

Mandarin-Speaking Late Talkers and Gesture Production at 24 Months

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Abstract

We studied gesture and language production in 21 Mandarin-speaking late talkers at 24 months of age and compared them with 28 age-matched typically developing children to determine their gestural and cross-modal communicative abilities. Spontaneous cross-modal data were collected during naturalistic mother-child interactions. Results from the Words and Sentences survey of the MCDI-T showed that late talkers had underdeveloped vocabulary and grammatical complexity. Nonetheless, their gestural competence was intact and comparable to that of typically developing children. Both groups demonstrated similar patterns in using declarative pointing, imperative pointing, showing, giving, representational, and conventional gestures to achieve communicative goals. Among these, declarative pointing was the most common for establishing joint attention and sharing interests or information with the addressee. Although late talkers were capable of reinforcing, clarifying, and supplementing speech with gestures, they did so less frequently than their typically developing peers. In sum, late talkers used gestures effectively to support communication; however, they showed limitations in integrating varied information for cross-modal communication.

Keywords: expressive language delay; gestural competence; cross-modal communication; mother-child interaction

Introduction

Infants spontaneously make gestures and sometimes accompanied by vocalizations to communicate with others since the second half of their first year of life. These early gestures have a positive correlation with later language development (Bang et al., 2023; Bates et al., 1979; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005; Özçalışkan et al., 2017; Rowe & Goldin-Meadow, 2009; Rowe et al., 2008; Tomasello et al., 2007). When children start to speak, gesture does not disappear but develops along with language acquisition. As they grow older, gesture takes on various functions in combination with speech. For instance, a child utters the demonstrative word *nàge* 'that' and, at the same time, produces a gesture to request for the intended referent such as a toy animal far from the child's reach. The child may produce two or more words and a gesture, which, together, present a complete

idea, such as uttering *māmā* 'mother' as the subject and *ná* 'get' as a predicate while pointing to a *línggǔ* 'tambourine' on a table as the object for communicating a propositional idea concerning 'an agent carrying out an action to obtain an object'. Sometimes, gestures add information to enrich the speech content, such as producing the clausal utterance *ná* 'that' *shì* 'be' *qìqíú* 'balloon' while raising the hand to head level to signify '(balloons) flying high'.

At the age of 24 months, typically developing children are already equipped with a wide range of spoken vocabularies and word combinations manifesting morphological, structural, and semantic relations. These language skills, however, are lacking in children who are delayed in expressive language. For a child to have a small vocabulary of about 50 word types and lack productive two-word combinations with no known neurological, sensory, or cognitive deficits at about two years old are the common indicators of language delay (e.g., Rescorla, 2011; Capone Singleton, 2018). Various language versions of the MacArthur-Bates Communicative Development Inventory have been employed to identify late-talking children who scored at or below the 10th or 15th percentile on the expressive vocabulary survey (Bello et al., 2018; Fenson et al., 1993; Liu & Lin, 2017; Liu et al., 2023; Rinaldi et al., 2022; Sansavini et al., 2019; Thal & Tobias, 1992, 1994). In this study, two-year-old children with expressive vocabulary scores at or below the 10th percentile on the Taiwan version of MCDI were considered as late talkers.

Research on children with delayed expressive language has explored a broad range of issues including whether late talking was transient or persistent, how late-talkers diverged from other child populations in language acquisition, risk factors, familial and social factors, and prediction of language-delay outcomes during and after the preschool years (Bruner, 1981; Capone Singleton, 2018; Chilosi et al., 2019; Desmarais et al., 2008, 2010; Fisher, 2017; Hawa & Spanoudis, 2014; Rescorla, 2011; Zambrana et al., 2014). Non-verbal communication, particularly the use of gestures, has also been a focus, since children, whether language-delayed or not, use gestures to communicate. Given the essential role gestures play in language development, research has investigated how

combining the two modalities can better characterize the communicative abilities of late-talking children. This joint gestural-linguistic approach would more effectively reveal the nature of cross-modal communication and help anticipate potential language obstacles for early detection and intervention treatment (Capone Singleton, 2018; Lüke et al., 2020; Rescorla et al., 2000; Rinaldi et al., 2022; Sylvestre et al., 2018).

Previous studies on children's gestural competence and its relationships with language in development have provided evidence supporting a close association between the two modalities (e.g., Butcher & Goldin-Meadow, 2000; Iverson and Goldin-Meadow, 2005; Iverson, Capirci, Volterra, & Goldin-Meadow, 2007; Özçalışkan and Goldin-Meadow, 2005; Rowe and Goldin-Meadow, 2009). However, findings regarding children with language delay have been more divergent and inconsistent. Thal and Tobias (1992) investigated ten children with 0 to 64 expressive vocabularies between 18 and 28 months, together with two control groups. Late talkers produced significantly more spontaneous and non-symbolic gestures of pointing, showing, and reaching than the age-matched and language-matched peers. Gesture-vocalization combinations were the large majority in late talkers and the language-matched group. After one year, six children caught up, called late bloomers, and, retrospectively, their production of spontaneous non-symbolic gestures surpassed the truly-delayed and control groups. The overall results demonstrated that gesture use was robust and could predict the persistence of language delay during the one-word stage in late bloomers. These results were not replicated in the authors' later study involving a different group of late-talking children between 18 and 33 months old, whose word production ranged from 1 to 59, together with a group matched for age and language comprehension, and another group matched for language production (Thal & Tobias, 1994). The three groups of children were found comparable in their gesture production. In a study by O'Neil and Chiat (2015), two types of late talkers between 24 and 36 months old were differentiated. Twelve children were delayed in expressive language, while ten further displayed deficits in language comprehension. Only the former group obtained a higher score in symbolic understanding of objects and produced more gestures. Lüke et al. (2017a) investigated the relationship between the hand shape of pointing gestures and language delay in a group of German-speaking one-year-olds who had a sibling or a parent with a history of language impairment. After one year, 15 participants were diagnosed as language-delayed, and demonstrated a significantly lower rate of using index-finger pointing gestures at 12 months. In a subsequent longitudinal study (Lüke et al., 2017b), only a small proportion of language-delayed children pointed with index-finger, and those who used pointing gestures did so at a very low rate at 12 months; yet, more index-finger points were produced at 21 months. The results corroborated the early predictive value of this type of gesture for identifying language delay. Sansavini et al. (2019) found that late talkers with an autistic older sibling and those born with a very low gestational age produced significantly fewer pointing gestures at 18 months, compared to typically developing children. The reduced

rate of pointing in these at-risk groups did not align with Lüke et al.'s (2017b) findings, which showed an increase in index-finger pointing gestures after 16 months in late talkers. Finally, Rinaldi et al. (2022) examined the use of deictic and representational gestures by a group of Italian-speaking late talkers without a later diagnosis of developmental language disorder and another group with persistent language deficits. The former group produced gesture-only instances more frequently, made more representational but less deictic gestures, and displayed a higher occurrence of supplementary gestures with speech. Together, previous research showed considerable variability in the ages of language-delayed children studied, the types of gestures examined, and the inclusion of control groups. Importantly, there is still no clear consensus regarding the gestural abilities of late talkers.

In Taiwan, Chi (2002) investigated verbal and non-verbal development in Mandarin-speaking children aged 8 to 30 months using parental reports. A variety of functions were identified for nonverbal acts. For example, by the age of 23 months, children used their hands to make requests for food, objects, help, or to provide information, and they made symbolic gestures to convey conventional meanings, such as waving the hand for 'goodbye'. Non-verbal behaviors extended beyond manual gestures, such as foot-tapping to express joy. There was no analysis of whether these non-verbal acts occurred with speech. To date, research on gesture use in Taiwanese children's language development remains scarce, particularly regarding late talkers with expressive language delays.

Our study addressed the research gap and investigated the gesture and language production of Mandarin-speaking late talkers at 24 months, relative to the age-matched children with typical development. Children's gestures and speech were spontaneously produced during naturalistic mother-child interactions. We asked how two-year-olds used different types of gestures with or without accompanying speech, and whether expressive language deficits would affect gesture production, to determine the gestural and cross-modal communicative competences of language-delayed children in interactional contexts.

Methods

Participants

Forty-nine children (27 boys; 22 girls) and their mothers participated in this study. The mean age was 24 months and 13 days. They were recruited through parental groups in social media and local infant labs for a longitudinal research project on the gesture and language development in Taiwan. All of the children were from two-parent Mandarin-speaking families in the greater Taipei area, mostly of middle to upper socioeconomic status. The Words and Sentences survey in the Toddler Form of MCDI-T was employed to assess children's expressive language abilities. Twenty-one children (15 boys; 6 girls) scored at or below the 10th percentile rank and were identified as language-delayed. They showed specific expressive language deficits with no reported neurological, sensory, or language comprehension problems. Twenty-eight children (12 boys; 16 girls) scored above the 20th

percentile rank and were considered as typically developing. Participants signed the consent form approved by the Research Ethics Committee of National Chengchi University. Their participation was remunerated.

Data Collection

Gesture and speech data were collected in a playroom which was set up for the observation of mother-child interactions. The room was equipped with two cameras on the walls, which captured the central activity area and the frontal, lateral, and back of the child, the mother, and objects. Two Sony camcorders were positioned on tripods and located near the activity area for audio-video recording at close range. The child and the mother sat opposite each other on the mat, and the child was free to move around during activities. Each dyad participated in a 48-minute session, including 15 minutes of free play, 10 minutes of viewing 19 pictures selected based on Taiwan children's first 50 words (Chi, 2002), and five semi-structured activity tasks, one lasting 3 minutes and the others 5 minutes each. Semi-structured activities were adapted from the Communication Play Protocol (Adamson et al., 2009) to facilitate gesture and speech productions, involving challenges and unexpectedness, such as a large roly-poly bear that was not easy to be taken out of a container or an unanticipated appearance of a new toy on a table. The session was administered by an assistant.

The overall play setting and communicative contexts very much resembled the home environment for play, and provided children equal chances of using gesture and speech for between-group and within-group comparisons. After all activities, the mothers filled in the Toddler Form of MCDI-T.

Transcription, Coding, and Analysis

We transcribed all of the speech that the children produced. In reference to Özçalışkan and Goldin-Meadow (2005b), we coded vocal sounds without clear meanings and babbling as 'vocalization'. 'Word' referred to sounds that were used reliably to refer to specific entities, properties, or actions (e.g., *əm* 'to eat'), onomatopoeic sounds (e.g., *kāchā-kāchā* 'train', *gūlūgūlū* 'to drink'), conventionalized evaluative sounds (e.g., *wā* to show surprise), and words (e.g., *xióngxióng* 'bear', *shuìjiàojiào* 'sleep').

Children's gestures were produced spontaneously for communicative purposes during activities, excluding the direct manipulation of objects such as closing the trunk of a toy car, hand movements in a ritualized game such as rock-scissors-paper, and ritual manual acts like blowing someone a kiss (e.g., Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005). Gestures were categorized into various types. 'Pointing' toward an intended referent was made either with the index finger extended relative to other fingers, or with the whole hand. It was coded as 'imperative' for requesting what was pointed to, accompanied by the child leaning forward or going toward an object to get it, making a request gesture with a flat palm facing upward or opening and closing the palm, pointing to the object two or more times consecutively, or a combination of these (Liszkowski et al., 2006). These behaviors were not present in 'declarative

pointing' which served to direct the addressee's attention, and inform what the child was attending to or interested in (Liszkowski et al., 2004). 'Showing' was to hold up something in the addressee's potential line of sight, usually including arm extension toward the addressee; 'giving' was to place something in the addressee's hand or close to the addressee. These deictic gestures involved referents in the immediate communicative environment. In addition, 'representational' gestures conveyed semantic information such as the hand slightly forming a curve to depict the round feature of a toy pumpkin, and 'conventional' gestures had culturally-defined meanings such as flat palms facing upward to signify 'something is gone'. After categorization, the referential or semantic information in gestures were identified in reference to the linguistic and interactional contexts. A gestural instance was further coded as 'gesture-only' if it was made without accompanying vocalization or word(s), or as 'gesture-speech combination' with vocalization and/or word(s) such as pointing to a picture of a cat and saying *māomāo* 'cat' *diédǎo* 'fall'. Lastly, the referent associated with each gesture was analyzed. Every occurrence of a gesture corresponding to a specific referent was counted as a 'gesture token'. Gesture repertoire was a set of gestures associated with distinct referents (Iverson & Goldin-Meadow, 2005; Liszkowski et al., 2004; Özçalışkan & Goldin-Meadow, 2005; Rowe & Goldin-Meadow, 2009).

In characterizing the relationship between the two components in gesture-word combinations, three types of gesture functions were distinguished (Özçalışkan & Goldin-Meadow, 2005). A gesture was 'reinforcing' if the gestural referent or meaning was also verbalized, such as saying *yāyā* 'duck' and showing the mother a toy duck in gesture. A gesture was coded as 'disambiguating' if it was made to denote the referent of a deictic or pronominal word, such as uttering the demonstrative *zhègè* 'this' and pointing to the target container with a toy bear inside. Thirdly, a gesture was 'supplementary' if it provided additional information not encoded in the speech content, such as producing the verb *jiào* 'make noise' and pointing to a toy lion. For the combination of a supplementary gesture and speech, we further analyzed it as an 'entity-related idea' when gesture and speech conveyed different information about an entity in one communicative act, as in saying *zān* 'three' and pointing to the apples in a picture to mean 'three apples'. A combination conveyed a 'predicative idea' when a verb was produced alongside a gesture or a gesture depicted an action while the accompanying word(s) served as an entity being affected or modifying element(s) of action, motion, and experiential state, such as saying *yáoyáo* 'shake' and pointing to a rattle to mean 'shake the rattle'. Finally, a 'propositional idea' consisted of the subject and predicate, such as saying *zǒulù* 'walk' and pointing to the bird in a picture to convey a complete idea—'The bird walks'.

Inter-rater reliability was established by having the second coder, who was blind to the purposes of the study, analyze a random 20% of the collected data – 756 gestural instances. Agreement between coders was 96.69% (Cohen's kappa; $\kappa = .962$) for speech content, 96.69% ($\kappa = .958$) for speech type, 92.59% ($\kappa = .885$) for gesture type, 92.86% ($\kappa = .927$) for gestural meaning, total agreement on

gesture-only versus gesture-speech combination, 89.40% ($\kappa = .779$) for whether gestural meaning was related to speech content, 87.77% ($\kappa = .812$) for gesture function, and 86.13% ($\kappa = .788$) for the type of idea conveyed by the combination of supplementary gesture and speech. The overall ratings yielded high Cohen's Kappas. Disagreements were resolved through discussion, and cases without consensus were not included in the study.

Results

Children's Expressive Language

We compared children with language delay (LD) and typically-developing children (TD) to examine expressive language abilities at 24 months (Table 1). Results from MCDI-T showed that late-talking children produced fewer word types and demonstrated lower complexity in word combinations than the other group ($ps < .001$). Similarly, in naturalistic mother-child interactions, late talkers produced fewer word tokens and word types ($ps < .001$).

Children's Gesture Production

To investigate gesture use in mother-child interactions, we analyzed the number of gesture tokens and gesture repertoires produced by the two groups of children (Table 2). Results showed no main effect of group on either measure ($ps > .10$), indicating that despite their expressive language deficits, late talkers exhibited similar gesture use to typical children in general. Further analysis found no group differences in the token count of different gesture types, including declarative and imperative pointing, showing, giving, representational, or conventional gestures ($ps > .10$; Table 3).

Table 1. Expressive language measured by MCDI-T and spoken language production in mother-child interactions.

Variable	LD	TD	<i>t</i>	<i>p</i>
MCDI-T				
Word type	21.19 (18.23)	323.21 (159.77)	-9.92	< .001
Complexity	2.05 (5.26)	25.11 (15.01)	-7.53	< .001
Mother-Child Interaction				
Word token	181.90 (201.14)	414.86 (232.65)	-3.75	< .001
Word type	51.86 (55.95)	117.96 (52.65)	-4.20	< .001

Note. Standard deviations are in parentheses.

Table 2. Gesture production in mother-child interactions.

Variable	LD	TD	<i>t</i>	<i>p</i>
Gesture token	77.71 (47.56)	81.39 (43.52)	-0.28	.783
Gesture repertoire	47.86 (21.77)	54.18 (21.36)	-1.01	.316

Note. Standard deviations are in parentheses.

Table 3. Types of gesture in mother-child interactions.

Variable	LD	TD	<i>t</i>	<i>p</i>
Declarative pointing	34.95 (21.02)	36.32 (22.91)	-0.22	.829
Imperative pointing	12.33 (14.15)	9.61 (7.41)	0.80	.428
Showing	5.48 (9.39)	7.14 (7.31)	-0.67	.504
Giving	9.62 (6.82)	12.32 (7.48)	-1.32	.194
Representational	2.76 (3.40)	4.18 (4.68)	-1.23	.226
Conventional	12.57 (16.08)	11.82 (17.23)	0.16	.876

Note. Standard deviations are in parentheses.

To examine the use of index finger or whole hand in pointing, we conducted a three-way mixed ANOVA with hand shape (index finger vs. whole hand) and gesture subtype (declarative vs. imperative) as within-participant factors and group (LD vs. TD) as a between-participant factor. Results showed that children overall produced more declarative than imperative gestures ($F(1, 47) = 70.10, p < .001$) and used index-finger pointing more frequently than whole-hand pointing ($F(1, 47) = 131.06, p < .001$). However, there was no interaction between group and either gesture type or the form of pointing, and the three-way interaction was not significant ($ps > .10$), indicating that the relative use of these two types of gesture and the hand shape of pointing was comparable across groups.

Furthermore, to examine the use of gestures alone versus those accompanied by speech, we conducted a two-way ANOVA with group and modality type (gesture-only vs. gesture-speech combined) as factors. Here, gesture-speech combined included both gesture-vocalization and gestures with meaningful speech. Results showed that children overall produced more gesture-speech combined instances than gesture-only instances ($F(1, 47) = 59.67, p < .001$). More importantly, the interaction between group and modality type was significant ($F(1, 47) = 5.72, p = .021$). Follow-up tests indicated that late-talkers showed a greater tendency to use gestures without accompanying speech compared to the other group ($p = .079$).

Comparing gesture-vocalization and gestures with meaningful speech, we also combined the three meaningful speech gesture categories and conducted a two-way ANOVA with group and cross-modal category (gesture-vocalization vs. gestures with meaningful speech). There was no overall group difference ($F(1, 47) = 1.53, p = .222$), but children produced more gestures with meaningful speech than gesture-vocalization ($F(1, 47) = 8.53, p < .005$). A significant interaction ($F(1, 47) = 27.39, p < .001$) showed that TD children used more gestures with meaningful speech ($p < .001$), while LD children relied more on gesture-vocalization ($p = .007$).

For declarative and imperative pointing, we further conducted parallel analyses for these two gesture subtypes. In the case of declarative pointing, the interaction between group and modality type was marginal ($F(1, 47) = 3.31, p = .075$), with late talkers being more likely to produce gesture-only declarative pointing than typical children ($p =$

.034). In the case of imperative pointing, although the interaction was not significant ($F(1, 47) = 0.44, p = .508$), post hoc analysis showed that late talkers still used more gesture-only imperative points than the other group ($p = .044$). These results suggest that late talkers might rely more on gesture-only communication, particularly for declarative pointing.

Gesture-Speech Combinations

To examine differences in gesture function within gesture-speech combinations, we conducted an ANOVA with group and gesture function as factors. Results showed a main effect of gesture function ($F(2, 94) = 5.54, p = .005$), indicating overall differences across gestures serving the reinforcing, disambiguating, or supplementary functions. More importantly, an interaction between group and gesture function ($F(2, 94) = 3.47, p = .035$) suggests that the distribution of these functions differed between the two groups. Post hoc analyses (Table 4) revealed that late talkers produced fewer reinforcing ($p = .003$) and supplementary ($p < .001$) gestures than the other group. No difference was found in disambiguating gestures ($p = .167$).

Additionally, we examined whether utterance length influenced the use of reinforcing, disambiguating, and supplementary gestures. Results showed that late talkers consistently produced fewer gestures with words ($F(1, 47) = 13.68, p < .001$), regardless of whether they were paired with one-word, two-word, or multi-word utterances (interaction: $F(2, 94) = 0.35, p = .707$). The main effect of utterance length ($F(2, 94) = 37.52, p < .001$) suggests that gestures were more commonly paired with one-word utterances. To further investigate these differences, we conducted parallel analyses focusing on gestures with one-word utterances. Results showed a main effect of gesture function ($F(2, 94) = 7.04, p = .001$) and a group by function interaction ($F(2, 94) = 3.74, p = .027$). Similar to the overall pattern, late talkers produced fewer reinforcing ($p = .024$) and supplementary ($p = .046$) gestures than typical peers (Table 4).

Table 4. Gesture functions within gestures-speech combinations.

Variable	LD	TD	<i>t</i>	<i>p</i>
All Gestures with Speech				
Reinforcing	6.76 (8.20)	18.43 (15.26)	-3.17	.003
Disambiguating	5.95 (10.67)	10.18 (10.25)	-1.40	.167
Supplementary	6.10 (9.49)	18.93 (12.00)	-4.04	< .001
Gestures with One-Word Utterances				
Reinforcing	6.52 (7.87)	13.93 (12.79)	-2.34	.024
Disambiguating	5.57 (10.32)	4.96 (6.60)	0.25	.803
Supplementary	5.81 (9.10)	10.89 (8.19)	-2.05	.046

Note. Standard deviations are in parentheses.

Finally, supplementary gestures conveyed information beyond speech content. We looked further into this type of cross-modal combinations in one-word utterances. The combined instances formed entity-related, predicative, or propositional ideas. A main effect of group was observed ($F(1, 47) = 4.30, p = .044$), confirming that late-talking children produced fewer supplementary gestures overall. There was also a main effect of idea type ($F(2, 94) = 26.08, p < .001$), with propositional ideas being less commonly expressed ($ps < .001$). However, no interaction was found between group and idea type ($F(2, 94) = 1.70, p = .188$), suggesting similar patterns of this type of combined instances across idea types in both groups. Post hoc comparisons revealed a general trend in which late talkers produced fewer supplementary gestures across all idea types, though the effects were not strong.

Discussion

Gesture, like language, serves as a critical channel of communication. Children spontaneously use gestures for a variety of communicative purposes. The two modalities together provide a more comprehensive view of children's communicative competence and their underlying referential and conceptual knowledge than language production can manifest alone. In this study, late-talking children had a small oral expressive vocabulary and showed delays in word combination and development of complex linguistic structures (cf. Liu & Lin, 2017; Liu et al., 2023).

Nonetheless, late talkers demonstrated intact gestural competence, producing gestures at a rate closely comparable to that of their typically developing peers. Gesture repertoires, measured by the number of gestures associated with distinct referents, were also similar between the two groups. They exhibited parallel tendencies in the types of gestures they used. Pointing gestures were the majority, with index-finger pointing outnumbering whole-hand pointing to a great extent. The studies by Liszkowski and colleagues (2004, 2006) had shown that children as young as 12 months were able to make declarative points in the joint-attention condition. This gestural ability to form joint attention with the addressee did not diminish in both groups at 24 months. Compared to imperative pointing, declarative pointing was dominant and served primarily to share interests and information in interactional contexts. Representational and conventional gestures conveyed meanings, but the former type was produced least frequently, for example, rotating the hand clockwise to depict a juicer spinning to make juice. The results suggest that children may have limited semantic knowledge or lack the ability to convey meaning readily through gestures at this age. In contrast, conventional head nods and head shakes, previously observed in Mandarin-speaking infants in Taiwan before 12 months (Chi, 2002; Chui et al., 2024), remained common at 2 years of age. Lastly, giving objects to others occurred more often than showing someone an object. These findings suggest that children's expressive language deficits did not affect their ability to use gestures to achieve diverse communicative purposes. Similar results have been reported in studies of English-speaking and Italian-speaking late talkers, whose

gestural use resembled that of age- and language-matched typically developing children (Rinaldi et al., 2022; Thal & Tobias, 1994; Wray et al., 2017). This cross-language consistency underscores the independence of the gesture modality in organizing communicative acts, particularly when verbal expression is limited.

Our study found that late talkers' gesture production fell within the typical range and did not exceed the typically developing children, contrary to earlier results that late talkers produced gestures at higher rates than age-matched peers or children with mixed expressive-receptive language difficulties (O'Neil & Chiat, 2015; Thal & Tobias, 1992). Gesture-type patterns also varied across languages. German-speaking late talkers and typically developing children showed comparable pointing rates at 18 months (Lüke et al., 2017b), whereas English- and Italian-speaking late talkers produced fewer pointing gestures at similar ages (Sansavini et al., 2019). The Mandarin-speaking two-year-olds in our study, regardless of their language abilities, used index-finger pointing to express interests and convey information. Italian-speaking late talkers aged 24 to 30 months without subsequent developmental language disorder used more representational than deictic gestures in a picture naming test (Rinaldi et al., 2022). Our results showed the opposite pattern, as Taiwanese late talkers produced far more pointing, showing, and giving gestures but fewer representational gestures. These discrepancies across studies may be attributed to methodological differences in data collection and analysis. Our findings indicate that there were no group differences in gesture production regarding use frequency and gesture type during dyadic interactions.

The nature of gestural competence is further evident in gesture-only and gesture-speech combinations. First, late talkers relied relatively more on gesture-only communication, particularly through declarative points, where gestures solely took on the full communicative load. Second, early gesture-speech coupling emerges as early as 12 months, and gesture-word and pointing-word combinations typically develop between 18 and 20 months (Capone & McGregor, 2004). In the present study, children produced cross-modal instances for integrated communication, with both groups showing increased gesture use. However, this increase was less pronounced in late talkers. Typically developing children had more gesture-speech combinations than gestures without speech, whereas late talkers produced significantly fewer gesture-speech combinations. Among these, the co-occurrence of gesture and vocalization was more prevalent, a finding consistent with prior research on English-speaking late talkers and their language-matched peers (Thal & Tobias, 1992). Overall, Mandarin-speaking late talkers showed weaker cross-modal communicative abilities.

While typically developing children frequently produced multi-word utterances with gesture, late talkers mainly combined gestures with single words. In these one-word utterances, both groups used gestures to indicate intended referents which were expressed by demonstrative words or pronouns. However, late talkers had fewer occurrences of reinforcing and supplementary gestures in their cross-modal productions. Supplementary gestures, which add information beyond speech content, often conveyed entity-

related ideas, for example, saying a color word *zǐsè* 'purple' and pointing to the target *jīnmù* 'building block' to mean 'a purple building block'. Gestures mostly indicated the intended entities. Predicative ideas were expressed by combining a verb with a gesture, for example, saying *nǎ* 'take' and pointing to the target object *chángjīnglù* 'giraffe', or by expressing the predicate in gesture with an entity word, such as saying *màomào* 'hat' while depicting the action of wearing a hat. The least common combination was a supplementary gesture co-occurring with a word to convey a propositional idea, for example, saying *shuìjiào* 'sleep' while pointing to the cat in a picture as the agent of the action. Both typically developing children and late talkers demonstrated the capacity to express these syntactic-semantic relationships. However, late talkers used supplementary gestures much less often to expand the speech content, revealing a relative weakness in organizing and integrating cross-modal information for communication.

In conclusion, this study of gestural behaviors in Taiwan Mandarin-speaking children with expressive vocabulary and grammatical delays at 24 months found that late talkers possess intact gestural competence to support communication, yet face challenges in cross-modal communication. These results are the foundation for our observation of gestures' long-term impact on language development in late-talking children in Taiwan.

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