

ARTICLE

Chinese preschoolers' acquisition of temporal adverbs indicating past, present, and future: a corpus-based study

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Abstract

This study investigated the development of temporal adverbs in early childhood Mandarin. All cases of temporal adverbs indicating the past, present, and future were extracted from the Early Child Mandarin Corpus (168 children in four age groups: 2;6, 3;6, 4;6, 5;6). Data analyses indicated: (1) Mandarin-speaking children produced a repertoire of 21 types of temporal adverbs, and the children in the first age group ($M = 2;6$) were capable of using temporal adverbs to denote past, present, and future events; (2) within each age group, the children produced significantly more future temporal adverbs than the other two subtypes; and (3) there was a significant age effect that, with increased age, more children were able to produce all subtypes of temporal adverbs. Overall, findings of this corpus-based investigation shed light upon Chinese children's early-attained ability to express the three fundamental notions of time by resorting to the appropriate linguistic devices.

Keywords: corpus-based study; preschool children; Mandarin Chinese; temporal adverbs; temporal expression

Time is a fundamental concept in human cognition, and its expression constitutes a crucial element of human language and communication. However, the linguistic device employed for time expression varies across languages (Qiu & Zhou, 2012). English, for instance, uses verbal inflections (e.g., suffix *-ed*, representing past tense) to indicate different tenses, whereas Chinese does not utilise such morphological markers on verbs to locate events on the timeline (Lin, 2003b; Slabakova, 2015). Instead, the Chinese language (CL) uses other linguistic structures (e.g., temporal adverbials, aspectual markers, and speech context) to express temporality, among which the temporal adverbs have essential roles to play (Lin, 2003a). Chinese temporal adverbs must be used appropriately, semantically and syntactically, in daily communication to specify the temporal relationships; thus its acquisition is a real challenge to preschoolers. Few studies, however, have comprehensively examined children's acquisition of Chinese temporal adverbs. Therefore, as part of a larger

research project investigating Chinese preschoolers' time expression, the present study is dedicated to examining the developmental trends of temporal adverbs denoting three basic time concepts: past, present, and future.

Time expression in early child language

Typically developing humans are capable of perceiving events in the past, present, and future by locating these happenings on the points along a mental timeline that stretches out from the present in both directions (Hudson & Mayhew, 2011). Considerable empirical evidence has indicated that children can talk about events of the past and the future before they turn two years old (e.g., Ames, 1946; Fivush, Gray, & Fromhoff, 1987; Nelson, 1989). This time-expressing ability and the associated temporal understanding would mature across the subsequent years of early childhood (Grant & Suddendorf, 2011), as a consequence of the joint effects of the biological, educational, and experiential influences including "brain maturation, experience of the temporal regularities of events, or the emergence of conscious awareness of the passing of time" (Droit-Volet, 2016, p.102).

Weist and his colleagues conducted a series of important cross-linguistic studies to explore the different stages that children undergo in the early acquisition of the temporal system in their first languages (L1) (e.g., Pawlak, Oehlich, & Weist, 2006; Weist & Buczowska, 1987; Weist, Lyytinen, Wysocka, & Atanassova, 1997; Weist, Pawlak, & Carapella, 2004). This development, according to Weist (2014a), involves the integration of three concepts: the speech time (ST), the event time (ET), and the reference time (RT). In the first stage (12–18 months), although children may have shown their ability to talk about future or past events spontaneously, they do not rely on morphosyntactic structures to do so. This initial phase is thus termed the "Speech Time (ST) System" (Weist, 1986). In the following stage, which is labelled as the "Event Time System" (ET) (Weist, 1986), children (18–24 months) start utilising morphosyntactic structures in their languages to express the temporal relations between the primary events and the speech time. In the third year, as demonstrated by Pawlak *et al.*'s (2006) study, young children start entering the stage of the "Reference Time (RT) System", which is characterised by children's expression of the complex temporal relations among ST, ET, and RT. In the advanced stage of the RT system, which is labelled as "Free RT system" by Weist (1986), children (36–52 months) gain the ability to introduce a different referential temporal location away from ST and ET and relate the focal event to this newly established time interval. The relocation of children's temporal deictic centre from ST and ET to RT reflects a process of 'temporal decentering' (McCormack & Hoerl, 2008), which can be characterised by children's flexible and appropriate use of temporal adverbs (e.g., *Kiedys* 'some time ago', in Polish) or temporal adverbial clauses (e.g., past *when*-sentence) (Weist & Buczowska, 1987; Weist & Zevenbergen, 2008). Therefore, investigating children's use of temporal adverbs can deepen our understanding of the development of the linguistic temporal system in the early years.

Temporal adverbs in the Chinese language

Temporal adverbs constitute a large portion of Chinese adverbs (Ma, 2010) and play a significant role in time expression. However, Chinese linguists have not yet reached a consensus regarding their definition and categorisation. Li (1956) was the first

Chinese scholar who used the term ‘temporal adverb’ in his book initially published in 1924, but he failed to provide a clear definition of what exactly they are. In fact, he included a number of temporal nouns in his study.

Contemporary Chinese linguists defined temporal adverbs from the semantic perspective by listing all possible cases (e.g., Lv, 1980; Qian, 1990). For example, Lu and Ma (1985) proposed that there are about 130 temporal adverbs in Modern Chinese, whereas Li (1996a) stated that the total number of Chinese temporal adverbs amounts to 116. This discrepancy in the size of the repertoire of temporal adverbs could be caused by linguists’ different subjective understandings and personal judgements. For instance, an important and common classification divides temporal adverbs into three subtypes expressing events happening in three broad time spans: past time, present time, and future time (Bi & Peng, 2002, 2004; Li & Shirai, 2000). Alternatively, temporal adverbs could be classified according to the duration of time they imply (short-term, long-term, and continued) (Zhang, 2002), while in Zhang’s (2004) viewpoint, temporal adverbs are categorised into three subgroups: those indicating the time-point, frequency, and sequence.

In the present study, we took a semantic perspective to analyse Chinese temporal adverbs. This is mainly because the participants of this study are preschoolers, who are in their early stage of developing the cognitive and language ability needed to understand and express temporal notions. They are unlikely to possess a diverse range of temporal words and use them the way adults do. Thus, we define temporal adverbs as adverbs that express the temporality of events, actions, or states. They primarily function as modifiers of verbs or adjectives (Ma, 2010; Wang, 2017). As Ma (2010) suggested, the temporality conveyed by temporal adverbs includes the following time concepts: past, present, future, duration, sequence, and frequency. This definition is an extension of that given by Zhang (2006), who did not include the collection of adverbs for sequence and duration. One study conducted by Tse, Li, and Leung (2012) suggested that this classification of temporal adverbs fits the natural utterances of children who spoke Cantonese, a major variety of the Chinese language. It should be noted that this typology of temporal adverbs does not include temporal nouns such as 今天 *jin-tian* ‘today’, 上午 *shang-wu* ‘morning’, or 星期一 *xing-qi-yi* ‘Monday’.

Acquisition of Chinese temporal adverbs

Recently a couple of scholars have empirically explored how Mandarin-speaking children acquire temporal adverbs. Research evidence has been converging on two major topics: children’s production and comprehension of temporal adverbs. Regarding the production aspect, Erbaugh (1992) proposed a three-stage model: the proto-temporal stage, the early temporal stage, and the sequenced temporal relations stage. In the first stage, children could only use a few connectives. In the second stage, they begin to produce temporal adverbs, while in the third stage, they start uttering multiple events in a sequenced manner. Chang (1998, 2004) found that older Mandarin-speaking children used more temporal devices, including connectives, aspectual expressions, and temporal adverbs, than younger children to make narratives. This age-related increasing pattern was also reported by Fu (2002), who found that the first temporal adverb produced by children was 在 *zai* ‘in the process of (2;0), followed by 就 *jiu* ‘already’ or ‘right away’, depending on the context, 然后 *ran-hou* ‘then’, 先 *xian* ‘firstly’, 马上 *ma-shang* ‘immediately’, 才 *cai*

'just', 后来 *hou-lai* 'afterwards', and 已经 *yi-jing* 'already' before they turned three. When they reached age four, they began to use 正 *zheng* 'in the process of', 刚刚 *gang-gang* 'just', 忽然 *hu-ran* 'suddenly', and 一直 *yi-zhi* 'always', despite the fact that these adverbs were rarely used. He also found that children's acquisition sequence of temporal adverbs was present time >future time> past time. According to the linguistic evidence provided by him, it is likely that children acquired the early use of the present time adverb 在 *zai* 'in the process of' owing to its frequent use as an indicator of the speech time events. However, this speculation cannot be confirmed due to rather limited evidence provided by the researchers. This acquisition pattern was later verified by Zhou (2004), who suggested that such a sequence indicates that temporal adverbs denoting the time close to the utterance time and in the near future pose less difficulty for children to acquire than the temporal adverbs relating to things that happened far back in the timeline. However, in Zhou's study, despite the fact that the past-time temporal adverbs occurred later than the other two subtypes, children as young as 1.5 years old have gained the ability to use the perfective marker 了 *-le* to denote the completeness or termination of an event that happened prior to the speech time. Thus, children's relatively late acquisition of past-time temporal adverbs in these studies does not necessarily mean they are unable to talk about the past event; they might do so via the use of perfective markers instead. Concerning the late acquisition of past time temporal adverbs, Fu (2002) proposed two explanations. First, it may have something to do with the pragmatic features of these adverbs. Usually, children use present and future temporal adverbs to make requests and state their upcoming actions, while they are less interested in making narrations about what they have done in the past. Second, as past-time temporal adverbs are usually combined with aspect markers such as 了 *-le* (indicating the completion of an event or action) and 过 *-guo* (indicating an experienced event or situation), in practice it may pose some challenges for young children to acquire them early in life. In general, these studies demonstrated that before Mandarin-speaking children enter primary school, they are capable of producing temporal adverbs featuring various temporal properties. Moreover, temporal adverbs indicating the present time and the future time appear earlier in their language than temporal adverbs relating to past events. This study will further examine these findings with the data elicited from a Chinese corpus.

Regarding the comprehension of temporal adverbs, many Chinese scholars have conducted experiments to explore the patterns and trends. Zhu, Wu, Ying, Zhu, and Zhuang (1982) found that, by five years of age, children were able to comprehend temporal words denoting a part of the day such as morning and afternoon. Researchers also drew the order of comprehension as present time >past time >future time. This order gained further support from later studies (i.e., Bi & Peng, 2002, 2004; Zhen & Chen, 1995). For instance, Zhen and Chen (1995) suggested that children showed better understanding of present and past temporal adverbs because these words are associated with tangible experiences that are happening in the moment of speech or relating to events that are still stored in children's memory, whereas temporal adverbs indicating the future are generally linked to a sense of uncertainty.

Interestingly, such a sequence differs from the one mentioned in the previous section. This difference reflected the different experimental designs, subjects' age groups, and also the potential different developmental trajectory of children's comprehension and production of temporal words. In addition, Zhen and Chen

(1995) reported that the six-year-olds performed significantly better than the five-year-olds in their comprehension of temporal adverbs denoting the present and the past but not the ones denoting the future, which indicated a partial but noticeable age effect. However, Bi and Peng (2002, 2004) reported that, among children aged four to six, older children did not demonstrate a significantly better understanding of all temporal adverbs (past, present, and future) than younger children did. Instead, it was during the age period of seven to eight that children made significant progress in their comprehension of all temporal adverb forms. Maturation and education were speculated as the driving forces of this advancement.

In general, the above literature review yields a couple of unresolved issues that inspired the present study. First, there is a shortage of corpus-based research examining Mandarin-speaking preschoolers' acquisition of temporal adverbs. Although there are a few Chinese studies investigating children's production of temporal adverbs, the sample sizes of these studies were unclear (e.g., Fu, 2002; Zhou, 2004), leaving the representativeness of the results of these studies in doubt. Second, children's speaking samples of the previous studies were mostly elicited under contrived experimental conditions, and it is necessary to collect authentic language materials from children's natural utterances in order to understand the natural occurrence of temporal adverbs in their language. Third, as mentioned earlier, previous studies differed in their findings of the developmental pattern of temporal adverbs; thus further study is needed to examine which acquisition pattern children show in their production of temporal adverbs. This study is dedicated to filling these research gaps using the data elicited from the Early Childhood Mandarin Corpus (ECMC; Li & Tse, 2011). Accordingly, the following research questions guided the present study:

1. What are the repertoires of temporal adverbs indicating past time, present time, and future time in early childhood Mandarin?
2. What developmental pattern could be observed in Mandarin-speaking children's acquisition of temporal adverbs during early childhood?
3. Are there any cases of misusing temporal adverbs in children's utterance?

Method

The corpus

The Early Childhood Mandarin Corpus (Li & Tse, 2011) used in the present study is a comprehensive and inclusive corpus that contains Mandarin-speaking children's natural utterances during 30-minute free-play sessions. In total, 168 preschool children were randomly sampled from eight preschools located in the four major districts of Beijing: Chaoyang district, Dongcheng district, Xicheng district, and Haidian district. The sample represented children from four age groups (ages 2;6, 3;6, 4;6, 5;6) with 21 boys and 21 girls in each age group. All children spoke Mandarin as their native language, and their parents and teachers were also native speakers of Mandarin Chinese at home and in preschool, respectively.

The communication task and transcription of data

Participants of the same age were randomly paired (boy/boy, girl/girl, or boy/girl). They were allowed to play freely in a separate room where a set of toys were provided, which

included cooking materials, fruits and faux foods, vehicles, furniture and electrical appliances and hospital materials. Only one dyad of participants was allowed to play in this area at one time. They were encouraged to talk to each other while playing with the toys. Children's natural conversations were videotaped using a digital camera while a trained research assistant observed their activities during the 30-minute free play sessions without making any interventions.

In the transcription stage, we followed the transcription conventions set up in Tse *et al.*'s (2012) work. Children's conversations were transcribed by research assistants to a level of detail that captured all words and word fragments (including overlapping speech) audible to the ear, with non-lexical fillers (e.g., 'uh') and other vocalisations (e.g., laughter) also included in the corpus. Next, other researchers proofread the transcripts independently against the taped audio clips to ensure the accuracy of the transcription. After that, the final Chinese script was segmented into individual utterances to be coded in the subsequent step.

Coding of Mandarin temporal adverbs

As mentioned previously, temporal adverbs broadly include six temporal concepts: past, present, future, frequency, duration, and sequence. This typology of temporal adverbs has been confirmed by Tse *et al.*'s (2012) research. In this study, we focused on the first three subtypes (i.e., past, present, future) when developing the coding book for Mandarin temporal adverbs for two significant reasons. First, these three broad temporal constructs together constitute the most fundamental human perception of the passing of time, stretching from the present to either end of the timeline. Second, a rich body of research has revealed that children as young as two years old have started talking about events happening at the present, past, and future (Fivush *et al.*, 1987; Nelson, 1989), and their ability to articulate and understand these basic temporal notions continue to mature as they get older. Therefore, we took the following steps to construct the coding scheme: initially, we identified the temporal adverbs that have been acquired by Mandarin-speaking children according to a number of previous studies conducted by Chinese researchers (e.g., Bi & Peng, 2002, 2004; Fu, 2002; Huang & Huang, 2011; Mi, 2014; Zhou, 2004). We then expanded our search to studies taking a broader linguistic perspective (e.g., Li, 1996b; Lu & Ma, 1985; Zhang, 2000; Zhang, 2006). Although these studies varied from each other in their counting of temporal adverbs owing to the researchers' different inclusion criteria, they provided abundant sources from which we could select the temporal adverbs that might be present in children's natural utterances. In the final step, temporal nouns such as 今天 *jīn-tiān* 'today', 下午 *xīa-wu* 'afternoon', and 星期一 *xīng-qī-yī* 'Monday' were excluded from the coding system.

The first draft of the coding book consists of 31 temporal adverbs. One author of this study applied the preliminary coding book to the corpus to extract participants' natural utterances that contained these target temporal adverbs. In the process of extraction, some cases of temporal adverbs in the coding book generated no outcome from the corpus, indicating that no participants produced these temporal adverbs. Thus, these temporal adverbs were removed from the original coding book. Meanwhile, a few cases of temporal adverbs were added to the coding book as they appeared in children's speeches. The final coding book comprises 21 temporal adverbs altogether (see Table 1). In addition, as some temporal adverbs convey multiple meanings other than the concept of time, and may not function as temporal adverbs (e.g., verbs,

Table 1. Inventory of temporal adverbs (TA) in Mandarin Chinese

Temporal adverbs (21)	Example
Past TA (9)	
P1: 就 ₁ * <i>jiu₁</i> Already	大风早晨就 ₁ 住了。 da feng zao chen <i>jiu₁</i> zhu le. big wind morning <i>jiu₁</i> stopped-le (le: perfect aspect). The wind had already stopped in the morning.
P2: 已经 <i>yi-jing</i> Already	任务已经完成。 renwu <i>yi-jing</i> wancheng. mission <i>yi-jing</i> complete. The mission has been completed already.
P3: 刚 <i>gang</i> A short while ago	他刚从上海回来。 ta <i>gang</i> cong Shanghai hui lai. he <i>gang</i> from Shanghai return. He returned from Shanghai a short while ago.
P4: 刚刚 <i>gang-gang</i> Just	他刚刚走，你快去追吧。 ta <i>gang-gang</i> zou, ni kuai qu zhui ba. He <i>gang-gang</i> leave, you quickly go chase-MP (MP: modal particle). He has just left, go chase him quickly.
P5: 刚才 <i>gang-cai</i> A moment ago	刚才他在车间里劳动。 <i>gang-cai</i> ta zai chejian li laodong. <i>gang-cai</i> he zai (zai: preposition) workshop in work. He was working in the workshop a moment ago.
P6: 早 <i>zao</i> For quite a while	他早走了。 ta <i>zao</i> zou le. He <i>zao</i> go-le. He has left for quite a while.
P7: 原来 <i>yuan-lai</i> Originally	原来这里有一棵大树。 <i>yuan-lai</i> zheli you yi-ke dashu. <i>yuan-lai</i> here exist one-CL (CL: classifier) big tree. Originally there was a tree standing here.
P8: 本来 <i>ben-lai</i> Used to be	他本来身体很瘦弱，现在很结实了。 ta <i>ben-lai</i> shenti hen shouruo, xianzai hen jieshi le. He <i>ben-lai</i> body very thin and weak, now he very strong-le. He used to be very thin and weak, now he has become very strong. 我早就到家了。

(Continued)

Table 1. (Continued.)

Temporal adverbs (21)	Example
P9: 早就 <i>zao-jiu</i> Long since	wo <i>zao-jiu</i> dao jia le. I <i>zao-jiu</i> arrive at home-le. I have long since arrived home.
Present TA (4)	
C1: 在 <i>zai</i> In the process of	风在刮, 雨在下。 <i>feng zai</i> gua, <i>yu zai</i> xia. wind <i>zai</i> blow, rain <i>zai</i> fall. The wind is blowing, and the rain is falling.
C2: 正 <i>zheng</i> In the process of	正下着雨呢。 <i>zheng</i> xia-zhe <i>yu</i> ne. <i>zheng</i> fall-zhe (zhe: imperfective aspect) rain-MP. The rain is falling.
C3: 正在 <i>zheng-zai</i> In the process of	我正在开会。 wo <i>zheng-zai</i> kai hui. I <i>zheng-zai</i> open meeting. I am having the meeting now.
C4: 现在 <i>xian-zai</i> Now	现在他当厂长了。 <i>xian-zai</i> ta dang changzhang le. <i>xian-zai</i> he become manager of the factory-le. Now he has become the manager of the factory.
Future TA (8)	
F1: 要 <i>yao</i> Be going to	我们要出国旅游了。 wo-men <i>yao</i> chuguo lvyou le. We <i>yao</i> broad travel-le. We are going to travel abroad.
F2: 就 ₂ <i>jiu₂</i> Right away	我就 ₂ 来。 wo <i>jiu₂</i> lai. I <i>jiu₂</i> come. I'll be there right away.
F3: 就要 <i>jiu-yao</i> Be about to	我们就要到达目的地了。 wo-men <i>jiu-yao</i> daoda mudidi le. We about to arrive destination-le. We are about to arrive at the destination. 这里就快下雨了。

(Continued)

Table 1. (Continued.)

Temporal adverbs (21)	Example
F4: 就快 <i>jiu-kuai</i> Be going to shortly	zheli <i>jiu-kuai</i> xiayu le. Here <i>jiu-kuai</i> fall rain-le. It's going to rain here shortly.
F5: 快 <i>kuai</i> Soon	你再等一会儿，他快回来了。 <i>ni zai deng yi hui-er, ta kuai</i> huilai le. You again wait a while, he <i>kuai</i> come back-le. Please wait for a bit more time, he will be back soon.
F6: 快要 <i>kuai-yao</i> Be about to soon	铅笔快要用完了，再买几支去。 <i>qianbi kuai-yao</i> yongwan le, zai mai ji-zhi qu. Pencil <i>kuai-yao</i> run out-le, again buy some-CL go. Pencil is about to run out soon, go buy some more.
F7: 马上 <i>ma-shang</i> Immediately	快进去吧，电影马上就要开演了。 <i>kuai jinqu ba, dianying ma-shang</i> jiuyao kaiyan le. Quick enter-MP, movie <i>ma-shang</i> start-le. Go in quickly, the movie is about to get started immediately.
F8: 正要 <i>zheng-yao</i> Be just about to	我们正要去吃饭。 <i>wo-men zheng-yao</i> qu chifan. we <i>zheng-yao</i> go eat dinner. We are just about to have dinner.

Note. * As 就 *jiu* can be used as a temporal adverb indicating either past and future, it is distinguished in this inventory by adding a subscript (*jiu₁* and *jiu₂*) to it.

nouns, adjectives), we manually excluded them from the dataset. Two authors of the study carefully examined all extracted utterances to ensure that only words used as temporal adverbs were included.

Results

Altogether 813 temporal adverbs were elicited from the corpus, and they were produced by 134 (79.8%) children out of all the participants. Among the 813 instances of temporal adverbs, 760 (93.5%) occurred in full sentences while the rest were found in speeches with missing or unrecognisable segments. Therefore, we focused the analyses on the 760 cases of temporal adverbs. On average, each participant produced 5.7 temporal adverbs during the half-hour free-play session.

The repertoire of Chinese temporal adverbs

Descriptive analysis was executed to examine all the occurrence of temporal adverbs. Overall, 21 different types of temporal adverbs (see Table 2) were identified from the

Table 2. The distribution of temporal adverbs (TA) across different age groups

Types of TA (21)	Age 2;6 Number (%) (n = 79)	Age 3;6 Number (%) (n = 91)	Age 4;6 Number (%) (n = 228)	Age 5;6 Number (%) (n = 362)	Total Number (%) (n = 760)
Past (9)	7 (8.9%)	13 (14.3%)	34 (14.9%)	75 (20.7%)	129 (17.0%)
1 就 ₁ <i>Already</i>	0 (0%)	2 (15.4%)	0 (0%)	5 (6.7%)	7 (5.4%)
2 已经 <i>Already</i>	2 (28.6%)	3 (23.1%)	9 (26.5%)	27 (36.0%)	41 (31.8%)
3 刚 <i>A short while ago</i>	0 (0%)	1 (7.7%)	9 (26.5%)	12 (16.0%)	22 (17.1%)
4 刚刚 <i>Just</i>	4 (57.1%)	3 (23.1%)	1 (2.9%)	2 (2.7%)	10 (7.8%)
5 刚才 <i>A moment ago</i>	1 (14.3%)	4 (30.8%)	14 (41.2%)	16 (21.3%)	35 (27.1%)
6 早 <i>For quite a while</i>	0 (0%)	0 (0%)	0 (0%)	4 (5.3%)	4 (3.1%)
7 原来 <i>Originally</i>	0 (0%)	0 (0%)	0 (0%)	3 (4.0%)	3 (2.3%)
8 本来 <i>Used to be</i>	0 (0%)	0 (0%)	1 (2.9%)	3 (4.0%)	4 (3.1%)
9 早就 <i>Long since</i>	0 (0%)	0 (0%)	0 (0%)	3 (4.0%)	3 (2.3%)
Present (4)	13 (16.5%)	17 (18.7%)	30 (13.2%)	65 (18.0%)	125 (16.4%)
1 在 <i>In the process of</i>	8 (61.5%)	11 (64.7%)	16 (53.3%)	33 (50.8%)	68 (54.4%)
2 正 <i>In the process of</i>	0 (0%)	0 (0%)	1 (3.3%)	4 (6.2%)	5 (4.0%)
3 正在 <i>In the process of</i>	0 (0%)	2 (11.8%)	3 (10.0%)	11 (16.9%)	16 (12.8%)
4 现在 <i>Now</i>	5 (38.5%)	4 (23.5%)	10 (33.3%)	17 (26.2%)	36 (28.8%)
Future (8)	59 (74.7%)	61 (67.0%)	164 (71.9%)	222 (61.3%)	506 (66.6%)
1 要 <i>Be going to</i>	54 (91.5%)	54 (88.5%)	150 (91.5%)	201 (90.5%)	459 (90.7%)
2 就 ₂ <i>Right away</i>	0 (0%)	2 (3.3%)	3 (1.8%)	3 (1.4%)	8 (1.6%)

(Continued)

Table 2. (Continued.)

Types of TA (21)	Age 2;6 Number (%) (n = 79)	Age 3;6 Number (%) (n = 91)	Age 4;6 Number (%) (n = 228)	Age 5;6 Number (%) (n = 362)	Total Number (%) (n = 760)
3 就要 <i>Be about to</i>	0 (0%)	0 (0%)	1 (0.6%)	2 (0.9%)	3 (0.6%)
4 就快 <i>Be going to shortly</i>	0 (0%)	0 (0%)	0 (0%)	1 (0.5%)	1 (0.2%)
5 快 <i>Soon</i>	5 (8.5%)	4 (6.6%)	8 (4.9%)	10 (4.5%)	27 (5.3%)
6 快要 <i>Be about to soon</i>	0 (0%)	1 (1.6%)	1 (0.6%)	3 (1.4%)	5 (1.0%)
7 马上 <i>Immediately</i>	0 (0%)	0 (0%)	1 (0.6%)	1 (0.5%)	2 (0.4%)
8 正要 <i>Be just about to</i>	0 (0%)	0 (0%)	0 (0%)	1 (0.5%)	1 (0.2%)

free speech of children, with those indicating the past and the future representing the richest forms (9 and 8, respectively), and those expressing the present the least (4). As shown in Table 2, temporal adverbs expressing the future were used nearly twice as much (506) as those indicating the past and the present combined (129 and 125, respectively). In particular, the most frequently used temporal adverb was 要 *yao* 'be going to' (459), which constituted 60.4% of all temporal adverbs in this corpus. It was followed by 在 *zai* 'in the process of' (8.9%). The least used temporal adverbs were 就快 *jiu-kuai* 'be going to shortly' and 正要 *zheng-yao* 'be just about to', with each representing only 0.1% of all occurrences.

Table 2 shows that, overall, children in the four age groups produced 79, 91, 228, and 362 cases of temporal adverbs, respectively, and this age-related developmental trend applied to their use of each subtype of temporal adverbs (as Figure 1 shows). In addition, Figure 2 illustrates that the repertoire size for each subtype of temporal adverbs increased with children's age. Children in the youngest age group (2;6) produced only seven types of temporal adverbs altogether, whereas children in the 5;6 group made use of all cases of temporal adverbs listed in this study. It should be noted that, although children in the 2;6 group had a relatively small repertoire size, they were capable of using temporal adverbs in their speech to locate the target events on various points of the timeline, including the past, present, and future.

The developmental pattern of Chinese temporal adverbs

Given the naturalistic, free-play data of the present study, a chi-square test was conducted to investigate the association between children's production of temporal adverbs and their ages. This analytical technique was considered appropriate because the frequency data (i.e., headcount) were available for the different subtypes of temporal adverbs produced by children in all age groups. As such, both variables (the subtypes of temporal adverbs and the age groups) were categorical in nature. In addition, the sample size of the present study ensured that no cell in the contingency table had expected frequencies that were less than five. Therefore, the assumptions for performing a chi-square test were met.

First, a chi-square test was conducted on the number of children who uttered the three subtypes of temporal adverbs (i.e., past, present, and future) across the four age groups. As can be observed in Table 3, the 'Linear-by-Linear Association' test for trend yielded a significant outcome [Linear-by-Linear Association (1, $N = 251$) = 6.50, $p = .01$], indicating that the number of children producing each subtype of temporal adverbs tended to rise with growing age. For instance, 52.38% of children in the 2;6 age group uttered future temporal adverbs, with this figure rising to 57.14% in the 3;6 age group, and this ascending trend continued to the 5;6 age group, in which 97.62% of children did so. Such a pattern could also be found in the other two temporal adverb subtypes.

Based on the above analysis, we went on to explore another relevant issue: Does age relate to children's ability to produce various subtypes of temporal adverbs? Specifically, frequency count was performed on two variables: age groups on the one hand, and how many subtypes of temporal adverbs the child produced (i.e., whether it was 1-subtype, 2-subtypes, or 3-subtypes) on the other. Table 4 illustrates the frequency and the chi-square test result. As the output shows, there was a significant relationship between children's age and how many subtypes of temporal adverbs they could produce [χ^2 (6, $N = 134$) = 26.30, $p < .001$], and this association represented a

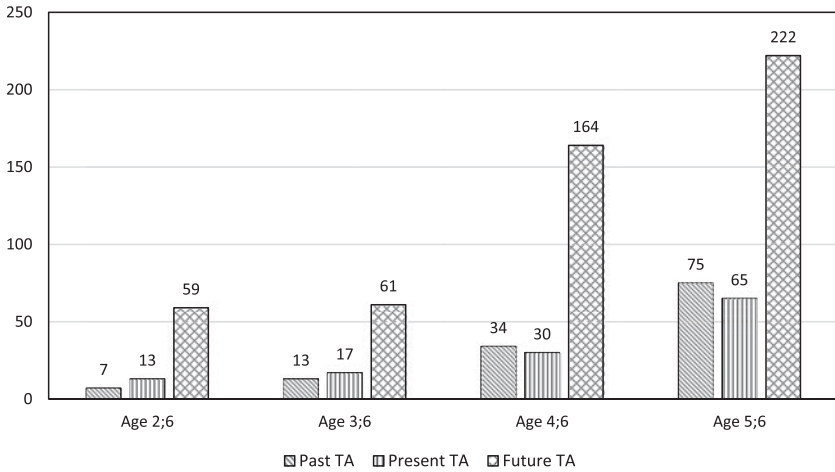


Figure 1. Production of Chinese temporal adverbs (TA) across different age groups.

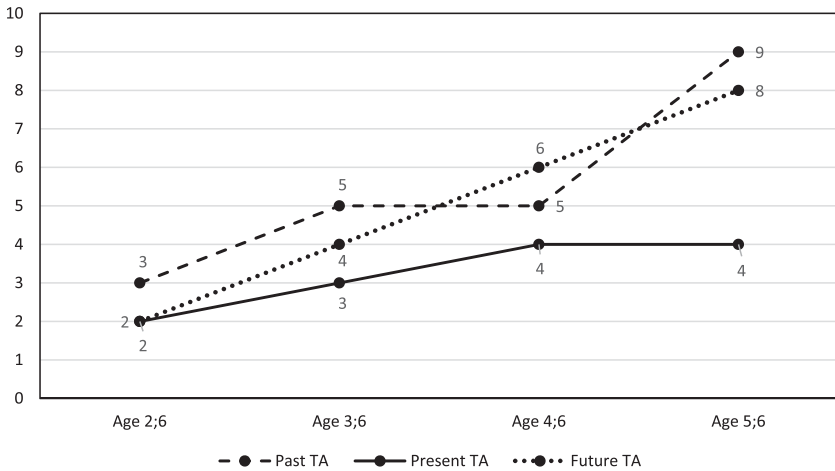


Figure 2. Repertoire of temporal adverbs (TA) across different age groups.

moderate size of effect [Cramers' $V = .31, p < .001$] based on Cohen's (1988) effect size guidelines.

In addition, the subscripts with each column in Table 4 provide us with more insights into the differences among column proportions at the .05 significance level. First, it is noticeable that in the third row of Table 4, the percentage 47.6% differed significantly from those of the other three columns (4.0%, 11.1%, and 17.5%), indicating that the proportion of children who produced all three temporal adverb (TA) subtypes in the 5;6 age group was significantly higher than the percentages of whom did so in the other three younger age groups. Second, on the row headed '1-Subtype', the percentage 14.3% differed significantly from those of the other three columns (56%, 44.4%, and 40%), indicating the proportion of children who used

Table 3. Number of children in all age groups producing the three subtypes of temporal adverbs (TA)

Temporal adverbs	Age groups ^a				Linear-by-Linear Association
	2;6 (n = 42)	3;6 (n = 42)	4;6 (n = 42)	5;6 (n = 42)	
Past TA n (%^b)	4 (9.52)	9 (21.43)	18 (42.86)	31 (73.81)	6.50*
Present TA n (%)	11 (26.19)	12 (28.57)	16 (38.10)	26 (61.90)	$p = .01$ $df^c = 1$
Future TA n (%)	22 (52.38)	24 (57.14)	37 (88.10)	41 (97.62)	N = 251

Notes. ^aThere are in total 168 children in our corpus, with each age group including 42 of them. But in our actual counting, as some children produced more than one type of temporal adverb, they were counted two or three times, making the N = 251 exceed the sample size of our corpus. ^bThe percentages in the brackets were calculated by dividing the frequency by the size of each age group (42). ^cThe degree of freedom for the linear-by-linear association test. * < .05.

Table 4. Number of temporal adverb (TA) subtypes produced by children in four age groups

Number of TA subtypes	Age groups (N = 134)				χ^2
	2;6 (n = 25)	3;6 (n = 27)	4;6 (n = 40)	5;6 (n = 42)	
1-Subtype n (%)	14 _a (56.0)	12 _a (44.4)	16 _{a, b} (40.0)	6 _b (14.3)	26.30*** $df = 6$ N = 134
2-Subtype n (%)	10 _a (40.0)	12 _a (44.4)	17 _a (42.5)	16 _a (38.1)	Cramer's V = .31***
3-Subtype n (%)	1 _a (4.0)	3 _a (11.1)	7 _a (17.5)	20 _b (47.6)	

Notes. The percentages in brackets were calculated just for each age group. Columns with different subscripts (a, b, or a, b) have significantly different column proportions at the .05 significance level. *** < .001

only one TA subtype in the 5;6 age group was significantly lower than the percentages of whom did so in the other three younger age groups. On the same row, the percentage 40% also significantly differed from 56% and 44.4%, demonstrating that the proportion of children who uttered one subtype of TA in the 4;6 age group was significantly lower than the percentages of those who did so in the two younger age groups (i.e., 2;6 and 3;6). In terms of the proportion of children who uttered two subtypes of TA, the result showed that the percentages did not differ significantly across the four age groups.

Cases of misusing Chinese temporal adverbs

As the third research question indicates, we paid special attention to any occurrence of children’s incorrect use of temporal adverbs. First, we expected to discover some cases of misuse in this corpus, particularly given the young age of the target children. Second, although Huang and Huang’s (2011) study detected one case of misuse of temporal adverbs, namely, redundant temporal adverbs, which was also found in our corpus (see ‘Child B’ below), they did not delve deeper to investigate the potential causes or what it may imply. Thus, for any mistakes found in the present corpus, we tried to break it down and see exactly where and how it ‘went wrong’, as we believe that grammatical errors made by children offer unique perspectives to gain further

understanding of their emerging language capacity in a range of aspects (e.g., syntax, semantics). In total, there were three cases of misusing temporal adverbs identified in the corpus, made by children in the 3;6, 4;6, and 5;6 age group, respectively. These cases are presented and analysed as follows:

A: repeated temporal adverbs

Child A (female, 3;6 group):

马上很快过去了。

ma-shang (immediately) *hen-kuai* (very quickly) *guo qu le*

Immediately very quickly passed by

'(it) passed by very quickly soon'

Correct form:

马上过去了/很快过去了。

ma-shang (immediately) *guo qu le* / *hen-kuai* (very quickly) *guo qu le*

(it) will go over soon / (it) went by very quickly

Child A produced two temporal adverbs relating to future time – 马上 *ma-shang* 'immediately' and 很快 *hen-kuai* 'very quickly' – in one sentence. It is speculated that in Chinese, as 马上 *ma-shang* 'immediately' expresses a notion that an event or action will occur in a short moment, Child A might have equated it to the word 很快 *hen-kuai* 'very quickly' and tried to combine the two terms to emphasise that the event happened swiftly. In this case, the meaning of the word 很快 'very quickly' overlapped with the word 马上 'immediately'.

B: redundant temporal adverbs

Child B (male, 4;6 group):

我们要来做饭吧。

wo men yao (be going to) *lai zuo fan ba*

We are going to shall cook.

'We shall cook.'

Correct form:

我们来做饭吧。

wo men lai zuo fan ba

'Let's cook.'

Child B uttered a superfluous 要 *yao* 'be going to' in a suggestive sentence to invite his friend to join him in action. He might have known that the semantic feature of 要 *yao* 'be going to' indicates future events, but it appeared that he lacked the practical knowledge that this word is not needed in such cases as making a suggestion or extending invitations.

C: inappropriate temporal adverbs

Child C (female, 5;6 group):

他正在坐椅子。

ta zheng-zai (in the process of) *zuo yizi*

he is sitting the chair

'He is sitting down the chair.'

Correct form:

他正坐在椅子上。

ta zheng (*in the process of*) zuo zai yizi shang.

'He is sitting on the chair.'

Child C combined a continuous temporal adverb 正在 *zheng-zai* 'in the process of' with a verb (坐) describing an action that happens momentarily (sitting down), which rendered this sentence syntactically incorrect. As 坐 'sit' is an intransitive verb that cannot be used directly in front of the object 椅子 'chair', the usage of 正在 *zheng-zai* 'in the process of' needs to be adapted to fit the sentence structure. However, it seemed that this girl had not acquired such a complex knowledge of grammar, which might have led to her mistake in using the term 正在 *zheng-zai* 'in the process of' in this utterance.

Cases of the irregular usage of Chinese temporal adverbs

We identified two broad categories of the irregular usage of Chinese temporal adverbs in the current corpus: post-positioned temporal adverbs and the co-occurrence of temporal adverbs.

A: post-positioned temporal adverbs

Seven instances of post-positioned temporal adverbs were found in the corpus. In these instances, temporal adverbs did not take the pre-position of the predicates as they usually do. Instead, they were placed at the end of the sentence, for example:

Child D (male, 3;6 age group):

又一个小孩来了，刚才。

you yi ge xiao hai lai le, gang-cai (*a moment ago*)

another child came, *a moment ago*

'Another child came a moment ago.'

Regular order:

刚才又一个小孩来了。

gang-cai you yi ge xiao hai lai le

a moment ago another child came

'Another child came a moment ago.'

Children in the 3;6, 4;6, and 5;6 age groups produced 1, 2, and 4 instances of post-positioned temporal adverbs, respectively. This finding seems to indicate that older children were more likely to end their sentences with temporal adverbs.

B: co-occurrence of temporal adverbs

In total there were 17 children who uttered more than one temporal adverb in a single sentence; examples are presented as follows:

Child E (female, 3;6 age group):

马上时间就要到啦！

ma-shang (*immediately*) shijian jiu-yao (*be about to soon*) dao la

immediately the time is *about to* arrive soon

'The time is about to arrive soon.'

Child F (male, 5;6 age group):

你刚才已经关了。

ni *gang-cai* (a moment ago) *yi-jing* (already) *guan le*

you a moment ago already closed it

'You had closed it already a moment ago.'

While only one child from the 2;6 age group produced multiple temporal adverbs in her speech, there were 4, 5, and 7 children who did so in the 3;6, 4;6, and 5;6 age groups, respectively. Among the 17 instances of co-occurrence of temporal adverbs, the majority of them (10 cases) were used for expressing the action or events that were about to happen, while 5 and 2 cases referred to events in the past and at present, respectively. One interesting finding was that two children from the 5;6 age group produced co-occurrence of temporal adverbs to express a more complex tense: past perfect (see the example of 'Child F'), whereas no younger children did so.

Discussion

As the first corpus-based developmental research project on preschool children's expression of temporality, this study utilised a rich Mandarin Chinese corpus to investigate children's use of temporal adverbs. We focused the analyses on exploring the repertoires of temporal adverbs that indicate the past, present, and future in early Mandarin Chinese. Descriptive analyses and chi-square tests were performed to examine if there were any developmental patterns in children's acquisition of temporal adverbs. Also, we investigated whether young children demonstrated any incorrect use of temporal adverbs in their natural utterances. This section discusses our findings in more detail.

The repertoire of early child temporal adverbs

The present study revealed that children in the corpus produced altogether 21 types of temporal adverbs, which is less than the totality in the original coding book we developed. This could be partly due to the fact that some temporal adverbs in the coding book were extracted from studies taking a broader linguistic perspective with written forms (e.g., novels, news report) or adults' utterances as the sources of material (i.e., Li, 1996a; Zhang, 2006). Thus, young children might not have acquired, or been unable to use these more complex forms in the target language (i.e., Mandarin Chinese). Despite that, among all the temporal adverbs we identified, 9, 8, and 4 were used for expressing the past, future, and present, respectively. This finding is to some extent consistent with that of Tse *et al.*'s (2012) investigation, in which they found that the present temporal adverbs produced by Cantonese-speaking children represented the least number of forms. However, it should be noted that, in our study, although the repertoire size of children's past temporal adverbs (9) exceeded those of the other subtypes, future temporal adverbs constituted a subtype that is almost equally variant in form (8). This finding indicates that the Mandarin-speaking children in our corpus have gained the cognitive capacity for mentally constructing past situations and have also acquired a variety of linguistic constructs in expressing future events. Similarly, Tse *et al.*'s investigation showed that Cantonese-speaking children have the most variant forms (24) of future temporal

adverbs. However, it was partly due to the fact that, in Cantonese, the future adverbial phrase *dang2* (A) *jat1* (B) *zen6* (C) *gaan1* (D) *sin1* (E) can be used interchangeably in a set of colloquial variations such as ABC, AC, ABCD, and so forth, whereas in our study of Mandarin temporal adverbs, there is no such case.

Not only do the future temporal adverbs constitute a variant subtype, our study also found that, across all age groups, children uttered substantially more future temporal adverbs than the other two subtypes. The least frequently used temporal adverbs are the present time adverbs (comprising 16.4% of all cases), despite a couple of prior investigations (e.g., Bi & Peng, 2002, 2004; Fu, 2002) which have reported that they are acquired by children earlier than the other two subtypes. We consider that such notably unequal use of each subtype of temporal adverbs relates to their pragmatic features; as Fu (2002) suggested, children tend to use future temporal adverbs more frequently to state their subsequent actions and desires. Therefore, children who were left to play freely for thirty minutes in the current study were more likely to produce utterances with future temporal adverbs. In our corpus, this was most conspicuously exemplified by children's extensive use of 要 *yao* 'be going to' in announcing what they were going to do, such as:

我要报警。

wo *yao* (*be going to*) bao jing

I am going to call police

'I am going to call the police.'

我要吃这个。

wo *yao* (*be going to*) chi zhe ge

I am going to eat this

'I am going to eat this.'

The developmental patterns of early Mandarin temporal adverbs

The present study found that children from the youngest age group in the corpus (2;6) produced temporal adverbs of all three subtypes. This result allows for no inference to be made concerning children's acquisition order of temporal adverbs, so we were unable to confirm the pattern of 'present time >future time >past time' proposed by Fu (2002). Nevertheless, this finding provides cross-linguistic support for a large body of research indicating that children of Indo-European language backgrounds have gained the ability to talk about past and future events around or before two years old (e.g., Ames, 1946; Fivush *et al.*, 1987; Nelson, 1989). In a previous study adopting the same communication task involving Cantonese-speaking preschool children, Tse *et al.* (2012) reported that three-year-old children produced temporal adverbs relating to past, future, and present events. Compared to our finding, it seems that Mandarin-speaking children acquire the ability to express different temporal concepts earlier than young Cantonese speakers. A comparative study with children from the same age groups should be conducted to investigate whether or not such a cross-language difference truly exists. Our investigation has also revealed that children in the older age groups possessed a larger repertoire of temporal adverbs compared to younger children, and those in the 5;6 age group produced all temporal adverbs included in the study. This finding substantiates Chang's work (1998, 2004),

in which the scholar found that older Mandarin-speaking children used more diversified temporal devices than younger children when making narratives.

In addition, we conducted a chi-square test to examine the association between children's age and their ability to produce different types of temporal adverbs. First, we were interested to see if children's age related to their production of the three TA subtypes. Our analysis revealed a significant linear relationship between these two factors. In other words, there was a significant trend that, with increasing age, children become more capable of making use of all three subtypes of temporal adverbs. Such a salient age effect provides further empirical evidence to support the notion that, across the preschool years, children gradually attain the linguistic maturity that allows them to express various temporal relations (Grant & Suddendorf, 2011). Second, with a further step, we investigated whether the number of TA subtypes produced by children related to their age. The chi-square test yielded a significant association between these two variables and suggested a general pattern that: (1) as children get older, more of them become competent in using all three TA subtypes. In particular, those in the 5;6 age group were more likely to do so than the younger children; and (2) conversely, those who can only use one TA subtype saw a decreasing trend in its number. From age 4;6 onwards, significantly fewer children produced utterances with only one subtype of temporal adverbs. These findings not only strengthened the age effect we have identified earlier but also corroborate previous studies concerning children's temporal system acquisition process. For example, Weist (1986) posited that children's acquisition of temporal system transfer from the 'Event Time system' to the 'Reference Time system' around three years old, and, a little over four years (52 months), they enter the 'Free RT system', during which time they gain the ability to relocate the temporal deictic centre from the speech time to a newly established time interval. Thus, it is possible that, upon fully entering this phase, for instance, aged 4;6 and beyond as our findings suggested, children begin to make more flexible use of temporal adverbs to describe temporal relationships in their daily experiences (Weist & Buczowska, 1987). Therefore, it comes as less of a surprise that, as more children produced all three TA subtypes, a decreasing number of them made use of only one TA subtype in their natural utterances.

Irregular use and misuse of temporal adverbs

There were two broad types of irregular use of temporal adverbs identified in our corpus, both of which demonstrate mature pragmatics of temporal adverbs and occur rather commonly in adults' speech. First, the relocation of temporal adverbs from the pre-position of the predicate to the sentence-final position occurred early (3;6) and became more frequent as children got older. According to Zhang (2006), in the colloquial form of Mandarin Chinese, temporal adverbs can sometimes be moved to the end of the sentence without altering the semantic features of the original sentence. In such cases, these adverbs are not pronounced with stress, and the sentence is only slightly changed in its pragmatic function. For example, the new utterance may imply a sense of urging. However, this is not what we observed in our data; the post-positioned temporal adverbs did not convey the explicit meaning of urging the other child to act. This was in part due to the nature of the communication task of this study, in which children tended to engage in playing with toys instead of making extensive conversation with each other, even though they were encouraged to do so. Therefore, it was unlikely that the post-positioned

temporal adverbs primarily served the function of prompting their peers to act quickly. Instead, they were more likely to be used as temporal modifiers to highlight the temporal frame in which the event took place. This is in line with Syrett, Arunachalam, and Waxman's (2014) finding that adverbial modifiers such as temporal adverbs can provide additional semantic content that proves to be useful for young language learners. In Mandarin Chinese, temporal adverbs, among other forms of adverbs (e.g., adverbs of degree, manner, scope), typically function as sentence modifiers. When they are placed in sentence-final position, they contribute additional information to the preceding utterances (Wang, 2012). According to Zhang (2006), such movement of temporal adverbs without altering the semantic structure of the sentence can be viewed as a change of 'pragmatical word order'.

Second, we found that children in the current corpus were able to produce utterances with multiple temporal adverbs from two years old, and this ability demonstrated an age-related developmental trend. This finding appears to suggest that, from an early age, children can emphasise the temporal information of the situation described by using more than one temporal adverbs in their utterance. According to Na (2017) and Zhang (2000), such a structure allows speakers' subjective perspective on how events unfold on the timeline to be more saliently presented. Zhang also pointed out that, in Mandarin Chinese, the co-occurrence of temporal adverbs can take two syntactic structures: the left-to-right and the right-to-left. In the former, the first temporal adverb modifies the following one, before they jointly modify the subsequent predicate, while in the second situation, the order is reversed, with the latter temporal adverb modifying the preceding one before they work as a whole to describe the predicate. In our data, all the instances of co-occurrence of temporal adverbs took the form of a left-to-right structure. This was in line with Zhang's suggestion that the left-to-right structure requires the co-existing temporal adverbs to be under the same classification (e.g., both temporal adverbs express the temporal positions on the timeline). In our study, all temporal adverbs met this criterion as they placed events at various locations on the timeline.

Furthermore, it was found that, among all the instances of co-occurring temporal adverbs, a major portion of them related to actions or events that were going to happen soon, followed by those indicating that events happened in the past, among which most referred to situations close to the utterance time. This result is partly congruent with previous studies indicating that young children's temporal references primarily rely on the situational context and background knowledge, which enable them to make past references that are relative to the 'here-and-now' (Huang, 2003). Noticeably, there were two children in the 5;6 age group who correctly produced co-occurring temporal adverbs to indicate a more complex tense, the past perfect tense, whereas there was no such case identified in the younger children's utterances. Although the cross-sectional nature of the present investigation and a limited number of instances prevent us from drawing inferences from this observation, we speculate that such complex use of temporal adverbs in part reflects the developmental stage termed by Weist (1986) as the 'Free RT system' (36–52 months), during which period children gradually gain the ability to mentally locate themselves at a certain time interval different from the 'speech time' and the 'event time' when they make references to a target event. In the case we presented (see 'Child F'), the child showed his ability to mentally place himself at an indefinite time-point (刚才 *gang-cai* 'a moment ago') prior to the moment of speech but away from the event time to describe a finished action (关 *guan* 'close').

In terms of the incorrect use of temporal adverbs, we found that children aged between 3;6 and 5;6 made a few mistakes when using temporal adverbs in their natural utterances. Similar cases of misuse have been recorded by previous researchers (e.g., Huang & Huang, 2011; Tse *et al.*, 2012). Collectively, these mistakes can be summarised as the mismatch between temporal adverbs and the predicates of the sentences. We suggest that such misuse of temporal adverbs partly reflected that children under six years old lack a comprehensive understanding of the semantic or pragmatic features of temporal adverbs; as Bi and Peng's (2002, 2004) studies suggested, it is between ages seven and eight that Mandarin-speaking children start to make significant progress in their comprehension of a wide variety of temporal adverbs.

In general, the findings of the present study have implications for the growing research field concerning children's early acquisition of temporal terms and how their linguistic capacity reflects their cognitive development. In particular, our findings suggest that Mandarin-speaking children are capable of making present, past, and future reference from an early age by using appropriate linguistic means (i.e., temporal adverbs) in the target language. It is reasonable to conjecture that children have gained a certain level of cognitive maturity by approximately two years old that allows them to mentally construct past and upcoming events, as they are unlikely to talk about temporal relationships that they are incapable of thinking about (Weist, 2014b). Also, in accordance with Weist's view that children's ability to re-experience past events opens the possibility for pre-experiencing future events, we found that children in our corpus produced extensive future references, mostly communicating the desires or actions they were going to perform. This not only demonstrates that children in their preschool years are capable of involving themselves in future events (Atance & O'Neil, 2005), it also shows that children's future references mostly relate to their subsequent actions with some degree of commitment (Gee & Savasir, 1985). In this regard, our finding provides cross-linguistic evidence to Swift's (2004) investigation, in which the researcher found that young speakers (under age 3;6) of Inuktitut, a language with tense morphology that specifies past and future into different degrees of remoteness from the deictic centre, made early and frequent use of the future suffix *-si-* 'about to, going to' to express an event or action that is going to take place shortly in the future. However, a few errors have also been detected, showing that the emergence of the RT system is gradual progress during which children could, as other researchers (e.g., Pawlak *et al.*, 2006) have noted, make mistakes in their efforts to construct sentences and concepts of temporal relationships. Such deficits in early language competency are likely owing to cognitive, linguistic, and brain-developmental restrictions, or a combination of these factors, which calls for further investigations.

Conclusion


In conclusion, this is a corpus-based study on Mandarin-speaking preschoolers' development of temporal adverbs. By eliciting children's natural utterances from a corpus established in Beijing, we were able to offer a descriptive account of children's repertoires of temporal adverbs and their developmental patterns across different age groups. In summary, we found that: (1) Mandarin-speaking children in our corpus produced a repertoire of 21 temporal adverbs, and those from the youngest age group (2;6) were capable of producing temporal adverbs indicating the past, present,

and future; (2) children of all age groups uttered temporal adverbs indicating the future time more frequently than those denoting the past and present time; (3) there was a significant age effect such that, with increasing age, more children in each age group were capable of producing all subtypes of temporal adverbs; (4) there was a significant association between children's age and the number of subtypes of temporal adverbs they could use; and (5) children's production of temporal adverbs demonstrated some irregular patterns and instances of errors, which were speculated to be relative to multiple factors including linguistic features of the Chinese language, children's cognitive developmental stage, and their comprehension of the temporal adverbs.

Limitation and future research

The present study has some limitations. First, this study collected children's utterances from their naturalistic conversations, and the final dataset may have only documented a particular portion of all the linguistic evidence we expected to gather. In other words, the absence of specific forms of temporal adverbs in our corpus does not in and of itself indicate children's lack of knowledge of them. Expanding the sample size may mitigate this problem to some extent, but it cannot be eliminated. Second, as participants of the study attended a 30-minute free-play session, in which they were accompanied only by toys and a peer, they might not have produced as much target language material as they would be in a more relaxed and everyday context. Third, despite this being a corpus-based study, the cross-sectional nature of the data we collected limited us from making consolidated conclusions about children's acquisition trajectory of temporal adverbs. Future studies may consider adopting a longitudinal design to map out an in-depth picture of how children progress through different stages of acquiring temporal adverbs, and what developmental characteristics they demonstrate. In terms of our findings of misuse and irregular use of temporal adverbs, it should be noted that, since such cases comprised only a small proportion of all children's utterances, the developmental pattern which appears to be suggested by our data (for example, older children seem to use more combined temporal adverbs to express temporality) cannot be generalized to the broader population, and future research may investigate these patterns in more depth by collecting a larger sample of misuse and/or irregular use of temporal adverbs. Last but not least, despite the present study's focus on examining the development of temporal adverbs, it should not be neglected that Mandarin Chinese also employs other linguistic structures for establishing temporal references, among which the aspectual system has a critical role to play. In the linguistic literature, the Mandarin aspectual system has been extensively discussed in regard to two broad domains: grammatical aspect and lexical aspect, with the former describing the speaker's viewpoint of the contour of the situation under discussion (Li & Bowerman, 1998), and the latter relating to the lexical content conveyed by the verb (Li, 2012). According to Erbaugh's (1982, also see Erbaugh, 1992) longitudinal study involving four Taiwanese children aged from 1;9 to 3;9, children made substantial and frequent use of the perfective aspect marker 了 *-le* before they reach 2;4 (the general boundedness stage), with 96% of them marking immediate past. Huang's (2003) study supports the finding that, compared to adults, young children under 3;3 relied more heavily on aspect markers in establishing past references. In terms of the imperfective aspect marker 在 *-zai*, Li and Bowerman's (1998, also see Li & Shirai, 2000) experimental study suggests that

utterances of children in the youngest age group (three-year-old) demonstrated a strong association between lexical and grammatical aspects. In particular, the imperfective marker 在-*zai* was associated almost exclusively with atelic verbs indicating the process of the given situation. Such biases in children's production were also documented by Stephany (1981), who proposed that it related closely to the parental language input, which also featured strong links between present/imperfective markers and non-resultative verbs. Interestingly, concerning children's production of future reference, Erbaugh (1992) reported that, in the early stage of temporal adverb acquisition (before 2;4), children produced time adverbs to describe their desires and fantasies in the immediate future for 80% of the time. Thus, the abovementioned studies leave us with two unanswered questions: first, there seems to be a pattern that children tend to make future references using temporal adverbs and resort to aspectual markers for past and present references during the early developmental period. How does this pattern hold with the empirical data? Second, what is the relationship between temporal adverbs and the aspectual system in early Mandarin acquisition? These matters will be further investigated in our subsequent research.

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