffe and Baron-Cohen, 2000; Landa, 2000) and make more pragmatic violations (Loveland and Tunali, 1993). Such deficits in narrative production have been related to the social impairments in ASD and, in particular, considered to reflect their insensitivity to other minds (Colle et al., 2008).

## 2. INTERNAL STATE LANGUAGE IN NARRATIVES

To account for the insensitivity in reasoning other minds, the theory of mind (ToM) hypothesis of autism is probably the most-documented theoretical construct (Baron-Cohen, 1995; Baron-Cohen, Leslie and Frith, 1986). ToM refers to individuals' abilities to attribute internal states—such as desire, emotion, belief and intention—to themselves and others so as to explain and predict behavior. The ToM abilities are considered essential to narrative construction, because a successful narrator relies on the abilities not only to elaborate story characters' internal states, but also to

take account of listeners' knowledge and perspectives (Tager-Flusberg and Sullivan, 1995).

To understand the influence of ToM deficits on narrative performance in ASD, several researchers have particularly explored to what extent autistic individuals can use internal state language (ISL), i.e., lexical expressions referring to internal states (for a review, see Stirling et al., 2014). The employment of ISL is important for narrative construction because it provides narratives the "landscape of consciousness" (Bruner, 1986:14). In particular, while using ISL in fictional narratives, a narrator needs to go beyond him-/her-self to interpret a story character's internal states so as to provide psychological motivations to account for the actions of the character (Chafe, 1994). And such a shift between the narrator's own stance and the story character's perspective requires ToM abilities. As Daiute and Nelson (1997) suggested, the use of ISL is indicative of narrators' attempts not only at sense making, but also at considering multiple perspectives on events.

Bang, Burns and Nadig's (2013) recent study examined the full range of internal-state terms, including categories of expressions referring to perception, physiology, desire, emotion and cognition. They found no significant difference between the ASD and control groups for each of these categories. More intriguingly, they suggested that narrative tasks are a more sensitive means than spontaneous conversations to reveal autistic individuals' difficulties in talking about internal states, because they found that, compared with control groups, the ASD group produced a smaller (though non-significantly different) proportion of ISL in personal narratives, but not in conversations. It is noteworthy that Bang et al.'s results were based on personal narratives. According to them, the construction of personal accounts involves speakers' "complex and sophisticated strategy" to convey their subjective experience (p.1738); the smaller proportion of ISL may be relevant to the complex feature of personal narratives.

To avoid the complexities involved in relating subjective personal accounts and to better control the content of narratives, a variety of studies chose to look at the use of ISL in fictional narratives produced by individuals with ASD. To begin with, Baron-Cohen et al. (1986) found that children with autism were less likely to refer to cognitive internal

states than controls. The reduced ISL in ASD was also reported by subsequent studies (Begeer, Malle, Nieuwland and Keysar, 2010; Pearlman-Avni and Eviatar, 2002). On the contrary, other studies found no differences in the use of ISL between ASD and comparison groups (Beaumont and Newcombe, 2006; Capps, Losh and Thurber, 2000; Colle et al., 2008; Norbury et al., 2014; Tager-Flusberg, 1995; Tager-Flusberg and Sullivan, 1995). Of interest, an uneven pattern is revealed in Siller, Swanson, Serlin and Teachworth's (2014) recent study in which children with ASD were less likely to use emotion terms than the controls; nevertheless, the ASD and control groups were similar in their use of cognitive terms. This finding underscores the importance of examining cognitive and emotional aspects of ISL separately.

The inconsistencies in previous findings may be attributed to methodological issues. The first issue is concerned with differences in the prompts for eliciting narratives. For the three studies revealing a significant difference in ISL between ASD and control groups: Baron-Cohen et al. (1986) elicited story-telling based on a sequence of four picture cards, Pearlman-Avni and Eviatar (2002) used slide shows as prompts for the story-telling task, while Begeer et al. (2010) focused on retellings of a verbally-presented stimulus story. Of interest, Begeer et al. found that the autistic participants used less ISL in story narration, but they showed no deficiency in using ToM in communication games. On the other hand, story-telling elicited by wordless picture books across studies revealed similar levels of performance in ISL between ASD and comparison groups, with the exception of Beaumont and Newcombe's (2006) work. As suggested by Berman (2004:265), because of the communicative and cognitive demands evoked in different narrative settings vary, children are likely to produce narratives better in some contexts than in others. Given the wide range of methods across studies, the above-mentioned inconsistent results are unsurprising. Another issue lies in the task design differences, more specifically, the selection of matching variables. Baron-Cohen et al.'s (1986) study did not use a matched comparison group design for the ASD and TD groups, which makes it difficult to determine whether the deficiency in using ISL is specific to ASD or the result of impairment in cognitive or language processing. In contrast, the other studies matched groups of participants

by either cognitive ability (Beaumont and Newcombe, 2006; Colle et al., 2008), verbal ability (Pearlman-Avni and Eviatar, 2002; Tager-Flusberg and Sullivan, 1995), or both (Norbury et al., 2014). To better understand the use of ISL and narrative performance in ASD, Capps and her colleagues suggested future research include participants with higher cognitive abilities and more verbal competence (Capps et al., 2000; Losh and Capps, 2003). A further issue for such discrepancy is the coverage of a wide age range of participants across studies. For instance, some studies recruited adults and/or adolescents as participants (Begeer et al., 2010; Colle et al., 2008), others focused on young children (Siller et al., 2014) and still others covered both children and adolescents (Norbury et al., 2014). In view of these issues, it is not conclusive whether individuals with ASD are as equally likely as normal speakers to employ ISL in narratives.

Given the significant role of ToM abilities in narrative construction, four observational studies have investigated the association between ToM abilities and the use of ISL in narratives produced by English-speaking individuals with ASD. To begin with, Tager-Flusberg and Sullivan (1995) detected a significantly positive correlation between ToM performance and the use of emotion and cognitive terms. This connection has also been replicated in Capps et al.'s (2000) study. On the contrary, Losh and Capps's (2003) research failed to demonstrate a significant association between children's use of ISL and ToM abilities. More intriguingly, Siller et al.'s (2014) recent study revealed an association between ToM performance and the use of emotion terms, but reported no association between that and cognitive terms. As seen above, to date, an inconsistent picture has been presented regarding the relationship between ToM and ISL in ASD.

### **3. INTERNAL STATE LANGUAGE OF MANDARIN-SPEAKING CHILDREN WITH ASD**

While much research has examined ISL in English-speaking individuals with ASD (e.g., Baron-Cohen et al., 1986; Beaumont and Newcombe, 2006; Begeer et al., 2010; Colle et al., 2008; Pearlman-

Avnion and Eviatar, 2002; Tager-Flusberg, 1992; Tager-Flusberg and Sullivan, 1995), studies on ISL and Mandarin-speaking children with ASD are relatively limited (Chen, 2007; Chen and Chang, 2005; Tsao, Tsai, Wang and Lu, 2012; Tsou and Cheung, 2007; Yang, 2011). Most studies on Mandarin-speaking autistic children found no significant differences in ISL between ASD and comparison groups. A careful analysis of the literature, however, reveals variations in the ways ISL were measured and computed across studies. For instance, Chen and Chang (2005) used a metric based solely on emotion terms, while Yang (2011) tallied various kinds of internal-state terms to yield a composite score. Though Chen (2007) found that the ASD and control groups were comparable in using ISL, she neither stated clearly how ISL were identified nor provided details of the data.

Recent research on English-speaking children's use of ISL suggests that expressions related to cognitive and emotional aspects be examined separately (Babar et al., 2013; Siller et al., 2014). Turning to the research on Mandarin-speaking children with ASD, however, only Tsao et al.'s (2012) and Tsou and Cheung's (2007) studies categorized cognitive and emotion terms separately. Neither study found significant differences between ASD and comparison groups in either category. It is noteworthy that developmental research has classified ISL into several categories on the basis of different aspects of internal states like perception, physiology, affect, volition, cognition and moral judgment/obligation (Bretherton and Beeghly, 1982). Moreover, different categories of ISL are found to develop along different timelines. For instance, Tardif and Wellman (2000) demonstrated consistency across English and Chinese languages in the overall developmental sequence of the acquisition of ISL, in which expressions for desire and emotion are acquired earlier than those for belief. Additionally, Tager-Flusberg (1992) reported that autistic individuals are selectively impaired in using different categories of ISL. From this view, future studies on Mandarin-speaking autistic children need to analyze different categories of ISL separately to provide more informative answers about autistic children's ability in this regard.

Given that children's overall narrative skills undergo substantial developments from preschool years through pre-adolescence (Bamberg, 1987; Justice et al., 2006), studies on English-speaking individuals with

ASD have covered a broad age range from preschoolers to pre-adolescents in order to understand children's abilities in different developmental stages. As Bang et al. (2013) indicated, pre-adolescents are expected to be able to use a full range of ISL. The studies of Capps et al. (2000) and Tager-Flusberg (1995) particularly focused on this age group. Both studies revealed no significant difference in the use of ISL between groups, though shorter narrative length and less syntactic complexity were found in ASD groups compared to control groups. On the other hand, previous studies with Mandarin-speaking autistic individuals were restricted to preschoolers or early elementary school children (1<sup>st</sup> and 2<sup>nd</sup> grade). As can be seen, an unresolved question is whether older Mandarin-speaking school-age children, or pre-adolescents, with ASD will produce ISL that resemble those seen in their typically-developing (TD) peers.

To our knowledge, Tsao et al. (2012) and Tsou and Cheung (2007) conducted the only two studies so far that examined narrative performance and ToM abilities of Mandarin-speaking autistic children within the same research work. Although Tsou and Cheung did not specifically look at the relationship between ToM and ISL, they revealed a significant correlation between ToM and the composite scores of evaluative devices, with ISL categorized as one such device. The researchers pointed out the limitations in the false belief tasks they used and suggested more challenging ToM tests involving diverse concepts be applied in future research to more adequately capture children's ToM abilities. In the other study, Tsao et al. found a significantly positive correlation between ToM scores and the ratios of ISL. However, Tsao et al.'s analysis was mainly concerned with the relationship between ToM and narrative measures rather than on ISL per se. Thus, more investigations are required to gain a better picture about the relationship between ToM and ISL in Mandarin-speaking autistic children.

The present study, therefore, aimed to address these concerns by examining various categories of internal-state terms separately and by applying a more challenging ToM test. Moreover, we focused on high-functioning pre-adolescents with ASD and matched them with TD controls on both cognitive and linguistic abilities. The primary question of interest was to explore whether Mandarin-speaking pre-adolescents with ASD are comparable to TD controls in using ISL in narratives. The other

major goal was to explore the relationships between ToM abilities and the use of ISL.

## 4. METHOD

### 4.1 Participants

Two groups of Mandarin-speaking pre-adolescents were recruited in this study, including 9 autistic ( $M_{age} = 11.29$ ) and 13 TD ( $M_{age} = 10.01$ ) participants. All of them were male and were older elementary school students (5<sup>th</sup> and 6<sup>th</sup> grade). The diagnosis of the ASD group was established from school records and clinical judgment by qualified clinicians. All the autistic individuals met DSM-IV (APA, 1994) criteria for Autistic Disorder based on the Autism Diagnostic Interview—Revised (ADI-R; Lord, Rutter and LeCouteur, 1994).

The control group was comprised of TD pre-adolescents, with no concerns about ASD, learning disabilities or language delays. The TD group was matched to the ASD group on the basis of gender, language ability, verbal IQ (VIQ), performance IQ (PIQ) and full-scale IQ (FSIQ). Participants' VIQ, PIQ and FSIQ scores were obtained from WISC-III; their language ability was estimated using the subset of the Language Impairment Checklist for School Children-Revised (Lin, Huang, Huang and Xuang, 2009). An analysis of variance (ANOVA), detected no significant differences between groups on cognitive and language abilities (Table 1). Despite that, the ASD group was significantly older than the TD group ( $F_{(1, 20)} = 29.81, p < .001$ ).

Table 1. Group characteristics

	ASD (N=9) M (SD)	TD (N=13) M (SD)	F	<i>p</i>
VIQ	114.1 (13.29)	105.9 (9.38)	0.17	.68
PIQ	115 (16.89)	105.2 (15.5)	0.03	.88
FSIQ	115.8 (14.19)	105.8 (12.57)	0.08	.78
Language ability	36.7 (1.94)	36.6 (1.71)	1.44	.25

Significance level:  $p < .001$



## 4.2 Material

Narratives were elicited using the wordless picture book *Frog, where are you?* (Mayer, 1969). This book was chosen because it has been regarded as a valuable tool for tapping narrative abilities of both typically- (Berman and Slobin, 1994) and atypically-developing children (Colle et al., 2008; Diehl et al., 2006; Losh and Capps, 2003). The frog story is a typical children's story depicting a readily understood plot with a hero, a problem, a series of actions following the problem and a happy ending. In the story, protagonists encounter many obstacles within an elaborate series of events, which provides a rich context for narrators to infer characters' thoughts, emotions and motivations throughout the story. It has thus been used in several studies on ISL in ASD (Tager-Flusberg, 1995; Losh and Capps, 2003; Colle et al., 2008; Tsou and Cheung, 2007), against which the results of this study can be compared. This book is, therefore, suitable for our research goal.

## 4.3 Data Collection

The data-collecting session was carried out individually with each child. The session includes an initial warm-up conversation and a story-telling task based on *Frog, Where are You*. Prior to the story-telling, the experimenter explicitly said to the child that she had no knowledge about this particular story book. Then, the child was first asked to look through the entire book on his own. When the child had finished reading the book, he told the story aloud, turning the pages as he went along. The story was audio- and video-recorded and subsequently transcribed.

## 4.4 Data Analysis

**Basic narrative measures.** Participants' basic narrative measures include narrative length, variety of words and syntactic complexity. The total number of clauses in each narrative was tallied to quantify narrative length. The variety of words was analyzed in terms of the total number of different words used in each narrative. The syntactic complexity was indexed based on the frequency of complex sentences used.

**Internal state language.** Previous research on ISL has suggested that expressions related to cognitive and emotional aspects be examined separately (Babar et al., 2013; Siller et al., 2014). In addition to these two categories, developmental research also regards expressions for desire and perception as cardinal categories of ISL (Bartsch and Wellman, 1995; Wellman, Phillips and Rodriguez, 2000). To analyze ISL comprehensively, we adapted from previous research (Bang et al., 2013; Bretherton and Beeghly, 1982; Tager-Flusberg, 1992; Tsou and Cheung, 2007; Wellman et al., 2000) the taxonomies and definitions for four cardinal categories of ISL: namely, lexical expressions referring to emotion, desire, cognition and perception. The elaboration for emotional state includes the expressions happy, sad, worried, anxious, etc., while words like want, wish and try were classified as references to desire. The lexical expressions judged to refer to cognitive mental states include belief, know, think, understand, wonder, etc. Finally, words such as look, hear, feel, smell, taste, etc. belong to the category of perception. Each internal-state term was coded into one of the four categories. Examples for the four categories of ISL are given below:

- (1) Reference to emotion  
*xiǎo nánhái jiù hěn gāoxìng*  
'The little boy (is) very happy'.
- (2) Reference to cognitive state  
*xiǎo nánhái yǐwéi xiǎo qīngwā shuì zhe le*  
'The little boy thought the little frog was asleep'.
- (3) Reference to desire  
*xiǎogǒu xiǎng qù wàimiàn*  
'The little dog wants to go outside'.
- (4) Reference to perception  
*xiǎo nánhái kànjiàn hǎoduō mìfēng*  
'The little boy saw many bees'.

To gain a general picture about the participants' ability in using ISL, we computed an overall index of ISL by summing all instances of internal-state words and dividing the sum by the total number of clauses. Following previous research (Bang et al., 2013; Tager-Flusberg, 1992; Tsou and Cheung, 2007), this study used proportion scores to report the use of individual category of ISL. To this end, we calculated the proportion of each category of ISL to the total number of clauses in each participant's story.

**Assessment of ToM abilities.** Participants' ToM abilities were estimated using an adapted version of the Chinese Theory of Mind Tasks developed by Yeh, Hua and Liu (2009), which is more advanced and more challenging than the ToM test used by Tsou and Cheung (2007). The tasks included three test batteries: basic, advanced and non-verbal ToM. The basic battery consists of two sets of classic tests: the first-order false belief and the second-order false belief tasks. The advanced battery involves more complex social situations like recognition of faux pas or lies. The third battery tests the attribution of internal states in a nonverbal task. Scores from all three batteries were combined to yield one composite ToM score.

**Reliability.** 25% of the narratives were randomly chosen and coded by a second coder for reliability. Inter-rater agreement for all measures ranged between 89% and 93% (Cohen's Kappa coefficient).

## 5. RESULTS

Previous studies have indicated that individuals' language and narrative abilities are closely associated with age (Berman and Slobin, 1994; Clark, 2017). In light of this, Begeer et al.'s (2010) and Norbury et al.'s (2014) studies on narratives and ASD assessed group differences by performing a repeated measures analysis of covariance (ANCOVA), with age as a covariate, because age was considered to be a confounding factor that might influence the outcome and because ANCOVA allows to additionally control for covariates to remove the effect of confounding factors. Since the autistic children were significantly older than the TD controls, the current study also used an ANCOVA, with age as a covariate,

to examine group differences on individual measures. For indices reported as percentage scores, arc sine transformations were carried out on the percentage data to normalize the distribution (Sheskin, 2000).

To understand participants' general narrative abilities, we looked at several basic narrative measures, including narrative length, variety of words and syntactic complexity. An ANCOVA detected no significant differences between groups, suggesting that the two groups were comparable in these aspects (Table 2).

Table 2. Means of numbers of clauses, different words and complex sentences

	ASD (N=9) M (SD)	TD (N=13) M (SD)	F	<i>p</i>
Number of clauses	64 (12.83)	63.38 (10.75)	.003	.96
Number of different words	159.22 (29.02)	148.31 (27.50)	.3	.59
Number of complex sentences	14.56 (2.4)	15.69 (6.25)	.002	.96

Significance level:  $p < .05$

**Internal state language.** We first examined the overall ratio of internal state expressions used by the two groups of participants. An ANCOVA revealed no significant difference between groups,  $F(1, 19) = 1.00, p = .33$ , suggesting that the two groups were similarly likely to use ISL in narratives. Table 3 provides the mean number of expressions referring to emotion, desire, cognition and perception, respectively. The analysis detected no significant group differences in any of the four categories of ISL, displaying that the two groups spoke equally about these internal states (Figure 1).

Table 3. Means of different categories of ISL

	ASD (N=9) M (SD)	TD (N=13) M (SD)
Emotion	1.11 (1.45)	1.23 (1.01)
Desire	0.66 (1.41)	1.15 (1.14)
Cognition	2.56 (1.88)	1.38 (1.19)
Perception	4.56 (3.40)	5 (3.58)

ToM abilities and ISL. The result of an ANCOVA displayed that the ASD and the TD groups did not differ in the ToM scores,  $F(1, 19) = 4.51$ ,  $p = .05$  (ASD:  $M = 54$ ,  $SD = 5.15$ ; TD:  $M = 58$ ,  $SD = 3.29$ ). Next, Pearson's correlation was administered to examine the relationship between the use of ISL and ToM abilities, in terms of the total ISL tokens and ToM scores. The analysis did not yield significant association between these two variables within both groups (ASD,  $r = .16$ ; TD,  $r = .17$ ).

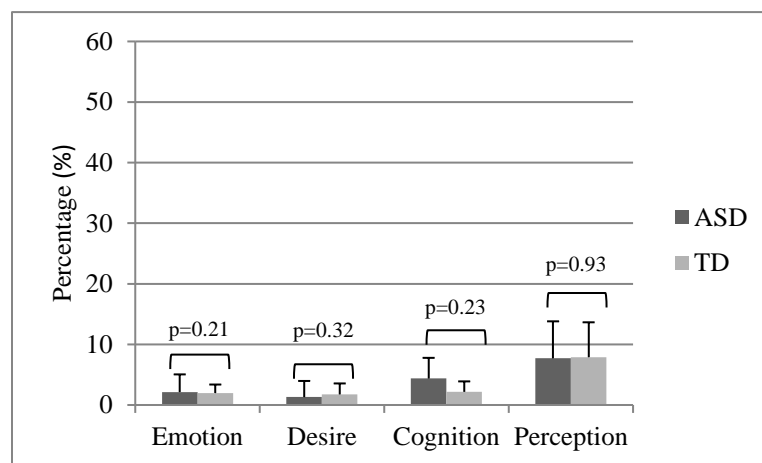


Figure 1. Comparisons between groups for different categories of ISL

Significance level:  $p < .05$

## 6. DISCUSSION

This study examined the ability of Mandarin-speaking pre-adolescents with ASD to use ISL in narratives. To begin with, no significant group differences were found in story length, variety of words or syntactic complexity, suggesting the ASD group did not differ relative to the TD group with respect to the basic narrative measures. This replicates previous findings about the intact performance in basic narrative measures in individuals with ASD within similar storybook contexts, with ASD group and comparison groups matching on language and cognitive abilities (Diehl et al., 2006; Losh and Capps, 2003; Tager-Flusberg and Sullivan, 1995; Tsou and Cheung, 2007; Yang, 2011).

In line with previous investigations (Bang et al., 2013; Capps et al., 2000; Norbury et al., 2014; Yang, 2011), our results for proportions of total internal-state references in the language samples suggest that the overall use of ISL did not differ between the two groups of participants. Similarly, no significant group difference was found for any of the four categories of ISL. The results for emotional- and cognitive-state expressions support earlier research based on English-speaking autistic children (Bang et al., 2013; Capps et al., 2000) and on Chinese-speaking ones (Tsao et al., 2012; Tsou and Cheung, 2007), suggesting that the ASD and TD groups were equally likely to talk about these two categories of ISL. This also provides additional evidence for the hypothesis suggesting rudimentary capacity in ASD for using emotion words (Tager-Flusberg, 1992).

Likewise, the ASD and TD groups did not differ in their references to desire or perception, which is consistent with previous literature reporting intact performance in English-speaking autistic children in this regard (Bang et al., 2013). It is worth noting that prior developmental research about TD children regarded expressions for desire and perception as cardinal categories of ISL (e.g. Bretherton and Beehly, 1982; Wellman et al., 2000), whereas, to our knowledge, in the literature on ISL and ASD, Bang et al.'s and Tager-Flusberg's (1992) studies were the few endeavors that analyzed references to desire and perception as distinct categories from references to other internal states. In keeping with such consideration in taxonomy, this study extended our current knowledge of Mandarin-speaking children's ISL through a fine-grained taxonomy. By so doing, we provided a more comprehensive analysis of ISL than previous investigations on Mandarin-speaking autistic children have done.

On the whole, our results indicated no deficits in the ASD group as compared to IQ- and language-matched TD group for any of the four categories of ISL. It is notable that this study extends previous research on Mandarin-speaking autistic individuals to show that not only early elementary school children (Chen, 2007; Chen and Chang, 2005) but also pre-adolescents with ASD were comparable to TD controls in using ISL. This indirectly corroborates Capps et al.'s (2000) observation that individuals with ASD still have appreciation, at least to a certain extent, about the need to include ISL in narrative discourse so as to engage their listeners.

The two groups' comparable performance in ISL, however, is at odds with previous studies that reported decreased use of ISL in ASD (Baron-Cohen et al., 1986; Begeer et al., 2010; Pearlman-Avni and Eviatar, 2002). Closer scrutiny of the selection of participants and narrative elicitation tasks across studies suggests plausible interpretations for the seemingly inconsistent results. Regarding selection of participants, unlike the pre-adolescents in this study, Baron-Cohen et al.'s ASD group ( $M_{age} = 12.4$ ) and TD group ( $M_{age} = 4.5$ ) belong to two different developmental stages, which makes it difficult to determine whether the deficiency in using ISL is specific to ASD or the result of maturation. Regarding narrative elicitation tasks, in the current study, the participants relied on illustrations of the picture book as visual aids to help them during their story-telling. On the other hand, Begeer et al.'s and Pearlman-Avni and Eviatar's research placed a greater cognitive load on the participants. Their retelling tasks were comparatively more challenging because the participants did not have visual aids during retelling and thus had to rely more on verbal working memory. One relevant research paper by Stoutz (2011) is worth noting here. According to Stoutz, the quality and content of retellings vary with the different elicitation methods employed. Specifically, she found that retelling without visual cues was more cognitively demanding than that with visual cues. Also notable is Gabig's (2008) study that revealed subtle verbal working memory deficits in children with ASD, with poorer recall performance on more challenging verbal tasks. Considered together, the difference in task demands across studies may contribute to the discrepancy in findings about ISL. Intriguing as the relationship among task demands, verbal working memory capacity and the use of ISL may seem, it is beyond the scope of the current discussion. It would be of interest for subsequent research on ISL and ASD to investigate this issue.

Equally likely, the comparable performance in ISL we found may be relevant to the nature of the frog storybook. As noted by Capps et al. (2000), the illustrations of this storybook displayed easily perceptible facial expressions of internal states, which may induce a potential ceiling effect that enables the participants to easily reach the upper limit for responses of ISL and, accordingly, overestimate their ability in this regard. Therefore, we speculated, this book may have lacked sensitivity in distinguishing the ASD from the TD group in terms of ISL. This speculation invites caution when drawing conclusions based on only a single story. Future studies would be beneficial to assess the use of ISL in ASD by means of different storybooks. Also plausibly, the autistic children's comparable performance in ISL merely reveals that they are able to label internal states, rather than indicate that they fully understand the internal states to which they referred. Similar concern has been brought up by Tager-Flusberg (1995). She found that the autistic children appeared to use ISL with a limited understanding of internal states of story characters, despite the ASD and comparison groups being equally likely to use ISL. Therefore, more research is needed to go beyond a tally of the mere production of particular lexical words to an assessment of the semantic and pragmatic functions of ISL (Shatz, Wellman and Silber, 1983).

Contrary to what one might expect, given the presumption of ToM deficits in ASD in previous research, the two groups of participants did not differ significantly in ToM scores. On the one hand, this result is in line with Roeyers and Demurie's (2010) finding that autistic individuals, at least to some extent, still have mind-reading abilities. On the other hand, the seemingly intact ToM performance in ASD reflects nothing more than the ability to respond properly to the questions and situations examined in the test; however, it is uncertain whether autistic children would perform properly in true interactions. This is because a fully developed ToM not only encompasses the skills probed here (e.g. detecting others' intentions and recognizing emotions), but involves several other abilities like memory, shared attention, face and gaze processing and imitation (Baars and Gage, 2010) which have not been addressed in standard ToM tests. Likewise, the ToM scores obtained here should not be misconstrued as evidence that autistic children are fine in social cognitive domains, on account of the multi-dimensional nature of the social cognition construct. As Fett et al. (2011:573) stated, social cognition comprises several functions such as emotional processing, social perception/knowledge,



attributional bias, as well as ToM. Given this, the inference of social cognitive abilities solely from ToM scores needs to be scrutinized carefully. Another way to view the result is to relate it to the comparable verbal ability of the two groups of participants. In the meta-analysis of false-belief understanding across languages, Liu, Wellman, Tardif and Sabbagh (2008) indicated that language ability significantly influences false-belief performances of ToM tests. In the current study, the two groups were comparable in general language ability (as they were matched in language ability and in VIQ) and in syntactic complexity, it is thus not surprising to find a comparable ToM performance. Equally possible, the group difference in ToM may not be easily discerned by the current tasks, because the reliance of the tasks on participants' ability to understand sentence complement structures may constitute a confounding variable damaging the validity of the ToM assessment. As noted in previous research (de Villiers and de Villiers, 2000; Miller, 2006), an individual's knowledge about sentential complement structures is relevant to his ToM performance. In view of this and the fact that Mandarin has simpler complement structures in relation to other languages, it would be informative for future research to examine to what extent Mandarin-speaking autistic children can use internal-state terms that take sentential complements.

Another intriguing finding is the absence of associations between ISL and ToM scores, which adds support to Losh and Capps's (2003) previous findings. We speculated that the above-mentioned limitation of the ToM tests is probably relevant to the absence of association reported here. Put another way, it is likely that the tests merely reflected the participants' competence in certain syntactic structures, but they were not sensitive enough to measure the mind-reading abilities per se. As a result, the analysis failed to display associations between ISL and ToM. The confounding variable and the limitation of the ToM tests will be crucial questions for future research in ISL and ToM in ASD. On the other hand, the results are inconsistent with the findings of three other studies (Capps et al., 2000; Siller et al., 2014; Tager-Flusberg and Sullivan, 1995). The discrepancies in research findings may be attributed to the wide variations of matching procedures. For one thing, in Capps et al.'s and Tager-Flusberg and Sullivan's studies, participants were matched only on language abilities; however, in Siller's and our studies, the matching variables included not only language but cognitive abilities. For another, while Siller et al.'s and our participants had scores of non-verbal cognitive abilities above 100, participants

in the other two studies had intelligence quotients below 80. A further issue is that participants across studies belong to different cognitive stages of development (Piaget, 1952). For instance, Siller et al. observed early elementary school children with ASD, while this study recruited pre-adolescents with ASD. Variations such as these are likely to increase the heterogeneity of participants and do not allow direct comparisons across studies. In view of all these, firm conclusions are still unable to be drawn regarding the relationship between ISL and ToM abilities in ASD and more investigations with rigorous matching of comparison groups are thus advocated to present a better picture in this regard.

## **7. CONCLUSION**

Although there were a relatively small number of participants included in this study, some interesting indications emerge. The analysis demonstrated that during story-telling tasks highly verbal pre-adolescents with ASD produced ISL at similar proportions to language- and IQ-matched peers. It is notable that this is the first study to provide a comprehensive examination of different categories of ISL used by Mandarin-speaking pre-adolescents with ASD. Also notable is that the ASD group performed equally as well as the TD group in the more advanced ToM tests. On the other hand, the analysis did not identify a significant linkage between ISL indices and ToM measures. The limitation of the ToM tests allows us to draw only tentative conclusions regarding the relationships between ISL and ToM. The consideration of using different research materials and reducing the language demands of the ToM tests will be crucial for future research about ISL and ToM in ASD.

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[Received 8 November 2016; revised 27 February 2018; accepted 1 March 2018]

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## 漢語高年級自閉症學童的圖畫書敘事：心智語彙與心智理論能力

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本文探討自閉症學童於敘事中使用心智語彙的能力。我們將自閉症與典型發展兒童就性別、語言、智商等能力指標配對，以 *Frog, where are you?* 為題材，量化敘事中有關情感、慾望、認知、感官等類別的詞彙，以分析兩組兒童心智語彙的使用及其與心智理論能力之關係。結果顯示：兩組兒童在心智語彙的使用及心智理論能力均未達顯著差異；心智語彙的使用與心智理論、語言、智商等能力指標間亦無顯著相關。

關鍵字：自閉症、心智語彙、心智理論、漢語高年級學童