

Temporal characteristics of child-adult conversations: utterances and turn-taking

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Abstract. Since its inception, conversation analysis has focused on the question of how participants achieve a fast and smooth alignment between two turns. Most research has analyzed adults' conversations, but much less has been known about child-adult interactions. The aim of this study is to analyze the temporal patterns of children's utterances and turn-taking (TT). Twenty adult-child conversations (ages 5 and 7) were selected from the GABI database. Articulation rate, duration of interpausal units, pauses, and FTO-value (Floor Transfer Offset) of turn-taking launched by the children were analyzed. Temporal patterns did not differ between the two age groups, but individual differences were found within both groups. TT mostly occurred with a gap, but children were also able to take the floor immediately. TTs after a gap were significantly longer than after overlapping speech. The results provide new information on the communicative competence in childhood, particularly regarding timing patterns and organization of child-adult dialogues.
Keywords: *children's speech; conversation; temporal characteristics; turn-taking; Floor Transfer Offset*

Kalbėtojo ir klausytojo vaidmenų pasikeitimo trukmė ir seka vaikų ir suaugusiųjų pokalbiuose

Santrauka. Nuo pat pradžių vienas kertinių pokalbio analizės tikslų buvo atsakyti į klausimą, kaip pokalbio dalyviams pavyksta greitai ir sklandžiai pasikeisti kalbėtojo ir klausytojo vaidmenimis. Dauguma ankstesnių tyrimų analizavo suaugusiųjų pokalbius, tačiau daug mažiau žinoma apie vaikų ir suaugusiųjų bendravimą. Šio tyrimo tikslas – išanalizuoti, kaip vaikai perima kalbėtojo vaidmenį ir kiek laiko toks vaidmens perėmimas užtrunka. Iš Vaikų kalbos duomenų bazės (*Gyermeknyelvi beszédAdatBázis és Információtár* (GABI)) buvo atrinkta 20 suaugusiųjų ir vaikų pokalbių (5 ir 7 metų amžiaus). Tyrime buvo analizuojama vaikų pasakymų pradžia, jų pasakymų artikuliacijos greitis, tarpauzinių vienetų trukmė ir pauzės tarp pasakymų. Išryškėję skirtumai nebuvo statistiškai reikšmingi tarp dviejų amžiaus grupių, tačiau abiejose grupėse buvo nustatyti ryškūs individualūs skirtumai. Tirtuose duomenyse kalbėtojo vaidmenų pasikeitimas dažniausiai įvykdavo po pauzės, tačiau pasitaikė ir tokių atvejų, kai vaikai iš karto perimdavo žodį. Pasakymas perėmus žodį po pauzės buvo žymiai ilgesnis nei po persidengiančios kalbos. Rezultatai suteikia naujos informacijos apie vaikų bendravimo kompetencijas, ypač apie pokalbio seką, žodžio perėmimo trukmę ir pokalbio struktūrą dialoguose tarp vaikų ir suaugusiųjų.

Raktiniai žodžiai: *vaikų kalba; pokalbis; kalbėtojo ir klausytojo vaidmenų pasikeitimas; pasakymas; kalbėtojo vaidmens perėmimo pradžia*

Acknowledgements. The research was supported by the Hungarian National Research, Development and Innovation Office of Hungary [project No. K-128810].

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1. Introduction

The process of language acquisition has been one of the most important and most studied areas of linguistics from the very beginning. One of the earliest methods of examining children's language is the parental diary, in which parents record their children's language development and the gradual expansion of their vocabulary. Observations of this kind date back to the 18th and 19th centuries, and several researchers, including Charles Darwin and Werner Leopold, kept diaries of their children's language acquisition (Crystal 2003). Later, the development of sound and image recording techniques allowed more objective and systematic analyses to be made, and experimental studies were carried out as well. Nowadays, well-equipped baby laboratories are able to conduct instrumental studies that objectively explore language acquisition in many participants. Additionally, there is an increasing number of child language databases available for researchers, some of which include Hungarian-language audio materials either in part or in full. For example, the CHILDES corpus contains spontaneous speech from children aged 2 to 9 years, as well as some longitudinal recordings and speech recorded using different tasks (MacWhinney, Snow 1990). Most of the databases have been developed by recording English-speaking children, e.g. the Kids' Audio Speech Corpus is a collection of speech samples of American children (Eskenazi 1996). However, child databases also exist for many other languages like French (Demuth & Tremblay 2008) or Russian (Lyakso 2010).

For Hungarian, the Hungarian Kindergarten Language Corpus (HUKILC, 'MONYEK' in Hungarian) has been developed mainly for child language variation studies (Mátyus, Orosz 2014). The database consists of 62 'interviews' with 4.5–5.5-year-old children from Budapest with different socio-cultural backgrounds. The interviews are 20–30 minutes long, consisting of different types of tasks. The corpus consists of 39 000 utterances with about 140 000 words (Mátyus, Orosz 2014). Another corpus, the so-called GABI (Gyermeknyelvi beszédAdatBázis és Információtár; Child Language and Speech Database and Information Repository, cf. Bóna et al. 2019) is a Hungarian speech database, which contains recordings of speech production by 420 children (3–18 years of age) using different protocols for the younger and older children. The corpus involves different speech tasks, such as sentence repetition, spontaneous speech, definition of words, reading, and storytelling based on picture sequence.

Most child language studies focus on the first years of language acquisition, when the most striking changes in speech occur. During this period, the child's vocabulary expands significantly just as the sounds of the given language (Clark 1995), they acquire more syntactic and semantic rules, and their regular usage evolves notably (Kirby 2009). At the same time, many other changes in speech take place during the preschool years. For instance, children produce longer speech units, their knowledge regarding grammatical rules and exceptions expands, they start to acquire the rules of written language, and a notable development of language awareness can be observed in their speech production. This development also involves the acquisition of pragmatic, politeness, and social communication rules (c.f. Selby et al. 2000, Marklund et al. 2015, Redford 2015).

One of the most investigated aspects in previous research is the development of temporal specificity in children's communication. It has been corroborated that, for example, the duration of different speech units increases over time, such as the number of syllables (Flipsen 2006), or longer interpausal units appear in the speech production of school-age children compared to those in kindergarten (Neuberger 2014). In addition, extremely long pauses can occur in children's speech compared to adults' utterances due to the lack of courtesy rules, which are acquired with more communicational experience (Horváth 2016). Moreover, temporal parameters also show a notable change in the first years: Amir and Grinfeld (2011) found an increase in the articulation rate between the ages of 3 and 17, while other

studies have shown that pauses and duration of words decrease between 4 and 8 years (Singh et al. 2007). However, it is difficult to generalize timing trends in mother tongue acquisition because of the large individual differences (Horváth 2016). Additionally, it is important to highlight that while the acquisition of simpler speech situations takes place at a relatively young age (for example, the child gains more experience in implementing simple question-answer sequences), the acquisition of more complex, longer conversations takes significantly more time due to the multiplex and often varying set of rules involved.

Conversations are fast interactive situations, in which the roles of the participants are constantly changing. In spontaneous conversations, the order and timing of turns are organized flexibly, and are not fixed in advance (e.g. Sacks et al. 1974, Iványi 2001, Boronkai 2009, Hámori, Horváth 2019). As children grow older, they gradually acquire the rules of interactional organization in conversation, but previous research provides relatively little information on the temporal characteristics of children's conversations. Most previous research has focused on mother-child dialogues, and there is little evidence of young children adhering to conversational rules, either in terms of timing parameters (such as awkward listening) or in terms of exchanging the speaker-listener roles. As language acquisition progresses, conversational strategy skills become more differentiated.

Turn-taking in child-adult conversations is more explicitly signaled than in adult dialogues, with stronger semantic and syntactic ties between turns (Nelson, Gruendel 1979). As children grow older, their conversational strategies become more differentiated. Some studies suggest that conversational strategies develop after the age of 2, with an average age of 3 (Nelson, Gruendel 1979), while others propose that preschool age is when children acquire more social communication skills, such as attracting and maintaining the listener's attention, using forms of address, greeting, and politeness, and applying an increasing number of communicative rules (Lengyel 1995). Research suggests that children are able to engage in adult-like conversations by the age of 5–6 years, as they learn how to organize speech turns (Casillas 2014, Lengyel 1995, Neuberger 2014).

For Hungarian, recent research has primarily focused on analyzing recordings of adult speakers to investigate the timing patterns of conversations. The results indicate that turn-taking generally occurred with relatively short duration, ranging between -250 and +500 ms in most cases (Horváth et al. 2021). These findings are consistent with values reported for English and Dutch conversations (Stivers et al. 2009, Levinson, Torreira 2015). Turn-taking in Hungarian conversations typically occurred with positive FTO values, with the next speaker taking the floor after a pause in over half of the cases (Horváth et al. 2021). Negative FTO values indicating overlapping speech were less common. In only 5% of cases, the next speaker began speaking immediately (FTO 0 ms) after the previous speaker stopped speaking.

The organization of conversation in adult-child dialogues (involving 5-year-old children) was analyzed, with a focus on turns, overlaps, backchanneling behavior, and turn-taking (Hámori, Bóna 2022). Results showed that turn-takings and overlaps were less frequent in adult-child dialogues compared to adult-adult dialogues. Moreover, overlaps in cooperative function were not proper in children speaking to adults. In contrast to adults' dialogues, turn-takings occurred with longer durations, indicated by higher FTO values.

In an earlier longitudinal case study (Lengyel 1995), it was found that 6-year-old children were able to use extended directives to give the floor to the next speaker, including the addressee, the activity, and its object. A conversation analytic approach was used to analyze the conversations of 6-year-olds, which revealed several metapragmatic reflections directed towards language activities such as reflections on language context, formation of humor, and role-playing games (Hámori 2019). Discourse

markers were not frequently used in early kindergarten age, but their frequency increased with age (Kondacs 2019).

Pragmatic competencies were investigated using a test, which revealed that the perception of non-literal meanings developed between kindergarten and school age, and the interpretation of unknown idioms may cause difficulties. However, irony was recognizable even for 6–7-year-old children (Balázs 2010). Overall, empirical studies suggest that discourse competencies continue to develop in later stages of language acquisition, and significant progressions occur after the age of 6–7 years.

Aim of the study

The majority of previous research on conversation organization and turn-taking has focused on adult communication (DeRuiter et al. 2006, Stivers et al. 2009, Levinson, Torreira 2015, Heldner, Edlund 2010, Holler et al. 2016, Barthel 2020). However, little is known about conversations between children and adults. This raises the question: How can we characterize adult-child interactions in terms of temporal parameters?

The aim of our study was twofold: to analyze conversations between children (ages 5 and 7) and adult interviewers in terms of the temporal characteristics of children’s utterances, and to examine turn-taking patterns by considering how children time their utterances when having dialogues with adults.

We hypothesized that the temporal characteristics of children’s speech would differ depending on their age, with longer utterances, faster articulation rates, and fewer and shorter silent pauses in 7-year-olds compared to 5-year-olds. We also predicted that turn-takings would mostly occur with pauses, the ratio of overlapping speech would be relatively small, and there would be no difference between the two age groups. However, we expected a difference in turn-taking patterns between the two groups, with shorter FTO values for the 7-year-olds.

2. Methodology

20 conversations were selected for the study from the Hungarian GABI database (Children Speech and Information Database, cf. Bóna 2019). The dialogues were recorded with the participation of an adult fieldworker and a child. The adult speaker asked the child about free time activities, hobbies, family, games in the kindergarten and school, and tried to make the child speak as much as (s)he can. The child might be asked to tell the rules of a given game or the content of a fairytale when she/he could not speak enough about the topics.

The study used conversations recorded with ten 5-year-old children and ten 7-year-old children. The 5-year-olds were preschoolers, while the 7-year-olds already attended school, allowing for the implicit examination of the effect of institutional education on conversation implementation. All participants selected for the study had unimpaired hearing and no known mental or speech impairments (except for age-specific pronunciation features).

The annotated material was manually corrected using Praat software (Boersma, Weenink, 2018). Several temporal parameters were analyzed, including the articulation rate (syll/s), the frequency and duration of silent pauses, and the duration of interpausal units. The articulation rate, duration of the interpausal units, and pauses were automatically extracted using a Praat script. Turn takings were manually annotated by the authors and analyzed regarding their frequency, types (whether they occurred after a pause, after an overlap, or immediately), and FTO value (the duration of changing between the current speaker and the next speaker).

The study used two different statistical methods. First, a general linear model analysis was performed in R software (R Core Team, 2020) with the lme4 package (Bates et al., 2015) to analyze the articulation rate and duration of silent pauses. P-values were obtained using the Satterthwaite approximation (lmerTest package, Kuznetsova et al., 2017). The fixed effect was the age of the participants (5 or 7 years old) and the type of FTO. The random effect was the speaker, and the dependent variable was the value of the articulation rate, duration of silent pauses, duration of the IPU, and FTO. For each parameter, a random intercept and a random slope model were constructed (with the speaker as a random factor for each variable), and the two models were compared using the ANOVA function available in the lmerTest package (Kuznetsova et al., 2017). No significant difference was found between the models, and we present the random slope values giving a lower AIC number (Akaike, 1973).

Second, the study analyzed the difference in frequency of the given parameters (frequency of the duration of the IPU) using the Mann-Whitney test (McKnight, Najab, 2010).

3. Results

The articulation rate of children’s speech was analyzed with respect to their age. The results revealed no significant difference between the five-year-olds and the seven-year-olds in terms of their articulation rate (Fig. 1). The mean articulation rate was 3.8 syllables per second (SD: 1.4 syll/s) in the 5-year-olds group, while it was 4 syllables per second (SD: 1.8 syll/s) in the 7-year-olds group.

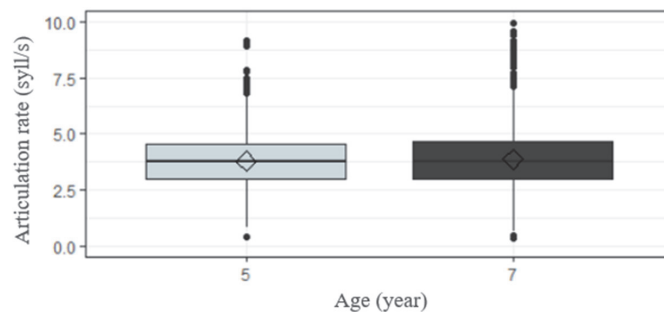


Figure 1. The articulation rate with respect to age

However, there were significant individual differences found between children in both age groups (Fig. 2). The highest value in the 5-year-olds’ group was 4.2 syll/s (SD: 2.9 syll/s), while the highest value in the 7-year-olds’ group was 5.2 syll/s (SD: 3.1 syll/s).

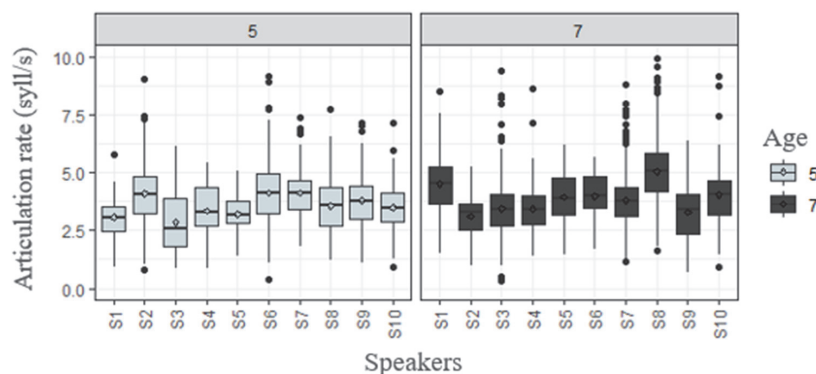


Figure 2. The articulation rate with respect to individual differences

Throughout the entire material, there were 3 130 silent pauses observed, with 1 744 in the 5-year-olds' speech and 1386 in the 7-year-olds' speech. The frequency of pauses was very similar in both age groups, with 19.25 items/minute for 5-year-olds and 19.01 items/minute for 7-year-olds. However, the duration of the pauses (Fig. 3) was significantly longer in the 7-year-olds group (mean: 744 ms, SD: 665 ms) than in the 5-year-olds' speech (mean: 607 ms, SD: 663 ms; Mann-Whitney: $Z = -8.960$, $p < 0.001$).

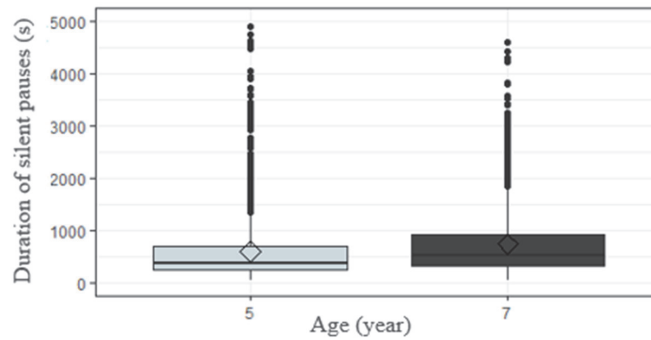


Figure 3. The duration of silent pauses

The frequency of interpausal units (IPUs) with different lengths was analyzed and compared between the two age groups (Fig. 4). The results indicate that younger children produced fewer utterances compared to older children, with five-year-olds producing a total of 8 008 IPUs and seven-year-olds producing 10 207 IPUs, representing a 27% increase in utterance production. In terms of length, both age groups had a higher frequency of shorter utterances and a lower frequency of longer utterances, whether analyzed based on syllable count or duration. While the duration-based diagram in Figure 4 suggested that 5-year-olds produced proportionally fewer utterances of each length than 7-year-olds, the syllable-based diagram (Fig. 5) revealed that very short utterances (1.2 syllables) were more common among 5-year-olds, while longer utterances (>2 syllables) were more prevalent in 7-year-olds.

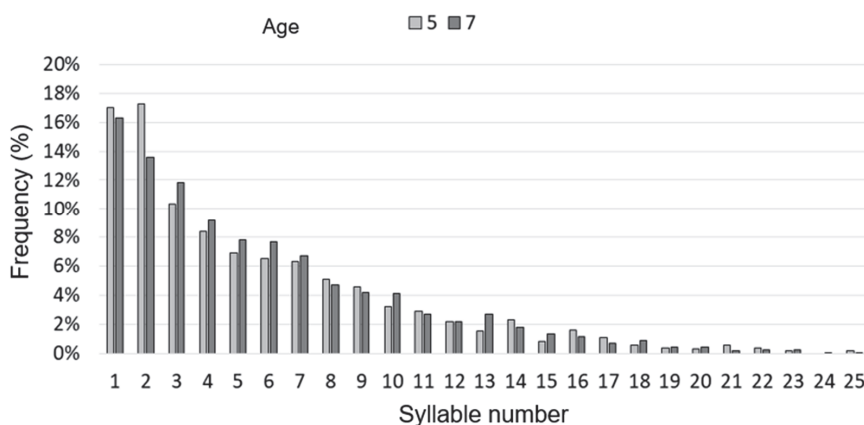


Figure 4. The frequency of IPUs of different lengths (syllables)

The average length of the speech units did not differ significantly between the two study groups: the mean value was 1.46 s (SD: 1.09 s) for five-year-olds and 1.49 s (SD: 1.07 s) for seven-year-olds. Statistical analysis did not confirm any significant difference in the length of the speech segments between the two age groups. For the five-year-olds, 60% of speech segments were realized in a maximum duration of 1.5s, for seven-year-olds the value was 73%, and only the remaining speech segments occurred in a longer duration.

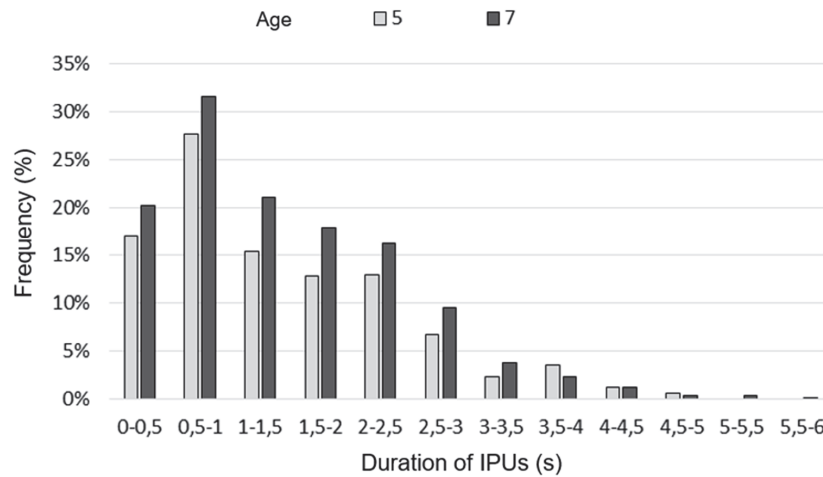


Figure 5. The frequency of IPUs with different durations

However, individual differences were substantial; the average duration of the shortest IPUs was observed in a 7-year-old speaker (mean: 1.09 s, consisting of 1–3 syllables on average), whereas the longest IPUs on average were produced by a 5-year-old speaker (mean: 2.19 s, consisting of 9 syllables on average) (Fig. 6).

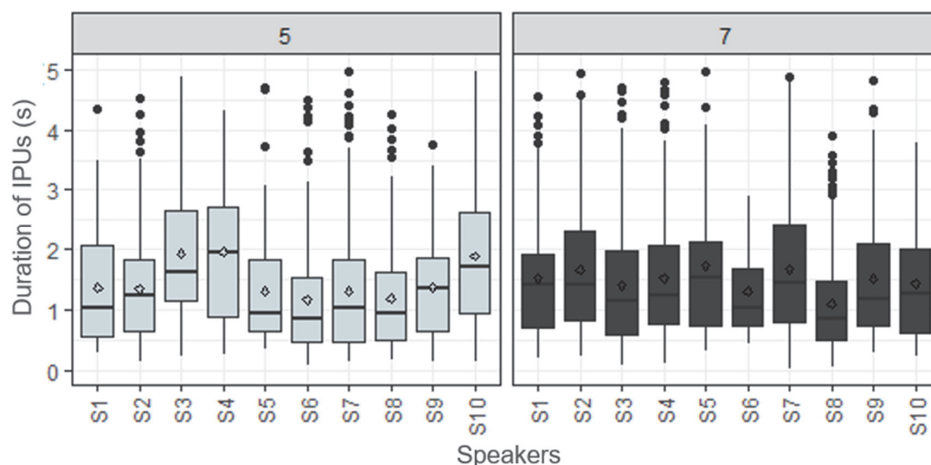


Figure 6. Individual differences in the length of IPUs

Furthermore, the study analyzed the frequency, types, and temporal organization of turn-takings in the children’s speech. A total of 1 385 turn-takings were observed in the 20 recordings, with 43% occurring in the dialogues of 5-year-olds and 57% in the conversations of 7-year-olds. The mean frequency of turn-takings was 16 TT/minute in the younger group’s material (SD: 10 TT/min) and by nearly 20% more frequent in the dialogues recorded with 7-year-olds (19 TT/min; SD: 19 TT/min). However, the difference was not significant between the two groups regarding the frequency of turn-takings.

The aim of the study was to analyze the temporal organization of children’s utterances. Therefore, we analyzed the TTs where the adult was the current speaker, and then the child took the floor becoming the next current speaker, resulting in 301 cases in the 5-year olds’ material and 395 cases in the 7-year olds’ recordings. The most frequent type of turn-taking, irrespective of the child’s age, was after a silent pause (positive FTO value), where the adult stopped speaking, and after some pause or gap, the child started to speak (5-year-olds: 76.7%; 7-year-olds: 82.5%). Consider example (1):

- (1) Adult: *and where did you fly to?*
(SIL: 140 ms)
Child: *I can't remember...*

The ratio of turn-taking events after an overlap (indicated by a negative FTO value) was much lower. In such instances, the child started speaking during the adult's speech, causing overlapping utterances, the adult then stopped speaking, and the child took over as the current speaker, as illustrated in example (2.) Among 5-year-olds, this type of turn-taking event happened in 16.3% of cases, while among 7-year-olds, it happened in 10.5% of cases.

- (2) Adult: *which is your favorite holiday can you tell me | what did you do there*
Child: *we were in the mountains*
(overlapping speech: 1151 ms)

The least frequent type of turn-taking event (occurring in 7% of cases in both age groups' data) was when there was no gap between the adult stopping speaking and the child starting to speak, resulting in a 0 ms FTO value. In this case, the child immediately took over as the current speaker after the adult stopped speaking. Here is an example of this type of turn-taking event:

- (3) Adult: *What do you like more: drawing or painting?*
(SIL: 0 ms)
Child: *drawing*

The temporal patterns of turn-taking events were analyzed by examining their FTO values. The distribution of the FTO data was similar in both age groups, as shown in Figure 7. However, there were more negative FTO values in the 5-year-olds' conversations, indicating a higher frequency of simultaneous speech with the adult speaker. On the other hand, longer pauses were more commonly observed before the children's utterances when taking turns in the 7-year-olds' data, suggesting a higher frequency of turn-taking events with longer pauses.

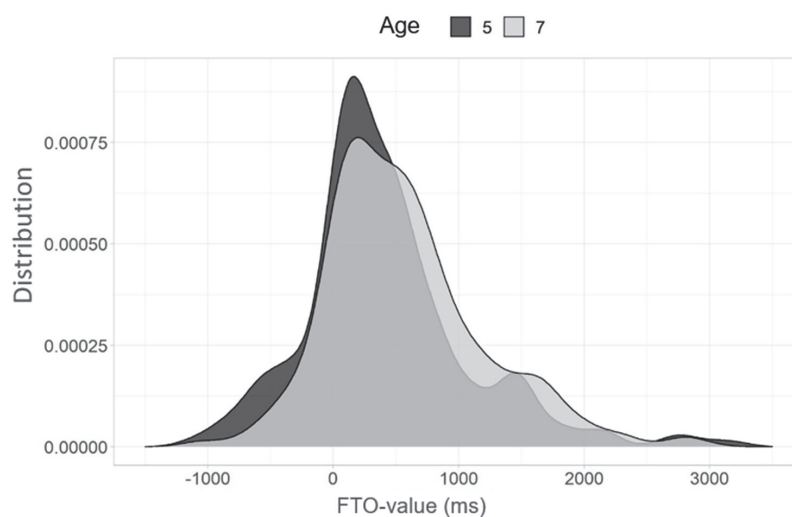


Figure 7. The distribution of FTO values regarding age

The FTO values were analyzed with respect to age and type of turn-taking (as shown in Fig. 8 and Table 1), using a linear model. The statistical analysis revealed no significant difference based on the age of the children, but it showed a significant effect of the type of turn-taking on the FTO value. Turn-

taking events following a pause had a significantly higher FTO value than those following an overlap, indicating a longer time interval between turns ($F = 23.515$; $p < 0.001$).

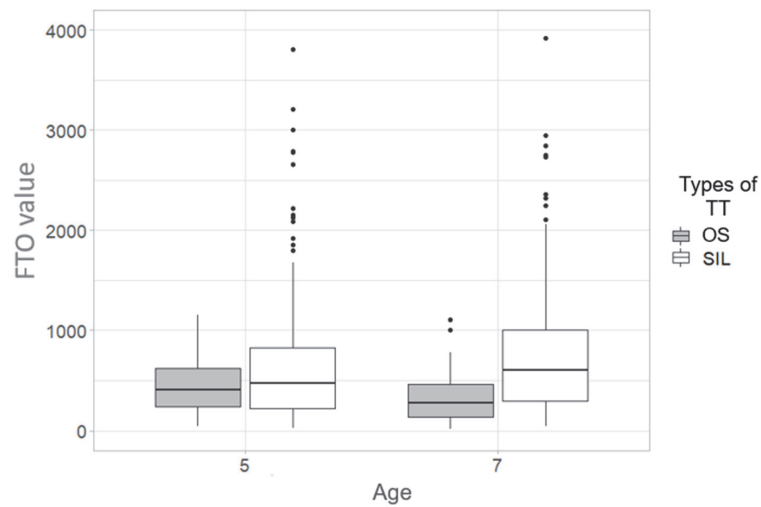


Figure 8. The FTO values regarding age and type of turn-taking events

Table 1. The absolute FTO values regarding age and type of turn takings

The absolute FTO values regarding age and type of turn-taking				
type of TT	5-year-olds		7-year-olds	
	mean	SD	mean	SD
pause (positive FTO)	653	626	742	594
overlap (negative FTO)	438	272	323	252

4. Conclusions and discussion

The aim of this study was to examine the temporal patterns and organization of turn-takings in children’s dialogues with adult fieldworkers. The findings revealed that only the duration of silent pauses differed significantly based on the children’s age, with longer pauses observed in the 7-year-olds’ speech compared to the younger children’s speech. Recent research, including research on Hungarian, has also supported this result, indicating longer pauses in older children’s speech compared to younger ones’ (cf. Neuberger 2014, Horváth 2016).

While individual differences played a decisive role, the role of school may also be a factor, where time is limited for speaking and conversational rules, such as “do not interrupt adults’ speech,” are continuously acquired. Additionally, the complexity of children’s utterances becomes more grammatically and syntactically advanced in school compared to kindergarten years (cf. Neuberger 2014). Planning these more complex utterances and applying conversational rules may require more time, resulting in longer pauses during the speech planning and execution process.

The frequency of turn-takings was not significantly affected by the children’s age. However, turn-takings occurred more frequently in child-adult conversations than in adult-adult conversations (3.7 TTs/min, cf. Krepesz et al. 2021). This was due to the fact that children produced shorter turns in conversa-

tions than adults. Children required more frequent questions and comments from the adult to continue their speech production, resulting in a higher density of turns. Turn-taking most often occurred after a pause in both age groups, whereas turn-taking with overlap of 0 ms FTO was much less frequent. Furthermore, the ratio of simultaneous transitions in these child-adult dialogues was lower than in adult-adult dialogues (Krepesz et al. 2021).

At this age, the child's communicative competence is still developing, and they need to learn the timing of their own utterances. Acquiring the use of overlapping speech as a cooperative strategy in organizing the turn-taking system is also a part of discourse competences. Additionally, children are often taught, particularly in institutional education, the rules of politeness, such as not interrupting others (especially adults) and waiting until the current speaker has finished speaking before taking over the turn. The recording situation can also make the child more "tense", affecting their communication strategies.

In summary, the period of school entry does not have a consistent impact on children's communication strategies and timing characteristics (at least not within a short span of two years between the ages of 5 and 7). The variations observed in spontaneous speech are primarily related to individual differences, and the influence of institutional education on communication is affected by various factors such as family status, number of siblings, communication habits, and physical and mental well-being. Any alterations in communication strategies and timing characteristics should always be evaluated in relation to the child's previous performance.

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Submitted January 2023

Accepted April 2023