



A comparative analysis of the production of aspect markers by Mandarin-speaking children with developmental language disorders and by their typically developing peers

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Abstract

Previous studies found that Mandarin-speaking children with developmental language disorder (children with DLD) have difficulty in producing aspect markers and their production of aspect markers was influenced by verbs' situation types. However, these studies did not include in their experimental paradigms all the four typical Mandarin aspect markers. Moreover, there have been controversies concerning the findings of these studies. Using a priming picture-description task, the present study investigated the performance of Mandarin-speaking preschool children with DLD in producing the four typical Mandarin aspect markers *zai-*, *-le*, *-zhe*, and *-guo*, as compared with typically developing age-matched children (TDA children). Seventeen 4 to 6-year-old children with DLD (mean age was 61.38 months old) and 17 TDA children (mean age was 62.31 months old) participated in the experimental task. The results demonstrate that children with DLD produced significantly fewer sentences with the three postverbal aspect markers *-le*, *-zhe*, and *-guo*, and produced significantly more sentences with bare verb forms and other types of responses (such as producing a single word or irrelevant sentences, saying 'I don't know', or giving no response, etc.) than the TDA children did; however, they performed similarly to their TDA peers in producing sentences with the preverbal aspect marker *zai-*. Furthermore, children with DLD were more likely to be affected by verbs' situation types than the TDA children were in producing Mandarin aspect markers. The difficulty of children with DLD in producing the postverbal aspect markers did not correlate with their general language abilities and intelligence, nor with their delay in aspectual development.

Keywords children with DLD, Mandarin aspect markers, postverbal aspect markers, neutral tone, bare verb forms

1. Introduction

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Developmental language disorder (also known as specific language impairment; hereafter, DLD) does not have a clear biomedical etiology (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE-2 Consortium, 2017). Children with DLD have impaired language abilities, yet they are normal in hearing and nonverbal intelligence (Leonard, 2014a). The literature demonstrates that children with DLD are weak in grammatical abilities (e.g., Wexler, Schaeffer, & Bol, 2004; Bishop, Adams, & Norbury, 2006; Lukács, Leonard, Kas, & Pléh, 2009; Leonard, 2014b; Auza, Harmon, & Murata, 2018; Moscati, Rizzi, Vottari, Chilosi, & Guasti, 2020), they tend to omit grammatical inflections which express number, tense and subject-verb agreement (Leonard, Deevy, Miller, Rauf, Charest, & Robert, 2003; Bishop, 2013; Chondrogianni & John, 2018; Deevy & Leonard, 2018), and use nonfinite forms of lexical verbs (i.e., bare verb forms) more frequently than typically developing (hereafter, TD) children (for a review, see Krok & Leonard, 2015). The production of verbs' bare forms rather than verbs with grammatical inflections by children with DLD is highly related to their limited phonological short-term memory (Conti-Ramsden, Botting, & Faragher, 2001; Norbury, Bishop, & Briscoe, 2001; Bishop, Adams, & Norbury, 2006). Children with DLD are impaired in phonological short-term memory (Taylor, Lean, & Schwartz, 1989; Gathercole & Baddeley, 1990; van der Lely & Howard, 1993; Baddeley, Gathercole, & Papagno, 1998; Torrens & Yagüe, 2018). It is evidenced by the fact that children with DLD perform significantly worse than TD children in non-word repetition task, the most popular task used to measure the phonological short-term memory (Bishop, North & Donlan, 1996; Conti-Ramsden, 2003; Gray, 2003; Leonard, 2014a).

Aspect markers are the main mean to express aspectual notions in Chinese languages. There are four typical aspect markers in Mandarin (Li & Thompson, 1981; Smith, 1994, 1997). The progressive marker *zai-* is pronounced with a falling tone and precedes the predicate verb in a sentence. It indicates that an action/event is progressive/ongoing, as shown in sentence (1) below.

- (1) *John zai qi yi-liang zixingche.*
 John ZAI ride a-CL bike
 'John is riding a bike.'

The perfective marker *-le* is pronounced with a neutral tone and without stress in a sentence. It follows the predicate verb and indicates the completion of an action, as shown in sentence (2) below.

- (2) *Xiao nvhai hua-le yi-duo hua.*
 little girl draw-LE a-CL flower
 'The little girl has drawn a flower.'



The postverbal durative marker *-zhe* is pronounced with a neutral tone and is stressless in a sentence. It expresses the enduring state of a situation, as shown in sentence (3) below.

- (3) *Xiao nanhai dai-zhe yi-ding maozi.*
little boy wear-ZHE a-CL hat
'The little boy wears a hat.'

The postverbal experiential marker *-guo* is pronounced with a neutral tone and without stress in a sentence. It is used to express that someone has the experience of doing something in the past, as shown in sentence (4) below.

- (4) *Mary qu-guo tuerqi.*
Mary go-GUO Turkey
'Mary has been to Turkey.'

Previous studies that investigate the acquisition of the Mandarin aspect markers by TD children demonstrate that Mandarin-speaking TD children are sensitive to the aspectual contrast between the perfective marker *-le* and the imperfective marker *-zhe* when they are about 30 months old (Yang, Shi, & Xu, 2018), and they are able to facilitate event recognition as well as adults with the cues of the temporal information encoded in aspect markers when they are three years old (Zhou, Crain, & Zhan, 2014). TD children acquire the aspect markers in the following order: the perfective marker *-le* > the progressive marker *zai-* and the durative marker *-zhe* > the experiential marker *-guo* (the aspect marker at the left side of the symbol '>' appears earlier than the aspect marker at its right side in TD children's production) (Erbaugh, 1992). The acquisition of aspect markers by TD children is consistent with the Aspect Hypothesis (Li & Bowerman, 1998; Jin & Hendriks, 2005). Based on the classifications of Vendler (1957) that verbs include Activity verbs, Accomplishment verbs, Achievement verbs and State verbs, the Aspect Hypothesis predicates that TD children use the past or perfective markers with Achievement verbs and Accomplishment verbs at the earliest stage of the aspectual development, and eventually extend their use to Activity verbs and State verbs; in languages that have the progressive aspect, TD children use the progressive aspect markers mostly with the Activity verbs at the earliest stage, and then extend them to the Accomplishment verbs and Achievement verbs (Shirai & Andersen, 1995; Andersen & Shirai, 1996). Chen and Shirai (2010) found that Mandarin-speaking TD children tend to combine the perfective marker *-le* with Achievement verbs, the progressive marker *zai-* with Activity verbs, the durative marker *-zhe* with Activity verbs, and the

experiential marker *-guo* with Accomplishment verbs at the earliest stage of their aspectual development; the strong tendency weakens with the aspectual development.

Children with DLD who speak Chinese languages perform poorly in producing aspect markers (Stokes & Fletcher, 2003; Cheung, 2005; Fletcher, Leonard, Stokes, & Wong, 2005; He, Sun, & Tian, 2013; Yu, Wang, & Liang, 2019). Two studies that investigate the performance of Cantonese-speaking children with DLD in producing aspect markers reveal that Cantonese-speaking children with DLD are less likely than TD children to produce aspect markers, and they are more likely to restrict aspect markers to verbs that present a maximal semantic match, such as Achievement verbs with the perfective marker, and Activity verbs with the progressive marker (Stokes & Fletcher, 2003; Fletcher, Leonard, Stokes, & Wong, 2005).

Consistent with the findings of the studies on Cantonese-speaking children with DLD, the studies that examine the production of aspect markers by Mandarin-speaking children with DLD demonstrate that Mandarin-speaking children with DLD also have difficulty in producing Mandarin aspect markers (Cheung, 2005; He, Sun, & Tian, 2013), and their production of aspect markers (i.e., grammatical aspect) is influenced by verbs' situation types (i.e., lexical aspect) (Yu, Wang, & Liang, 2019). Cheung (2005) examined the production of aspect markers *zai-*, *-le*, and *-zhe* by 6-7 years old children with DLD with a picture-story narrative elicitation task. He found that children with DLD improved in their production of these aspect markers within a one-year span and their performance was similar to that of the four-year-old TD controls. He, Sun, and Tian (2013) investigated the production of the aspect markers *zai-* and *-le* by 4 to 6-year-old children with DLD with an elicitation task. Their results showed that children with DLD had difficulty in producing the perfective marker *-le* evidenced by the fact that they were less likely to produce the perfective marker *-le*; however, no significant difference was observed between DLD and TD groups in the production of the progressive marker *zai-*. Two outstanding questions exist in the studies of Cheung (2005) and He, Sun, and Tian (2013). First, the two studies did not cover all the four typical Mandarin aspect markers in their experimental paradigms. As a result, the whole picture of the ability of children with DLD in producing the Mandarin aspect markers was not examined. Second, the two studies did not examine the correlation of the difficulty of children with DLD in producing aspect markers with their general language abilities and intelligence. Besides the two studies, Yu, Wang, and Liang (2019) investigated the performance of 7-10 years old children with DLD in processing the semantic consistent and inconsistent combination of lexical and grammatical aspects as compared with TD age-matched (hereafter, TDA) children and TD younger (hereafter, TDY) children through a self-paced reading task. By measuring the reaction time of the aspect markers *-le* and *-zhe* that followed different types of verbs,



they found that children with DLD, like TDY children, processed faster when verbs' situation types were consistent with aspect markers than inconsistent situations, as predicted by the Aspect Hypothesis. The authors concluded that the lexical aspects still affected the grammatical aspect processing in children with DLD and TDY children, and children with DLD were in their early stage of development of grammatical aspect processing.

Why do children with DLD who speak Chinese languages have difficulty in producing aspect markers? Stokes and Fletcher (2003) interpreted the difficulty of Cantonese-speaking children with DLD in producing Cantonese aspect markers within a limited processing-capacity account. However, they did not interpret the influence of the limited-processing capacity on children with DLD's poor performance of producing Cantonese aspect markers in depth. Fletcher, Leonard, Stokes, and Wong (2005) and He, Sun, and Tian (2013) attributed the difficulty of children with DLD in producing aspect markers to the features of aspect markers in Chinese languages. Fletcher, Leonard, Stokes, and Wong (2005) proposed that the sparse morphology of Cantonese aspect markers and the nonobligatory nature of these forms were the causes of the difficulty of Cantonese-speaking children with DLD in producing Cantonese aspect markers. The sparse morphology of Cantonese aspect markers refers to the fact that each aspect marker is represented by a phonologically unvarying form. The nonobligatory nature of Cantonese aspect markers means that sentences with bare verb forms (i.e., without aspect markers) are still grammatical and acceptable in Cantonese although a different meaning is conveyed. Under the view of formal linguistics, He, Sun, and Tian (2013) interpreted the difficulty of children with DLD in producing the postverbal perfective marker *-le* with the proposition of Li and Xu (2010) that the aspect marker *-le* is a bound morpheme which attracts the movement of predicate verb in forming a sentence, and the movement might increase the burden of producing the aspect marker *-le*. The propositions of Fletcher, Leonard, Stokes, and Wong (2005) and He, Sun, and Tian (2013) that the difficulty of children with DLD in producing aspect markers is caused by the features of aspect markers in Chinese languages could explain the poor performance of children with DLD in producing aspect makers. However, it could not interpret well why children with DLD perform significantly worse than TD children in producing aspect markers when both groups are treated with the same experimental conditions.

In consideration of the outstanding issues in the previous studies, the present study aims to investigate the performance of Mandarin-speaking children with DLD in producing the four typical Mandarin aspect markers as compared with TDA children with a priming picture-description task. The research questions of the present study are:

- (i) How do children with DLD perform in producing the four Mandarin aspect markers as compared with TDA children?
- (ii) Does the ability of children with DLD in producing aspect markers correlate with their general language abilities and intelligence?

2. Methodology

Previous studies that elicited the production of aspect markers by children with DLD used video/picture story narration tasks (e.g., Stokes & Fletcher, 2003; Cheung, 2005), picture-description elicitation tasks (e.g., Fletcher, Leonard, Stokes, & Wong, 2005; He, Sun, & Tian, 2013), or conversational tasks (e.g., Stokes & Fletcher, 2003). The disadvantage of these experimental paradigms is that they could not provide participants with appropriate conditions to produce the experiential marker *-guo* since it is used to express someone's experience in the past, which is difficult to be displayed by the tasks mentioned above. Therefore, a priming picture-description task that takes the advantage of the structural priming effect was conducted in the present study to elicit the four typical Mandarin aspect markers.

Children with DLD show similar structural priming effect to TD children, and priming is promising as a method for investigating production factors in language development (Miller & Deevy, 2006). In a priming picture-description task, the experimenter describes a picture with a sentence that contains a grammar point first, then the participant is encouraged to describe a similar picture. The participant could be primed to produce another sentence with the grammar point by the experimenter's sentence if he/she has mastered it.

In the present study, the experimenter and the participant described pictures in turn. The experimenter described the priming picture with a sentence that contained an aspect marker first, and then a similar picture (the target picture) was displayed to the participant. The participant was expected to describe the picture with a sentence that contained the same aspect marker.

2.1 Participants

Thirty-four 4 to 6-year-old children participated in the present study. Seventeen children with DLD were recruited from special education schools, kindergartens, and hospitals, and 17 TDA controls were recruited from kindergartens. The criteria to recruit the participants were listed below.

First, the intelligence of the participants was measured with the fourth edition of Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV; Wechsler, 2012). The scores of the full-scale index in the WPPSI-IV test (i.e., IQ scores) for all the participants were higher than 75.

Second, the general language abilities of the participants were tested with the Peabody Picture Vocabulary Test-Revised Chinese Version (PPVT-R; Dunn & Dunn, 1981) and Rating Scale for Pre-school Children with Language Disorder-Revised Chinese Version (RSPCLD-R; Lin, 2008). Three scores were



obtained from the two language tests, including the score of PPVT-R, and the scores of language comprehension and language production in the RSPCLD-R. At least two out of the three scores of children with DLD were 1.25 SD below the norms of their age (Tomblin, Records, Buckwalter, Zhang, Smith, & O'Brien, 1997); while the scores of all the TDA children were within the norms of their age.

Then, the teachers or therapists of all the participants were interviewed to exclude those who had hearing loss, neurological or psychiatric disorders, behavioral disorders, emotional abnormality, etc. Finally, the parents of the participants signed the consent form. The descriptive information of the participants is shown in Table 1.

Table 1
 The participants' basic information

Group	N	MoA (SD)	PPVT(SD)	LC(SD)	LP(SD)	IQ(SD)
DLD	17	61.38 (9.56)	48.24 (11.39)	21.76 (3.98)	26.29 (5.53)	96.18 (10.38)
TDA	17	62.31 (6.54)	70.59 (20.52)	31.76 (2.73)	39.59 (1.77)	111.06 (9.16)

Notes: N = Number of Participants, MoA =Months of Age, LC = Language Comprehension, LP = Language Production, IQ=the score of the full-scale index in WPPSI-IV.

The DLD group and the TDA group were group-matched in age, $t(32)=0.332$, $p=.742$. The TDA children, however, got significantly higher scores on the general language abilities tests and IQ test than children with DLD, $t_{ppvt}(32)=3.93$, $p=.000$; $t_{LC}(32)=8.56$, $p=.000$; $t_{LP}=9.44$, $p=.000$; $t_{IQ}(32)=4.43$, $p=.000$.

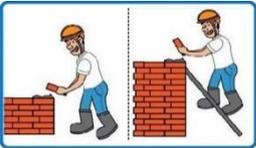
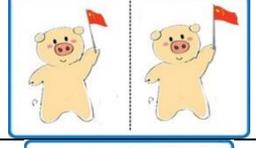
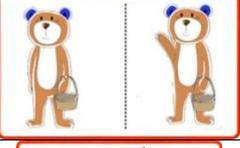
2.2 Stimuli

There were two practice items and 20 test items (five for each aspect marker) in the task. Each test item included the priming part and the target part. The verbs used in the priming part of this task were all Activity verbs. For the aspect markers *zai-*, *-le*, and *-zhe*, the priming picture and the target picture demonstrated the same stage of different actions/events (the priming picture was above the target on a page). Following Li and Bowerman (1998) and He, Sun, and Tian (2013), each picture contained two small pictures that depicted the process (both small pictures displayed the ongoing stage of an action/event) or the completed state (one small picture displayed the ongoing stage and the other displayed the completed stage of an action/event) for the aspect markers *zai-*, *-le*, and *-zhe*. Since the experiential marker *-guo* is used to indicate that someone has experienced something at least once in the past, there were photos behind the figures in both the priming and the target

pictures to represent the experience of the figures in these pictures. Table 2 demonstrates the examples of the priming and target pictures for the four aspect markers.

Table 2

Examples of the pictures for the four aspect markers

aspect markers	priming picture	target picture
<i>zai-</i>		
<i>-le</i>		
<i>-zhe</i>		
<i>-guo</i>		

The pictures in the task were displayed with the PowerPoint on a laptop or a pad with the pictures of each test item on a page.

2.3 Procedure

Participants were tested individually in a quiet room. At the beginning of the task, an experimenter instructed each participant with the rules of the task. For each test item, the experimenter described the priming picture with a sentence that contained an aspect marker firstly, and the participant was asked to describe the target picture. For instance (taking the progressive marker *zai-* as the example), the experimenter gives the following instruction first, “The man is building a house’ in this picture.’ (Point to the priming picture). How about this picture? (point to the target picture)”. The instructions were given in Mandarin. The participant was expected to describe the target picture (which displayed the ongoing stage of a different action/event) and he/she was expected to describe the target picture with the progressive marker *zai-*. The test process was audio recorded by an assistant, who also kept a written record of the responses of participants. The task lasts for fifteen minutes.



2.4 Data treatment

The production written down by the assistant was checked and confirmed by the experimenter after the experiment. The production was analyzed from four aspects.

From the first aspect, participant's production for each aspect marker was classified into four types: 1) the sentences with the target aspect marker; 2) the sentences with bare verbs; 3) sentences with other aspect markers; 4) the other types of responses, which includes producing sentences irrelevant to the task or a single word, saying "I don't know", and giving no response, etc. Then, the proportion of each type in the production of the participant was calculated separately and presented in percentage form.

It was hard to say that one participant was wrong if he/she viewed a picture presented to him/her differently from other participants and described the picture with one aspect marker that was not our expectation. Therefore, each participant's total production was classified into six types: 1) the sentences with the progressive marker *zai*; 2) the sentences with the perfective marker *-le*; 3) the sentences with the durative marker *-zhe*; 4) the sentences with the experiential marker *-guo*; 5) the sentences with bare verbs; 6) other types of responses, which includes producing the sentences irrelevant to the task, producing a single word, saying "I don't know", or giving no response, etc. Then the proportion of each type of production among the total production was calculated and presented in percentage form.

Thirdly, the verbs combined with the aspect markers in the production of the participants were classified according to the classifications of Vender (1957) and analyzed to examine whether children with DLD follow the Aspect Hypothesis.

Finally, the correlations between the performance of children with DLD in producing aspect markers and their general language abilities as well as their intelligence were analyzed.

3. Findings

No participant was excluded from the data analysis in this section. In section 3.1, the proportion of each type of production for every aspect marker was compared between the DLD group and the TDA group. Then, the proportions of the six types for the total production were compared between the two groups in section 3.2. In section 3.3, the verb's situation types combined with the perfective marker *-le* were classified and analyzed. Finally, the correlation analyses were conducted in section 3.4.

3.1 Comparison of the production for each aspect marker

The mean proportion and SD of each type of production of the four aspect markers are presented in Table 3 below.

Table 3
Mean proportion (%) of each type of production for each aspect marker

Types of production	<i>zai-</i> (SD)		<i>-le</i> (SD)		<i>-zhe</i> (SD)		<i>-guo</i> (SD)	
	DLD	TDA	DLD	TDA	DLD	TDA	DLD	TDA
target aspect markers	85.88 (24.25)	98.82 (4.85)	23.53 (26.68)	87.06 (15.72)	71.76 (33.96)	97.64 (6.64)	42.35 (38)	95.3 (8.75)
bare verbs	12.94 (23.39)	1.18 (4.85)	10.59 (12.49)	1.18 (4.85)	12.94 (23.39)	1.18 (4.85)	23.53 (28.49)	0 (--)
other aspect markers	1.18 (4.85)	0 (--)	4.71 (11.25)	0 (--)	14.12 (25.26)	0 (--)	7.06 (12.13)	2.35 (6.64)
other types of responses	0 (--)	0 (--)	61.17 (30.39)	11.76 (14.25)	1.18 (4.85)	1.18 (4.85)	27.06 (30.77)	2.35 (6.64)

Because the data of this task were non-normally distributed (confirmed with the Kolmogorov-Smirnov test), Mann-Whitney U tests were conducted to compare each type of production between the DLD group and the TDA group for the four aspect markers. The results are as follows:

1) For the progressive marker *zai-*, there were no significant differences between the DLD group and the TDA group in the four types of production, the sentences with the target aspect marker *zai-*: $U=100.5$, $Z=2.148$, $p=.131$; the sentences with bare verbs: $U=101$, $Z=2.127$, $p=.14$; the sentences with other aspect markers: $U=136$, $Z=1$, $p=.786$; other types of responses: $U=144.5$, $Z=.00$, $p=1.0$.

2) For the perfective marker *-le*, the DLD group produced significantly fewer sentences with the target aspect marker *-le* than the TDA group did, $U=10$, $Z=4.73$, $p=.000$; on the contrary, the DLD group produced significantly more sentences with bare verbs ($U=84.5$, $Z=2.691$, $p=.038$) and other types of responses ($U=28.5$, $Z=4.107$, $p=.000$) than the TDA group did. No significant difference was observed between the two groups in producing the sentences with other aspect markers, $U=119$, $Z=1.785$, $p=.394$.

3) For the durative marker *-zhe*, the DLD group produced significantly fewer sentences with the target aspect marker *-zhe* ($U=63$, $Z=3.238$, $p=.004$) and significantly more sentences with other aspect markers ($U=85$, $Z=2.909$, $p=.041$) than the TDA group did. Meanwhile, there was no significant difference between the two groups in producing the sentences with bare verbs ($U=101$, $Z=2.127$, $p=.14$) and other types of responses ($U=144.5$, $Z=.00$, $p=1.0$).

4) For the experiential marker *-guo*, the DLD group produced significantly fewer sentences with the target aspect marker *-guo* than the TDA group did, $U=27$, $Z=4.267$, $p=.000$; on the contrary, the DLD group produced significantly more sentences with bare verbs ($U=59.5$, $Z=3.645$, $p=.003$) and other types of responses ($U=69.5$, $Z=3.034$, $p=.009$) than the TDA group did. In producing the sentences with other aspect markers, no significant difference was observed between the two groups, $U=118$, $Z=1.298$, $p=.375$.



The comparisons above indicate that the DLD group produced significantly fewer sentences with the target aspect marker than the TDA group did for the three postverbal aspect markers *-le*, *-zhe*, and *-guo* on the one hand; and on the other hand, the DLD group produced significantly more sentences with bare verbs than TDA group did for the postverbal aspect markers *-le* and *-guo*, more sentences with other aspect markers for the durative marker *-zhe*, and more other types of responses than TDA group did for the experiential markers *-guo*.

3.2 Comparison of each type of production for the total production

Since children in both groups described pictures with other aspect markers rather than the aspect marker expected for the four aspect markers, and it could not recognize that one participant was wrong if he/she viewed a picture presented to him/her differently from other participants, the total production of each participant was classified into six types and compared between the DLD group and the TDA group in this section. The mean proportion and SD of each type for the total production is displayed in Table 4.

Table 4

Mean proportion (%) of each type of production for the total production

groups	<i>zai-</i> (SD)	<i>-le</i> (SD)	<i>-zhe</i> (SD)	<i>-guo</i> (SD)	bare verbs (SD)	other types of responses (SD)
DLD	27.35 (11.61)	8.24 (7.89)	18.53 (8.97)	10.88 (9.23)	29.71 (15.66)	5.29 (7.6)
TDA	25 (1.77)	22.35 (5.04)	24.41 (1.66)	23.82 (2.19)	3.82 (4.85)	0.6 (1.66)

Because the data were non-normally distributed (confirmed with the Kolmogorov-Smirnov test), Mann-Whitney U tests were conducted to compare the DLD group with the TDA group in the six types of production. The results show that there was no significant difference between the two groups in producing the sentences with the preverbal aspect marker *zai-*, $U=112$, $Z=1.257$, $p=.274$. However, the DLD group produced significantly fewer sentences with the postverbal aspect markers *-le* ($U=20.5$, $Z=4.359$, $p=.000$), *-zhe* ($U=79$, $Z=2.595$, $p=.024$), and *-guo* ($U=27$, $Z=4.262$, $p=.000$), and significantly more sentences with bare verbs ($U=7$, $Z=4.798$, $p=.000$) and other types of responses ($U=73.5$, $Z=2.9$, $p=.013$) than TDA group did.

The analysis in this section and Section 3.1.1 demonstrates that children in the DLD group had difficulty in producing the postverbal aspect markers.

3.3 The verbs combined with the perfective marker *-le*

As revealed by Erbaugh (1992), TD children acquire the perfective marker *-le* firstly, and then the progressive marker *zai-* and the durative marker *-zhe*; the experiential marker *-guo* is the last aspect marker acquired by TD children. To testify whether the children with DLD in the present study followed the Aspect Hypothesis, the perfective marker *-le* that acquired firstly was concerned with and the verbs combined with it in the participants' production were classified according to the verbs' situation types of Vender (1957) in this section. Figure 1 displays the mean proportion of each combination of verbs' situation type with the perfective marker *-le*.

As shown in Figure 1, children in both the DLD group and the TDA group combined the perfective marker *-le* with Achievement verbs, Activity verbs, and Accomplishment verbs although they were primed by the Activity verbs. Because the data were non-normally distributed (confirmed with the Kolmogorov-Smirnov test), Friedman tests were conducted to examine whether there were significant differences in the proportions of Activity verbs, Achievement verbs, and Accomplishment verbs within each group of children.

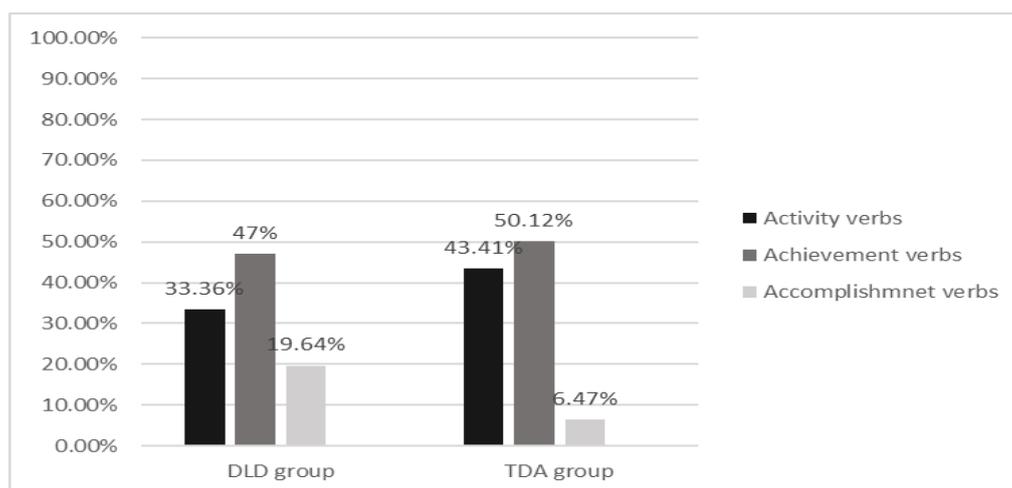


Figure 1. Mean proportion (%) of each type of verbs combined with the perfective marker *-le*

The results show that there was no significant difference between the three types of verbs for the DLD group, $\chi^2=4.667$, $p=.097$. However, a significant difference was observed for the TDA group, $\chi^2=10.133$, $p=.006$. The post hoc Friedman's test shows that the TDA group combined significantly fewer Accomplishment verbs than Activity verbs ($p=.049$) and Achievement verbs ($p=.018$) with the perfective marker *-le*, while no significant difference was observed between Activity and Achievement verbs.

It can be speculated from the combination of verbs' situation types with the perfective marker *-le* in the present study that the production of children with DLD was consistent with the Aspect Hypothesis, but they were in the early



stage of aspectual development because they combined the perfective marker *-le* with Achievement verbs and Accomplishment verbs as many as Activity verbs although they were primed with Activity verbs.

3.4 Correlational analyses

In section 2.1, it can be seen that children with DLD got significantly lower scores on the language tests and the intelligence test than TDA children did. As a result, it could be supposed that the difficulty of children with DLD in producing the postverbal aspect markers might be related to their poor language abilities or intelligence. To test whether there were correlations between the language abilities and intelligence of children with DLD with their performance in producing postverbal aspect markers, the Pearson correlation tests were conducted in this section.

The language abilities were represented with the three language scores and the intelligence was represented with the score of the full-scale index in the WPPSI-IV test. The proportions of the postverbal aspect markers *-le*, *-zhe*, and *-guo* in the total production were applied in the correlation analysis. The Arc-sine transformations were applied to the percentage data for the postverbal aspect markers. The correlations between pairs of variables are reported in Table 5.

Table 5

Results of correlation analysis (*r*)

	<i>-le</i> (<i>p</i>)	<i>-zhe</i> (<i>p</i>)	<i>-guo</i> (<i>p</i>)
PPVT	-.003 (.99)	.058 (.824)	.146 (.577)
LC	-.274 (.288)	-.072 (.784)	-.026 (.921)
LP	.004 (.989)	-.212 (.413)	-.1113 (.665)
IQ	-.005 (.986)	-.063 (.811)	-.158 (.544)

Notes: **LC** = Language Comprehension, **LP** = Language Production, **IQ**=the score of the full-scale index in WPPSI-IV.

The table above shows that the performance of children with DLD in producing the three postverbal aspect markers did not have significant correlations with their language abilities and intelligence.

4. Discussion

The analyses above showed that Mandarin-speaking children with DLD have difficulty in producing the three postverbal aspect markers *-le*, *-zhe* and *-guo*. Specifically, children with DLD were less likely to produce sentences with the postverbal aspect markers, and were more likely to produce sentences with bare verb forms or other types of responses than TDA children did; for the preverbal progressive marker *zai-*, however, they performed as well as TDA children did.

The results of the present study were consistent with Stokes and Fletcher (2003) and Fletcher, Leonard, Stokes, and Wong (2005). The two studies examined the performance of producing Cantonese aspect markers by Cantonese-speaking children with DLD as compared with TD children and found that children with DLD were less likely to produce aspect markers and more likely to produce sentences with bare verbs than their TD peers did. Since the aspect markers in Cantonese are postverbal, it could be deduced from the two studies that Cantonese-speaking children with DLD have difficulty in producing postverbal aspect markers. The results of this study were also compatible with He, Sun, and Tian (2013). With an elicited production task, they found that Mandarin-speaking children with DLD were less likely to produce the postverbal perfective marker *-le* and were more likely to use bare verb forms than TDA children, but no significant difference was observed in producing the preverbal progressive marker *zai-* between children with DLD and TD children. The results of the present study, however, were inconsistent with the findings of Cheung (2005). With a picture-story narrative elicitation task, Cheung found that Mandarin-speaking children with DLD produced the aspect marker *-le* most (account for 89.09% in six years old, and 82.3% in seven years old children with DLD), and the aspect markers *zai-* and *-zhe* ranked second and third in the production of children with DLD. He, Sun, and Tian pointed out that, “Cheung (2005) counted the sentence-final *-le* as the perfective marker *-le*” (He, Sun, & Tian, 2013, track 30). The production of *-le* mostly in Cheung (2005) might be attributable to his counting of sentence-final *-le* as the post-verbal perfective marker *-le*.

Why do Mandarin-speaking children with DLD are less likely to produce sentences with the postverbal aspect markers than TDA children do? Since children with DLD got significantly lower scores than TDA children in the tests of language abilities and the intelligence test, one might propose that the poor performance of children with DLD in producing the three postverbal aspect markers might be correlated to their language abilities and intelligence. However, as shown in section 3.4, there were no significant correlations between the language abilities and intelligence of children with DLD with their performance in producing the three postverbal aspect markers in the present study. Therefore, the poor performance of Mandarin-speaking children with DLD in producing the three postverbal aspect markers might be related to other factors.

Through analyzing the combination of verbs' situation types with the perfective marker *-le*, the present study showed that Mandarin-speaking children with DLD followed the Aspect Hypothesis, but they might be in their early stage of aspectual development because they combined the perfective marker *-le* with Achievement verbs and Accomplishment verbs as many as Activity verbs although they were primed with Activity verbs. This finding is consistent with other studies (e.g., Stokes & Fletcher 2003; Cheung, 2005;



Fletcher, Leonard, Stokes, & Wong, 2005; He, Sun, & Tian, 2013; Yu, Wang, & Liang, 2019) which found that children with DLD are inclined to combine the aspect markers with maximal semantic matched types of verbs. Therefore, it can be proposed that the reason for the difficulty of Mandarin-speaking children with DLD in producing the three postverbal aspect markers in the present study was that they were in the early stage of aspectual development. However, Erbaugh (1992) found that TD children acquire the perfective marker *-le* earlier than the progressive marker markers *zai-*. If children with DLD of the present study were in the early stage of aspectual development, they would also have difficulty in producing the preverbal progressive marker *zai-*. The results of the present study showed that children with DLD performed as well as TDA children in producing the preverbal progressive marker *zai-*. Hence, the difficulty of Mandarin-speaking children with DLD in producing the postverbal aspect markers might not attribute to the fact that they were in the early stage of aspectual development.

Fletcher, Leonard, Stokes, and Wong (2005) attribute the difficulty of Cantonese-speaking children with DLD in producing the Cantonese aspect markers to their sparse morphology and the nonobligatory nature of these aspect markers. And He, Sun, and Tian (2013) explain the difficulty of Mandarin-speaking children with DLD in producing the perfective marker *-le* from the view of formal linguistics that the movement of predicate verbs in forming sentences with the postverbal aspect markers may increase the cognitive burden of producing sentences. However, the interpretations of Fletcher, Leonard, Stokes, and Wong (2005) and He, Sun, and Tian (2013) from the features of aspect markers in Chinese languages could not explain why children with DLD performed significantly worse than TD children did when the two groups were treated with the same experimental conditions. Stokes and Fletcher (2003) interpret the difficulty of Cantonese-speaking children with DLD in producing Cantonese aspect markers with a limited processing-capacity account. However, Cheung (2005) commented that “the limited processing-capacity account is not elaborated” (Cheung, 2005, track 11). To make the limited processing-capacity account more specific, it is proposed in the present study that the difficulty of children with DLD in producing the three post-verbal aspect markers was related to their impaired phonological short-term memory. Although the phonological short-term memory of children with DLD was not measured in the present study, numerous previous studies have found that children with DLD performed significantly worse than TD children in the non-word repetition task, the best way to measure the phonological short-term memory (Bishop, North & Donlan, 1996; Conti-Ramsden, 2003; Gray, 2003; Leonard, 2014a; Torrens & Yagüe, 2018).

The performance of English-speaking children with DLD in producing inflectional morphemes that relate to tense and agreement is highly related to their impaired phonological short-term memory (Gathercole & Baddeley, 1990; Bishop, Adams, & Norbury, 2006). Specifically, English-speaking children with DLD are more frequently than their TD peers form sentences that may be optionally finite (with tense markers) or nonfinite (with the bare verb form) (Rice, Wexler, & Cleave, 1995; Rice & Wexler, 1996). Mandarin-speaking children with DLD perform similarly to English-speaking children with DLD because they produce the postverbal aspect makers that are bounded to the predicate verbs less frequently and the bare verb form more frequently than TD children do. Therefore, it could be proposed that the poor performance of Mandarin-speaking children with DLD in producing the three postverbal aspect markers might be related to their impaired phonological short-term memory.

Furthermore, the pronunciation features of the three postverbal aspect markers might also lead to the difficulty of children with DLD in producing them. Unlike the preverbal progressive marker *zai-* which has a falling tone and is salient in front of the predicate verbs, the three postverbal Mandarin aspect markers are pronounced with the neutral tone, and they are stressless in sentences. The pronunciation features of the postverbal aspect markers make them less prominent than the preverbal progressive marker *zai-* in sentence production. As a result, children with DLD who are impaired of phonological short-term memory might ignore the three postverbal aspect markers and produce more sentences with bare verb forms than their TDA peers because they are unable to store the inconspicuous postverbal aspect markers efficiently in the process of sentence formation.

Therefore, it can be speculated from the discussion above that the difficulty of Mandarin-speaking children with DLD in producing the three postverbal aspect markers might be related to their impaired phonological short-term memory and the pronunciation features of the postverbal aspect markers.

5. Conclusions

With a priming picture-description task, the present study investigated the performance of Mandarin-speaking children with DLD in producing the four typical Mandarin aspect markers as compared with TDA children. The findings of the present study are the following. First, children with DLD produced significantly fewer sentences with the three postverbal aspect marker *-le*, *-zhe*, and *-guo* than their TDA peers. Second, children with DLD produced significantly more sentences with bare verbs and other types of responses than TDA children did. Third, children with DLD were more likely to combine the perfective marker *-le* with its cognate inherent verbs' situation type Achievement verbs than their TDA peers did. The poor performance of children with DLD in producing the postverbal markers might be related to their



impaired phonological short-term memory and the pronunciation features of the postverbal aspect markers. The present study has its limitations. First, the phonological short-term memory of children with DLD was not measured in the present study, and the conclusion about the correlation between phonological short-term memory and performance in producing the postverbal aspect markers was speculative. Second, the gender difference was not taken into account in the present study because the majority of children with DLD were boys, which makes it difficult to match the participants in gender.

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