6

Prosodic features

6.1 Previous research on prosodic features of CDS

In many languages, the mean fundamental frequency of adults' speech is higher when they talk to young children, and adults also use a wider frequency range than in ADS. This has been documented for English (Remick 1976; Garnica 1977), German (Fernald & Simon 1984), French, Italian, German, Japanese, British and American English (Fernald et al. 1989), and for the tonal language Mandarin (Grieser & Kuhl 1988). All of these studies use semi-spontaneous data, manipulating the addressee variable but otherwise trying to hold the situation as natural as possible. Only Garnica (1977) uses elicited production data from various language games.

Previous research has shown that the prosodic features typical for CDS figure most prominently in speech to children up to one year of age (Saxton 2015). Hence, researchers occasionally refer to infant-directed speech (IDS) as a separate register from CDS. However, the typical adaptations have also been attested in speech to older children. Ratner and Pye (1984) show that the speech of US-American mothers speaking English to children of 32.5 months has a significantly higher pitch than when talking to adults. Garnica (1977) reports the same for children of 27 months. However, the speech to children of 65 months did not show a significantly higher fundamental frequency than speech to adults. Yet, the frequency range was significantly higher than ADS for both age groups. Warren-Leubecker and Bohannon (1984) found that mothers had a higher fundamental frequency both when talking to children of 24 and

of 60 months of age. Although Warren-Leubecker and Bohannon referred to Garnica's study, they did not comment on the differences found for mothers' speech to the older children.

The fathers in the study by Warren-Leubecker and Bohannon (1984), as opposed to the mothers, hardly altered their fundamental frequency when talking to the 60-month-olds, although they did so when talking to 24-month-olds. These reports show that both the sex of the person talking to the child, and the child's age, are variables that have to be taken into account.

For speaking rate, it has been reliably documented that CDS is slower when adults address infants (Broen 1972). Fernald et al. (1989) report longer pauses in infant-directed speech in their cross-linguistic study, a feature Goldman-Eisler (1973) has shown to be responsible for the lower speaking rate in CDS. Such adaptations give the listener more time for processing, which might support comprehension. Given this ample evidence, prosodic modifications have been hypothesised to be a universal feature of CDS (Sachs 1977).

However, few studies have addressed non-WEIRD societies (see Section 1.1 and Section 1.2). The studies that do exist do not always confirm the predictions. At least two studies report diverging evidence: in K'iche' Maya, adults occasionally even use a lower pitch when they address children of 25.3 months (Ratner & Pye 1984). K'iche' mothers' speaking rate does not differ from ADS either, or is even slightly increased (Pye 1986b). Conversely, there are other studies on non-WEIRD societies that do confirm the predictions from Western, urban societies. Broesch and Bryant (2014), using semi-spontaneous data, report for Kenyan, Fijian and North American mothers that all used a higher pitch, a greater pitch variation and fewer syllables per second. Those features have been suggested to foster attention, emotional bonding and identification of boundaries (Fernald 1992; Broesch & Bryant 2014). Golinkoff et al. (2015: 340) propose that 'exaggerated intonational characteristics highlight the structural properties of utterances, and provide information about how speech "chunks" together'. The distribution of those characteristics within utterances is then of central importance. Fernald (1992) found that English mothers place words denoting new referents utterance-finally and mark them with an exaggerated intonation when talking to infants. They hypothesised that 'adults may also be biased to provide relevant linguistic information at positions of perceptual prominence in the speech stream'

(Fernald 1992: 209). Children also give special attention to utterance ends (Weisleder & Waxman 2010). The information presented utterance-finally therefore has a special status.

One of the typologically unusual features of Qaqet is that intonation units (IUs) tend to have a flat contour, with all major pitch movements taking place at their right boundary (Hellwig 2019: 56). Do these prosodic characteristics also hold for CDS or are they more evenly distributed across the intonation unit? In the first case, they may be helpful only for identifying borders of whole intonation units, and not for identifying smaller units. While I will not deal with this question systematically in the present study, I will offer preliminary insights from the corpus. To summarise, much research on non-Western, rural societies confirms the pattern found for WEIRD languages, but there are counter-examples like K'iche' or Pitjantjatjara. Given the evidence reported above, and speakers' reports (see Section 2.2.4) that adults, especially mothers, adapt their speech to children, I hypothesise that CDS in Qaqet shows the typical prosodic features, that is, a higher frequency range and a higher mean fundamental frequency. Likewise, a slow speech rate is to be expected in the data, especially given that adults in Raunsepna confirm that this feature is typical and useful for communication with small children. As for the mean length of utterance (Chapter 4), I found a turning point in the data that appeared in speech to children at around 40 months, so I expect to find a similar turning point for prosodic features.

6.2 Method and results

6.2.1 Frequency

The recordings were not made with head-mounted microphones as is recommended for studies in phonology (Klimes 2017), but with the internal microphone of the Zoom Q8 (see Section 3.1.2). While a head-mounted microphone only records the voice of a participant, a microphone placed in the room is susceptible to acoustic interferences. Nevertheless, all data were checked for audio quality, and intonation units with major interference were excluded. The data from speaker BLN had to be excluded entirely from the analysis: in the ADS-session, there

is constant overlap from a crying child. Once I had deleted those units with interference from other voices, there were not enough segments left for analysis.

For each intonation unit, F_0, F_{max} and F_{min} were extracted using Praat software (Boersma & Weenink 2021). Then a mean was calculated for each speaker in semitones for the sake of comparability. Calculating in semitones makes the data easier to interpret as they correspond to the musical scales. An interval of one semitone is clearly distinguishable for the human ear. The total frequency range was obtained by subtracting the mean F_{min} from the mean F_{max}. The frequency range analysed was 75–300Hz, all the values are provided in semitones (st, reference value 100 Hz).

The results for the frequency extraction are given in Table 6.1.

Table 6.1: Mean F0 (ADSm,CDSm), total F0 range (ADSr,CDSr), difference between ADS and CDS for mean F0 (MeanDiff) and difference between ADS and CDS for total F0 range (RaDi).

Age, ID	ADSm	CDSm	ADSr	CDSr	MeanDiff	RaDi
34, DCK	81.20	83.03	5.00	6.82	1.84	1.83
34, ARL	85.76	89.68	6.90	8.89	3.92	1.99
40, AVD	81.56	81.98	3.96	7.40	0.42	3.44
40, BCP	82.45	84.90	8.20	8.87	2.45	0.67
44, AMT	91.50	92.57	9.93	11.29	1.07	1.36
53, ABD	91.90	93.32	8.86	11.41	1.42	2.55
53, AGK	90.70	91.39	7.47	8.48	0.69	1.01
60, ALR	93.20	91.65	7.14	11.77	–1.55	4.63
67, DCM	81.27	81.84	5.14	10.42	0.56	5.28

The mean difference in fundamental frequency between ADS and CDS is 1.20 st (SD = 1.51), for frequency range it is 2.53 st (SD = 1.61). A Wilcoxon-test showed that the difference between CDS and ADS for mean F_0 is not significant ($Z = 6.0$; $p = 0.051$). For the total frequency range, the test showed that they differ significantly ($Z = 45.0$; $p = 0.008$). The results are illustrated in Figure 6.1 and Figure 6.2.

The difference in mean pitch ($r = -0.672$; $p = 0.047$) furthermore correlates negatively with the age of the child listeners, see Figure 6.3. As for MLU (Chapter 4), there is a turning point, at around 40 months, where the difference between ADS and CDS decreases.

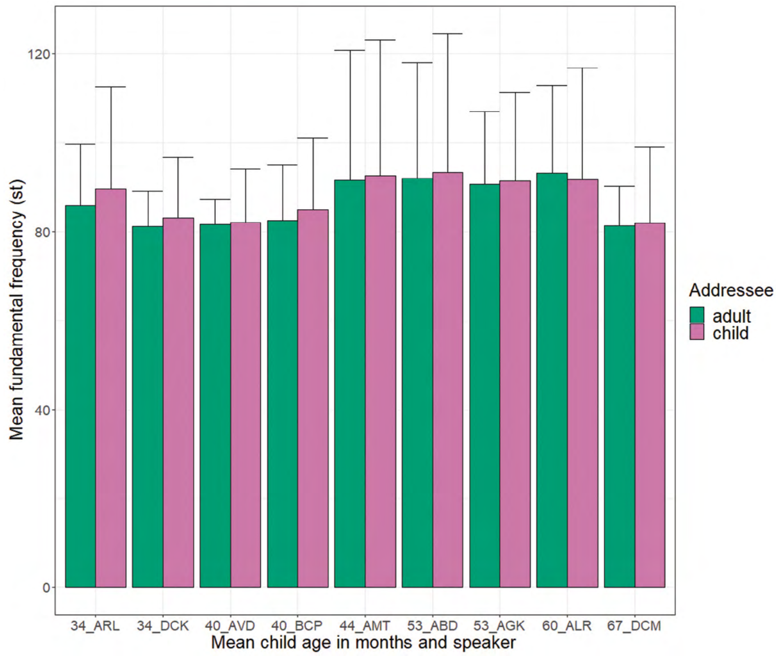

Figure 6.1: Mean fundamental frequency for ADS and CDS.

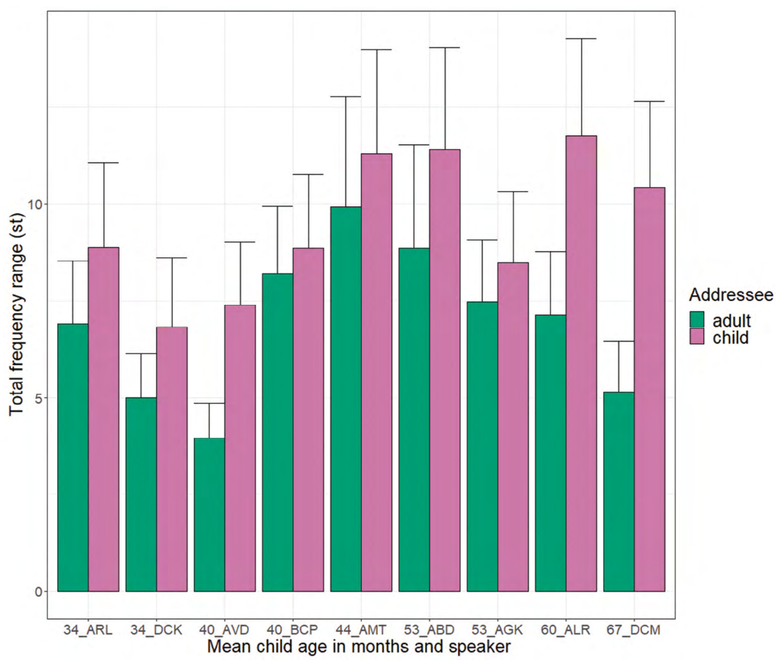

Figure 6.2: Total frequency range for ADS and CDS.

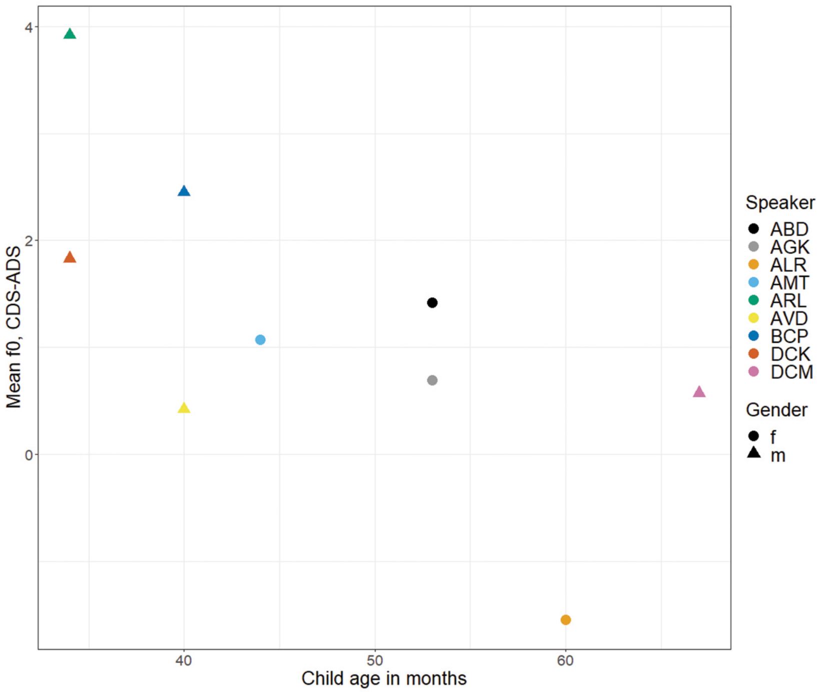

Figure 6.3: Difference between CDS and ADS for mean fundamental frequency.

Yet, the difference in pitch range does not diminish as the children mature (Spearman; r = 0.487; p = 0.183). On the contrary, at the upper age range of the child participants, the frequency ranges are even higher than for the younger children (ALR, DCM), see Figure 6.4.

This suggests that the turning point for the frequency range is later than the turning point for a higher mean fundamental frequency, as reported by Garnica (1977). In order to explore those pitch movements further, the following section briefly examines their location within IUs in Qaqet CDS in comparison to ADS. The highest pitch movements in Qaqet ADS are located IU-finally (Hellwig 2019). In order to investigate the pitch movements, I chose examples with largely similar content from CDS and ADS for two female speakers and one male speaker, and extracted their intonation contours (see Section 3.2.3).

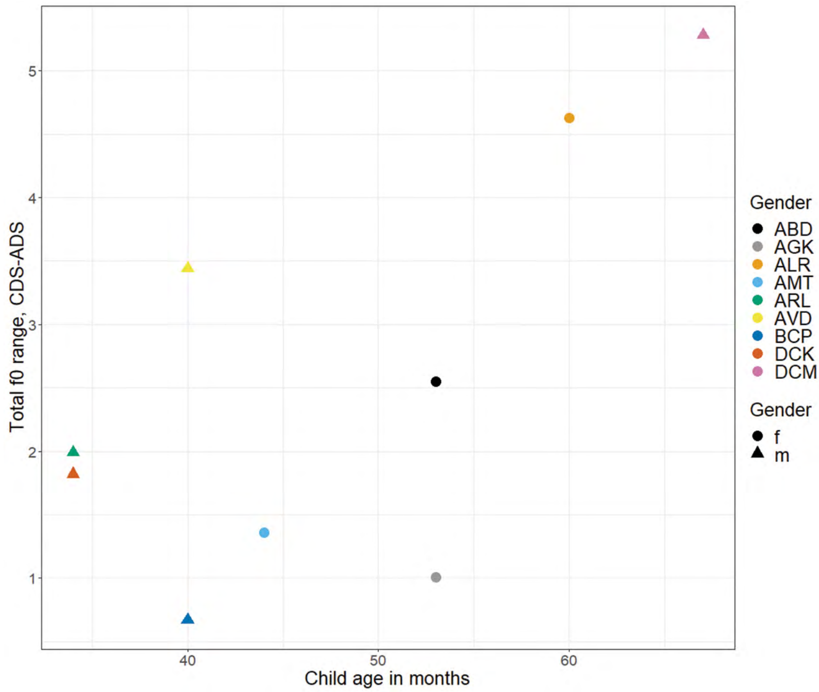

Figure 6.4: Difference between CDS and ADS for total frequency range.

Both in Figure 6.5 (44, CDS) and Figure 6.6 (45, ADS), there is a final rise-fall (CDS 3.3 st rise and 1 st fall; ADS 5.3 st rise and 1.2 st fall), and also a general downdrift in the utterances before the rise (CDS 3.9 st; ADS 2.9 st).

The steepest movements are likewise located at the end of the units.

(44) *qeqiuaiqiamanu*
ke=qiuaik i-a-manu
3SG.M.SBJ.NPST=run away-DIR-across
'He goes away' (PearBCPP 67)

(45) *qui qatden saqianamuk*
kui ka=tden se-ki
quoting 3SG.M.SBJ=come to/with-3SG.F
a-na-muk
DIR-back-across
'He comes with the things' (PearBCPA 030)

For ALR, both CDS (Figure 6.9, 46) and ADS (Figure 6.8, 47) show a general downdrift of 3st and a final fall (CDS 5.4 st; ADS 2st).

(46) *beiva deqatit*
de=ip-a de=ka=tit
CONJ=PURP-DIST CONJ=3SG.M.SBJ=go
'And he goes' (PearALRP 029)

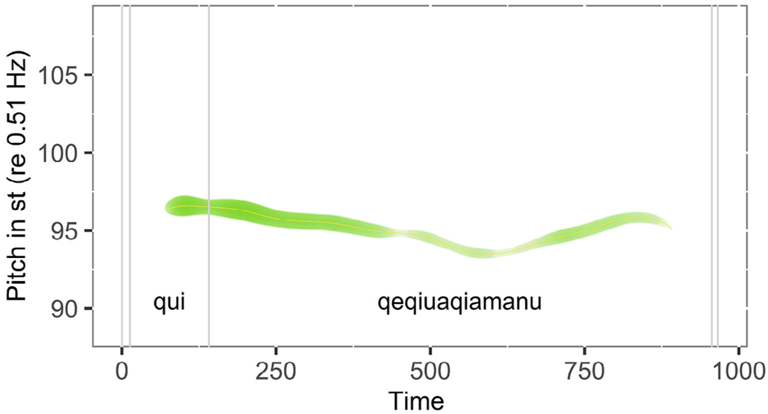

Figure 6.5: Íntonation contour for CDS (44), male speaker.

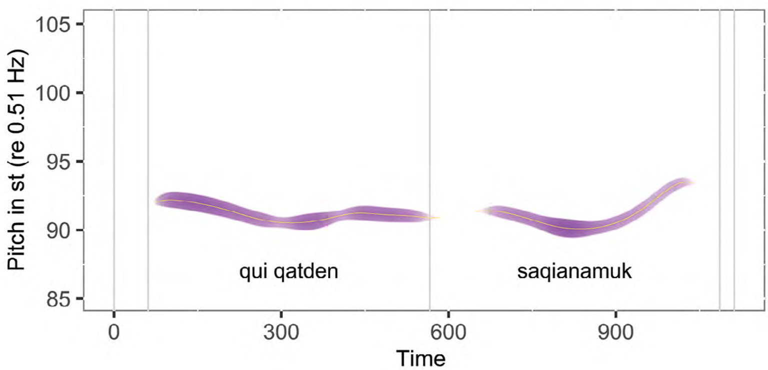

Figure 6.6: Intonation contour for ADS (45), male speaker.

(47) *luqa deqatit*
de=ka=tika lu-k-a
CONJ=3SG.M.SBJ=EMPH DEM-NC.SG.M-DIST
de=ka=tit
CONJ=3SG.M.SBJ=go
'And this man too he goes' (PearALRA 137)

The pattern repeats for the last speaker, AGK, for both CDS (Figure 6.9, 48) and ADS (Figure 6.10, 49). There are no major movements within the unit, but there is a rise of 7.5st followed by a fall of 6.7st in CDS and equally a rise of 9st followed by a fall of 4st in ADS, both in utterance final position.

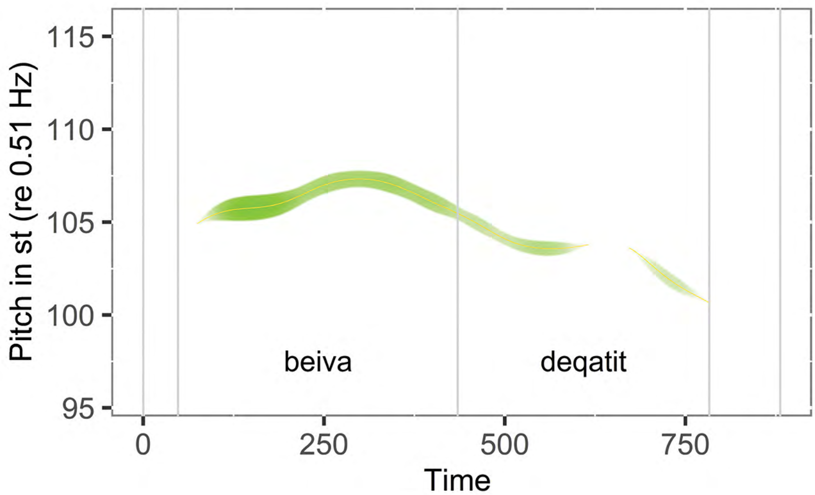

Figure 6.7: Intonation contour for CDS(46), female speaker.

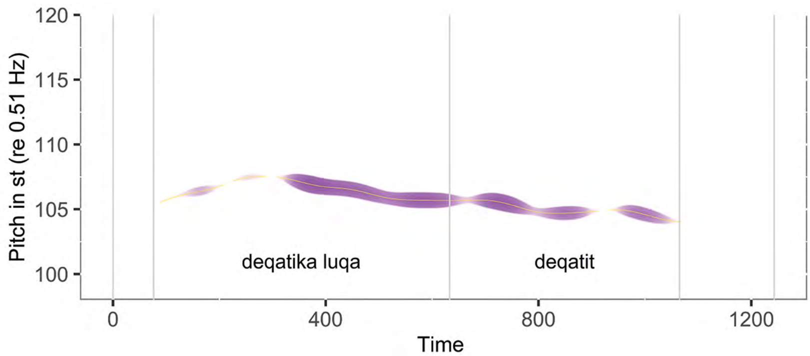

Figure 6.8: Intonation contour for ADS (47), female speaker.

(48) *amangerlmamga qatirinamuk*
ama=ngerlmam-ka ka=tit-i=ne=muk
ART=man/father-NC.SG.M 3SG.M.SBJ=go-SIM=from/with=across
'Another man comes' (PearAGKP 028)

(49) *luqa amangerlmamga qatirimanep*

lu-ka-a ama=ngerlmam-ka
DEM-NC.SG.M-DIST ART=man/father-NC.SG.M
ka=tit-i-manep
3SG.M.SBJ=go-SIM-down
'This man goes down' (PearAGKA 051)

Based on these primary insights, the hypothesis would be that the distribution of pitch contours in CDS mirrors the patterns found in ADS. The exaggerated pitch movements at the end of intonation could make it easier for children to identify the boundaries of intonation units, but not to identify boundaries within intonation units (e.g. at the word-level). This is further supported by the habit several children displayed when listening to the stories. They repeated the end of the previous adult utterances with the intonation of a polar question (see (50)). ZDL repeats the last part of his mother BLN's utterance two times, both times with the intonation of a polar question. BLN confirms both times.

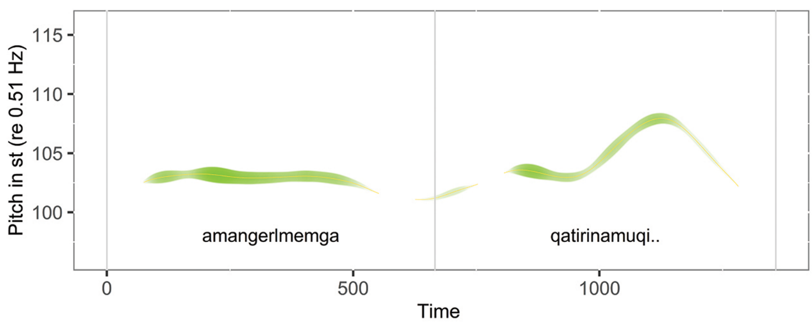

Figure 6.9: Intonation contour for CDS (48), female speaker.

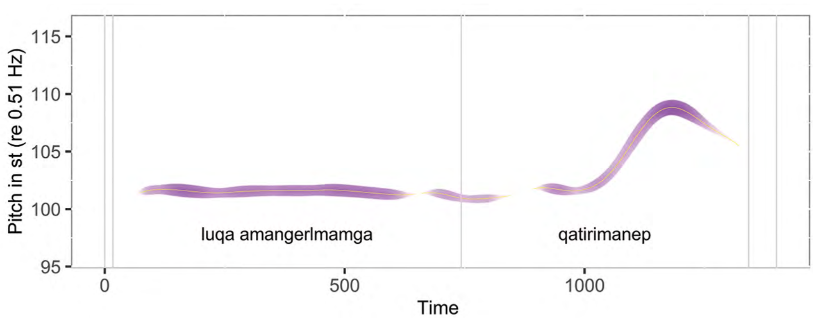

Figure 6.10: Intonation contour for ADS (48), female speaker.

(50) a. BLN: *iqeqiuaik daacarki*
i=ke=qiuaik
SIM=3SG.M.SBJ.NPST=run
de=aa=car-ki
LOC.PART=3SG.M.POSS=car-NC.SG.F
'And he runs by car.'

b. ZDL: *karki?*
kar-ki
car-nc.sg.f
'Car?'

b. BLN: *ee. amagilki*
ee ama=gil-ki
yes ART=small-NC.SG.F
'Yes, a small one.'

c. ZDL: *gilki?*
gil-ki
NM=small-NC.SG.F
'A small one?'

d. BLN: *mm* mm
yes
'Yes' (PearBLNP 54-60)

ZDL shows that his special attention is directed towards the part of the utterance that is marked by pitch movements. He echoes *gilki*, echoing his mothers' utterance incompletely. While providing feedback that he is attending to what his mother says, his utterance works equally as a clarification request that is confirmed by BLN *mm*.

A similar routine is described for children in Trackton, U.S. by Heath (2009):

> Here they seem to be remembering fragments of speech and repeating these without any active production. (Heath 2009: 91)

Heath described several 'stages of participation' Trackton children experience during their second year of life. The first stage is marked by complete imitation, followed by a stage that adds some variation to the theme. In the last stage, they fully enter the conversation. The first stage seems to be very similar to the Qaqet technique, but there is a slight difference. While Trackton children initially merely echoed what they heard, including the original intonation, the Qaqet children changed it into a polar question, which adults then confirm.

In this section, I have presented evidence that ADS and CDS in Qaqet differ in their intonation patterns, that the ends of utterances are prosodically prominent in Qaqet and that children also preferably attend to them. In Section 6.2.2, I compare the speaking rate of Qaqet ADS and CDS.

6.2.2 Speaking rate

The speaking rate was calculated by dividing the total number of words by the total duration of all intonation units of a single speaker, thereby obtaining words per second. The difference in speaking rate between ADS (m = 4.6; SD = 0.6) and CDS (m = 4.6; SD = 0.4), as revealed by a nonparametric Wilcoxon-test for related samples, is not significant (Z = 24.0; p = 0.721). Adults do not talk significantly slower to children than to adults. The individual results for each speaker are illustrated in Figure 6.11.

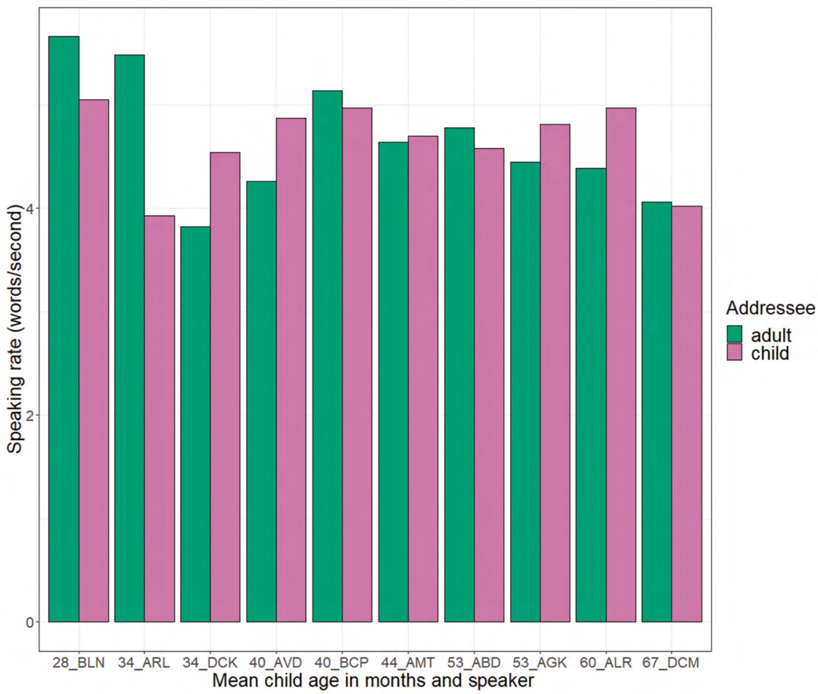

Figure 6.11: Speaking rate in words per second ADS vs CDS.

From Figure 6.11 we note that for the two speakers, BLN and ARL alone, the speaking rate is markedly lower in CDS than in ADS. Table 6.2 shows that the results obtained for Qaqet are totally different from the rates reported by Broen (1972). Broen recorded 132 words per minute in ADS, while in Qaqet I recorded 280.2. For CDS, the numbers also differ: while there are 278.7 words per minute in Qaqet, Broen recorded 115 words per minute.

Table 6.2: Words per minute CDS and ADS in comparison with results from Broen (1972).

Language	ADS	CDS
English	132	115
Qaqet	280.2	278.7

This considerable difference is partly caused by my methodological decision to count clitics as full words. Furthermore, the exclusion of inter-IU pauses in the Qaqet count has to be considered. Goldman-Eisler (1973) found that speaking rate depends on time spent pausing, not on time spent articulating. This might also explain the missing difference between CDS and ADS in the present study. O'Grady (2005) reported for English that the pauses in CDS were longer than in ADS. My testing procedure, excluding those pauses, thus may have failed to measure the desired variable. Accordingly, I measured the mean pause length for each speaker in CDS and ADS, respectively. I analysed only pauses between two IUs by the same speaker. The results are displayed in Table 6.3 and Figure 6.12.

Table 6.3: Mean pause length (ms) ADS and CDS, standard deviation (SD) and difference between ADS and CDS (diff).

Age, ID	ADS Mean	ADS SD	CDS Mean	CDS SD	diff
28, BLN	567.51	577.504	495.95	500.936	–71.56
34, ARL	846.16	650.690	545.68	430.094	–300.49
34, DCK	715.32	626.995	977.65	587.228	262.33
40, AVD	1,149.54	755.115	920.71	579.162	–228.82
40, BCP	786.70	667.048	803.67	661.535	16.97
44, AMT	596.79	697.551	643.97	439.862	47.18
53, ABD	837.59	672.605	851.09	645.334	13.50
53, AGK	676.50	639.208	739.43	723.681	62.92
60, ALR	679.84	723.056	792.06	674.915	112.23
67, DCM	1,163.60	882.361	1,019.23	780.095	–144.37

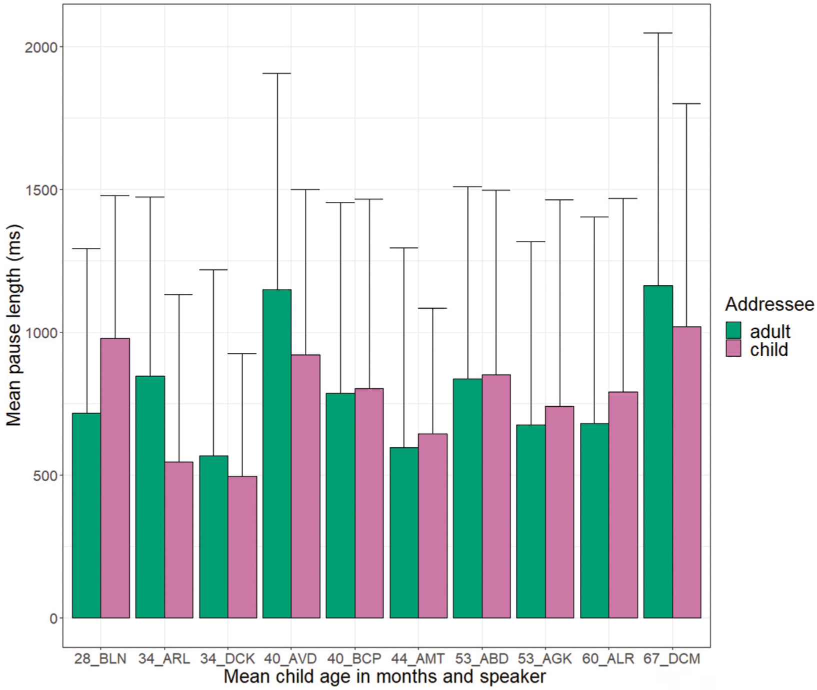

Figure 6.12: Pause length CDS vs ADS.

A Wilcoxon-test confirmed that CDS does not differ significantly from ADS in pause length ($Z = 25.0$; $p = 0.799$). Neither does the difference in pause length between ADS and CDS correlate with child age (Spearman coefficient: $r = 0.079$; $p = 0.828$). From Figure 6.12, I noticed that the (comparably) shorter pause lengths seem to be found in the stories directed at the talkative children. I therefore tested if there was a correlation between CDS pause length and the number of child utterances, but did not find one ($Z = 0.644$; $p = 0.061$).

6.3 Summary: Prosodic features of CDS in Qaqet

To summarise, speaking rate does not differ between CDS and ADS but is exceptionally high when compared to previous results (Broen 1972). Impressionistically, the pace of speech in both CDS and ADS is quite high. However, both the mean fundamental frequency (with near-significance) and the total frequency range differ between CDS and ADS

in Qaqet. The mean fundamental frequency is furthermore negatively correlated with child age: the biggest differences between ADS and CDS are found in speech to children of up to 40 months of age. For all of the older children, the difference is around one semitone.

While the mean fundamental frequency difference decreases with increasing child age, the highest frequency ranges are found in speech towards the oldest children. This is consistent with findings from Garnica (1977). She found that the increased frequency range persisted longer in speech towards children than the increased mean pitch. With regard to their function, it seems likely that the pitch modifications serve to attract the children's attention. This is a necessary condition to fulfill common communicative goals (Broesch & Bryant 2014). Additionally, the modifications may signal positive emotional affect (Fernald & Mazzie 1991).

Preliminary results indicate that the largest pitch movements are located utterance-finally in both CDS and ADS. The attested intonation contours in Qaqet serve different communicative functions (Hellwig 2019). In the above discussion, I have presented contours that signal non-final and final units of declarative utterances. These are, by nature, connected to the organisation of turns. The indicators of these functions are promoted into a more salient position by exaggerating their frequency range. The communicative function is therefore also salient in children's perception. This is indicated by evidence that Qaqet children repeat the ends of utterances. Possibly, then, the attested differences could be helpful in the acquisition of turn-taking practices by directing the listeners' attention to the relevant modifications. Attracting and directing children's attention will again be a salient topic in Chapter 7 on speech acts.

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