

1 **Comprehension of the presupposition trigger *ye* "also" by**
2 **Mandarin-speaking preschoolers with and without Autism Spectrum**
3 **Disorders**

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17 **ABSTRACT:**

18 Individuals with Autism Spectrum Disorders (ASD) have been reported to be
19 widely impaired in their understanding of linguistic expressions that rely on
20 elements of the context or norms of communication. The accurate interpretation
21 of sentences conveying presuppositions often relies on such context, however,
22 little previous research has investigated the ASD population's understanding of
23 these sentences. The present study attempts to remedy this by exploring the
24 understanding that Mandarin-speaking pre-schoolers with ASD and their
25 typically developing peers have of sentence containing the presupposition
26 trigger *ye* "also". We used a Picture Selection Task and found that
27 Mandarin-speaking preschool children with ASD performed significantly worse
28 than their TD peers with regard to their understanding of the presuppositional
29 content of sentences containing this presupposition trigger. Additionally, in
30 contrast with previous results, TD preschoolers' understanding of this
31 presupposition trigger was found to be adult-like. We attribute this to an
32 improved experimental design.

33 **Keywords:** Autism Spectrum Disorders, Mandarin-speaking preschoolers,
34 linguistic impairments, presuppositions trigger, *ye* "also"

1 INTRODUCTION

2 Over the last few decades, a great many studies have revealed that individuals with Autism
3 Spectrum Disorder (ASD) are impaired in their ability to accurately comprehend certain types
4 of linguistic meaning (Lord & Paul, 1997; Loukusa and Moilanen, 2009; Tager-Flusberg and
5 Cooper, 1999, Tager-Flusberg, 2000; among many others). Notably, these tended to be types
6 of linguistic meaning that rely on contextual/social knowledge to be accurately derived. For
7 example, the ASD population has been reported to be impaired in comprehending figurative
8 language (Happé, 1993; Norbury, 2005), as well as in understanding humor, irony, and jokes
9 (Deliens et al., 2018; Emerich et al., 2003; Martin and McDonald, 2004).

10 Interestingly, a number of recent studies have found that there are a few types of
11 linguistic meaning which individuals with ASD appear to understand as readily as their TD
12 peers, despite them also being thought to rely on contextual/social knowledge. Specifically,
13 the performance of people with ASD has been found to match their TD peers when it comes
14 to accurately interpreting indirect requests and scalar implicatures (Chevallier et al., 2010;
15 Deliens et al., 2018; Pijnacker et al., 2009; Su and Su, 2015). Considered together, these
16 findings raise the possibility that the ability to understand language in context may only be
17 selectively impaired in individuals with ASD.

18 The present study attempts to further investigate language impairments in the ASD
19 population by focusing on their understanding of the presuppositions conveyed by certain
20 lexical items (i.e. presupposition "triggers"). To understand how presupposition triggers
21 contribute to linguistic meaning, a hearer has to be able to distinguish the presupposed
22 information introduced by the trigger from any non-presupposed information (e.g.,
23 entailments, implicatures) and also understand how these various components interact and
24 contribute to the final meaning of a host-utterance (Cheung et al., 2020; Karttunen, 1974;
25 Levinson, 1983; Stalnaker, 1974, 2002).

26 In recent years, a small but growing number of acquisition studies have investigated
27 presuppositions in TD populations (Amaral and Cummins, 2015; Berger and Höhle, 2012;
28 Bill et al., 2016; Romoli et al., 2015; Schwarz, 2015). However, very little attention has been
29 paid to the understanding that individuals with ASD have of presuppositions, including how
30 an understanding of them is acquired by children with ASD.

31 As far as we know, Cheung et al. (2017, 2020) are the only studies that have investigated
32 the understanding that individuals with ASD have of presupposition triggers. Notably, these
33 studies targeted Cantonese-speaking school-aged children and did not include the Cantonese
34 counterpart of the presupposition trigger "also". In other words, the current study is the first
35 work to investigate the understanding that people with ASD have of the presupposition
36 trigger "also".

37 The presupposition trigger "also" is a focus particle, meaning that it associates with some
38 other constituent in the sentence and its exact contribution to sentence meaning is determined
39 by the set of alternatives in the discourse model. That is, in order to accurately understand a
40 sentence containing the presupposition trigger "also", one has to be able to identify and
41 access the relevant shared information between the speaker and listener, i.e. from the verbal
42 context, the situational context and world knowledge (Höhle et al., 2009). Given that deriving
43 an accurate interpretation of such sentences relies on identifying which elements of the
44 context are relevant, and given that this is an aspect of sentence interpretation that people

1 with ASD have been shown to have difficulties with, it is plausible that this population might
2 experience difficulties accurately understanding sentences containing this particle. As for
3 previous work, not only have no existing studies investigated the understanding that
4 preschoolers with ASD's have of *ye* "also", but no work has looked at the understanding that
5 any individuals with ASD have of this trigger. Therefore, this investigation has the potential
6 to provide important insights into the linguistic competence of both children with ASD, as
7 well as of the ASD population more generally.

8 LITERATURE REVIEW

9 Theoretical Background of Presuppositions

10 The presuppositions of a given sentence are the propositions that are required to be a part of
11 the conversational common ground in order for that sentence to be felicitously uttered¹
12 (Karttunen, 1974). To put it another way, in order for a given utterance to be felicitous, its
13 presuppositions must be agreed to by all conversational participants. For example, the
14 utterance in (1) conveys the presupposition that the speaker owns a hat, therefore, it can only
15 be felicitously uttered in contexts where the fact that the speaker owns a hat is already part of
16 the common ground.

17 (1) My hat is yellow.

18 According to a traditional analysis (Karttunen, 1974; Stalnaker, 1974), when (1) is
19 uttered in a context in which the presupposition is not a part of the common ground, there are
20 two possible outcomes. The first and arguably most common outcome is that a hearer
21 "accommodates" the presupposition and interprets the sentence as though the presupposition
22 had already been a part of the common ground. The second possible outcome is for
23 "presupposition failure" to occur. This will result in the utterance being perceived by the
24 hearer as infelicitous and lacking a truth value (i.e. being "undefined"), and moreover, the
25 propositions conveyed by the utterance will not be added to the common ground (Heim, 1983;
26 Karttunen, 1974; Stalnaker, 1974).

27 The lexical items or phrases that engender presuppositions are called "presupposition
28 triggers" (Huang, 2014; Levinson, 1983). As mentioned, one such presupposition trigger is
29 the focus particle, or more precisely the additive particle, "also". The inclusion of "also" in a
30 sentence results in the meaning of its host-sentence being partitioned into an asserted element
31 and a presupposed element (Krifka, 1998; Lee, 2002). Specifically, the additive particle
32 "also" targets a focused constituent within its host-sentence and conveys the "existential
33 presupposition" that the predicate holds for at least one alternative of the element in focus.
34 For example, in the case of a sentence like (2a), if "tennis" is focused, then the sentence
35 presupposes that Mary played something other than tennis, as shown in (2c). In contrast, if
36 "Mary" is focused, then the sentence presupposes that someone else played tennis, as shown
37 in (2d). The assertion conveyed by the sentence in (2a) is always (2b).

38 (2) a. Mary also played tennis.

39 b. Assertion: Mary played tennis.

¹ The "common ground" is comprised of the set of propositions that all participants in a conversation have agreed to (Stalnaker, 2002).

1 c. Presupposition: There is an $x \neq$ tennis, and Mary played x .

2 d. Presupposition: There is an $x \neq$ Mary, and x played tennis.

3 The counterpart of the additive particle "also" in Mandarin Chinese, namely *ye*,
4 partitions sentence meanings into the same presuppositions and assertions (Ji, 2015; Liu,
5 2009; Liu et al., 2011; Wang, 2011). Taking an example from Liu et al. (2011) to illustrate:

6 (3) Zhangsan *ye kan-le yichang dianying*.

7 Zhangsan also watch-ASP one-classifier movie

8 'Zhangsan also watched a movie.'

9 As with "also", the focus particle *ye* in Mandarin Chinese can be associated with the
10 subject or the verbal phrases in the sentence, with each association giving rise to different
11 presuppositions. More specifically, when the subject "Zhangsan" is emphasized, the sentence
12 in (3) presupposes that someone other than Zhangsan watched a movie; when stress is put on
13 the verbal phrase *kanle yichang dianying* "watched a movie", the sentence in (3) presupposes
14 that Zhangsan did something else, in addition to watching a movie (Liu et al., 2011).

15 Notably, in order to accurately identify the contribution of the additive particle to the final
16 meaning of a sentence, the hearer must identify the focused constituent in the utterance, as well
17 as the set of relevant alternatives in the common ground. This process requires, among other
18 things, integrating information from different sources. For example, as shown in (4), it often
19 involves the integration of prosodic content as well as content from the immediate situational
20 context. That is, deriving the correct presuppositions for the sentences in (4a) and (4b) requires
21 an accurate perception of the prosodic contours of the utterance in order to identify which
22 element is the focused constituent. Moreover, in (4) the presuppositions associated with (4a)
23 and (4b) are satisfied, not from the previous linguistic discourse, but from the immediate
24 environmental context.

25 (4) *Anne and Bill are attending a work party. They run into each other out the front of*
26 *the building where the party is being held. Anne is holding a packet of chips and a*
27 *bottle of wine. Bill is only holding a packet of chips, but he also has a bottle of wine*
28 *in his backpack.*

29 (4a) Bill: Oh hi Anne. [I]_F also brought a bottle of wine.

30 Presupposition: Someone else (i.e. Anne) brought a bottle of wine.

31 (4b) Bill: Oh hi Anne, I also brought [a bottle of wine]_F.

32 Presupposition: Bill brought something else (i.e. a packet of chips).

33 In this way, determining both the nature of the presuppositions conveyed by (4a) and (4b),
34 as well as whether they are satisfied in the context requires integrating information from
35 different sources (i.e. from the sentence prosody and from the situational context).

36

37 Acquisition Background of "Also"

38 Previous studies (Bergsma, 2006; Höhle et al., 2009; Hüttner et al., 2004; Lee, 2002; Liu et
39 al., 2011; Matsuoka et al., 2006; Müller et al., 2009; Nederstigt, 2003 among others) have
40 reported that TD children start producing the focus particle "also" as early as one and half
41 years of age across a variety of languages, including Cantonese, Mandarin, Japanese, Dutch
42 and Germany. However, a series of studies have also found that TD children's comprehension
43 of this particle is not adult-like until around eight years of age. More specifically, before this

1 age, TD children did not accurately understand the presuppositional content introduced by
2 "also" (for relevant reviews, see Berger and Höhle, 2012; Höhle et al., 2009).

3 It is worth noting, however, that many of these previous comprehension-based studies
4 adopted Picture Selection/Judgment tasks, which presented test sentences, like (5), in isolated,
5 "out of the blue" contexts. That is, without any introduction or leading sentences.

6 (5) The boy is also patting a dog.

7 Following this, participants were required to select a matching picture or to judge whether
8 the presented picture matched the utterance (Bergsma, 2006; Höhle et al., 2009; Hüttner et al.,
9 2004; Liu et al., 2011; Matsuoka et al., 2006). For example, Liu et al. (2011) presented a picture
10 where a boy and a girl are petting a dog and a cat, respectively, and asked participants
11 (4;02–7;10) to judge whether the sentence in (5) was a correct description of the picture. The
12 results of this study suggested that children could not access the presupposed meaning of
13 "also" in an adult-like fashion until around 7 or 8 years of age (7;02–7;10, M=7;05).
14 Specifically, the participants of a 7-year-old group could interpret "also" in an adult-like
15 manner at a rate of 86%, while the 6-year-old group (6;00–6;11, M=6;06) only interpreted it in
16 this manner at a rate of 34%. A similar result was found in Bergsma (2006), which adopted a
17 Picture Selection Task, where participants were presented with three pictures and asked to
18 select which of them matched the presented single test sentence. The study found that 6 to 7
19 years of age Dutch-speaking children (6;05–7;11) were not adult-like in their understanding of
20 *ook* "also". Finally, a study with the same experimental design, Hüttner et al. (2004), found that
21 Germany-speaking children (5;1–7;8, M = 5;8) did not access an adult-like interpretation of
22 *auch* "also".

23 One thing these previous studies have in common is that they presented the test sentences
24 in quite an isolated and unnatural manner, which is very different from the way they would be
25 presented in a "normal" discourse. For example, in a typical conversation, an utterance like (5)
26 would often be produced after there had either been some mention of the fact that someone
27 else had patted "a dog", or some mention of "the boy" having done something else, that is,
28 after the content presupposed by the additive particle had been clearly added to the common
29 ground.

30 In contrast, many of the studies investigating TD children's understanding of the additive
31 particle (e.g., Hüttner et al., 2004) presented the test sentence without any (or with a minimal)
32 preceding discourse. Following such a presentation, children were required to identify which
33 picture (from a set) was accurately described by the presented utterance. Presenting the test
34 sentences in this isolated manner means that in order to get the "correct" interpretation, not
35 only must a participant understand the presuppositional content conveyed by the additive
36 particle, but they must detect that some of the presented pictures depict a presupposition
37 failure and reject them on that basis. Previous work has found that even adults often fail to
38 reject pictures on this basis, seemingly due to a tendency to only focus on whether the picture
39 satisfies the truth conditions of a target sentence (Hornby, 1974; Kim, 2008). Given the
40 difficulties that adults have "successfully" completing such a task, it seems likely that the use
41 of similar tasks in acquisition research may have resulted in an under-estimation of children's
42 understanding of the presuppositional content of these particles (Berger and Höhle, 2012;
43 Höhle et al., 2009).

44 In fact, this interpretation of the previous literature is supported by a more recent study

1 by Berger and Höhle (2012), which tested TD children's understanding of additive particles
2 using a method that was free from the issues just outlined. That is, they used a paradigm in
3 which the relevant presuppositions were explicitly satisfied in the context, but where a
4 knowledge of them was still required to give the target response. Berger and Höhle (2012)
5 found that such changes improved preschoolers' performance in displaying an accurate
6 interpretation of "also", such that it was more adult-like than had been found in previous
7 studies. Following Berger and Höhle (2012), the present study tried to give children the best
8 chance of interpreting "also" appropriately by increasing the salience of the alternatives
9 satisfying the presupposition and making the presuppositional content clearly relevant to the
10 successful completion of the experimental task.

11 In contrast to the large numbers of studies which have investigated "also" in TD children,
12 to the best of our knowledge, no existing research has investigated atypical children's
13 understanding of the presupposition trigger "also". That is, Cheung et al. (2017, 2020) (which
14 we will turn to next) are the only existing work which has examined the interpretations of
15 presupposition triggers in children with ASD and they did not include this trigger in their
16 investigation.

17 Both Cheung et al. (2017) and Cheung et al. (2020) adopted the same task, which
18 involved participants judging whether a given utterance was or was not a presupposition of a
19 preceding utterance. Specifically, participants were presented with Cantonese versions of
20 sentences like (6a), followed up with either the continuation in (6b) or (6c). The sentence in
21 (6a) conveys the presupposition that "Daaiman has a sister". Therefore, participants were
22 considered to have understood the presupposition if they judged (6b) as "correct" and (6c) as
23 "incorrect".

- 24 (6) a. Daaiman's sister will be 10 years old next year. That is to say,
25 b. Daaiman has a sister.
26 c. Daaiman doesn't have a sister.

27 Cheung et al. (2017) investigated children with ASD's understanding of a range of
28 presuppositions and compared them with their Typically Developing (TD) peers. The
29 participants with ASD ranged in age from 6;06 to 14;03 (M=8;09). Cheung et al. (2017) found
30 evidence that children with ASD's understanding of existential (definite descriptions, proper
31 names and possessives), factive (factive verbs), lexical (change-of-state verbs and iteratives)
32 and structural (cleft sentences and temporal clauses) presuppositions was worse than their
33 age-matched TD peers. One limitation of this study was that it did not control for participants'
34 language ability, a variable that is likely to have an influence on participants' performance in
35 this task. Another limitation of the study was that they grouped together a number of
36 presupposition triggers that might have independent developmental trajectories (e.g.,
37 change-of-state verbs and iteratives were grouped together as "lexical presuppositions"). That
38 is, it is possible that there is some variation between the triggers that Cheung et al (2017)
39 grouped together with regard to the ease with which an understanding of their presuppositional
40 content is acquired. For this reason, we think a natural next step for research in this area is to
41 investigate some of these triggers in isolation, thereby allowing us to check whether, as far as
42 acquisition is concerned, they actually do follow the same trajectory.

43 Cheung et al. (2020) investigated the understanding that Cantonese-speaking children with
44 ASD (7;07-11;11, M=9;01) have of the presuppositions associated with seven different types

1 of presupposition triggers, namely, definite descriptions ("the professor"), factive predicates
2 ("know", "regret"), change-of-state verbs ("start", "quit"), implicative verbs ("forget"),
3 iteratives ("again", "not anymore"), counterfactual conditionals ("if") and temporal clauses
4 ("before"). It was found that children with ASD performed significantly worse than their
5 age-matched TD peers, but similarly to their language-matched TD counterparts, in regard to
6 their understanding of the presuppositions associated with all of the trigger classes, except for
7 temporal clauses. That is, in the case of the presuppositions triggered by temporal clause,
8 Cheung et al. (2020) found that Cantonese-speaking children with ASD showed a deficit in
9 their understanding even when age, language ability and non-verbal intelligence were
10 controlled for. In sum, Cheung et al. (2017, 2020) show that while children with ASD's
11 understanding of presuppositions is below their age-matched peers, it is generally similar to
12 their language-matched peers (with the exception of temporal clauses).

13 One thing worth noting at this point is that (as we have already discussed to some extent)
14 research on TD children's understanding of presuppositions has found substantial variation in
15 children's performance between methodologies and between triggers (e.g., Berger and Höhle,
16 2012; Höhle et al., 2009). Moreover, as Cheung et al. (2017, 2020) demonstrate, when related
17 variables (for instance, language ability) are included and controlled for, a more complete
18 developmental picture of the ASD population's understanding of presuppositions is revealed.
19 Therefore, some promising avenues of further investigating in this area include exploring new
20 triggers, using different methods, and controlling for as many influential variables as possible.

21 The present study contributes to this effort by using a novel method to examine
22 Mandarin-speaking children with ASD's understanding of the presupposition associated with
23 sentences containing the trigger *ye* "also". This trigger has not been included in any previous
24 investigations of the ASD population, as far as we are aware. Moreover, existing research that
25 studied the acquisition of the presupposition trigger "also" in TD children reported mixed
26 findings, which may have been caused by differences in the experimental methods. The
27 unique experimental design in this study is expected to provide a better chance for children to
28 demonstrate their knowledge of the presupposition trigger "also". Furthermore, the present
29 study targets Mandarin-speaking preschoolers with and without ASD, whose age, receptive
30 language ability, intelligence, working memory, inference ability and executive function will
31 be measured and controlled for.

32 **Research Aims**

33 This study's primary aim is to further investigate the understanding that children with
34 ASD and individuals with ASD more broadly have of presuppositions. The current study does
35 this by testing how participants from this population interpret sentences containing the
36 presupposition trigger *ye* "also". Moreover, as noted above, the experimental design in
37 previous acquisition studies, which used isolated sentences as test stimuli, might not have
38 provided a felicitous context for the production and comprehension of this trigger, and thus,
39 may not represent an accurate picture of TD children's knowledge of "also". In an effort to
40 improve the experimental design and give children the best chance of accessing the adult-like
41 interpretation of "also", this study presented the target sentences in contexts where the
42 relevant presuppositions were plausibly satisfied in the preceding clause, and where accessing
43 the presupposition was integral to successfully completing the task. Presenting the stimuli in

1 this manner allows us to address a secondary research aim: to test whether TD preschoolers
2 are capable of interpreting the presupposition trigger "also" in the same way as adults, when
3 the salience of the elements satisfying the presupposition is increased and the overall felicity
4 of the utterance within the experimental context is improved.

5 **MATERIALS and METHODS**

6 **Participants and Procedures**

7 Twenty-five participants with ASD were recruited from a training school for preschoolers
8 with ASD. All of the children who were admitted to the training school were required to
9 provide formal diagnosis results. The ASD participants in the present study had been
10 diagnosed by experienced child psychiatrists or child neurologists as meeting the criteria of
11 the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American
12 Psychiatric Associations, 2013) and the Chinese version of the Autism Spectrum Quotient:
13 Children's Version (AQ-Child; Auyeung, Baron-Cohen et al., 2008) for ASD. The children
14 had been recorded as demonstrating mild to moderate degrees of qualitative impairments in
15 social interactions and communications, as well as restricted, repetitive and stereotyped
16 interests and activities.

17 Based on reports from their families and teachers, all of the participants with ASD did not
18 have any other neuropsychiatric or developmental disorders, or any hearing loss or language
19 impairments. The diagnosis of each participant was confirmed by a family member. Taking
20 these facts into account, we decided not to carry out another diagnosis interview or evaluation
21 to confirm their ASD symptomatology.

22 Twenty-two TD preschoolers and college students were recruited from a mainstream
23 kindergarten and a university, respectively. All of the TD participants had not been reported
24 as having any developmental or psychiatric disorders, learning disabilities or language
25 impairments.

26 The children were administered the Chinese Peabody Picture Vocabulary Test (C-PPVT;
27 Sung and Miao, 1990) to assess their receptive language ability. Their Verbal Intelligence,
28 Non-Verbal Intelligence and Full Intelligence, Inference Ability and Working Memory were
29 evaluated using the Chinese version of the Wechsler Preschool and Primary Scale of
30 Intelligence-Fourth Edition (C-WPPSI-IV; Li and Zhu, 2014). Their executive function was
31 assessed with the Day/Night Stroop Task (Gerstadt et al., 1994) and the Flexible Item
32 Selection Task (Jacques and Zelazo, 2001). Three children with ASD were excluded from the
33 study due to attention problems. Table 1 presents descriptive characteristics of the
34 participants included in the present study.²

35 All of the participants were introduced to the task and tested individually. The experiment
36 was conducted in quiet rooms in the schools. Child participants and their family as well as

² As noted by an anonymous reviewer, we did not conduct a test directly measuring participants' syntactic abilities, which is a parameter that could influence children's ability to accurately interpret a sentence containing presuppositional content. We agree that this is a relevant parameter. However, there is (to our knowledge) no existing well-developed standardized test to assess syntactic ability in Mandarin Chinese, therefore, obtaining such a measurement was not straightforward. Having said that, we agree that research in this area would ideally include such a measure and so must accept its absence as a limitation of our study.

1 adult participants were fully informed about the procedures. Written consent was obtained
2 from adult participants and family of the child participants. In addition, oral consent for
3 taking part in the study was given by each participant.

4 The procedures were in accordance with the ethical guidelines presented in the
5 Declaration of Helsinki (World Medical Association General Assembly, 1964) and its later
6 amendments or comparable ethical standards.

7 **Experimental Design**

8 We used the Picture Selection Task paradigm. The main part of the experiment was
9 comprised of ten filler trials and ten test trials, which were interspersed with each other. All of
10 the trials were compound sentences, which were made up of two simple clauses and recorded
11 by a female Mandarin native speaker at a moderate speed. After recording, the verb phrases
12 of the first clauses were replaced by sounds of "cars passing by". As mentioned earlier, the
13 presupposition introduced by the additive particle targets a focused constituent of its
14 host-sentence and dictates that this constituent be interpreted in relation to a set of
15 alternatives.

16 Specifically, the particle presupposes an "additive" relationship between the focused
17 particle and its alternative/s. For example, if the subject "Jim" is focused in a sentence like
18 "Jim also bought an apple", then this sentence presupposes that someone else bought an apple.
19 Therefore, a natural context in which to present such a sentence would be "Mary bought an
20 apple, Jim also bought an apple". Therefore, in our test trials, the first clause of the example
21 provides the alternative that satisfies the presupposition of the second clause, which contains
22 the focus particle. That is, the presupposition trigger "also", introduced in the second clause,
23 will be interpreted in a context that already includes the first clause (Schwarz, 2015).

24 According to Berger and Höhle (2012) and Stalnaker (1974, 2002), introducing the focus
25 particle in a discourse context where the content satisfying the relevant presupposition is
26 absent or is of low salience would require the participant to carry out some extra step (i.e.
27 accommodation or a content search) to access the target interpretation, and so may lead to an
28 underestimation of children's knowledge of this particle. This study attempted to avoid this
29 by presenting "also" with a preceding clause, which explicitly satisfied the presupposition
30 and so provided a felicitous context for the production of a sentence including "also".

31 Four practice trials were given prior to the presentation of any test items to familiarize
32 participants with the task. The experiment was introduced with the Mandarin equivalent of
33 the following dialogue:

34 *Hello. You are going to see many pictures, which are numbered 1, 2, 3, 4 (an*
35 *experimenter pointing to the numbers), and hear many sentences. In each*
36 *sentence, there is a part you cannot hear because there are cars passing by.*
37 *Your job is to figure out what the unheard parts are and find the corresponding*
38 *pictures for the sentences. When you find the correct pictures, you may tell me*
39 *its number or point it out.*
40
41

1 The practice trials³ were of the same structures as and presented similarly to the trials in
 2 the main part of the experiment, but with the verb phrases in the second clause being replaced
 3 by the sounds of "cars passing by". This was to make sure that participants were capable of
 4 processing compound sentences that were made up of two simple clauses. Corrective
 5 feedback was given to participants when they chose wrong pictures.

6 (7) Nanhai zai qiche, nühai zai huahua.
 7 a boy be doing ride a bicycle a girl be doing draw a picture
 8 'A boy is riding a bicycle, a girl is drawing a picture.'

9 (8) Nanhai zai qiche, nühai ye zai qiche.
 10 a boy be doing ride a bicycle a girl also be doing ride a bicycle
 11 'A boy is riding a bicycle, a girl is also riding a bicycle.'

12 In the main part, participants were presented with filler and test trials, as exemplified in
 13 (7) and (8), in which the verb phrases of the first clauses (i.e. underlined sections) were made
 14 inaudible by playing sounds of passing cars. Figure 1 shows the pictures that were paired
 15 with these sentences. Upon hearing the filler sentence in (7), participants were expected to
 16 look for a picture where a girl is drawing a picture (i.e. Figure 1, picture ④). If a participant
 17 had acquired an understanding of the presuppositional content of the test sentence in (8), they
 18 were expected to select the picture in which a girl is riding a bicycle and a boy is carrying out
 19 the same activity (i.e. Figure 1, picture ①). On the other hand, if a participant had not
 20 acquired an understanding of the presuppositional content of the test sentence, they could
 21 interpret the second clause as just conveying that a girl is riding a bicycle, the same
 22 interpretation as the clause without *also*. In this case, picture ③ is a possible answer, in
 23 addition to picture ①. We coded responses that correctly selected picture ① as *also-correct*
 24 and responses that selected picture ③ as *also-without-presupposition*. Answers as ② or ④
 25 were coded as *also-false*. The positions of the target pictures were counterbalanced.

26 RESULTS

27 Table 2 presents the mean and standard deviation of the answers provided by each group. We
 28 analyzed the data with the software package of SPSS 25. Each group correctly answered the
 29 filler trials over 96% of the time, which suggests that all of the participants understood the
 30 task and were capable of processing sentences where the first clause is partially "obscured".

31 Participants' answers to the test trials were evaluated by conducting a oneway ANOVA,
 32 with the adoption of Tamhane's T2 test for post hoc pairwise multiple comparisons. The
 33 ANOVA revealed significant differences among the three groups with regard to *also-correct*
 34 answers, $F(2,63) = 12.53$, $p = 0.000$, $\eta^2 = 0.28$, and *also-without-presupposition* answers,
 35 $F(2,63) = 11.95$, $p = 0.000$, $\eta^2 = 0.28$. No significant difference was found for *also-false*
 36 answers, $F(2,63) = 1.53$, $p = 0.23$, $\eta^2 = 0.04$.

37 Specifically, ASD children chose significantly less *also-correct* answers ($p = 0.01$) and
 38 more *also-without-presupposition* answers ($p = 0.009$) than TD children. Both groups

³ For example, one practice trial is as following:

nanhai zai jiao hua, nühai ye zai jiao hua
 a boy be doing water flowers a girl also be doing water flowers
 'A boy is watering flowers, a girl is also watering flowers.'

1 performed at a similar level in their choices of *also-false* answers ($p = 0.99$). Moreover, to
2 control for the effect of age, receptive language ability, non-verbal intelligence, verbal
3 intelligence, working memory, inference ability and executive functions, we further compare
4 the performance of both groups with a general linear model. The above-mentioned potential
5 influential variables were treated as covariances. After controlling for the effect of the
6 variables, we found that TD children provided significantly more *also-correct* answers than
7 ASD children group ($p = 0.006$). Moreover, ASD group chose significantly more
8 *also-without-presupposition* answers than TD group ($p = 0.004$). Both groups performed
9 similarly with regard to their choice of *also-false* answers ($p = 0.97$).

10 Finally, TD children and adults performed very similarly. That is, we found no difference
11 between the two groups with regard to their choices of *also-correct* answers ($p = 0.16$),
12 *also-without-presupposition* answers ($p = 0.48$) and *also-false* answers ($p = 0.28$).

13 DISCUSSION

14 The present study set out to further our understanding of the linguistic competence of ASD
15 individuals by exploring ASD children's understanding of the additive particle. We primarily
16 examined whether Mandarin-speaking preschoolers with ASD had the same level knowledge
17 of the presuppositional content associated with sentences containing the presupposition
18 trigger *ye* "also" as their TD peers. A secondary goal of this experiment was to investigate
19 whether TD preschool children would readily access an adult-like interpretation of sentences
20 containing this presupposition trigger.

21 Methodological Implications

22 As for the second goal, our experiment found no difference in their interpretations of our test
23 sentences between TD adults and children. This finding differs from the series of studies
24 (Bergsma, 2006; Höhle et al., 2009; Hüttner et al., 2004; Liu et al., 2011; Matsuoka et al., 2006),
25 which found preschool children were not adult-like in their understanding of the presupposed
26 meaning of "also". In contrast, it is in line with previous work showing that children's
27 understanding of the presupposition conveyed by sentences including focus particles like
28 "also" is improved when presented in a more felicitous context (Berger and Höhle, 2012). We
29 therefore interpret our result as indicating that, as intended, our experiment presented
30 participants with a similarly felicitous context. That is, it seems likely that by increasing the
31 salience of the elements of the context that satisfied the relevant presuppositions, we enabled
32 TD Mandarin-speaking preschool children (4.3-6.09 years old, $M=5.24$) to achieve adult-like
33 competence in their understanding of sentences containing the presupposition trigger *ye*. To
34 put it another way, presenting our test sentences in a context where the content satisfying its
35 presupposition was presented in the immediately preceding clause reduced the ancillary
36 demands associated with accessing an adult-like interpretation of these sentences. Therefore,
37 we take our results to be a more accurate representation of TD children's understanding of the
38 presuppositional content of sentences containing the presupposition trigger "also"⁴.

4 As noted by an anonymous reviewer, it is possible that our participants would have performed similarly to adults, even if our methodology had placed higher demands on participants (e.g. by presenting sentences with minimal/no surrounding context). While we cannot rule out the possibility that our TD child participants would have performed just as well with another methodology, we would again note that in many of the previous studies

1 This aspect of our results seems to support the argument, proposed by Crain and Fodor
2 (1993), that it is only when appropriate discourse conditions are provided that children's true
3 understanding of linguistic phenomena is revealed. In the case of presuppositions, when an
4 utterance conveying a presupposition is presented in isolation, with none or very little of the
5 surrounding context in which such an utterance would usually be produced, children's (and in
6 fact, even adults') performance in understanding that utterance can often be underestimated.
7 Therefore, we take our results as providing further support for Berger and Höhle (2012)'s
8 suggestion that these factors of the experimental design should be given careful consideration
9 when investigating children's understanding of any presuppositional content.

10 **Theoretical Implications**

11 The main novel contribution of this study was the finding that preschoolers with ASD
12 demonstrated impairments in their understanding of the existential presupposition associated
13 with the additive particle *ye* "also", even after controlling for the effects of age, language
14 ability, verbal intelligence, working memory, inference ability and executive function. This
15 study is the first investigation of ASD children's (or of any individual with ASD's)
16 understanding of this specific presupposition trigger and this result identifies another respect
17 in which the linguistic abilities of people with ASD appear to be impaired. This naturally
18 raises the question of why children with ASD's understanding of the presuppositional content
19 of sentences containing "also" should be worse than that of TD children.

20 As we mentioned in the Literature Review section, accessing an adult-like interpretation of
21 a sentence containing the focus particle "also" involves identifying the focused constituent
22 within the host-sentence and picking out the set of alternatives related to this focused
23 constituent from the the discourse context. The successful identification of these elements and
24 the derivation of the associated presupposition can involve, among other things, the integration
25 of information from different sources. For example, our experiment was designed so that
26 participants would be facilitated in achieving an accurate understand of the presuppositional
27 content of our test sentences if they understood the relationship between them and the
28 preceding clauses. That is, if they took note of the mentioning of "a boy" in the first clause of
29 (7), this should facilitate the accurate identification that the focused constituent in the second
30 clause was "a girl" and not "riding a bicycle". This aspect of our test sentences is notable
31 because it has been suggested that when processing information, individuals with ASD
32 demonstrate a unique processing style called "Weak Central Coherence" (WCC; Happé and
33 Frith, 2006), which makes them more likely to focus on details and pay preferential attention to
34 parts rather than wholes. It is possible that our results could be accounted for as being a result
35 of such a WCC processing style. That is, WCC may have made it more difficult for children
36 with ASD to accomplish the necessary step of identifying and integrating relevant information
37 from multiple information sources, in order to accurately interpret sentences containing the
38 presuppositional trigger "also". Specifically, unlike TD children, they may have struggled to
39 identify and/or integrate into their processing of sentence meaning, the prosodic information

which had such higher requirements, preschool age children were not adult-like in their performance (e.g. Hüttner et al. (2004)). We take this as at least suggestive evidence the noted properties of our methodology contributed to the relatively high performance children exhibited in our experiment.

1 signaling the focused constituent and/or the fact that the preceding clause presented a plausible
2 alternative to that focused constituent. We should note that many previous linguistic
3 impairments in the ASD population have been accounted for by suggesting that this population
4 have certain limitations which affect their accurate understanding of aspects of language
5 associated with syntactic ability and vocabulary (Norbury, 2004, 2005), Relevance Theory
6 (Happé, 1993) and Theory of Mind (Cummings, 2013). We remain open to the alternative
7 explanations of our results along these lines (or others). Future work in this area would benefit
8 from the inclusion of tests measuring the syntactic, vocabulary and central coherence abilities
9 of the participants in order to explore their role in presuppositions understanding.

10 Another point we should discuss is a certain contrast between our results and those
11 obtained by Cheung et al. (2020). Our study investigated Mandarin-speaking preschoolers
12 (4.30 to 6.09 years of age, $M=5.24$) with ASD's understanding of the presuppositional content
13 of sentences containing the presupposition trigger *ye* "also", which is a lexical presupposition
14 trigger (Huang, 2014). Notably, Cheung et al. (2020) also investigated the interpretation of
15 lexical presupposition triggers (i.e., definite descriptions, factive predicates, change-of-state
16 verbs, implicative verbs and iteratives) in Cantonese-speaking school-aged children (7.58 to
17 11.92 years old, $M=9.07$) with ASD. However, unlike us, Cheung et al. (2020) found that their
18 ASD participants performed similarly with language-matched TD peers in their
19 comprehension of the lexical presupposition triggers they investigated This naturally raises the
20 question of what factors might be responsible for the difference in results between our and
21 these previous studies.

22 One possibility is that differences in matching criteria between our study and Cheung et al.
23 (2020) are responsible for these different findings. Specifically, we assessed receptive
24 language abilities using the Chinese Peabody Picture Vocabulary Test (C-PPVT test), the only
25 available standardized assessment tool for receptive language ability in Mandarin Chinese.
26 Notably, this test is less challenging than the textual comprehension test (TCT) used by
27 Cheung et al. (2020), and so the language abilities of the children with ASD in the current
28 study may have been overestimated. Additionally, the fact that we used a different assessment
29 for Non-Verbal Intelligence from Cheung et al. (2020) might also have contributed to the
30 different performances of participants with ASD. Future research could provide more
31 comparable findings by using the same batteries of assessments to compare the
32 developmental trajectories of different lexical presuppositions in children with ASD.

33 Finally, this study provides further evidence of difficulties that individuals with ASD have
34 in understanding elements of linguistic meaning that rely on contextual/social knowledge or
35 abilities to be accurately derived. However, it is interesting to note that quite different results
36 have been found in recent work investigating people with ASD's understanding of another type
37 of linguistic meaning that has been suggested to involve similar knowledge and abilities,
38 namely, "scalar implicatures". Specifically, studies by Chevallier et al. (2010) and Pijnacker et
39 al. (2009) found that the understanding ASD participants displayed of this element of meaning
40 was in line with their TD peers. Considered together, our results and the previous literature
41 could be interpreted as evidence that people with ASD are selectively impaired when it comes
42 to understanding elements of linguistic meaning that rely on identifying and integrating
43 relevant elements of the context. This is an interesting prospect as it may help in identifying
44 more precisely the impairments that people with ASD have. For example, Andrés-Roqueta and

1 Katsos (2017) propose that the set of processes traditionally grouped under “pragmatics”
2 should be re-grouped into two categories called “linguistic-pragmatics” and “social
3 pragmatics”. In this sense, research investigating the understanding that ASD individuals have
4 of linguistic meaning phenomena, with measures of various cognitive and linguistic abilities,
5 promises to shed light not only on the linguistic abilities of this population, but also on the
6 nature of the targeted phenomena.

7 **CONCLUSION**

8 The current study aimed to advance the knowledge of linguistic impairments in ASD people
9 by examining how Mandarin-speaking preschoolers with ASD interpreted sentences
10 containing the presupposition trigger *ye* “also”. We found that children with ASD performed
11 significantly worse than their TD peers in understanding the presuppositional content of
12 sentences including this trigger. We further found that TD four to six-year-old children’s
13 interpretation of this trigger is adult-like.

14 **AUTHOR CONTRIBUTIONS**

15 S. A. conceived the study, designed and carried out the experiments. S. A. analyzed the data
16 with the assistance of Q. Y. S. A and Q. Y. interpreted the data and discussed the structures of
17 writing with each other. S.A. drafted the manuscript. C. B. contributed to the writing and
18 revision of the Introduction, Literature Review, Discussion and Conclusion part of the
19 manuscript. Altogether, S. A. and C. B. contributed equally to the research and are joint
20 first-author. All authors contributed to manuscript revision, read and approved the submitted
21 version.

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1 DECLARATION OF INTEREST

2 The authors declare no conflicts of interest.

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22

1 Table 1. Characteristics of participants.
2

	ASD-Children	TD-Children	TD-Adults
Number of Participants	22	22	22
Age in years	5.24 (0.49)	5.24 (0.31)	19.32(0.84)
Age range in years	4.30-6.09	4.51-5.58	18-20
C-PPVT	118.18 (18.19)	116.68 (9.12)	—
Verbal Intelligence (VIQ)	115.18 (18.72)	110.82 (13.50)	—
Non-verbal Intelligence (N-VIQ)	114.18 (18.10)	110.14 (11.36)	—
Full Intelligence (FIQ)	115.41 (18.76)	110.41 (10.31)	—
Inference Ability (IA)	113.55 (14.11)	109.95 (13.18)	—
Working Memory (WM)	106.82 (22.53)	100.45 (11.87)	—
Executive Function-Stroop Task	0.61 (0.34)	0.67 (0.31)	—
Executive Function-FIST	0.67 (0.35)	0.76 (0.29)	—

Note: Numbers presented are group means, with standard deviation shown in parentheses.

1 Table 2. Proportion of answers of participants

2

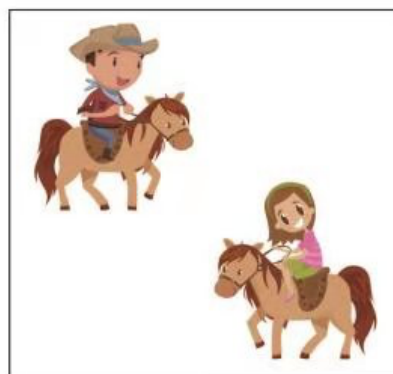
Answers	ASD (n=22)	TD-Children (n=22)	TD-Adults (n=22)
<i>Also-Correct</i>	0.67 (0.35)	0.93 (0.09)	0.97 (0.06)
<i>Also-Without-Presupposition</i>	0.31 (0.35)	0.05 (0.07)	0.03 (0.06)
<i>Also-False</i>	0.02 (0.06)	0.02 (0.05)	0.00 (0.00)

Note: Numbers presented in the table are means of each group, with standard deviation in parentheses.

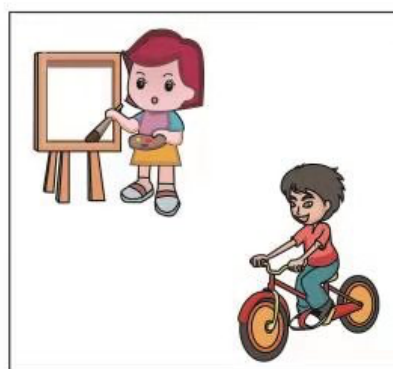
①



②



③



④

1

2 Figure 1. Pictures of example trials.