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Stylistic and linguistic variations in compliments: an empirical analysis of children's gender schema development with machine learning algorithms

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As hypothesized by Bem (1981)'s Gender Schema Theory, individuals regulate themselves and their expectations towards others according to the gender norms in a community. The current study examines children's gender schema regarding the language styles in compliments addressed to both the gendered self and others. Two types of oral discourse completion tasks were designed for the purpose, where twenty-five Mandarin-speaking children were instructed to pay compliments in a normal-speaking style and an imitated style of the opposite gender. Machine learning algorithms were implemented to analyze the variations of language features at lexical, discourse-pragmatic, and discourse-semantic levels. The results show that, compared to lexical features such as lexical richness and word choices, discourse-pragmatic features are more prone to gender ideologies and exhibit style-shifting in children's imitation of the opposite sex when addressing compliments. At the discourse-semantic level, a significantly low probability of positivity was demonstrated in girls' imitated compliments, according to the results of the logistic regression. In general, the findings support the presence of gender-differentiated language styles among pre-adolescent children. In particular, girls at this age have developed the stereotype that boys tend to use language with a less prosocial sentiment for the manifestation of their "maleness". Directions for improving the experimental design and uncovering the possible confounding mechanisms were discussed to illuminate the multidimensional complexity of the cross-gender variations in the more nuanced speech traits, such as the use of intensifiers.

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Introduction

As a common conversational practice in day-to-day interactions, compliments could be used strategically to convey positive sentiments (Holmes, 1988) and build interpersonal relationships (Mirivel & Fuller, 2018). A widely adopted definition for compliment research in linguistics is given by Holmes (1988, p. 446) as "a speech act, which explicitly or implicitly attributes credit to someone other than the speaker, usually the person addressed, for some 'good' (possession, characteristic, skill, etc.), which the speaker and hearer positively value." Thus, compliments can be used to accommodate the addressees' positive face of being appreciated and respected, as in Brown and Levinson's Politeness Theory (1987). In other words, complimenting speech acts can be used as a positive politeness strategy to create solidarity between speakers (Holmes, 1988). However, the meaning of compliments is multifaceted, and, in some instances, complimenting acts can also be face-threatening when listeners perceive them as evaluations or judgments. Moreover, the implications of compliments become complicated when considering the cross-cultural differences regarding the norms of how and when to respond to compliments (see Chen, 2010, for a review of cross-cultural differences in compliment use). The compliment people use in interactions thus provides a lens through which we can investigate the sociocultural values in a given speech community (Manes, 1983).

Moreover, how people pay compliments also interacts with other social and situational factors, such as gender, social distance, status differential, and regional differences (Yuan, 2002; Chen, 2010: Gao, 2020). Among them, gender-based differences in compliment language have received particular scholarly interest. Empirical research on this topic can be traced back to Holmes's study (1988) on the sex differences in paying compliments among New Zealand English speakers. Later research, such as Talbot (1998), concurred substantially with Holmes's findings that females generally paid and received more compliments than males, and the topic of females' complimenting centered around dressing or appearance. However, since the data of compliments in previous research is predominantly gathered by female researchers, the results might not tell the whole picture (Jucker, 2009). Rees-Miller's study (2011) on American-English speakers thus found that women and men paid and received compliments in comparable numbers. More importantly, Rees-Miller (2011) argued that women's common compliments on appearance and men's on sports performance in task-oriented activities all manifested and strengthened the ideal values of masculinity and femininity.

Compliments can be regarded as 'conversational routines' that repetitively reinforce the gender norms in a certain speech community. A compliment is a 'gendered' linguistic practice in which the syntactic structures, discourse organization, pragmatic strategies, and the overall compliment topic and frequencies could all be influenced by the speakers' or addressee's gender identity (see Holmes, 1988; Herbert, 1990; Rees-Miller, 2011; Golato, 2005). In light of previous compliment and gender-based research, the focus is predominately on adults' compliment strategies from either naturally occurring interactions or elicited discourse completion tasks. Few studies investigate the linguistic features (e.g., grammatical organization and use of pragmatic markers) in compliments and how pre-adolescent children's compliments can shed light on the gender values in a speech community. Moreover, this gender-based variation in linguistic features of compliments remains under-explored in children's development of gender schema (Bem, 1981)—how pre-adolescent children develop an organized mental representation of linguistic features based on the gender norms in a given community.

To address the gaps, the current study investigates the children's development of gender schema of themselves and their opposite-sex peers through linguistic variations in their compliments. Oral discourse completion tasks in two contrastive conditions, normal speech style versus imitated speech style of the opposite sex, were administered to twenty-five Mandarin-speaking children (aged between nine and twelve) in a primary school in Ningbo, China. Specifically, the experiment focuses on the following three levels of language features: the lexical feature as measured by the general word use and lexical richness; the discourse-pragmatic feature as measured by the two pragmatic markers –intensifiers and affective sentence-final particles; and the discourse-semantic feature based on the polarity of sentiments with probabilistic oppositions between positivity and negativity. Facilitated by automated sentiment detection and clustering through supervised machine learning, this study aims to answer the following research questions:

(1) To what extent do pre-adolescent boys and girls differ in the linguistic features of their compliments?

(2) To what extent do pre-adolescent boys and girls differ in the sentiment polarity (positivity and negativity) of their compliments?

(3) To what extent do boys' and girls' imitated compliments of the opposite sex differ from the supposedly normal compliments?

Gender schema and children's language development

Previous studies from developmental psychology, sociolinguistics, and language acquisition have investigated how gender interacts with children's language development and socialization. A plethora of studies demonstrated girls' advantages in language acquisition, especially in lexical production and expressive vocabulary (e.g., Galsworthy et al., 2000; Frank et al., 2021). Previous sociolinguistic studies also showed that children develop their knowledge regarding gender-specific variants that are shown among adult males and females (such as in pitch and pitch range) (Ferrand & Roland, 1996). Children acquire sociolinguistic variants in a given community as early as three years of age (Labov, 2013). Furthermore, since parents usually adopt different speaking styles when speaking with boys and girls (usually using more supportive language with daughters), children in many studies also presented gender-typical speaking styles and word choices (Bleses et al., 2018). Girls generally used more intensifiers (such as 'so' and 'very'), color words (Gleason & Fly, 2002), and more collaborative speaking styles with more tag questions and fewer imperatives (Sachs, 1987). These styles are not static features associated with boys and girls. Robertson and Murachver (2003) also showed that children (aged between 7 and 11) could accommodate these gender-differentiated conversational styles by their interlocutors regardless of the interlocutors' gender. Similarly, Hannah and Murachver (1999) found that pre-adolescent children can recognize the gender meanings behind different speech styles and dynamically change their speech styles to either converge to or diverge from their interlocutors.

Aside from the gender-preferential language styles, children also internalize gender-typical behaviors from their interactions with caregivers or peers (Leman & Tenenbaum, 2011). They also show awareness of sex-based play theme preferences (Munroe & Romney, 2006) and same-sex peer groups (Zosuls et al., 2011). Bem (1981) proposed a socio-cognitive Gender Schema Theory to account for children's development of gender-typical patterns (which are not restricted to language behaviors). According to the theory, individuals are mostly socialized with a gender-schematic mentality where people form a constellation of rigid mental representations associating behaviors and preferences with both the self and others according to gender expectations. Those gender-schematic individuals usually regulate their behaviors and their categorical or cognitive processing of the world based on the gender ideologies in the community culture. For instance, at the age of two,

children of different genders have started to diverge their interest regarding the theme of the play activities and their preferences for toys (Munroe & Romney, 2006). Cartei et al. (2019) demonstrated that children listeners between the ages of seven and eight have already started associating gender-stereotypical fictional characters with the differences in voices usually found among adult males and female speakers. A dimension of gender schema that has yet to be explored is whether children are consciously aware of how certain linguistic features can be associated with gender in a concrete speech event, such as compliment-paying. We suggest that the Gender Schema Theory not only applies to how individuals associate behaviors with their gender to accommodate the gender norm in mainstream society but also to how they form the contrastive linguistic mentality of the opposite-sex others. For the extension, therefore, the current paper will analyze children's gender-specific linguistic variations in the compliments of both the normal speech style (how children perform their gendered self) and imitated speech style of the opposite sex (children's mental representations of the gendered others).

Compliment research

Previous compliment research has received scholarly attention mainly from (cross-cultural) pragmatics and interactional sociolinguistics. The primary focus was exploring how interlocutors in different speech communities used different types of discourse or pragmatic strategies to either offer or respond to compliments. Inquiries of linguistic research on complimenting language can be traced to Pomerantz (1978) on compliment response strategies. Since then, a bulk of compliment studies have been conducted in American-English communities (e.g., Herbert, 1990; Rees-Miller, 2011) and many other languages, such as German (Golato, 2002, 2005), Spanish (Lorenzo-Dus, 2001), Japanese (Matsuura, 2004), and Chinese varieties (Yuan, 2002; Xia et al., 2021). Most of these studies used interactional pragmatics and discourse analysis perspectives to investigate conversation compliments. In other words, these studies tend to relate compliments to, for instance, the Politeness Theory (Brown & Levinson, 1987) and, consequently, various conversation strategies situated in the given contexts. In the literature, two main discursive strategies for performing compliments are explicit and implicit compliments, which are distinguished by whether the utterances explicitly contain the positive semantic carrier (Lewandowska-Tomaszczyk, 1989).

Despite the fruitful results gained from the studies uncovering how compliments are realized in interactive dynamics, the internal linguistic features (e.g., syntactic and lexical patterns) of compliments received much less attention except, for instance, in limited early studies by Manes and Wolfson (1981) and Holmes (1988). From a corpus of 686 compliments in American English collected from ethnographic observations, Manes and Wolfson (1981) found that compliments were formulaic in nature. In other words, speakers repetitively use similar syntactic structures and lexical choices to make compliments. For example, nearly 54 percent of American English compliments were formed by 'noun phrase (NP) is/looks (really) adjective (ADJ)'. A typical example of this syntactic structure is 'Your hair (NP) looks nice (ADJ)' (Manes & Wolfson, 1981, p. 120). In line with this finding, Holmes (1988) found a similar result: New Zealand English speakers used the 'NP BE/BE LOOKING ADJ' structure most frequently in their complements.

Previous studies have used various methods to collect compliment data for different research purposes. As summarized in Golato (2005) and Xia et al. (2021), there were five main compliment collection methods, namely the ethnographic observation and field notes as in Manes and Wolfson (1981), recording of naturally occurring interactions (e.g., Kasper & Dahl, 1991; Golato, 2002, 2003), role-playing games (Kasper, 2000), recall protocols that require participants to recall the last compliment they offered or accepted (Golato, 2005), and discourse completion tasks (DCTs) in written or oral forms in which participants' compliments are elicited to complete a conversational turn-exchange (e.g., Gao, 2020). Among these methods, DCTs have been criticized for not gathering authentic data compared to recordings of speakers' compliments or compliment responses in conversations (Holmes, 1991; Golato, 2003). However, as Golato (2005) explained, DCTs can provide metapragmatic language data that reveals speakers' expectations or beliefs regarding the socially appropriate ways of paying compliments in a given situational context. Moreover, the design of DCTs can also manipulate the context and the target variables for further quantifiable analysis. Thus, the current study adopts this method to understand the gender schema formed among children through their compliments. Moreover, as inspired by the role-playing games, this study also adds imitation tasks requiring children to imitate their opposite-sex peers' compliments in the same conversational scenarios. Details for the data collection are provided in the Methodology section.

Compliment and gender

When focusing on the influence of gender on compliments, previous studies tend to adopt a 'difference' approach to investigate how men and women produced and perceived compliments differently. An accumulating body of studies showed that the internal syntactic and lexical features, pragmatic strategies, frequency, and topic of compliments all could vary between males and females (e.g., Holmes, 1988, 1991; Herbert, 1990; Rees-Miller, 2011). Among these, Holmes's pioneering work (1988) reported that New Zealand women generally paid and received significantly more compliments than males, and females were especially inclined to compliment other females' appearance. Besides, women used more 'What (a) (ADJ) NP' structures in their compliments. Based on the results, Holmes further argued that, whereas compliments between females can create affective connections and interpersonal solidarity, some compliments might be understood as face-losing or discomforting for males. Concurring with Holmes's findings, studies also found a similar tendency that women produced more compliments and paid more attention to their outlook in the naturally occurring interactions or the conversation scenarios in DCTs (e.g., Chiang & Tsai, 2003; Chen, 2010). As influenced by the recent postmodernism and the third wave of feminist studies, the 'difference' approach adopted by previous studies is also ontologically challenged by the constructivist approach that emphasizes the performance of gender through compliments (e.g., Eckert, McConnell-Ginet, 2013). Many previous studies on gender differences in compliments are thus susceptible to recreating stereotypes regarding males' and females' language behaviors.

However, these concerns do not imply that gender is not significant. On the contrary, gender and power relations are still largely penetrating society, including language use at various levels, such as phonology, lexis, syntax, and pragmatics (Hultgren, 2008). In line with this observation, the purpose of analyzing the gender differences in children's compliments is not to make simplistic generalizations regarding the language differences between boys and girls in real-life interactions. Rather, by adopting the oral discourse completion tasks (ODCTs), this study aims to uncover how the gender differences in linguistic features of their commendations in different conditions might mirror their development of gender schema and their gendered socialization in pre-adolescence.

Methodology

Data collection: oral discourse completion tasks (ODCTs). Participants of the current study were fifteen boys and ten girls,

Table 1 Description of compliment situations.

Compliment situations	Compliment topics
1). Hairstyle 1	Appearance
2). Skirt	Appearance
3). Barbie doll	Possession
4). Basketball match	Ability/performance
5). Ballet show	Ability/performance
6). Black pencil box	Possession
7). Teddy bear	Possession
8). Chinese dance	Ability/performance
9). Football match	Ability/performance
10) Blue pencil box	Possession
11). Jacket	Possession
12). Hairstyle 2	Appearance

aged between nine and twelve, from a primary school in Ningbo, China. Data collection consent for the research was agreed upon and permitted by the school. Compared to the traditional written DCTs, the ODCTs were suitable for eliciting children's more immediate and spontaneous compliments in interactional scenarios. As discussed in Golato (2005), ODCTs could elicit participants' compliments in a designed scenario while controlling other variables for the quantitative investigation. The tasks in the current study selected the three most common topics in compliments—appearance, possession, and ability/performance (Holmes, 1988) as the conversation themes for children to offer compliments. There were twelve compliment situations in total designed in the study (see Table 1 below). In addition, as inspired by the paradigm of role-playing games, this study also added an imitation task asking the participants to imagine and imitate how children of their opposite gender would pay compliments in the same interactional settings. Finally, this study also investigated children's development of gender schema and stereotypes regarding their peers of the opposite gender through compliments. In the process of the ODCTs, visual pictures of the compliment situations (e.g., a boy's nicely cut hairstyle) were presented to aid children's offering of compliments in a more vivid and natural context.

Lexical features: word choices and lexical richness. After compiling the elicited data into corpora, this study first examined the differences in the lexical choices based on the word frequency list generated by a corpus analysis software *AntConc* (Anthony, 2022). The frequency list contains all the running words ranked by either the frequency of the occurrences or the alphabetic order in the corpus (Baker, 2006). Children's lexical differences in terms of the overall frequency of functional words (e.g., pronouns and particles) and content words (e.g., nouns and adjectives) can be displayed and compared based on the frequency list. Besides the raw frequency of the words automatically generated in *AntConc*, the relative or normalized frequency of the words was also calculated using the following formula to control the text length effect in a corpus.

$$\text{Normalized word frequency} = \frac{\text{Raw word frequency}}{\text{Total number of words in the given corpus}} \times 1000$$

Another variable for analyzing lexical variations in compliments is lexical richness. Lexical richness (LR) generally refers to the sophistication and uniqueness of the words used in a given text (Daller et al., 2003; Zhang, 2020). Given the importance of lexical richness in language proficiency (especially vocabulary size and lexical proficiency), previous measurements of lexical richness have been mostly applied to language acquisition studies (Crossley, Salsbury & McNamara, 2011). Moreover, the variations of LR can also index the social stratification regarding age, educational level, profession (Zhang, 2014), and social class (Shi and Lei, 2022). This study thus incorporated LR into the analysis since the variations of LR could suggest different degrees of verbal sophistication in paying compliments and might then relate to the gendered values as females tend to be expected as more verbally sophisticated when paying compliments. The most widely adopted measurement of lexical richness is the Type-Token ratio (TTR), which represents the ratio of the number of different words and the total number of all the running words. The main drawback of TTR is its sensitivity to the length of the text. The longer the text is, the less likely the new types of words (types) could occur. TTR thus could become smaller due to the longer text length (Richards, 1987). To address the influence of text length, previous studies proposed various transformed formulas of TTR, such as LogTTR, RootTTR, Somers (1966), and *D* (Malvern & Richards, 1997). Recent empirical research, for example, Zhang and Wu (2021), demonstrated that *D* is one of the most accurate measures of Mandarin Chinese based on its performance in classifying L1 and L2 Chinese speakers. This study thus used *D* to measure children's lexical richness in compliments, where the relationship between TTR and *D* is given by

$$\text{TTR} = \frac{D}{N}\left(\sqrt{1+\frac{2N}{D}}-1\right)$$

where *N* is the total number of running words or tokens of the text under analysis.

Discourse-pragmatic features: intensifiers and affective sentence-final particles. In addition to the variations of lexical features in compliments, this study analyzed two pragmatic markers, namely intensifiers and affective sentence-final particles, which have been shown as ideologically linked with gender performance (Chan, 1998; Macaulay, 2006; Plug et al., 2021). Quirk et al. (1985) defined intensifiers as modifiers that can scale up the magnitude or degree of the following adjectives. Since the seminal work of Lakoff (1973) on woman's subordinate social position and their distinctive 'powerless' linguistic styles, the high frequency of intensifiers (e.g., 'so' and 'very' in English) have been categorized as part of typical "women's language." However, this claim has been challenged since the features of 'women's language' mainly originated from the anecdotal observations. Many later studies did not find consistent differences regarding the frequency of intensifiers between men and women (Liu, 2019). Moreover, apart from gender, a range of other social factors, including age, social class, regional varieties, and conversational topics, all contribute to the variations of intensifiers (Liu, 2019; Ito & Tagliamonte, 2003; Fuchs, 2017). Nevertheless, this study selected intensifier usage as one of the discourse-pragmatic features of compliments, as the intensification of emotive effect is still ideologically linked with cute femininity in Chinese culture (Chan & Lin, 2019). Incorporating intensifiers is also expected to elucidate how Chinese-speaking children recognize the gendered meanings behind intensifiers as research on the interplay between gender and children's intensifier usage is still scarce. In Mandarin Chinese, affective sentence-final particles (ASFPs), such as 啦 *la*, 嘛 *ma*, 呢 *ne*, and 呃 *eh* are monosyllabic words put at the end of the clause to strengthen the affective expressions. Similar to Lakoff (1973)'s suggestion of certain intonation strategies being feminine in the English language, using ASFPs in Mandarin Chinese is commonly deemed a gendered language practice in various settings. Given that past research studies show that frequent uses of ASFPs are perceived as a feminine speech style, mostly with the connotation of cuteness (Diao, 2016; Taguchi, 2016; Chan, 1998; Chan & Lin, 2019), it is logical for the current study to include ASFP as an indicative parameter of gender in the discourse-pragmatic design.

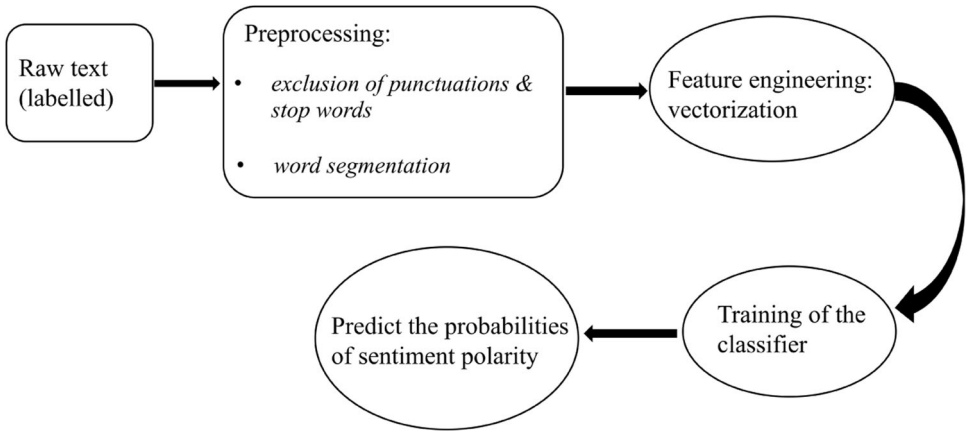

Fig. 1 Flowchart for Chinese sentiment analysis (adapted from Peng et al., 2017). The figure outlines the major steps of sentiment analysis for Chinese text. Particular attention should be paid to Chinese word segmentation as there is no space between words in written Chinese (see also Zhang & Wu, 2021).

Discourse-semantic features: sentiment polarity. Finally, since compliments usually express an affective stance, this study also incorporated sentiment analysis to explore whether the sentiment polarity (i.e., the gradient continuum between the possibilities of positivity, neutrality, and negativity) will differ between boys' and girls' compliments and in different conditions (natural speech vs. imitated speech of the opposite gender). Briefly speaking, sentiment analysis is a process in which computer algorithms automatically evaluate and detect the affective stances, opinions, and feelings concerning products, events, or people in the texts (Prabhat & Khullar, 2017). Sentiment analysis can thus be applied to extract the subjective sentiments in the language (be it positive, negative, or neutral) at the levels of texts, sentences, and words (Lei & Liu, 2021). Generally, there are two approaches to sentiment analysis. One is the lexicon-based approach that makes use of an annotated corpus where words are already tagged by the sentiment polarity or scores for calculating the sentiment values (e.g., '−1', '0', '+1' stand for negative, neutral, and positive respectively). Another approach is supervised machine learning. In contrast to the lexicon-based approach with a pre-existing annotated corpus, supervised machine learning involves training algorithms to acquire the rules based on the labeled input of sentiment polarity (Prabhat & Khullar, 2017). In other words, although the annotated sentiment corpus is not needed, part of the entire dataset should be manually pre-labeled or classified as positive or negative texts to train the algorithms to learn the rules. The amount of pre-labeled texts for the training is affected by the quantity of the entire dataset.

Considering the higher accuracy of the machine learning approach (Taboada, 2016) and the lack of an existing annotated lexicon for compliments in Chinese, the current study thus used the supervised machine learning approach with logistic regression to detect and predict the sentiment polarity in the compliment data. The detailed steps of conducting the sentiment analysis are illustrated in Fig. 1 below. In the first step, the current study manually labeled 50% of the compliment data into positive and negative texts to train the classifier that will be trained to automatically predict the probability of sentiment polarity in the rest of the data. Then in the pre-processing stage, the labeled texts were segmented by the software named *SegmentAnt*, since Chinese texts lack inter-word spacing. For instance, instead of separating two characters 好hǎo 'good' and 看 kàn 'look' as two words, 好看 hǎokàn 'good-looking' should be put together into one word to mean good-looking. Moreover, some special symbols (e.g., punctuations) and stop words (e.g., personal pronouns and sentence-final particles) were also excluded in the pre-processing stage. After the pre-processing stage, the labeled positive and negative utterances of children's compliments need to be converted into numbers in the matrix (or feature set) through vectorization in the feature engineering stage. Vectorization is needed here since the words need to be transformed into vectorized numbers for algorithms to recognize. The matrix of vectorized numbers will then be used as the input for training the classifier, namely the logistic regression model in the current study, to learn the rules of classifying negative and positive texts. Finally, this model will then be applied to predicting the probabilities of sentiment polarity of the corpus.

Table 2 Types and tokens in each corpus.

Corpora	Types	Tokens
Boys' normal speech	319	1396
Girls' normal speech	310	1195
Boys' imitated feminine speech	260	1196
Girls' imitated masculine speech	241	832

Results

Lexical variations: general lexical choices in compliments. Before analyzing the frequency lists, this study first compiled the compliment data into four corpora according to gender (boys vs. girls) and speech styles (normal speech style vs. imitated speech of the opposite gender). *SegmentAnt* was first used to segment the Chinese characters into different words. For instance, although 可爱 kěài 'adorable' contains two characters 可 kě 'can' and 爱 ài 'love', they should be put together as one word and separated from other words to mean 'adorable'. The segmented texts are all manually checked by native speakers of Mandarin Chinese to ensure the segmentation quality. General features regarding the types (number of different words) and tokens (number of all the running words) in these corpora are presented in Table 2.

Tables 3 to 6 displays the first 10 words in the word lists with raw frequency and relative frequency for comparison. When closely examining the word types in the four tables, a striking similarity regarding the word choices was found across the four corpora. Despite the variations regarding the ranking order or frequency, 70% of the word types in the top 10 words, such as 你 *nǐ* 'you', 真 zhēn 'really', 的 de 'a modal particle that can indicate possession and modify adverbs', and 好看 hǎokàan 'good-looking', are repetitively present in these word lists. These repetitive uses of the common word types across boys and girls

Table 3 Top 10 words in boys' normal speech style.

Word types	Raw frequency	Relative frequency
你 *nǐ* 'you'	118	84.5
真 *zhēn* 'really'	76	54.4
的 *de* 'a modal particle'	63	45.13
好 *hǎo* 'good'	61	43.7
好看 *hǎokàn* 'good-looking'	56	40.1
我 *wǒ* 'I'	42	30.09
这个 *zhège* 'this'	36	25.79
你的 *nǐde* 'your'	33	23.64
买 *mǎi* 'buy'	22	15.76
啊 *a* 'ah'	21	15.04

Table 4 Top 10 words in boys' imitated feminine speech.

Word types	Raw frequency	Relative frequency
你 *nǐ* 'you'	73	61.04
好 *hǎo* 'good'	65	54.35
我 *wǒ* 'I'	53	44.31
真 *zhēn* 'really'	49	40.97
的 *de* 'a modal particle'	45	37.63
好看 *hǎokàn* 'good-looking'	42	35.12
这个 *zhège* 'this'	33	27.59
跳 *tiào* 'jump'	29	24.25
也 *yě* 'also'	27	22.58
买 *mǎi* 'buy'	23	19.23
你的 *nǐde* 'your'	23	19.23

Table 5 Top 10 words in girls' normal speech.

Word types	Raw frequency	Relative frequency
你 *nǐ* 'you'	93	77.82
的 *de* 'a modal particle'	74	61.92
很 *hěn* 'very'	39	32.64
好 *hǎo* 'good'	37	30.96
真 *zhēn* 'really'	31	25.94
你的 *nǐde* 'your'	29	24.27
好看 *hǎokàn* 'good-looking'	28	23.43
这个 *zhège* 'this'	23	19.25
可爱 *kěài* 'adorable'	22	18.41
可真 *kězhēn* 'so'	22	18.41

Table 6 Top 10 words in girls' imitated masculine speech.

Word types	Raw frequency	Relative frequency
你 *nǐ* 'you'	58	69.71
的 *de* 'a modal particle'	40	48.08
我 *wǒ* 'I'	36	43.27
好 *hǎo* 'good'	31	37.26
也 *yě* 'also'	22	26.44
好看 *hǎokàn* 'good-looking'	22	26.44
这个 *zhège* 'this'	21	25.24
很 *hěn* 'very'	20	24.04
你的 *nǐde* 'your'	16	19.23
了 *le* 'a particle indicating perfect aspect'	15	18.03

concur with the previous compliment research that compliments are formulaic in nature with limited and repetitive use of certain lexis and syntactic structures (Manes & Wolfson, 1981; Holmes, 1988). Moreover, since compliments are usually realized as

Table 7 Most frequent adjectives in boys' normal speech style.

Adjectives	Raw frequency	Relative frequency
好看 *hǎokàn* 'good-looking'	56	40.1
可爱 *kěài* 'adorable'	16	11.5
好 *hǎo* 'good'	15	10.82
漂亮 *piàoliang* 'pretty'	15	10.82
帅 *shuài* 'handsome'	7	5.1
美 *měi* 'beautiful'	7	5.1

Table 8 Most frequent adjectives in boys' imitated feminine speech.

Adjectives	Raw frequency	Relative frequency
好看 *hǎokàn* 'good-looking'	37	31.12
可爱 *kěài* 'adorable'	20	16.82
好 *hǎo* 'good'	13	10.93
漂亮 *piàoliang* 'pretty'	12	10.09
帅 *shuài* 'handsome'	6	5.05
厉害 *lìhai* 'remarkable'	5	4.21

Table 9 Most frequent adjectives in girls' normal speech style.

Adjectives	Raw frequency	Relative frequency
好看 *hǎokàn* 'good-looking'	27	22.68
可爱 *kěài* 'adorable'	22	18.49
好 *hǎo* 'good'	15	12.61
厉害 *lìhai* 'remarkable'	12	10.08
漂亮 *piàoliang* 'pretty'	11	9.24
帅 *shuài* 'handsome'	6	5.04

Table 10 Most frequent adjectives in girls' imitated masculine speech.

Adjectives	Raw frequency	Relative frequency
好看 *hǎokàn* 'good-looking'	22	26.54
可爱 *kěài* 'adorable'	10	12.06
漂亮 *piàoliang* 'pretty'	10	12.06
厉害 *lìhai* 'remarkable'	8	9.65
好 *hǎo* 'good'	6	7.24

evaluative speech acts, the prominent part of speech semantically loading the compliments is the adjective (existing in nearly 92% of the compliments in the current study and 80% of Manes and Wolfson's study in 1981). Accordingly, this paper generated the word frequency lists for the most used adjectives whose frequency of use is above 5. As shown in Tables 7 to 10, the choices of adjectives in compliments made by boys and girls in two different conditions (normal vs. imitated speech of the opposite gender) are strikingly similar. Four common adjectives used across the corpora include 好看 *hǎokàn* 'good-looking), 可爱 *kěài* 'adorable', 漂亮 *piàoliang* 'beautiful', and 好 *hǎo* 'good'. Interestingly, among these adjectives, 好看 *hǎokàn* 'good-looking' and 可爱 *kěài* 'adorable' are the top two adjectives in all the corpora. This finding also supports the formulaic nature of compliments, as discussed earlier. Furthermore, the formulaic use of the adjectives has shown the same pattern cross-linguistic since 'good', 'beautiful', and 'pretty' were also the most used adjectives found

in American-English speakers' compliments (Manes & Wolfson, 1981).

Lexical variations: lexical richness (LR) of compliments. Since previous studies generally concurred that females paid and received more compliments across interactional settings (especially on the topics of appearance) (e.g., Holmes, 1988; Lorenzo-Dus, 2001), it remains under-explored whether there are gender-based differences in compliments in terms of the lexical richness (LR) that relates to verbal sophistication or variations. As introduced in the Methodology section above, this study selected *D* instead of type-token ratio (TTR) to reduce the influence of text length. As an iterated calculation of TTR for measuring lexical diversity, *D* has shown great effectiveness in measuring the LR of Mandarin Chinese (Zhang & Wu, 2021). The linear-mixed-effects regression was carried out (Bates et al., 2015) to model the variations in LR as measured by *D*, where gender and speaking styles are treated as fixed effects and individual differences are treated as random effects. As summarized in Table 11 and Fig. 2, girls' verbal sophistication in compliments, as indicated by *D*, was significantly higher ($t = 2.04$, $p = 0.04$) than their imitated masculine styles and boys' LR in both normal-speaking styles and imitated feminine styles. This finding seems to indicate that, despite the formulaic structures and lexical choices in compliments as discussed above, pre-adolescent girls used more diverse and sophisticated word choices when making compliments in their normal speech styles. Children's LR, indicating their acquired vocabulary resources and productive skills, did not differ between their normal speech styles and imitated styles of the opposite sex. In other words, LR seems not to be explicitly recognized by children as indexical resources for performing the desired gender identity in imitation tasks. However, this finding on girls' greater LR in compliments provides new evidence on gender and compliment research and reflects that girls generally tend to be more skillful in articulating more lexically sophisticated compliments to their peers. Throughout socialization in schooling, girls seem to conform to the general expectations of being caring and generally more capable of using a diverse range of lexical resources to address relational-oriented tasks (such as the use of compliments to establish solidarity).

Table 11 Results of the linear-mixed-effects regression model for *D*.

	Estimate	Std. error	*t*-value	*p*-value
(Intercept)	28.18	2.85	9.9	<0.001***
Boys' normal style	−3.98	3.95	−1	0.32
Girls' imitated masculine style	3.64	4.54	−1.48	0.15
Girls' normal style	8.99	4.4	2.04	0.04*

*p-value < 0.05, ***p-value < 0.001.

Discourse-pragmatic variations: intensifiers in compliments. The data identified eight intensifiers used by pre-adolescent boys and girls across different styles. These intensifiers include 真 *zhēn* 'really', 可真 *kězhēn* 'so', 很 *hěn* 'very', 好 *hǎo* 'good', 挺 *tǐng* 'very', 特别 *tèbié* 'especially', 真是 *zhēnshì* 'really', and 这么 *zhème* 'so'. A first look into the word frequency lists shows that the intensifiers were used with high frequency across the four corpora. This study then used the linear-mixed-effects regression model in R (Bates et al., 2015) to examine the influence of gender and style on the relative frequency of intensifiers per thousand words. In this model, the dependent variable is each child's relative frequency of the use of the intensifier. Styles of speaking (including boys' normal speech, boys' imitated feminine speech, girls' normal speech, and girls' imitated masculine speech) are the independent variables or the fixed effects. Speakers are assumed and treated as a source of the random effect in analysis to accommodate individual differences in the modeling.

The modeling results are presented in Table 12, and each speaker's average use of intensifiers in compliments across the four corpora is illustrated in Fig. 3. Overall, there is a significant gender difference regarding the relative frequency of intensifiers in pre-adolescent children. As shown in Table 12, the relative frequencies of intensifiers in girls' compliments were significantly high in both the normal speech ($t = 2.36$, $p = 0.02$) and their imitated masculine speech ($t = 2.1$, $p = 0.04$). Also, boys' use of intensifiers did not differ between their imitated feminine and normal speech styles ($t = -0.4$, $p = 0.69$). In other words, girls seem to have habitually applied more intensifiers in

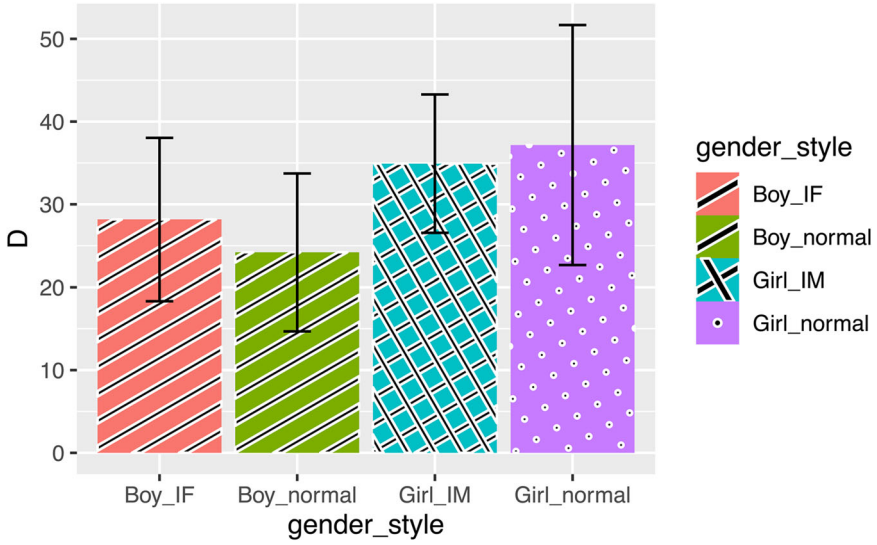

Fig. 2 The mean LR of Children's compliments. The figure provides a cross-gender comparison of the LR in terms of *D* as profiled in children's normal speech and the designed imitating context. Here boys_normal and girls_normal stand for boys' and girls' normal speech styles; boys_IF and girls_IM stand for boys' imitated feminine and girls' imitated masculine speech styles.

complimenting without metalinguistic awareness that the usage of intensifiers can stereotypically connotate femininity in language. On the other hand, the similarity between boys' use of intensifiers across the two styles (normal vs. imitated feminine) and the mismatch between boys' imitated feminine speech and girls' normal speech in terms of the use of intensifiers support the idea that boys habitually used fewer intensifiers. Moreover, boys did not develop the stereotypical knowledge that more use of intensifiers in compliments can help them perform femininity in imitating their opposite-sex peers' speech styles. Thus, boys tend to disengage with the lexical features that strengthen emotions and feelings (i.e., intensifiers) when paying compliments. Overall, the children did not change the use of intensifiers when asked to imitate their peers of the opposite gender, demonstrating that pre-adolescent children might not have cognitively recognized the use of intensifiers as a girl-typical lexical feature in their lexicon. In addition, the findings provide updated cross-generational and cross-cultural evidence on females' more frequent use of intensifiers (Fuchs, 2017).

Discourse-pragmatic variations: ASFPs in compliments. This study identified six types of ASFPs across the four corpora, including 呀 *ya*, 呃*eh*, 啊*ah*, 呢*ne*, 哟*yo*, and 啦*la*. Setting each child's relative frequency of ASFPs as the dependent variable, the results for the linear-mixed-effects regression are presented in Table 13 and Fig. 4. As demonstrated, the relative frequency of ASFPs used in boys' normal-speaking styles ($t = -2.2$, $p = 0.04$) and girls' imitated masculine speaking styles ($t = -2.47$, $p = 0.02$) are significantly lower. The results differ from those for gender-specific intensifiers, where girls habitually used more intensifiers. In other words, pre-pubertal children might have cognitively categorized the use of ASFPs as more girl-typical language behaviors in their gender schema when making compliments. Although boys still used some ASFPs to increase the emotional strength of compliments, their use of ASFPs is comparably less frequent. These pre-adolescent boys also consciously increased their ASFPs when asked to imitate girls' speaking styles, which thus suggests their social awareness of femininity embodied in the ASFPs at the end of utterances. On the other hand, although girls in the current study also used more ASFPs in their compliments in normal conditions, they decreased the frequency of ASFPs when imitating boys' speaking styles. Compared to the relatively static results for intensifiers, this clear style-shifting in adopting the ASFPs between children's normal speech and imitated speech of the opposite gender suggests that the speech strategy involving ASFPs might be subject to more overt social evaluation.

Table 12 Results of the linear-mixed-effects regression model for intensifiers.

	Estimate	Std. error	*t*-value	*p*-value
(Intercept)	8.15	1.04	7.91	<0.001***
Boys' normal style	−0.34	0.85	−0.4	0.69
Girls' imitated masculine style	3.64	1.67	2.1	0.04*
Girls' normal style	3.83	1.61	2.36	0.02*

*p-value < 0.05, ***p-value < 0.001.

Sentiment analysis and variations in probabilities of sentiment polarity. After labeling the sentiment polarity of half the compliment data (either positive or negative) to train the classifier, a logistic regression was run, with a forecasting accuracy of 95%, to predict the probabilities of positivity and negativity in compliment data across the four corpora. In each instance of compliment, the probability of negativity plus the probability of positivity equals 1. This study then transformed the probabilities of negativity and positivity predicted by the logistic regression model into sentiment scores (between −5 and 5) that indicate the strength of possibilities of sentiment polarity (see Table 14). In this transformation, the higher the sentiment scores, the higher likelihood of positivity in the compliments.

As seen in Table 15 and Fig. 5, boys' and girls' averaged sentiment scores across different speaking styles are all above 3 (probability of positivity is higher than 0.7 and negativity is lower than 0.3), indicating the overall positivity of compliments. This result is consistent with the social function of compliments, i.e., to

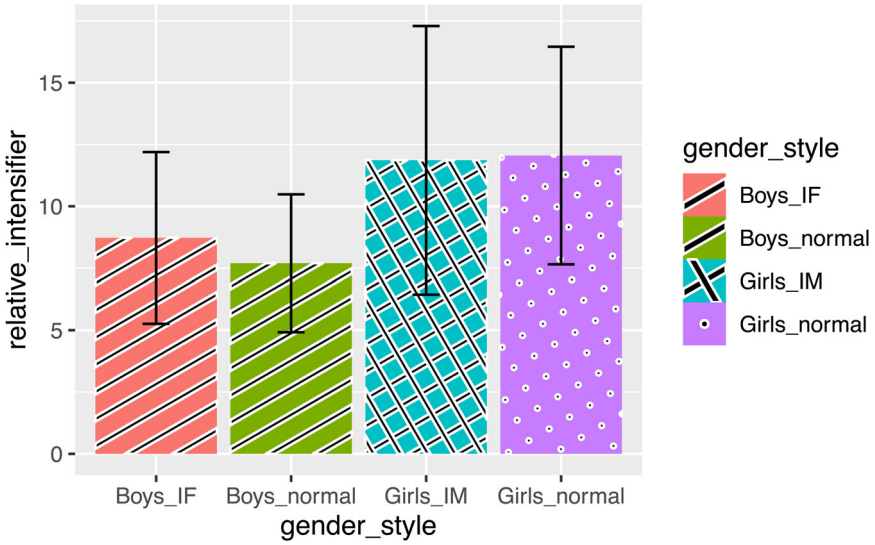

Fig. 3 The mean relative frequency of the use of intensifiers in children's compliments. It is demonstrated that the girls used almost equally more intensifiers in both their normal speech style and the designed imitating tasks. On the other hand, boys used much fewer intensifiers in their normal speech style. They increased using intensifiers when intimating girls' speech. But the average frequency of the use of intensifiers by boys, even after such an increase in the imitating tasks, is still below the level of the frequency of use by girls.

convey positive affect and establish solidarity or interpersonal relationships (Mirivel & Fuller, 2018). However, the variability of the sentiment of girls' imitated masculine speech is of a particularly high level, with std. = 2.75 among the four groups. To investigate how the speaking style might predict the sentiment score, this study also ran a regression by setting the speaking style as the fixed effect and the individual speaker as a random effect. When examining the results of the mixed-effects models in Table 16, the sentiment scores of girls' compliments in their imitated masculine speaking styles are significantly lower ($t = -3.86$, $p < 0.001$) than their normal-speaking styles and boys' normal and imitated feminine speaking styles. Moreover, when looking closely at the instances of the less positive compliments made by girls in imitated masculine styles, some participants made strongly negative comments when complimenting peers' possession and appearance by imitating boys' speaking styles:

(1) 这有什么的
Zhè yǒu shénme de
'Nothing special'

(2) 这个女生真臭美
Zhè ge nǚ shēng zhēn chòuměi
'Such a self-flattering girl'

The results above indicate that some pre-adolescent girls developed stereotypes of boys' more pugnacious and less supportive speaking styles when providing compliments. Although this stereotype is inconsistent with the distribution of sentiment scores in boys' compliments in their normal-speaking styles, the result still reflects some girls' development of gender schema in which they mentally associate boys with compliments in less supportive manners.

Table 13 Results of the linear-mixed-effects regression model for ASFPs.

	Estimate	Std. error	*t*-value	*p*-value
(Intercept)	3.53	0.68	5.17	<0.001***
Boys' normal style	−1.46	0.66	−2.2	0.04*
Girls' imitated masculine style	−2.69	1.08	−2.47	0.02*
Girls' normal style	1.17	1.06	1.1	0.28

*p-value < 0.05, ***p-value < 0.001.

Discussion

Overall, differences in the probabilities of sentiment polarity predicted by logistic regression (95% accuracy) at the discourse-semantic level of compliments indicate girls' different mental representations of their opposite-sex peers in their gender schema. The significantly lower sentiment scores in girls' imitated compliments of boys mismatched with the sentiment scores in boys' compliments in their normal-speaking style. This finding, to some extent, concurs with previous studies, which showed girls' inclination to use adjectives, such as 'aggressive' and 'negative', for describing other boys (Miller et al., 2009). Moreover, this mismatch might be attributed to the limitation of the ODCTs where boys were elicited to express compliments in an 'appropriate' manner in conversation tasks instead of the actual compliments they usually pay in the naturally occurring interactions. In other words, boys might not reveal their compliment practices as they usually do in their daily life in the fictional conversation scenarios in ODCTs. Therefore, future research is encouraged to include children's conversational compliments with ethnographic methods.

At the lexical level, the general word choices and lexical richness in compliments seem less regulated by children's gender schema and gendered expectations. Pre-pubertal children's choices of most frequent words in compliments across the four groups are strikingly similar, consistent with the formulaic feature of compliments discovered in many previous studies (Manes & Wolfson, 1981; Holmes, 1988; Macaulay, 2006; Tagliamonte, 2008). Girls' higher LR in the normal condition of compliment-paying provided new evidence of the 'gender myth' of girls' more expressive vocabulary in language development. Moreover, although higher LR as measured by *D* was observed in girls' complimenting in the normal-speaking style, the degree of LR did not seem to change when performing the imagined masculinity in the imitation tasks by the girls. Since LR generally symbolizes a speaker's vocabulary, the comparable LR patterns across different contexts could be attributed to girls' overall more extensive lexical resources in paying compliments. As argued by

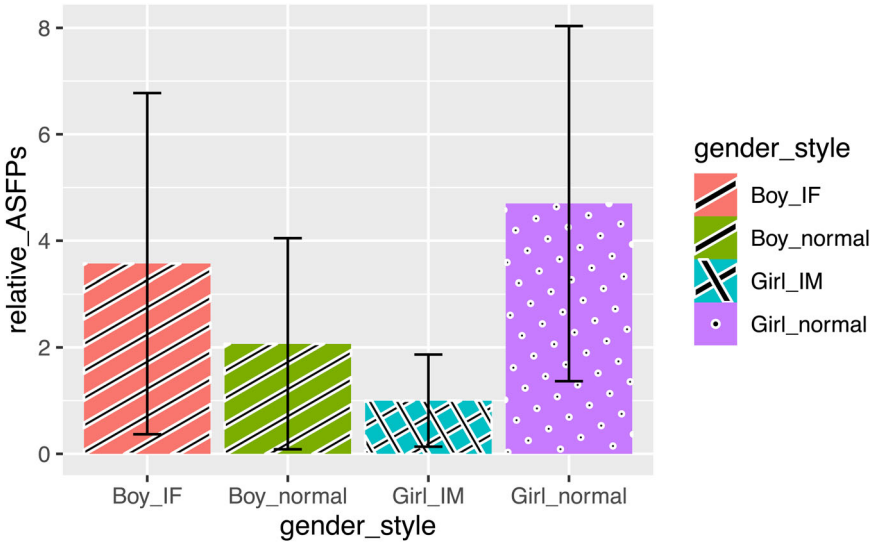

Fig. 4 The mean relative frequency of the use of ASFPs in Children's compliments. It is demonstrated that the girls used much more intensifiers in their normal speech style and used dramatically fewer ASFPs in the designed imitating tasks. Boys used much fewer ASFPs in their normal speech style and increased using ASFPSs when intimating girls' speech, but the average frequency of the use of ASFPs by boys, even in the imitating tasks, is lower than the level of the frequency of use by girls in normal speech.

Eckert (1990), women in society tend to more efficiently accumulate linguistic investment (e.g., using more standard variants) to acquire certain social status semiotically. Therefore, pre-adolescent girls in the current study might have accumulated more vocabulary capital and naturally exhibited higher linguistic skills without explicit awareness of the gendered connotations attached to LR in compliments.

In contrast, the discourse-pragmatic features in compliments are subject to more overt social evaluation and gender ideologies in children's gender schema. First, a salient gender-based variation in the normalized frequency of ASFPs was shown as statistically significant in normal-speaking styles. In the normal-speaking styles, boys used significantly fewer ASFPs than girls in compliments. However, children have finely applied the connotations of the ASFPs in the imitation condition by maneuvering the frequencies of such ASFPs in girls' imitating masculinity or boys' imitating femininity. This clear style-shifting in terms of ASPFs usage suggests that both boys and girls have acquired the gendered meanings of ASPFs for paying compliments. A more mixed picture was seen for the cross-gender usage of intensifiers. As shown by the current study, girls generally offered compliments with significantly more frequent use of intensifiers in both their normal and imitated masculine speaking styles. On the one hand, this high use of intensifiers by female speakers is consistent, in principle, with previous studies such as Ito and Tagliamonte (2003), Macaulay (2006), and Tagliamonte (2008). On the other hand, recent studies such as Liu (2019) and Plug et al. (2021) demonstrated that the use of intensifiers by females could largely be affected by socioeconomic, institutional, contextual, and emotional factors. For example, Liu (2019) showed that men actually used significantly more intensifiers than women in college lecturing, especially in science and engineering disciplines. In general, it is believed that a more robust and comprehensive factoring analysis is indispensable for a more thorough understanding of the dynamicity of cross-gender behavior of intensifier use. In particular, the results of the current study tend to underscore the age effect on intensifier use, where the frequency of intensifier use has not proven a socio-cognitive or sociolinguistic parameter for the pre-adolescent children to betoken gender difference. In addition, the degree of delexicalization could also be one important linguistic factor to account for the different patterns of cross-gender deviations in using ASFPs and intensifiers. Although the degrees of delexicalization of ASFPs and intensifiers in the current research are heuristically different, further empirical studies are needed from multiple perspectives, particularly corpus linguistics, to validate such a conjecture.

Table 14 Transformation of probability into sentiment scores.

Sentiment score	Probability of positivity	Probability of negativity
5	0.9–1	0–0.1
4	0.8–0.9	0.1–0.2
3	0.7–0.8	0.2–0.3
2	0.6–0.7	0.3–0.4
1	0.5–0.6	0.4–0.5
0	0.5	0.5
−1	0.4–0.5	0.5–0.6
−2	0.3–0.4	0.6–0.7
−3	0.2–0.3	0.7–0.8
−4	0.1–0.2	0.8–0.9
−5	0–0.1	0.9–1

Table 15 Descriptive statistics of sentiment scores across the four speaking styles.

Gender & style	Mean	Standard deviation
Boys' normal style	4.84	0.85
Boys' imitated feminine style	4.88	0.35
Girls' imitated masculine style	3.8	2.75
Girls' normal style	4.65	1.29

Conclusion

The current study investigated children's development of gender schema through linguistic variations in compliments. To explore pre-adolescent children's social mentality of gender, two contrastive speech conditions, namely the normal-speaking condition and the imitated condition of the opposite-sex peers, were designed through the ODCTs at various structural levels—lexical features, discourse-pragmatic features, and finally the sentiment

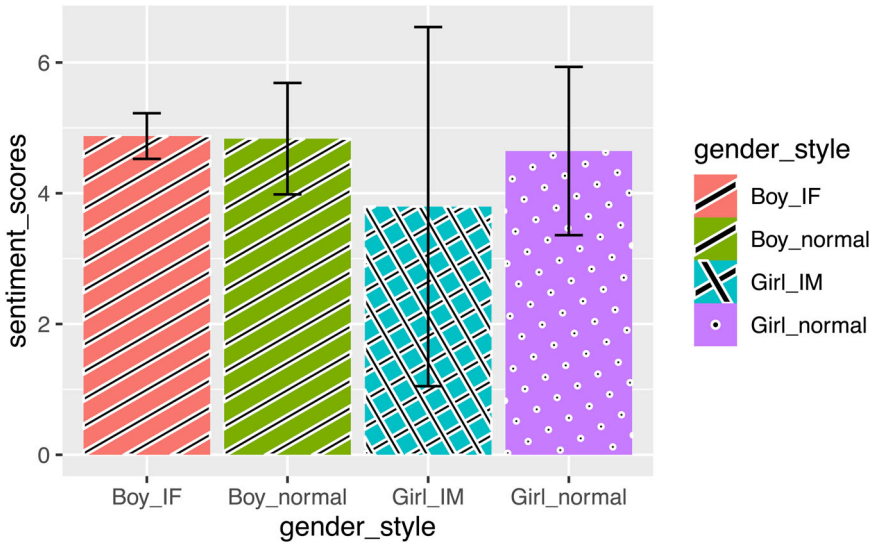

Fig. 5 Sentiment scores in compliments. Both girls and boys exhibited high sentiment scores in their normal compliments. Boys exhibited almost equally high sentiment scores in their imitating tasks compared to their normal speech style. Girls showed substantially lower sentiments when imitating boys' compliments than their normal speech styles.

Table 16 Results of the linear-mixed-effects regression model for sentiment scores.

	Estimate	Std. error	*t*-value	*p*-value
(Intercept)	4.88	0.22	22.23	<0.001***
Boys' normal style	−0.02	0.13	−0.18	0.85
Girls' imitated masculine style	−1.34	0.35	−3.86	<0.001***
Girls' normal style	−0.2	0.33	−0.6	0.55

***p-value < 0.001.

polarity at the discourse-semantic level. Previous compliment research has primarily focused on the pragmatic application of compliment-paying as a conversational strategy. By combining the ODCTs with role-playing speech imitation games, the current study extended the compliment research to a new front, where compliment, as a speech event governed by social norms (Hymes, 1974), was proven as a linguistic medium helping to illuminate the biases and stereotypes related to gender. In addition, the findings garnered from the structural linguistic features of children's compliment-paying shed fresh light on the classical Gender Schema Theory (Bem, 1981) in terms of how gender difference is ubiquitously embedded in even the most mundane settings.

More concretely, gender variations were manifested at all linguistic levels in children's normal-speaking conditions, including lexical richness (measured by *D*), and relative frequency of intensifiers and affective sentence-final particles (ASFPs). Among these variables, the relative frequency of ASFPs at the discourse-pragmatic level is especially subject to children's gender stereotypes as such frequencies for both boys and girls style-shifted in the imitation condition. Although the sentiment scores predicted by the logistic regression did not exhibit gender-based variation in the normal-speaking condition, girls notably lowered their sentiment positivity when imitating boys' compliments. Different linguistic features seem to be assigned by gender evaluation and schema with varying weights in children's mental lexicon for paying compliments. Compared with ASFPs at the discourse-pragmatic level (a clear style-shifting was found in the imitation condition), lexical features (e.g., word choices and LR) seem to be categorized as less salient features in the gender schema. These results revealed an overall complexity involved in language socialization and children's development of gender schema, where different language features might receive different probabilistic weights for saliency of gender evaluation and performance.

However, it could be acknowledged that the current study is limited by the speech imitation methodology that did not generate the most authentic compliment-paying activities in naturally occurring conversations. Since the focus of the experiment is on children's development of gender schema with the lens of linguistic variations in the compliments at both normal and imitated conditions, the current study made a compromise by adopting the DCTs in the oral forms to elicit children's spontaneous and immediate compliments in a series of conversational scenarios. With 585 compliments gathered from twenty-five children in the speech imitation tasks, the sample size is still relatively small from a corpus analysis perspective. Future directions are recommended to expand the scope of the experiment by incorporating children at different stages of pre-adolescence to track the trajectories of language socialization and the development of gender schema.

Data availability

Data used for the current study are available upon reasonable request for academic research.

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Competing interests
The authors declare no competing interests.

Ethical statement
The data collection procedure for the study was approved by the Research Ethics Panel, School of Education and English, University of Nottingham Ningbo China.

Informed consent
Informed consent was obtained from all the participants or their guardians with the permission of the schools involved in the study.

Additional information
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