The prosody of yes/no-questions in German first language acquisition

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Previous research of adult speech has shown that declarative statements (DCLs) in German are frequently accompanied by a falling pitch contour, whereas yes/no-questions (YNQs) are marked by a rising pitch contour. The most common intonation patterns are a H*L-% pattern for DCLs and a L*H-^H% pattern for YNQs (e.g. [1], [2]). Regarding the realisation of pitch contours in early childhood, [3, 4] reports that English-learning 1-year-olds do not actively control sentence intonation and that pre-schoolers have difficulties with rising intonation. Instead of rising f0, 4-year-olds rely on a longer final syllable duration to signal interrogativity, 7-year-olds use a combination of rising f0 and longer final syllable duration and only 11-year-olds are able to rely on f0 alone ([5] for children acquiring English). However, there are also studies suggesting good intonational control in 2- and 3-year-old German and Spanish monolingual children ([6]).

In order to find out more about children's phonetic and phonological realisation of intonation, we conducted a production experiment, eliciting YNQs and DCLs from 12 monolingual German-learning 2.5- to 4-year-olds. In the first phase of the experiment, children watched a hand puppet play, which set the scene for the elicitation phase. In this second phase, children examined one of the hand puppets with a doctor's bag and the experimenter encouraged the child to address the hand puppet with DCLs and YNQs. Recordings were labelled for boundary tones and pitch accents according to the GToBI annotation system ([1]), as well as for f0 minima and maxima within the range from the final accented syllable to the right boundary tone. Pitch range was calculated in semitones (st).

Our results show that across all age groups, DCLs are predominantly marked by falling pitch contour and realised with a L-% boundary tone (fig. 1), even though the youngest age group is not as consistent in the prosodic realisations as the two older groups. In order to mark an utterance as a YNQ (fig. 2), 2.5- to 3-year-olds produce both falling (63%) and rising patterns (37%), with L-% being the most common boundary tone overall. Rising tones are realised as either H-% or H-^H%. 3- to 3.5-year-olds have no problems producing rising intonation (94%), which is realised phonologically with L-H% or the adult-like pattern H-^H%. The same is basically true for the oldest age group (75% rises, 25% falls; the high number of falls in this group is due to the productions of a single child who consistently produced falling utterances). For the analysis of pitch range, a linear-mixed-effects regression model revealed that age group has no effect at all, whereas there is a significant effect of contour ($p = 0.03$). The range of rising utterances (av. 6.11st) is on average 1.52st larger than that of falls (av. 4.59st; fig. 3).

Overall, these data support the conflicting findings from previous studies in that they offer two main insights. First, similar to e.g. [6], our study shows that children of all age groups are able to manipulate intonation in order to distinguish YNQs and DCLs. We find evidence that rises are produced with a larger pitch range than falls from an early age on. Second, age effects become visible with regard to the distribution of falls and rises across sentence types, supporting studies reporting difficulties with YNQs ([5], [3, 4]). The two older age groups use the appropriate direction of intonation (rise for YNQ, fall for DCL) rather consistently and they mostly use an adult-like phonological accent realisation. There is, however, a lot of variability, both phonetically and phonologically, in 2.5- to 3-year-olds' productions, especially with regard to YNQs. This could mean that children younger than 3 years of age are still uncertain about which intonational pattern to use. It thus seems that the problem with YNQ intonation is not producing such patterns *per se*, but rather of producing them consistently and in the appropriate semantic context.

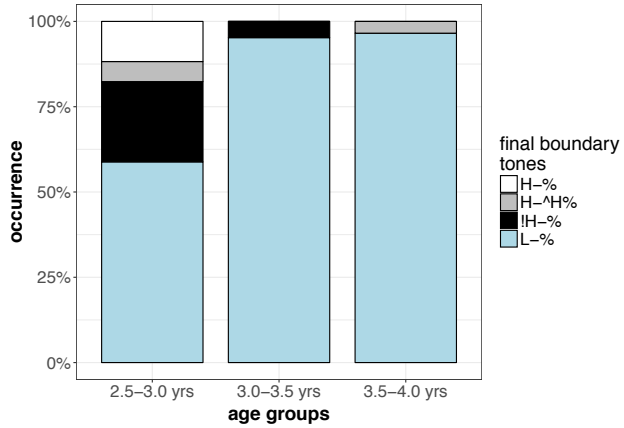

Fig. 1: *Realisation of the final boundary tone in DCL targets by age group (on average 22 utterances per age group).*

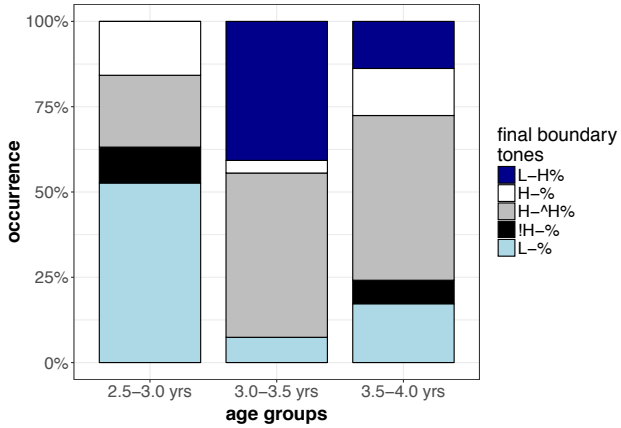

Fig. 2: *Realisation of the final boundary tone in YNQ targets by age group (on average 25 questions per age group).*

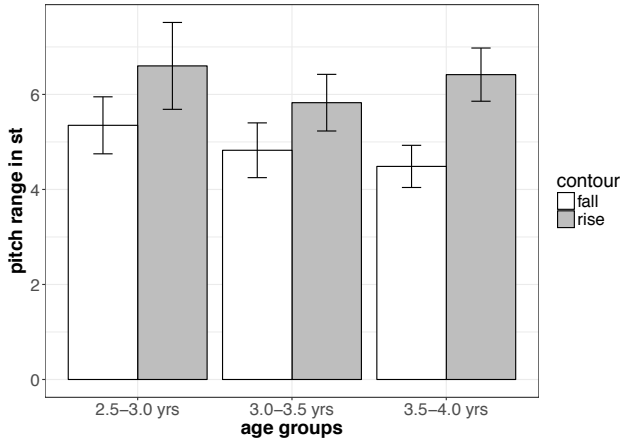

Fig. 3: *Pitch range in falling and rising utterances by age group (whiskers represent standard errors).*

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