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Lexical Alignment is Pervasive Across Contexts in Non-WEIRD Adult–Child Interactions

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Abstract

Lexical alignment, a communication phenomenon where conversational partners adapt their word choices to become more similar, plays an important role in the development of language and social communication skills. While this has been studied extensively in the conversations of preschool-aged children and their parents in Western, Educated, Industrialized, Rich, and Democratic (WEIRD) communities, research in other pediatric populations is sparse. This study makes significant expansions on the existing literature by focusing on alignment in naturalistic conversations of school-aged children from a non-WEIRD population across multiple conversational tasks and with different types of adult partners. Typically developing children aged 5 to 8 years ($n = 45$) engaged in four semi-structured conversations that differed by task (problem-solving vs. play-based) and by partner (parent vs. university student), resulting in a corpus of 180 conversations. Lexical alignment scores were calculated and compared to sham conversations, representing alignment occurring at the level of chance. Both children and adults coordinated their conversational utterances by re-using or aligning each other's word choices. This alignment behavior persisted across conversational tasks and partners, although the degree of alignment was moderated by the conversational context. These findings suggest that lexical alignment is a robust phenomenon in conversations between school-age children and adults. Furthermore, this study extends lexical alignment findings to a non-WEIRD culture, suggesting that alignment may be a coordination strategy employed by adults and children across diverse linguistic and cultural backgrounds.

Keywords: Lexical alignment; Lexical entrainment; Adult–child conversation; School-aged children; Conversational context; Non-WEIRD

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1. Introduction

During conversation, speakers naturally adapt their verbal and non-verbal behaviors to become more similar to their conversational partners. These adaptations have been observed in many behaviors including speaking rate (e.g., Wynn, Barrett, & Borrie, 2022), articulatory precision (e.g., Borrie et al., 2020), word choice (e.g., Stabile & Eigsti, 2022), syntactic structure (e.g., Dideriksen, Christiansen, Tylén, Dingemans, & Fusaroli, 2023), and body gesture (e.g., Rasenberg, Özyürek, Bögels, & Dingemans, 2022). This paper specifically explores lexical alignment, where conversational partners adapt their language and reuse one another's words. The phenomenon of lexical alignment has been observed in adult–adult and adult–child conversations (e.g., Dideriksen et al., 2023; Duran, Paxton, & Fusaroli, 2019; Fusaroli, Weed, Rocca, Fein, & Naigles, 2023b). Both theoretical models and empirical evidence suggest that lexical alignment is crucial for supporting communication success by facilitating cognitive, emotional, and pragmatic functions (e.g., Dideriksen et al., 2023; Nenkova, Gravano, & Hirschberg, 2008; Rasenberg et al., 2022). When conversational partners converge on similar words to conceptualize an object or action, it reduces ambiguity and promotes a shared understanding of the topic under discussion. Moreover, lexical alignment facilitates cognitive processing by reducing the processing load required to comprehend and produce spoken language, resulting in smoother and more engaging conversations (Pickering & Garrod, 2004). Pragmatically, lexical alignment has been shown to support rapport-building, joint attention, and engagement. Aligning with each other's word choices reflects an internal state of mutual agreement and a positive affect toward each other, which is essential for a smooth conversational flow (Huiyang & Min, 2022; Ireland et al., 2011).

Within alignment research, a great deal of attention has been placed on lexical alignment in interactions between adults and toddlers/preschool-aged children (e.g., Denby & Yurovsky, 2019; Fusaroli, Weed, Rocca, Fein, & Naigles, 2023a; Misiak & Fourtassi, 2022). These studies have been conducted in various conversational settings, such as the home environment (Clark, 2007) and the research laboratory (Schwab & Lew-Williams, 2016). Additionally, a diverse range of tasks, including toy play (Foushee et al., 2022), interactive games (Leung, Tunkel, & Yurovsky, 2021), and spontaneous conversation (Borelli, Klemfuss, & Hollas, 2019), has been used. Further, children have engaged in interactions with conversational partners who are both familiar (Kunert et al., 2011) and unfamiliar (Girolametto & Weitzman, 2002) to them. Findings have revealed that during such interactions, adults align their word choices with children, and children (as young as 2 years of age) align their word choices with their adult partners. Importantly, research has also evidenced the benefits of lexical alignment in children's linguistic growth and development (e.g., Che, Brooks, Alarcon, Yannaco, & Donnelly, 2018; Denby & Yurovsky, 2019; Fusaroli et al., 2023a). For example, Fusaroli et al. (2023a) demonstrated that parental alignment predicts a child's vocabulary growth and syntactic structure complexity. It is speculated that by aligning their lexicons with their children, mothers capture their children's attention, establish shared conversational knowledge, and prepare them to learn new and more sophisticated words. Beyond parental alignment, children's lexical alignment with adults is crucial for predicting their linguistic abilities, suggesting that alignment is an essential component of language and conversational skill development (Fusaroli et al., 2023b).

Despite a relatively well-established body of literature documenting lexical alignment patterns in young children, there is limited research on the developmental trends of lexical alignment in older children. Given the significant developmental changes in language, cognition, and social communication abilities (e.g., Anderson, Clark, & Mullin, 1994; Gallagher, 1993; Sehley & Snow, 1992), we would expect that the alignment patterns of early school-aged children would differ from those of younger children. However, the patterns that appear in this age group are unknown. Theoretically, one might expect *less* alignment in school-aged children than in younger children. That is, school-aged children may be able to rely less on the repetition of adult utterances as they develop the ability to generate longer and more diverse utterances of their own. Adults may also align less with older children as the need to use alignment to promote language acquisition decreases (Misiek et al., 2020). In contrast, it is possible that school-aged children align their lexicons *more* than younger children. That is, with lexical growth, children's verbal skills become more adult-like and, thus, more similar to those of their adult conversational partners. Additionally, as children begin to develop social communication skills, they may be more equipped to adopt their partners' lexical choices to promote shared understanding or reflect a state of mutual agreement. Within the small body of research that focuses on children in this age group, it has been suggested that they align lexically (Branigan, Tosi, & Gillespie-Smith, 2016; Hopkins & Branigan, 2020). However, most studies have relied on a highly structured conversational paradigm, such as the SNAP picture-naming task developed by Branigan, McLean, and Jones (2005). In this task, a child and an adult experimenter took turns naming sets of cards. Lexical alignment is measured by the extent to which children use names similar to their adult experimenter when labeling their cards. Although these studies have provided valuable insights, one potential limitation is that the SNAP! game is highly structured in nature and thus might overestimate children's alignment performance. The predictable conversational turns and limited set of lexical items used in the task may not fully capture the complexities of lexical alignment in real-world conversations (Slocombe et al., 2013). To gain a better understanding of lexical alignment in naturalistic conversations, it is important to conduct further research using naturalistic paradigms. This would allow us to better understand whether children align their lexical choices with others in more complex and unpredictable communicative contexts (for a review, see Duran et al., 2019).

Beyond the need to look at lexical alignment in more natural conversations, examining alignment in different cultural contexts is important as well. To date, the literature on adult-child alignment has predominantly focused on WEIRD or Western, Educated, Industrialized, Rich, and Democratic societies. However, there is growing recognition that investigations should be expanded to non-WEIRD societies, as differences in adult-child verbal conversation styles and patterns are likely to exist because of cross-linguistic and cross-cultural variations (e.g., Christiansen, Contreras Kallens, & Trecca, 2022; Dideriksen et al., 2023; Henrich, Heine, & Norenzayan, 2010). In adult-child conversations, it is speculated that cultural differences in language socialization beliefs and practices, such as the degree of collectivism, the value placed on child-centered parenting, and expectations for children's responses to adults, may affect the degree of lexical alignment between adults and children (e.g., Fernald & Morikawa, 1993; Hwa-Froelich & Vigil, 2004; Kleeck, 1994). For example,

adults tend to view their children as equal partners in individualistic cultures. They follow their children's leads, provide language that aligns with their interests, and place importance on their opinions and thoughts (Ganek, Nixon, Smyth, & Eriks-Brophy, 2019; Johnston & Wong, 2002). In contrast, adults from collectivist cultures tend to view their children as subordinates. Parents are expected to teach and guide, and children are expected to show deference to adults by listening and observing rather than actively participating in conversations (Keshavarz & Baharudin, 2009; Simmons & Johnston, 2007). These differences can, in turn, impact the amount of talk, the number of conversational turns, and, presumably, lexical alignment patterns. Accordingly, a comprehensive understanding of lexical alignment and its role in child development must also be informed by research conducted in non-Western societies.

For a complete understanding of lexical alignment in school-age children, it is also important to consider conversational context. According to the interpersonal synergy model of spoken dialogue (Fusaroli, Raczaszek-Leonardi, & Tylén, 2014), conversational partners' behaviors are functionally constrained by communicative context. Recent work on adult–adult conversations has provided empirical support for this theoretical model, evidencing a higher degree of lexical alignment in task-oriented conversations, where partners are required to collaboratively solve a problem relative to affiliative conversations, in which partners are more focused on getting to know one another (Dideriksen, Fusaroli, Tylén, Dingemanse, & Christiansen, 2019; Dideriksen et al., 2023). The authors suggested that the degree of lexical alignment is dependent on contextual demand in supporting conversational success. For example, in task-oriented conversations, where a high level of precision and accuracy is required to solve a task (e.g., identifying differences between picture sets), a higher degree of lexical alignment (i.e., number of words repeated) can improve information processing and language comprehension. This can prevent misunderstandings and ensure the successful completion of the task. Nevertheless, thus far, few studies have explored the extent to which conversational tasks might influence alignment patterns in adult–child conversations. In addition to the conversation task, differences between one's partners may also influence the degree of lexical alignment. For example, some studies have found that adults and preschool children align more with familiar partners (i.e., spouse, caregivers, sibling, and close friends) than with unfamiliar partners (e.g., Borelli et al., 2019; Menshikova, Kocharov, & Kachkovskaia, 2021; Weise, Silber-Varod, Lerner, Hirschberg, & Levitan, 2021). Whether the type of partner functionally constrains alignment patterns in school-aged children and adults remains unknown.

1.1. Present study

In this study, we examined lexical alignment in adult–child conversations using a cross-sectional study design involving 45 school-aged children (5 to 8 years old) from Malaysia, an ethnically diverse, multilingual, and non-WEIRD country.¹ To gain a comprehensive picture of lexical alignment in this age group, participants engaged in conversations across multiple contexts. Specifically, each child participated in two different semi-structured conversational tasks (problem-solving vs. play-based) with two different adult partners (parent vs. university student), yielding a corpus of 180 conversations. The study addressed the following key research questions: (a) Do adults and children align lexically? (b) Is the degree of

Table 1
Demographics of the participants

Variable	Mean/Count (SD/Percentage)		
	Children (<i>n</i> = 45)	Parents (<i>n</i> = 45)	University Students (<i>n</i> = 45)
Age (years)	6.0 (0.8)	39.0 (4.6)	21.0 (1.7)
Gender			
Male	23 (51.1%)	-	11 (24.4%)
Female	22 (48.9%)	45 (100.0%)	34 (75.6%)
Ethnicity			
Bumiputera	4 (8.9%)	4 (8.9%)	-
Chinese	32 (71.1%)	32 (71.1%)	33 (73.3%)
Indian	5 (11.1%)	5 (11.1%)	5 (11.1%)
Malay	4 (8.9%)	4 (8.9%)	7 (15.6%)
Language Dominance Score	83.0 (9.7)	83.4 (4.7)	81.8 (5.8)

Note: Language Dominance Score was determined from the Language Exposure Questionnaire (Cattani et al., 2013) for children and the Language History Questionnaire Version 3 (Li et al., 2020) for adults.

lexical alignment moderated by conversational context (i.e., task and partner)? Given previous research on lexical alignment in adult–child conversations (e.g., Denby & Yurovsky, 2019; Misiek et al., 2020; Yurovsky et al., 2016), we predicted that both adults and children would demonstrate lexical alignment in these conversations. However, we also predicted that the degree of alignment would be moderated by the conversational context.

2. Method

Ethical approval was obtained from the Research Ethics Committee of the University of Nottingham, Malaysia, for the Faculty of Arts and Social Sciences. Adult participants provided online written consent, while child participants provided online verbal assent after receiving a child-friendly explanation of the study. All study procedures were conducted remotely using virtual Zoom appointments, owing to the restrictions imposed by the Coronavirus Disease 2019 (COVID-19) pandemic.

2.1. Participants

The conversation corpus was compiled from 135 participants. This included 45 typically developing children aged 5 to 8 years, 45 parents (all mothers) of the children participants, and 45 university students who had no prior contact with the children. Table 1 shows the demographic details of the three groups of participants. None of the adult participants self-reported hearing, vision, speech, language, cognitive impairment, or other relevant medical concerns that could affect their ability to participate in the study. All the participants were Malaysians. Due to Malaysia's diverse population and cultural heritage, participants were either bilingual or multilingual. However, their dominant language was Malaysian English. Language

dominance was defined as having exposure to and using English in at least 60% of daily conversations as determined through the Language Exposure Questionnaire (Cattani, Abbot-Smith, Farag, & Krott, 2013) for children and the Language History Questionnaire Version 3 (Li, Zhang, Yu, & Zhao, 2020) for adults (see Table 1). In addition to Malaysian English, the participants spoke a variety of other languages, including Malay, Mandarin, Tamil, Punjabi, Hokkien, and Cantonese.

All the children had typical language abilities, as confirmed by their scores on the Core Language Subtest ($M = 104.0$, $SD = 9.4$) of the Clinical Evaluation of Language Fundamentals–Fifth Edition (Wiig, Semel, & Secord, 2013), with standard scores equal to or greater than 86. Non-verbal cognitive abilities were also within typical limits, as confirmed by their scores on the Matrices subtest ($M = 114.4$, $SD = 14.7$) of the Kaufman Brief Intelligence Test–Second Edition (Kaufman & Kaufman, 2004), with standard scores equal to or greater than 85.

2.2. Conversational tasks

Each adult–child dyad engaged in two conversational tasks: a problem-solving task and a play-based task. For the problem-solving task, we used the Diapix Task (Baker & Hazan, 2011; Van Engen et al., 2010). This task is a “spot-the-difference” task, where each dyad member is provided with a different picture depicting the same scene (e.g., farm scene) but with 12 differences (e.g., two vs. three sheep). The participants interacted verbally and viewed their pictures from their respective screens to identify the differences between the picture sets. For the play-based task, we used the Toca Kitchen Task (Toca Boca, 2023). This task is a virtual pretend-play cooking task in which the adult acts as the chef and the child acts as the customer. Viewing the same scene, the adult–child dyad collaborates to prepare meals such as blending juice or frying fish. The dyads engaged in each conversational task for 10 min.

2.3. Experimental procedure

All conversations were carried out in Malaysian English. The children participated in two online sessions. Each session differed by adult conversational partner: parents (child’s mother) and university students. To account for any potential order effects, we counterbalanced the order of partners and conversational tasks. That is, half of the children interacted with a university student first, whereas the other half interacted with their mother first. Within this counterbalanced partner order, half of the participants engaged in the Diapix Task first and the other half in the Kitchen Task first. The same task sequence was used for the same child in both sessions.

All sessions were audio- and video-recorded using Zoom. Conversations were digitally recorded using separate audio channels for each speaker and standard settings (i.e., zoom-optimized audio and low background noise). The child and adult interacted with each other using different devices (i.e., laptops or desktops). To ensure that the experimental setup was the same for the mother and university students, mother–child dyads interacted from different rooms to avoid physical contact during conversations. Each task consisted of a 5-min familiarization phase (i.e., explaining and practicing the task) and a 10-min experimental

phase. A short break was provided between conversational tasks. The total duration of each experimental session was approximately 30–45 min.

2.4. *Data preparation*

Our dataset consisted of 180 audio recordings of conversations, each lasting 10 min and saved as .wav files. Trained research assistants manually segmented the conversations into individual turns and orthographically transcribed them using the PRAAT TextGrid function (Boersma & Weenink, 2023). We used the criteria established by Duncan (1972) to define spoken utterances. In this context, a spoken utterance begins when one speaker starts talking and ends when the speaker stops talking, giving the conversational floor to their partner. This definition includes cases in which one speaker starts talking before the other speaker has finished (overlapping turns), but it does not include backchannels, which are utterances made by the non-floor holder for social or meta-conversational purposes (e.g., “hmm,” “uh-huh”), while the floor holder is still talking. The transcription included linguistic vocalizations, such as discourse particles in Malaysian English (e.g., “loh,” “meh”), part-word repetition, meaningful sounds (e.g., “amm”—eating), and Malay and Mandarin words (e.g., “baju”—shirt) but excluded non-linguistic vocalizations (e.g., laughter, coughs, cries).

We employed a two-step process to ensure the accuracy of the transcription. First, a research assistant transcribed speech recordings. Then, a second research assistant listened to and read the transcripts while noting discrepancies such as utterance boundaries, grammatical morphemes, or words. Disagreements were discussed and resolved with the first author and an additional research assistant through group discussions, where videos and transcripts were reviewed. In the very few cases in which no consensus was reached, unintelligible words or utterances were noted and excluded from the analysis. The transcripts were then formatted into an $N \times 2$ matrix in a text file format, with each row corresponding to the speech turn by a speaker and arranged in chronological order based on their appearance in the conversation, alternating between speakers.

2.5. *Measuring alignment: Lexical alignment score*

In our study, the lexical alignment score was the dependent variable. This score was generated using ALIGN (i.e., Analyzing Linguistic Interactions with Generalizable techNiques), an automated linguistic Python package, which quantifies the degree of lexical alignment between the adult and child on a turn-by-turn basis (Duran et al., 2019). To compute the lexical alignment scores, ALIGN relied on Python’s Natural Language Toolkit (NLTK, Version 3.2.5; Bird, Klein, & Loper, 2009) to identify the lemma of each word in a conversational utterance. Lemma is the root or base form of a word; for example, “running” becomes “run,” “are” and “is” become “be.” Then, for each conversational turn, the lemma is vectorized to tabulate the frequency of occurrence. These vectors are used to calculate cosine similarity, a measure of the angle between two vectors, for successive conversational turns as a single turn-by-turn exchange (see Table 2). This calculation yields the lexical alignment score, which ranges from 0 to 1. A score of 0 indicates no alignment, 1 signifies exact repetition, and higher scores denote a greater degree of lexical alignment.

Table 2

Examples of frequency counts for the vectorized lemma and lexical alignment scores generated across the conversational turn level.

Participant	Content	Vectorized Lemma	Lexical Alignment Score
Adult	okay wait okay so there is a pear there	[okay: 2, wait: 1, so: 1, there: 2, be: 1, a: 1, pear: 1]	
Child	pear and then the rice	[pear: 1, and: 1, then: 1, the: 1, rice: 1]	0.124
Adult	and the rice okay what else do you want	[and: 1, the: 1, rice: 1, okay: 1, what: 1, else: 1, do: 1, you: 1, want: 1]	0.447
Child	in kitchen	[in: 1, kitchen: 1]	0

Note. The lexical alignment score represents the alignment of the participants' current turn with their partners' previous turn.

2.6. Sham conversations

To ensure that the degree of lexical alignment captured from the conversations in the current study was meaningful and not an accidental or coincidental phenomenon, we further analyzed the alignment pattern from “sham” conversations. This approach was established in previous linguistic alignment studies (e.g., Duran et al., 2019; Fusaroli et al., 2023a; Misiak & Fourtassi, 2022). Sham conversations are artificial conversations generated by ALIGN by interleaving turns of the child speaker from a complete conversation with turns of the adult speaker (from the same partner and task group) from a different conversation. For example, the conversational turns of Child A were matched with those of Mother B for the problem-solving task. Additionally, the order of conversational turns among the sham partners was carefully matched. For instance, the first turn of the child speaker in the original conversation was followed by the first turn of the adult speaker in the sham conversation, and so on, with the number of turns determined by the shortest of the two original conversations. This preserves the conversation's temporal structure while removing the partners' interdependent behavior. In total, we generated 180 sham conversations, one for each real conversation, to analyze their alignment patterns alongside those of the real conversations.

2.7. Statistical analyses

We investigated whether adults and children align their lexicons with each other and whether this alignment is influenced by conversational context (e.g., task and partner). To address these questions, we used a Bayesian zero-one-inflated beta mixed-effects model. This model was used for four main reasons: (a) the lexical alignment scores were bounded between zero and one, (b) an observed inflation of zero values (i.e., no repetition), (c) an observed (although less so than for the zero values) inflation of one values (i.e., exact repetition), and (d) the repeated-measures design. We specified weakly informed priors ($M = 0$, $SD = 0.3$) for the population level of the regression coefficient. These weakly informed priors allowed

the data to inform the model, while starting with realistic possibilities for the effect size of the coefficient.

For Research Question 1, the models included lexical alignment scores as the dependent variable, a fixed effect of conversation type (sham vs. real), and a nested random effect structure that included participant and conversation ID. This was done to account for intra-individual variability (i.e., the tendency of individuals to use similar words across different conversations) and intra-conversation variability (i.e., the tendency of words to be used more frequently within a given conversation). The general model for this question can be expressed as follows:

$$Y_{pct} = \beta_0 + \beta_1 X_{pc} + \alpha_p + \alpha_{pc} + \varepsilon_{pct}, \quad (1)$$

where Y is the lexical alignment score, X is the conversation type, p is the p th participant, c is the c th conversation, t is the t th turn, α_p is random effect by participant ID, and α_{pc} is the random effect by conversation ID nested within participant ID.

For Research Question 2, we used a similar model but included a two-way interaction between the type of conversation (real vs. sham) and our factors of interest—task (problem-solving vs. play-based) and partner (parent vs. university student). The model for the second question can be expressed as follows:

$$Y_{pct} = \beta_0 + \beta_1 X_{1pc} + \beta_2 X_{2pc} + \beta_3 X_{3pc} + \beta_4 X_{1pc} X_{2pc} + \beta_5 X_{1pc} X_{3pc} + \alpha_p + \alpha_{pc} + \varepsilon_{pct}, \quad (2)$$

where X_1 is the conversation type, X_2 is the partner type, and X_3 is the task type.

We sampled the posterior distribution using the Hamiltonian Monte Carlo method with four chains and 1000 warm-up samples per chain. The posterior distribution combines the prior distribution and likelihood function derived from the data. The results of the models provide distributions of effects between the independent and dependent variables. We summarized these distributions by reporting the beta coefficient, average marginal effect (AME)—for interpretation in the original units of the dependent variable—and the 95% credible intervals (CI). The 95% CI represents the range of values that comprise the minimal interval containing 95% of the probability distribution. All models passed the diagnostic statistics (all \hat{R} values were < 1.01 ; all effective sample sizes were > 400 with zero divergent iterations). Statistical analyses were conducted in the R statistical environment (R Version 4.3.0; R Development Core Team, 2023). Descriptive statistics were calculated using “furniture” (Barrett & Brignone, 2017). Data wrangling and visualization relied on the “tidyverse” (Wickham et al., 2019) and “bayesplot” (Gabry & Mahr, 2022) packages. The Bayesian models were estimated in Stan language version 2.29.2 (Carpenter et al., 2017) and executed using the R packages cmdstanr version 0.5.2 (Gabry & Češnovar, 2022) and brms version 2.17.0 (Bürkner, 2017). The AME was calculated by the emmeans package (Lenth, 2023).

3. Results

3.1. Descriptive statistics

In total, our dataset consisted of 24,106 adjacent conversational turns. The number of analyzed turns per participant per conversation ranged from 50 to 209 ($M = 133.9$, $SD = 28.63$). Out of the 24,106 conversational turns, 12,066 were adults' conversational turns, and 12,040 were children's conversational turns. For children, there were 6266 conversational turns in the problem-solving task and 5800 conversational turns in the play-based task. For adults, there were 6265 conversational turns in the problem-solving task and 5775 conversational turns in the play-based task. These numbers demonstrate the comparability between children and adults in terms of the number of conversational turns explored in our study.

3.2. Lexical alignment

Our first research question focused on whether school-aged children and adults were lexically aligned with one another. First, we found that children aligned to some degree in 49.73% of their utterances, with an average lexical alignment score of 0.15. Further, Bayesian mixed-effects models indicated that alignment scores in the utterances of children were substantially higher in real conversations than in sham conversations ($\beta = 0.38$, 95% CI = 0.32, 0.42, AME = 0.07), meaning that the alignment observed was greater than chance. Next, adults aligned to some degree in 55.93% of their utterances, with an average lexical alignment score of 0.19. Bayesian mixed-effect models indicated that alignment scores in the utterances of adults were substantially higher in real conversations than in sham conversations ($\beta = 0.55$, 95% CI = 0.50, 0.59, AME = 0.11). A comparison of the alignment between adults and children (i.e., an interaction between conversation type and speaker type) indicated that adults displayed a higher degree of lexical alignment than children ($\beta = 0.18$, 95% CI = 0.13, 0.22, AME = 0.04). Thus, both adults and children lexically aligned with each other; however, adults aligned more than children did (see Fig. 1).

Our second research question focused on whether lexical alignment in school-aged children and adults was modulated by conversational context (i.e., task and partner). Regarding children, our two-way interaction revealed a difference in alignment levels during the problem-solving and play-based tasks ($\beta = -0.07$, 95% CI = -0.13 , -0.00). More specifically, the children aligned more when engaged in the problem-solving task relative to the play-based task (AME = 0.02). Fig. 2 shows the posterior distributions by task type and partner type for the children. There was no meaningful difference between children's alignment levels when speaking to a parent vs. university student ($\beta = 0$, 95% CI = -0.07 , 0.06, AME = 0). Regarding adults, our two-way interaction suggested a difference in the alignment level between problem-solving and play-based tasks ($\beta = 0.08$, 95% CI = 0.01, 0.16). Specifically, adults aligned more when engaged in the play-based task relative to the problem-solving task (AME = 0.02). Further, we found differences in alignment levels between parents and university students when speaking to the children ($\beta = 0.16$, 95% CI = 0.09, 0.23). Students aligned more with the children than their parents (AME = 0.04). Fig. 2 shows the posterior

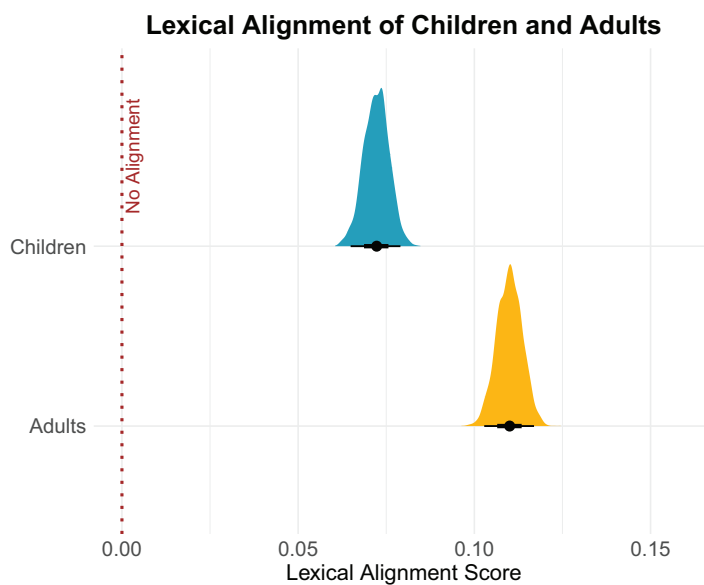


Fig. 1. Lexical alignment of children and adults.

distributions by task and partner types for adults. Thus, alignment in children is modulated by task, whereas alignment in adults is modulated by task and partner.

4. Discussion

This study examined lexical alignment in conversations between early school-aged children and adults. Specifically, we investigated whether lexical alignment is present in semi-structured naturalistic conversations between children and adults and whether the degree of alignment is modulated by conversational context in relation to both the task (play-based vs. problem-solving) and partner (parent vs. student). We observed evidence of lexical alignment in the language use of both school-aged children and adults, which was robust across multiple conversational contexts. However, while lexical alignment was observed in multiple tasks and partners, the degree of alignment varied across these contexts. Further, we extended evidence of lexical alignment to children from non-WEIRD societies. The findings are discussed below.

One of our primary research questions was whether school-aged children aligned lexically during conversations with adults. Consistent with our hypothesis, we found that these children aligned lexically with different partners across various tasks, and this alignment surpassed chance levels (i.e., a higher degree of alignment in real conversations than in sham conversations). These results are consistent with those of earlier studies in which school-aged children aligned their lexicons during highly structured picture-naming tasks (Branigan et al., 2016; Hopkins & Branigan, 2020). In this study, we extended previous findings to a semi-structured naturalistic conversational paradigm encompassing contexts that would more closely

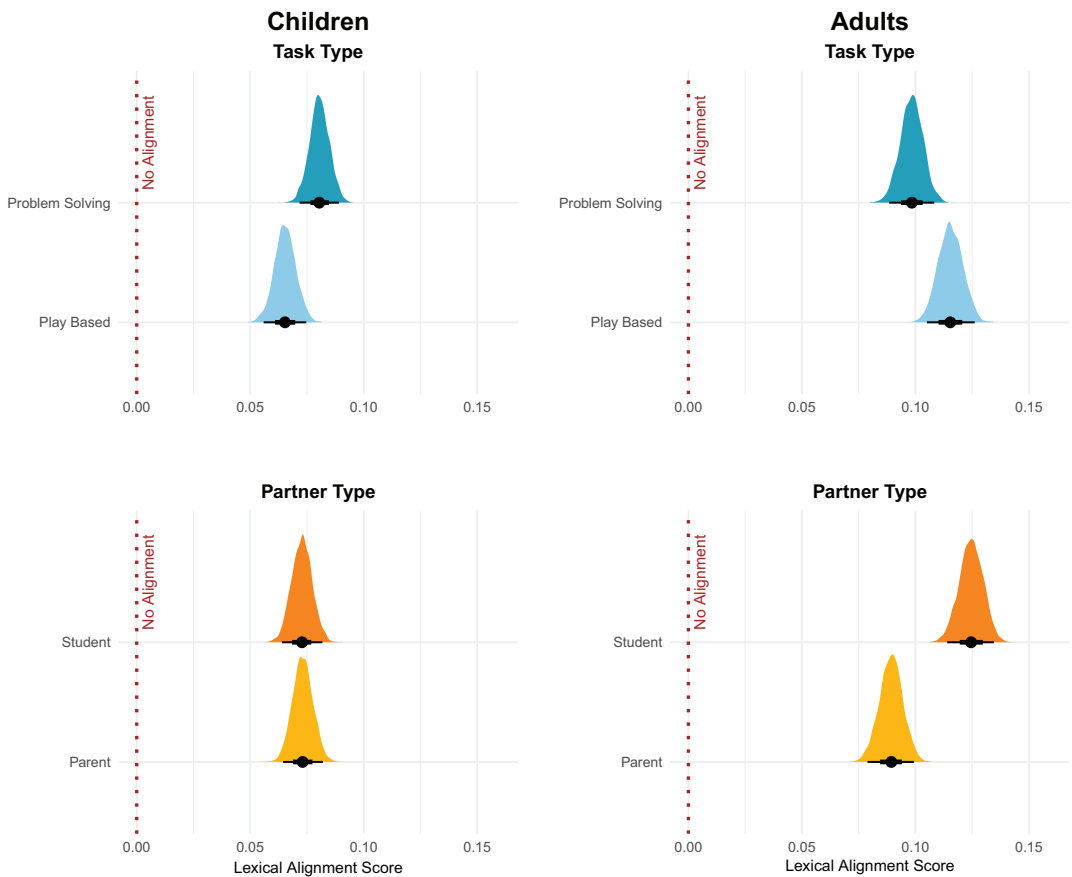


Fig. 2. Effect of task and partner type on lexical alignment in children and adults.

represent children's daily conversations. Previous literature has demonstrated that younger children use lexical alignment as a language learning strategy (e.g., Fusaroli et al., 2023b; Rydland & Aukrust, 2005; Strapp & Federico, 2000). In contrast, adults, who already have fully developed linguistic systems, use alignment to facilitate social communication (Huiyang & Min, 2022; Ireland et al., 2011). As school-aged children are still developing their language abilities and simultaneously beginning to acquire more adult-like social communication skills, it is difficult to ascertain the exact reason for their use of this strategy. Importantly, using alignment as a language-learning mechanism and as a social communication strategy is not mutually exclusive, and it is possible that school-aged children align to serve both functions. Regardless of the underlying reason, the overall findings of the current study are clear—across various types of conversational tasks with different conversational partners, school-age children align their language with adults' partners in relatively naturalistic conversations.

This study also found that adults aligned lexically during conversations with early school-aged children. As above, this alignment was significantly greater than that observed in the

comparative sham conversations. Previous research has shown that adults align their word choices in conversations with younger children aged 2 to 5 years (e.g., Denby & Yurovsky, 2019; Fusaroli et al., 2023a; Misiek et al., 2020). The current study extends these findings by demonstrating that adults' use of lexical alignment persists with early school-aged children. Further, alignment was evidenced in both parents and university students, demonstrating the robustness of this behavior across adults of different ages and genders with different parenting experiences and familiarity with the child. While past research has suggested that adults' degree of alignment decreases as children grow older and develop higher language proficiency (Denby & Yurovsky, 2019; Misiek et al., 2020), we showed that adults do, at least to some degree, continue to align with their children. Here, we propose that adults may use alignment as a scaffolding technique for more advanced language development. When adults align their language, it facilitates children's ability to process and engage in complex levels of comprehension and production (Masek et al., 2021; Rowe & Snow, 2020). Contrastingly, adults' alignment to older children may be less about facilitating language development and more about enhancing conversation and teaching social communication. That is, as children begin to use conversation to exchange more complex thoughts and ideas, adults may align to create coherence in information exchange, achieve mutual understanding, and encourage back-and-forth interaction (Anderson et al., 1994; Girolametto & Weitzman, 2002).

In addition, we observed that the degree of lexical alignment was higher in adults than in children, which is consistent with the findings reported by Misiek et al. (2020) and Yurovsky et al. (2016) for younger children (aged 5 years and below). There are a few possible reasons for this finding. First, this disparity may be representative of differing developmental stages. Adults who have fully developed social communication skills are better able to leverage lexical alignment as a conversational strategy to coordinate conversation flow and foster children's participation in conversations. This finding is consistent with research on other forms of alignment, such as speech alignment, which suggests that, as the underlying skills needed for alignment are developed, alignment becomes more pronounced and refined (Wynn, Barrett, Berisha, Liss, & Borrie, 2023). Additionally, the audience design mechanism (Clark & Murphy, 1982) suggests that speakers tailor their utterances according to their partners' language proficiency (Cai, Sun, & Zhao, 2021; Suffill, Kutasi, Pickering, & Branigan, 2021). Therefore, considering that children generally have lower language proficiency than adults do, adults will align more toward children than vice versa (Denby & Yurovsky, 2019; Misiek & Fournassi, 2022). Taken together, our findings suggest that like the children in this study, lexical alignment in adults is a pervasive phenomenon and may serve as a scaffolding strategy to facilitate children's development of language and social communication skills.

We found evidence of lexical alignment across conversational contexts that differed in terms of the task and partner type. However, our results also revealed that the degree of alignment was modulated by the context. Specifically, we observed that children used lexical alignment more in the problem-solving task than in the play-based task. Indeed, this makes intuitive sense. In the problem-solving task, partners need to collaborate verbally to be successful (i.e., identify differences between picture sets). Because partners cannot see each other's pictures, they must ensure that the verbal information conveyed is accurate. Lexical alignment becomes pivotal in achieving mutual understanding and agreement for the

exchanged information. Notably, adults used lexical alignment more in the play-based task than in the problem-solving task. Although the need for accuracy in the problem-solving task persists, the nature of the adult-child roles in the play-based task may carry greater weight. Specifically, in the play-based task, the adults' role as "chef" meant that they often responded to the child's requests by repeating words to confirm understanding. As direct evidence from this study, when a child requested "I want apple juice, please," the adult would acknowledge the request by responding with "Alright, apple juice coming up." This confirms that the adult has heard and understood the child's request, shares their perspective and intention, and is ready to fulfill it. That the degree of alignment is modulated by context provides empirical support for the interpersonal synergy model, which proposes that individuals adjust their conversational behaviors purposively and selectively according to the context's functional needs and their complementary role (Fusaroli, Raczaszek-Leonardi, & Tylene, 2014).

We also investigated whether lexical alignment is influenced by conversational partners and observed no difference in the degree of lexical alignment exhibited by the children when interacting with their parents relative to an unfamiliar university student. These findings contrast with previous findings in which younger children (i.e., aged 5 years and below) exhibited more alignment with familiar than unfamiliar partners (e.g., Borelli et al., 2019; Ostashchenko, Deliens, Geelhand, Bertels, & Kissine, 2019; Strapp & Federico, 2000). While there are several potential reasons for these differences, it is possible that, as children get older and are exposed to a wider social circle, they may learn to adapt to the linguistic patterns of the broader community, such as teachers, friends, or strangers, more generally than their primary caregivers. As for the adults, we observed differences in the degree of alignment, finding that the university students aligned more with the children than the parents. This finding is consistent with the communication accommodation theory (Giles, Coupland, & Coupland, 1991), which states that partners align their utterances to become more like their conversational partners to reduce social distance and increase likability. Therefore, it is possible that university students, who were unfamiliar with the children, might rely more on alignment for rapport building and to establish joint engagement. Taken together, these findings highlight the complex dynamics of lexical alignment and the role of different conversational partners in shaping language behavior during conversation.

Finally, it is important to note that a significant contribution of this study is that it examines the lexical alignment patterns of children from non-WEIRD societies. To date, almost all research in this area has focused on children from WEIRD societies (e.g., Branigan et al., 2016; Garrod & Clark, 1993; Hopkins & Branigan, 2020). However, considering cross-cultural differences in beliefs and practices regarding adult-child interactions (e.g., Girolametto & Weitzman, 2002; Johnston & Wong, 2002; Rochanavibhata & Marian, 2020), we cannot assume that patterns from WEIRD societies will generalize to children of other cultures, nationalities, and/or ethnic groups. Here, we demonstrate robust alignment patterns of Malaysian children from multiple ethnic backgrounds. Thus, we show that in adult-child interaction, this phenomenon is not simply a product of Western parenting styles, language socialization beliefs, or specific aspects of Western conversational skill development in children. Instead, it appears to be a strategy for fostering connections and coordinating linguistic structures beyond the WEIRD societies.

5. Limitations and future direction

Given the novelty of this study, there are several potential avenues for future research in this field. First, our study suggests that lexical alignment is a pervasive phenomenon in early school-aged children aged 5 to 8 years old. This highlights the importance of alignment in children's developmental milestones. However, our study recruited only children within this small age range. Next, research could recruit children from a wider age range, such as early preschool to older school-aged children. This would allow us to gain robust insight into the developmental trajectory of lexical alignment and the interplay between lexical alignment and children's language, social, and cognitive abilities. Second, our findings highlight the significant impact of context on language use in both children and adults. This emphasizes the need for further research into the influence of contextual factors on lexical alignment in order to replicate the findings of this study. In this study, we specifically investigated lexical alignment within an online, semi-structured, naturalistic conversational paradigm with different partners, including mothers and students. To build upon these findings, future studies could expand the scope by exploring other naturalistic conversational contexts that include toy play, shared book reading, and mealtime interaction with other conversational partners, such as fathers and teachers. Third, this study extends previous findings on lexical alignment in adult-child conversations to non-WEIRD societies. Nevertheless, while our findings show patterns of lexical alignment in one non-WEIRD group, it is not clear how similar these patterns are to those in other cultural groups. Therefore, future research should compare adult-child conversations in different cultures. Further, by conducting research with direct cross-cultural comparisons, we can identify potential variations in the prevalence and patterns of alignment between these different groups and gain a more nuanced understanding of how linguistic alignment is influenced by cultural contexts. Finally, we examined only lexical alignment, which provides a partial perspective on how adults and children coordinate their verbal and non-verbal behaviors (multimodality) in social conversations (Rasenberg et al., 2022). Future research could delve into understanding other forms of alignment, including speech, syntactic, semantic, or non-verbal behaviors, and how they may be influenced by conversational context. Gaining insight into alignment across these modalities will provide a more comprehensive perspective on how children and adults coordinate these modalities through alignment and how it influences the success of the conversation.

6. Conclusion

In conclusion, this study found that early school-aged children and adults coordinate their conversational utterances by re-using or aligning each other's word choices and that this is a robust communication phenomenon that persisted across various conversational contexts. Notably, the degree of lexical alignment in both adults and children was modulated by conversational context. Moreover, this study provided evidence of lexical alignment within a non-WEIRD culture, suggesting that alignment may be a coordination strategy employed by adults and children across diverse linguistic and cultural backgrounds. Finally, in light of

the preliminary nature of the findings from the study, we recognize the necessity of future research to validate and expand upon our results.

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Data Availability Statement

Data analysis code and model outputs associated with this work are available at the study repository hosted at <https://osf.io/jcx5s/>

Conflict of Interest Statement

The authors have no relevant conflicts of interest to disclose.

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Note

1 Notes. We employ the term “non-WEIRD” to represent our study context because Malaysia is a non-Western developing nation and is not classified as a “high-income” country (World Bank, 2022). Demographically, Malaysia is ethnically and culturally diverse and is characterized by a collectivist cultural orientation.

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