Referential choice in narratives of Mandarin-speaking children with autism spectrum disorder: Form, function, and adequacy

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Abstract

This study investigates the referential choice of Mandarin-speaking children with autism spectrum disorder (ASD). The data consist of narratives from 16 children with ASD and 16 typically-developing (TD) children. The narratives were elicited using the wordless picture book *Frog, where are you?* Participants' referential expressions were coded in terms of referential form, function, and adequacy. The results revealed that, compared with the IQ- and language-matched TD children, the children with ASD used significantly more pronominal forms for subsequent mentions, showed insufficient ability to use definite and indefinite noun phrases to mark the information status of referents, and made fewer adequate reintroductions. Additionally, this study demonstrated the potential of the three-category classification to advance our understanding of referential choice in ASD. The outcomes underscore the importance of analyzing referential adequacy across referential functions, and suggest that referential functions are not equally difficult.

Introduction

Narratives provide a way for humans to communicate information. To successfully construct a narrative, a speaker needs to attend to and relate categories of information. One

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means to achieve this is to use referential expressions referring backward or forward to story characters (or referents) to help listeners identify and track the characters as the narrative unfolds. By so doing, cohesion is achieved and the listeners' comprehension may thus be facilitated.

Referential choice: Form, function, and adequacy

A speaker's choice of referential expressions is associated with his/her assumption about the degree to which a referent is linguistically retrievable or cognitively accessible to the listener (Ariel, 1990). Research has indicated that arguments whose referents are not highly accessible are more likely to be realized overtly than arguments with highly accessible referents. For instance, speakers tend to use indefinite noun phrases (NPs) to mark the least accessible referent, while null forms (zero anaphora) are used for the most accessible referent (Givón, 1983). To this end, Ariel has developed an accessibility marking scale, on which null forms and pronouns are the high accessibility markers, while complex NPs are the low accessibility markers.

Another way to view the accessibility of a given referent is through its discourse-pragmatic function involved in narrative discourse. Analysis of narrative production has looked at the association between linguistic forms and three referential functions, including referent introduction, maintenance, and reintroduction (Colozzo & Whitely, 2014; Hickmann & Hendriks, 1999; Orsolini, Rossi, & Pontecorvo, 1996). 'Introduction' refers to the very first mention of a character in a story. Although 'maintenance' and 'reintroduction' are both subsequent mentions referring back to someone or something that has been previously identified, reintroduction particularly refers to the condition in which the reference continuity has been interrupted by intervening utterances focusing on another character. Generally, nominal forms are used more frequently for introducing or reintroducing characters in a story, while pronominal forms are mostly used for reference maintenance.

In one recent study, Colozzo and Whitely (2014) underscored the importance of examining referential adequacy for our understanding of how speakers achieve referential success. A reference is considered adequate if the pairing of referential form and function is appropriate in the discourse context. Several studies have examined referential adequacy (or appropriateness) in typically-developing (TD) children's narratives. For instance, Hickmann, Hendriks, Roland, and Liang (1996) looked at referential adequacy of referent introduction, and Hickmann and Hendriks (1999) focused on that of subsequent mentions. In addition, Colozzo and Whitely (2014), and Wong and Johnston (2004) investigated referential adequacy across all three referential functions, and found that children achieved the highest adequacy level for reference maintenance, while performing least adequately for reintroduction.

Referential choice in individuals with autism

The association between narrative skills and theory-of-mind (ToM) abilities has been addressed in studies with typical individuals as well as individuals with autism spectrum disorder (ASD) (e.g., Fernández, 2013; Tsou & Cheung, 2007). For

instance, Fernández found that higher-order ToM abilities are a good predictor of children's pragmatic language skills needed for narrative construction. Equally importantly, reference production also involves ToM abilities to understand listeners' perspectives and needs. Following the ToM account for the social-communicative difficulties in ASD, previous studies have examined autistic individuals' choice of referential forms in relation to referential functions in narratives. To begin with, regarding referent introduction, Tager-Flusberg (1995) found that, compared with the ASD group, the TD group were significantly more likely to use NPs to specify first mentions; in contrast, Colle, Baron-Cohen, Wheelwright, and van der Lely (2008), and Norbury and Bishop (2003) revealed that the ASD and TD groups were comparable in this respect. For subsequent mentions, the research of Tager-Flusberg (1995), and Norbury and Bishop (2003) yielded similar results, suggesting that the two groups did not differ in referent maintenance or reintroduction. However, these findings are inconsistent with those of Colle et al. (2008). The latter indicated that the two groups showed similar referential choices in reintroducing referents, while the ASD group used significantly more NPs than the TD group for reference maintenance. These mixed results suggest that much remains to be explored about the referential abilities in ASD.

In addition, the occurrence of ambiguous references has been explored. Norbury and Bishop (2003) reported that the ASD group produced significantly more ambiguous pronouns than the TD group. This was replicated by Colle et al. (2008) and Novogrodsky (2013). Nevertheless, it should be pointed out that, in Colle et al.'s (2008) study, this finding holds true only for references to the secondary characters, while no significant difference between groups was found when references were restricted to the main protagonist. Overall, despite previous studies reporting inefficient reference resolution in ASD, we still lack knowledge about how referential function may influence referential adequacy in narratives of individuals with ASD.

Purpose of the study

Although several studies on narratives of Mandarin-speaking children with ASD have reported that they failed to provide enough information to meet listeners' needs, these studies were mainly concerned with the structural or evaluative aspect of narratives (e.g., Chen & Chang, 2005; Sah & Torng, 2015, 2016; Tsou & Cheung, 2007). The referential abilities of Mandarin-speaking autistic children are relatively much less understood. To my knowledge, three studies (Chen, 2007; Chen & Chang, 2005; Tsou & Cheung, 2007) have looked at the use of referential expressions by Mandarin-speaking autistic children. Chen (2007) reported that the ASD and TD groups were comparable in using pronominal references, though some autistic children marked reference in a less adequate way. Nevertheless, she examined only pronominal references and did not clearly state how 'adequate' reference was defined. Chen and Chang (2005) focused on nominal and pronominal references, without looking at null forms or referential functions. Lastly, Tsou and Cheung's (2007) analysis found no significant difference between the ASD and TD groups regarding irrelevant or erroneous nominal references; however, they did not tap into referential functions or other linguistic forms.

As seen above, more studies are required to advance our understanding of referential abilities in Mandarin-speaking autistic children.

Previous studies of referential abilities and ASD have focused mainly on English-speaking individuals (Arnold, Bennetto, & Diehl, 2009; Colle et al., 2008; Novogrodsky, 2013; Tager-Flusberg, 1995); however, Mandarin Chinese would also be an interesting testing ground to advance our knowledge in this regard. There are some linguistic features that make Mandarin informative for this endeavor. To begin with, because there are no obligatory morphological markings of case and gender distinctions in spoken Mandarin, the same person pronoun is used for both male and female genders, and for subject and object case roles. For instance, *tā* can be used to refer to 'he,' 'she,' 'it,' 'him,' or 'her.' Second, as a pro-drop language, Mandarin permits null arguments in both subject and object positions.[1] Relatedly, because first and second person referents are readily identified in the discourse context, they are often associated with null forms unless there is particular reason to indicate the reference to the listener (Li & Thompson, 1981). It is thus not surprising that null forms were found to be used more frequently in Mandarin as compared to other languages for reference maintenance in oral narratives (Chen & Lei, 2013; Hickmann & Hendriks, 1999). Third, languages such as German, French, and English use determiners like articles to distinguish indefinite and definite NPs so as to mark given/new referents. In contrast, Mandarin has no articles; determiners are optional in the language. The given/new distinction is usually conveyed through a combination of nouns with demonstratives, numerals, or classifiers. Generally, numeral NPs function as indefinite expressions to mark new referents, demonstrative NPs function as definite expressions to mark given referents,[2] while bare nouns (without determiners or classifiers) can potentially denote either new or given referents (Cheng & Sybesma, 1999; Hickmann, 2003). As can been seen, the internal structure of an NP is relevant to whether the NP functions as a definite or indefinite expression. In view of all these linguistic features, it would be illuminating to investigate whether they impact Mandarin-speaking autistic children's referential choice.

Since null references barely exist in English, previous research with English autistic individuals adopted a binary contrast between nominal and pronominal forms by collapsing pronominal and null forms into one category (e.g., Colle et al., 2008). However, as Clancy (1997) indicated, a binary system such as this would be an oversimplification and might obscure the possible contribution or limitation of null forms in a speaker's referential production. Another crucial concern is that, despite the significance of null forms in the Mandarin discourse data (Hickmann & Hendriks, 1999), none of the prior studies on Mandarin-speaking autistic children included null forms as referential means to analyze. As can been seen, much still needs to be done to further our understanding of how Mandarin-speaking autistic children mark reference in narratives, especially by systematically investigating the contribution of null forms, together with nominal and pronominal forms, to referencing.

The current study was an attempt to address these gaps by examining the referential abilities of Mandarin-speaking children with ASD in terms of referential form, function, and adequacy. One central question to ask was whether autistic children are comparable to TD children in marking reference in oral narratives. The other goal was to explore the influence of referential function on referential adequacy.

Table 1. Descriptive statistics for IQ, and language ability scores.

	ASD M (SD)	TD M (SD)	F	p
Full Scale IQ	104.69 (18.12)	102.94 (10.56)	0.11	.74
Receptive language	31.67 (5.00)	29.69 (3.88)	1.53	.23
Expressive language	33.80 (7.23)	33.99 (7.02)	0.10	.76

Method

Participants

Two groups of Mandarin-speaking children participated in this study, including 16 children with ASD (ages 6.6–9.5; M_{age} = 8.25) and 16 TD children (ages 6.6–9.5; M_{age} = 7.16). All the children were male and were early elementary school students. The diagnoses of autistic children were established from school records and clinical judgment by qualified clinicians. All the children with ASD met DSM-IV (American Psychiatric Association, 1994) criteria for Autistic Disorder based on the ASD Diagnostic Interview – Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994). The TD children had no history of learning disabilities or language delays.

Because this study involved a storytelling task, the ASD children were matched to the TD children by group means on both Full Scale IQs (FSIQs) and language abilities (Arnold et al., 2009). The participants' FSIQs were obtained using the Wechsler Intelligence Scale for Children – 3rd edition (WISC-III) (Chinese version; Chen, 1997), and their language (receptive and expressive) scores were derived from the Revised Language Impairment Checklist for School Children (Lin, Huang, Huang, & Xuang, 2009). Results from analyses of variance (ANOVA) confirmed that there were no significant differences between groups regarding these abilities (Table 1).[3] The establishment of language levels allows referential abilities to be examined without being confounded by deficits in language abilities. Written informed consent forms were sent to the homes of participants. Prior to testing, informed consent was obtained from all parents and participants. Ethical approval for the study was provided by the Research Ethics Committee of the National Taiwan University.

Material

To control the content of the narratives, we used a wordless picture book *Frog, where are you?* (Mayer, 1969) to elicit a narrative from each participant. This book was chosen because it has been used to tap narrative ability of not only TD children from different language backgrounds (Berman & Slobin, 1994), but also a variety of developmentally disordered populations (Norbury & Bishop, 2003). In particular, much of the prior research on referential abilities and ASD has collected narrative data based on this book (e.g., Colle et al., 2008; Norbury & Bishop, 2003; Novogrodsky, 2013); therefore, the frog-story-based narrative sample would allow us to make comparisons across studies.

Data collection

Rapport was first established in the observation period. The data-collecting session was carried out individually with each participant, and consisted of an initial warm-up conversation followed by a storytelling task based on *Frog, where are you?*

Given that referential choice may vary as a function of mutual knowledge between interlocutors (Kail & Hickmann, 1992), previous research focused on participants' reference production in the absence of mutual knowledge (Colle et al., 2008; Novogrodsky, 2013). Following this, we also elicited narratives in a situation that the experimenter and participants did not share knowledge of the story. To this end, prior to the storytelling, the experimenter explicitly said to each participant that she had no knowledge about this story. The experimenter sat opposite the participant, and was unable to see the pictures, so only the participant had privileged access to them. The participants were first asked to look through the entire book on their own and then to tell a story while looking at the pictures. The entire sessions were audio- and video-taped and subsequently transcribed.

Data analysis

Each reference was coded in terms of referential form, function, and adequacy. Because referents' animacy may affect speakers' referential choice (Fukumura & van Gompel, 2011; Serratrice, 2013), to control animacy, this study followed Colozzo and Whitely's (2014) and Serratrice's (2007) methodology by tagging references to all animate referents in the story, including the boy, the dog, the frog, the bees, the gopher, the owl, and the deer.

Referential form. Referential forms were examined in terms of a three-category classification (Clancy, 1997; Huang, 2013), in which null forms were treated as a distinct category because they were considered as equally important as nominal and pronominal forms. The three categories and their definitions are stated as below:

  Nominal form: including noun phrases, bare nouns, and proper names.

  Pronominal form: including pronouns and demonstratives.

  Null form: absence of overt form.

There were 827 nominal, 284 pronominal, and 334 null forms for referencing in the language sample. In addition to the three major categories, we further examined the use of indefinite and definite NPs by focusing on instances of numeral and demonstrative NPs, respectively.[4]

Referential function. Three referential functions were differentiated: referent introduction, maintenance, and reintroduction. A referential expression was coded for introduction if it was used to introduce a story character for the very first time in the story. To distinguish referent maintenance from reintroduction, we largely followed Orsolini et al.'s (1996) and Serratrice's (2007) practice in coding subsequent mentions. A referential

expression to be coded for reintroduction must meet two criteria. First, its referent must have been introduced in previous part of the story. Second, the expression represented a subject or object argument whose referent was not mentioned in the immediately preceding clause; that is, its reference was interrupted by an intervening clause denoting another referent. Or, in some special cases of our language sample, though the reference was not interrupted, it was regarded as a reintroduction if the referential expression represented "a subject argument whose immediate antecedent was in object position" (Serratrice, 2007: 1067). All other subsequent mentions were coded for reference maintenance, except for the condition of reintroducing.

Example 1 illustrates how these three functions were differentiated. Here, an indefinite NP *yī gè xiǎo nánhái* 'a little boy' was used to introduce a story character 'boy' at the beginning of the story (line 1), while a pronoun *tā* 'he' maintained reference to the boy (line 2). Because another character, doggie, denoted in the intervening clause (line 3) interrupted the referential continuity, the NP *xiǎo nánhái* 'little boy' in line 4 helped to re-establish the boy as the narrative focus and was therefore coded as reintroduction. Example 2 illustrates the case that the subject NP *zhè xiǎogǒu* 'this dog' was coded as reintroduction because its immediate antecedent *xiǎogǒu* was in object position of the preceding clause.

Example 1: Introduction, maintenance, and reintroduction

1   **yī gè xiǎo nánhái** zài fángjiān kàn zhè tāde qīngwā chǒngwù
     'A little boy looks at his pet frog in the room.'
2   **tā** hěn xǐhuān zhèzhī xiǎo wā
     'He likes this little frog very much.'
3   **gǒugōu** yě hěn kāixīn
     'Doggie is also very happy.'
4   **xiǎo nánhái** yào xiǎo wā hǎohǎo shuìjiào
     'Little boy wants little frog to sleep well.'

Example 2: Reintroduction

1   nánhái zài jiào xiǎogǒu
     'boy is yelling at the dog,'
2   ér **zhè xiǎogǒu** diào xiàqù chítang
     'and this dog falls down to the pond.'

Frequencies and percentages were used to report the distribution of referential forms for each referential function (Colle et al., 2008). To obtain the percentage of nominal forms for referent introduction, for instance, we divided the number of nominal forms used for introduction by the total number of referential expressions used for such purpose in a story.

Referential adequacy. Each reference was rated for referential adequacy using a binary adequate/inadequate classification adapted from the research of Colozzo and Whitely (2014) and Liles (1985). Previous studies with typical Mandarin speakers regarded null and pronominal forms as the preferred forms for reference maintenance, and nominal forms for referent introduction and reintroduction (Chen & Lei, 2013). In this study, we

judged whether a reference is adequately made by considering not only such criteria but also the discourse context.

Adequate reference indicates that a speaker uses a referential expression appropriately in the discourse context so that his/her listener can easily and successfully identify a story character. In contrast, a reference was coded as inadequate when a character cannot be readily or clearly identified in the context. Examples of inadequate references include: a referential expression denotes more than one possible referent but the context is insufficient to determine the intended referent; a referent is referred to but not provided in the context.

The references in Example 3 are both adequately marked. In line 1, an adequate introduction was made by the indefinite NP *yī zhī lù* 'a deer'; in line 2, the null form in subject position maintained reference to the deer introduced in the preceding clause. In Example 4, the pronoun *tā* 'he' (line 4) was coded as inadequate, because both boy and dog are possible referents. Here, instead of the pronoun, a nominal form would be more informative for listeners to refocus on the boy. Similarly, in Example 5, it was unclear that the intended referent of the pronoun *tā* (line 2) was the boy or the dog because both characters are possible referents in the picture. In Example 6, an inadequate reference was made because what the bees chase is the 'dog,' rather than the 'owl.'[5]

Example 3: Adequate references

1   yǒu **yī zhī lù** zài shítou hòumiàn
        'There is a deer behind rock.'
2   **Ø** yǒu liǎng zhī dà jiǎo
        '(It) has two big antlers.'

Example 4: Inadequate reference

1   xiǎo nánhái xiǎngyào xiàqù zhǎo qīngwā
        'Little boy wants to go down to look for (the) frog.'
2   gǒugōu zhuī guòlái
        'Doggie chases through here.'
3   gǒu diào jìn shuǐchí
        'Dog falls into (the) pond.'
4   **tā** yě xiàqù le
        'He also goes down.'

Example 5: Inadequate reference

1   xiǎogǒu tiào qǐlái
        'Little dog jumps up.'
2   **tā** duì nàér jiào
        'He/It is yelling at there.'

Example 6: Inadequate reference

mìfēng zài zhuī **māotóuyīng**
'Bees are chasing (the) owl.'

To explore the influence of referential function on referential adequacy, we computed the percentages of adequate and inadequate references regarding each referential function. For instance, the percentage of adequate maintenance was calculated by dividing the number of adequate maintenance by the total number of reference maintenance within a story.

Reliability. Coding was carried out by one trained coder. A second coder scored 25% of the narrative samples, selected at random, for reliability. Inter-coder reliability achieved 90% for determining adequate reference, and 92% for inadequate reference. The reliability for all other measures exceeded 90%.

Results

This study used nonparametric statistical tests because variables were not normally distributed. Following Colle et al. (2008), we conducted Mann–Whitney U tests to analyze differences between participant groups. For within-group comparisons, Wilcoxon signed-rank tests were conducted with a Bonferroni correction applied, resulting in a significance level set at $p < .017(.05/3)$.

Referential form and function

Table 2 presents the raw frequencies and percentages of the three major categories of referential forms in relation to referential functions. First, for referent introduction, Mann–Whitney U tests detected no significant group difference for any type of the referential forms (nominal: $U = 114.50$, $p = .61$; pronominal: $U = 124.00$, $p = .89$; null: $U = 114.00$, $p = .62$). Within each group, Wilcoxon signed-rank tests revealed significant differences in referential forms. For the ASD group, the percentage of nominal forms was significantly larger than that of pronominal forms ($Z = -3.65$, $p < .001$), and than that of null forms ($Z = -3.65$, $p < .001$); however, no significant difference was found between pronominal and null forms ($Z = -0.27$, $p = .79$). A similar pattern was displayed for the TD group, with significant differences detected between nominal and pronominal forms ($Z = -3.62$, $p < .001$), and between nominal and null forms ($Z = -3.62$, $p < .001$), while the difference between pronominal and null forms was nonsignificant ($Z = -0.11$, $p = .92$).

With regard to reference maintenance, Mann–Whitney U tests revealed that the TD group used nominal forms significantly more often than the ASD group did ($U = 68.50$, $p = .02$), while the reverse pattern was displayed for pronominal forms ($U = 63.00$, $p = .01$). The group difference regarding nulls forms, however, failed to reach significance ($U = 122.00$, $p = .83$). Wilcoxon signed-rank tests detected further differences within each group. For the ASD group, null forms were used significantly more often than nominal forms ($Z = -2.44$, $p = .015$), while the difference between pronominal and nominal forms ($Z = -2.05$, $p = .04$), and that between pronominal and null forms ($Z = -1.16$, $p = .26$) failed to reach significance. For the TD group, null forms were used significantly more often than pronominal forms ($Z = -2.74$, $p = .01$), while differences between pronominal and nominal forms ($Z = -2.07$, $p = .04$), and between nominal and null forms

Table 2. Frequencies (*n*) and percentages (%) of referential forms, by function and group.

Referential function	Referential form	ASD	TD
		n (%)	*n* (%)
Introduction	Nominal	111 (94.87)	111 (91.74)
	Pronominal	3 (2.56)	5 (4.13)
	Null	3 (2.56)	5 (4.13)
Maintenance	Nominal	55 (17.08)	89 (32.72)
	Pronominal	115 (35.71)	60 (22.06)
	Null	152 (47.20)	123 (45.22)
Reintroduction	Nominal	185 (65.37)	276 (83.64)
	Pronominal	68 (24.03)	33 (10.00)
	Null	30 (10.60)	21 (6.36)

($Z = -1.57$, $p = .12$) were non-significant. To understand whether null forms were specifically preferred for maintaining reference, the percentage of null forms used for each referential function as a proportion of all referential expressions used within a story was also calculated. Wilcoxon signed-rank tests revealed that, within both groups, the percentage of null forms used for maintaining reference was significantly larger than that for introducing (ASD: $Z = -3.54$, $p < .001$; TD: $Z = -3.52$, $p < .001$) and that for reintroducing (ASD: $Z = -3.46$, $p = .001$; TD: $Z = -3.52$, $p < .001$) referents.

Pertaining to referent reintroduction, Mann–Whitney U tests revealed that the TD group used nominal forms significantly more often than the ASD group ($U = 64.50$, $p = .02$), while a reverse pattern was displayed for pronominal forms ($U = 75.50$, $p = .05$). Null forms used by the two groups did not differ ($U = 108.00$, $p = .47$). Within each group, Wilcoxon signed-rank tests detected significant differences in referential forms. For the ASD group, the percentage of nominal forms was significantly larger than that of null forms ($Z = -3.12$, $p = .002$), while the difference between nominal and pronominal ($Z = -1.99$, $p = .05$) and that between pronominal and null forms ($Z = -2.35$, $p = .02$) did not reach significance. For the TD group, nominal forms were used significantly more often than both pronominal ($Z = -3.52$, $p < .001$) and null forms ($Z = -3.52$, $p < .001$), while no significant difference was found between pronominal and null forms ($Z = -1.89$, $p = .06$).

This study also examined the use of definite and indefinite NPs by analyzing instances of numeral and demonstrative NPs. Table 3 presents the frequencies and percentages of the two types of NPs with regard to each referential function. For referent introduction, Mann–Whitney U tests revealed that the TD group used significantly more indefinite NPs than did the ASD group ($U = 28.50$, $p < .001$), while no significant difference between groups was found for definite NPs ($U = 102.00$, $p = .12$). Wilcoxon signed-rank tests showed that the TD group used significantly more indefinite than definite NPs to introduce new referents ($Z = -3.36$, $p = .001$); however, within the ASD group, the difference between the two types of NPs was non-significant ($Z = -1.60$, $p = .11$). Next, for reference maintenance, the TD group used significantly more definite NPs than did the ASD group ($U = 63.00$, $p = .016$), while no significant difference between groups was found for indefinite NPs ($U = 91.00$, $p = .55$). Wilcoxon signed-rank tests did not detect any significant difference between definite and indefinite NPs within each group (ASD:

Table 3. Frequencies (*n*) and percentages (%)[a] of definite and indefinite NPs, by function and group.

Referential function	NPs	ASD	TD
		n (%)	*n* (%)
Introduction	Definite	1 (0.90)	6 (5.41)
	Indefinite	12 (10.81)	58 (52.25)
Maintenance	Definite	0 (0)	12 (13.48)
	Indefinite	3 (5.45)	3 (3.37)
Reintroduction	Definite	1 (0.54)	24 (8.70)
	Indefinite	2 (1.08)	2 (0.72)

[a]Relative to total number of nominal forms.

$Z = -1.00$, $p = .32$; TD: $Z = -1.17$, $p = .24$). Finally, for referent reintroduction, Mann–Whitney U tests revealed that the TD group used significantly more definite NPs than did the ASD group ($U = 35.00$, $p < .001$), while no significant difference between groups was found for indefinite NPs ($U = 111.00$, $p = .92$). Wilcoxon signed-rank tests revealed that the TD group used significantly more definite than indefinite NPs to mark the given referents ($Z = -2.67$, $p < .01$); however, the difference between the two types of NPs was non-significant in the ASD group ($Z = -1.00$, $p = .32$).

Referential adequacy

Table 4 presents the frequencies and percentages for referential adequacy. With respect to adequate reference, Mann–Whitney U tests detected no significant difference between groups for referent introduction ($U = 110.00$, $p = .52$) or maintenance ($U = 93.50$, $p = .20$); in contrast, a significant group main effect revealed that more adequate reintroductions were made by the TD group as compared to the ASD group ($U = 40.00$, $p < .001$). Similarly, regarding inadequate reference, Mann–Whitney U tests did not detect significant group difference for referent introduction ($U = 110.00$, $p = .52$), or maintenance ($U = 93.50$, $p = .20$). However, a significant difference between groups was found for reintroduction ($U = 40.00$, $p < .001$), suggesting that more inadequate reintroductions were made by the ASD group.

Table 4. Frequencies (*n*) and percentages (%) of referential adequacy, by function and group.

Referential adequacy	Referential function	ASD	TD
		n (%)	*n* (%)
Adequate	Introduction	111 (94.87)	111 (91.74)
	Maintenance	264 (81.99)	242 (88.97)
	Reintroduction	206 (72.79)	303 (91.82)
Inadequate	Introduction	6 (5.13)	10 (8.26)
	Maintenance	58 (18.01)	30 (11.03)
	Reintroduction	77 (27.21)	27 (8.18)

Discussion

To understand the ability of Mandarin-speaking autistic children to use referential expressions within narrative contexts, this study looked not only at form–function pairings, but also examined referential adequacy across referential functions.

Referential form and referential function

Both groups of children showed a significant preference for nominal forms in making referent introductions. Compared with the ASD group, the TD group used significantly more nominal forms for reference maintenance and reintroduction. In contrast, the ASD group used significantly more pronominal forms than did the TD group for the subsequent mentions.

Existing studies generally suggest that it appears more appropriate to use pronominal than nominal forms for reference maintenance (Chen & Lei, 2013; Colozzo & Whitely, 2014; Wong & Johnston, 2004). Given this, one unresolved question is why the ASD group demonstrated this pattern, but the TD group showed the reverse one. Closer scrutiny of the data suggests several plausible explanations for the unexpected results.

First, in some contexts, the third person pronoun *tā* could refer to more than one possible referent (either the boy protagonist or other characters), and thus lead to ambiguous reference, because *tā* in spoken Mandarin can be used for both genders and for humans as well as animals. In consideration of this, some TD children chose to use bare nouns like 'boy' or 'doggie,' instead of pronouns, for reference maintenance. Such use of nominal forms needs not be regarded as inappropriate maintenance of reference; rather, it revealed TD children's attempt to disambiguate reference for their listener in the condition that only the speaker has privileged access to the referent. In contrast, when the reference was contextually ambiguous, the use of pronouns by some autistic children rendered their reference maintenance, and even reintroduction, under-informative, which suggests that they might not be sensitive enough about what the listener needed to successfully understand the reference.

Second, in some instances, autistic children seemed to use the pronoun *tā* deictically in describing story characters, rather than doing this anaphorically for referential continuity. This therefore does not constitute genuine reference maintenance; instead, such deictic use of pronouns has been regarded as an immature referential strategy in Karmiloff-Smith's (1981) three-stage model for the development of anaphoric reference.

Third, Hickmann and Hendriks's (1999) findings about reference maintenance are relevant here. As they reported, pronominal forms were used significantly more often than nominal forms by Mandarin-speaking preschoolers, 10-year-olds, and adults, while the 7-year-olds displayed a reverse pattern. In addition, they observed an interesting age effect whereby the use of pronominal forms decreased with age, particularly between preschool age and 7 years, but increased again thereafter. Similarly, a preference for nominal forms to maintain reference was found in our TD children whose average age was 7.16. Considered together, these findings lead us to speculate whether the preference for nominal over pronominal forms for reference maintenance would be specific to Mandarin-speaking children at early school years. If this is the case, a related question

concerns whether the autistic children exhibited a different developmental trend in this respect. Because we are lacking longitudinal data from preschool to adulthood regarding reference production, these questions remain open for further developmental research.

Finally, it has been claimed that speakers' use of pronouns may be affected by referential distance, measured by the number of clauses between the current referential expression and its antecedent (Chiarcos & Krasavina, 2008; Givón, 1983). Support for this also comes from Arnold et al.'s (2009) findings that the autistic speakers tended to use pronouns/null forms when the referent had been mentioned in the immediately preceding clause; as referential distance increased, they would decrease the use of such forms. From this view, referential distance is likely to bear on the participants' choices between nominal and pronominal forms for reference maintenance in this study. Further investigation would be needed to address this issue.

Our analysis revealed that both groups showed a preference for null forms to maintain reference. We first exclude the possibility that the use of null forms is due to the presence of mutual knowledge, because only the participants had privileged access to the book (Skarabela, Allen, & Scott-Phillips, 2013). According to the notion of accessibility, a subsequently mentioned referent is expected to be realized by means of high accessibility markers (Ariel, 1990). In his recent research, Huang (2013) argued that null forms mark the highest degree of accessibility on the accessibility scale for anaphoric expressions in Mandarin Chinese. Considered together, when cues of the discourse context are sufficiently informative for listeners to retrieve the correct referent of a subsequent mention, Mandarin speakers would prefer to maintain reference with a null form, rather than an overtly marked argument. This may explain why null forms were found to be used more frequently for reference maintenance by Mandarin-speaking children as compared to children of other languages (Chen & Lei, 2013; Hickmann & Hendriks, 1999), and why our participants showed frequent use of null forms for such purpose. In support of Clancy's (1997) argument, this study revealed that, compared with the binary contrast adopted in previous studies, the three-category classification can better capture the discourse function associated with null forms, and might contribute to a deeper understanding of Mandarin-speaking autistic children's referential abilities.

The analysis on choices between definite and indefinite NPs found that, compared with the ASD group, the TD group used significantly more indefinite NPs for referent introduction, but used definite NPs significantly more often for subsequent mentions. The within-group comparisons revealed the TD children's contrastive uses of indefinite and definite NPs for introduction and reintroduction, respectively, to distinguish between new and given referents. In contrast, the autistic children made no differential use of the two types of NPs for any of the referential functions. This finding is inconsistent with Colle et al.'s (2008) finding that autistic adults and the normal controls were comparable in using indefinite NPs to introduce referents. As Wong and Johnston (2004) indicated, unlike languages such as English that mark definiteness of NPs by means of obligatory determiners, the definiteness of an NP in Mandarin Chinese varies with the internal structure of the NP. It could be presumably challenging for Mandarin autistic children to distinguish the structural distinctions within NPs to mark the given/new referents appropriately. More cross-linguistic studies are necessary to provide more informative answers for this assumption.

Alternatively, as previous research suggested, both narrative and reference production involve ToM abilities (Colle et al., 2008; Fernández, 2013), while ASD is associated with deficits and delays in the development of such abilities (Tager-Flusberg, 2007). Based on this literature, it is likely that the autistic children's failure in marking the given/new distinction through indefinite and definite NPs, and their under-informative subsequent mentions reported above might be relevant to their ToM deficits. Since we did not administer any ToM assessments, we can only speculate about the plausible influence of ToM deficits on the participants' referencing. Further investigations need to include ToM assessments to explore the relationships between referential choice and ToM abilities.

This is the first study examining Mandarin-speaking autistic children's use of numeral and demonstrative NPs across referential functions. The analysis here suggests that the autistic children had insufficient ability to mark the informative status of referents through these NPs. Due to the limited scope, however, the instances of bare nouns were not analyzed. Further research is needed to understand autistic children's ability in this regard by examining how such forms are used as definite or indefinite nominals. In addition to NP types, the position of a nominal form in relation to the verb of a clause is also central to studies on referential choice. For instance, in Mandarin, post-verbal position is found to be more frequent with referent introduction, while pre-verbal position is more frequent with subsequent mentions (Hickmann et al., 1996). Further research is necessary to examine whether Mandarin-speaking autistic children have difficulty in using pre-verbal and post-verbal position as contrastive markers to distinguish given/new referents.

Referential adequacy

Analysis of referential adequacy revealed that the two groups of children were comparable in making adequate as well as inadequate references for referent introduction and maintenance. Where we did find a significant group difference was in referent reintroduction. Here, the TD group produced significantly more adequate reintroductions than the ASD group did, while the ASD group made significantly more inadequate reintroductions. As noted previously, compared with the TD group, the ASD group used pronominal forms more frequently to reintroduce referents; reintroductions such as these were sometimes not informative enough for listeners to easily identify the intended referent.

The result on adequate reintroductions contradicts Colle et al.'s (2008) claim that reintroduction did not prove difficult for autistic individuals. One possible explanation for this inconsistency relates to the difference in participants' age range. Previous developmental research has suggested that children's ability to achieve referential adequacy is closely related to their maturation, and that reintroduction is the latest developing referential function in TD children (Colozzo & Whitely, 2014; Wong & Johnston, 2004). In view of these, we speculate that the adult speakers of Colle et al.'s (2008) study might exhibit a comparatively better ability to make adequate reintroductions, while the early school-age children of this study were not fully competent in this regard. Since the ability in achieving referential adequacy continues to develop throughout the school-age

years, it would be illuminating to follow these children up into adolescence to gain more insights into their strengths and weaknesses in referential adequacy.

Perhaps more noteworthy, in this study, reintroduction appeared to be the most difficult referential function for autistic children, which has not been reported before in the literature on ASD. As Whitely and Colozzo (2013) explained, compared with other referential functions, reintroduction would place greater demands on a speaker's working memory updating capacity, which enables a speaker to monitor whether the previously-established referent remains in his/her listener's attentional focus so as to adequately reintroduce the given referent. Relatedly, Schuh and Eigsti (2012) found working memory deficits in individuals with ASD, and suggested that working memory abilities are necessary for updating information needed in successful social interactions. Given these findings, one unresolved question is whether the autistic children's difficulty in making referent reintroduction would be relevant to the working memory deficits noted in ASD, which is beyond the scope of the current discussion. It would be of interest for future studies on referential choice and ASD to address this issue.

Finally, though this study seems to provide informative observations about autistic children's referential abilities, care should be taken when we try to generalize findings to a larger population. For one thing, previous research has noted that children's referential choice may vary with contextual constraints such as the presence or absence of mutual knowledge. This consideration invites caution when drawing conclusions based on only one contextual constraint. Thus, future research will have to look at the impact of mutual knowledge to achieve a more comprehensive understanding of autistic children's referential abilities. For another, our analysis focused only on references to animate referents. However, factors such as animacy and referent status may also have an impact on speakers' referential choice. These issues need to be tested in future research by analyzing references to both animate and inanimate entities, and by examining whether autistic children would mark reference to protagonists and secondary characters differently.

Conclusions

To recapitulate, this study extended previous research on referential choice and ASD by looking at referential form, function, and adequacy in narratives of Mandarin-speaking autistic children. Overall, our results revealed that the autistic and IQ- and language-matched TD children were equally likely to use nominal forms for referent introduction. For referent maintenance and reintroduction, nominal forms were used more frequently by the TD group as compared to the ASD group, while a reverse pattern displayed for the use of pronominal forms. Despite such differences, a preference for using null forms to maintain reference was shown in both groups, which exemplifies a characteristic feature of Mandarin speakers and demonstrates the potential of the three-category classification to advance our understanding of referential choice in ASD. More noteworthy, this is the first study to report that the autistic children made no differential use of indefinite and definite NPs to distinguish between new and given referents, suggesting that they might have insufficient ability to mark the information status of referents. Equally intriguingly, the analysis revealed that the ASD group was less able to make adequate reintroductions.

This result evinces the merit of analyzing referential adequacy across referential functions, and suggests that referential functions are not equally difficult.

Declaration of Conflicting Interests

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Notes

1. For example, in the sentence Ø[1] *yīqǐ kàn* Ø[2] *ba* 'Ø[1] together read Ø[2]', two null forms (Ø) are used. In this particular context, Ø[1] refers to the speaker and his friend, while Ø[2] refers to the book they want to share. Because the subject and object can be clearly identified in the context, they are both null arguments.
2. In a numeral NP, a numeral (NUM) is followed by a classifier (CL), resulting in the structure [NUM+ CL+N] (e.g., *yī gè nánhái* 'one-CL boy'). In a demonstrative NP, a demonstrative (DEM) precedes a classifier to form the structure [DEM+ CL+N] (e.g., *zhè gè nánhái* 'this-CL boy').
3. As part of another study (Sah & Torng, 2016) involving this sample, more detailed data about participants' characteristics were reported in that paper.
4. Bare nouns were not included in the analysis, because, in Mandarin Chinese, they can have a variety of interpretations: definite, indefinite, or generic; and sometimes they may be used deictically (Cheng & Sybesma, 1999). Given such multiple interpretations and the limited scope of the present study, we focused only on instances of numeral and demonstrative NPs.
5. In the story, the dog forcefully shakes the tree and causes the beehive to fall off. Consequently, all the bees come out and chase the dog, not the owl.

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