Intonation of polar questions produced by German 2.5- to 4-year-olds

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Background

Polar questions and statements in German adult speech

	polar questions (YNQs)	declarative statements (DCLs)
pitch contour	mostly rising	mostly falling
pitch range	large	small
word order	VSO(V)	SVO(V)
answer	required	not required
example	L* H-^H% Trinkt Peter Kaffee? 'drink-3SG. Peter coffee' 'Does Peter drink coffee?'	H* L-% Peter trinkt Kaffee. 'Peter drink-3SG. coffee' 'Peter drinks coffee.'

(e.g. Grice et al. 2005, Van Heuven & Haan 2000, Wochner et al. 2015)

Background

Production of pitch contours in first language acquisition

Snow (2002, 2004)

- English 1-year-olds do not actively control sentence intonation.
- English 1-year-olds' pitch range is narrower compared to that of pre-schoolers.
- English 4-year-olds have more difficulties realising an adult-like accent range in rises than in falls.

Patel & Grigos (2006)

- English 4-year-olds use a longer final syllable duration to signal interrogativity.
- English 7-year-olds use a combination of rising f0 and longer final syllable duration.
- Only English 11-year-olds can manipulate f0 as a single cue to signal a question.

Lleó & Rakow (2011)

- German and Spanish 2- and 3-year-olds show good intonational control in rising pitch contours and large pitch ranges of YNQs.

Background

Summary of the literature:

- different findings for children's realisation of pitch contours and pitch ranges in German and English (Snow 2002, 2004, Patel & Grigos 2006, Lleó & Rakow 2011)

Research questions:

In the period between 2.5 and 4 years of age,

- do children use rising vs. falling contours to distinguish YNQs from DCLs?
- does age affect their realisation of pitch range for YNQs?

Hypotheses:

H1: German children use rising vs. falling contours to distinguish YNQs and DCLs from an early age on.

H2: Pitch range increases as a function of age.

H3: Rises are produced with a larger pitch range than falls from an early age on.

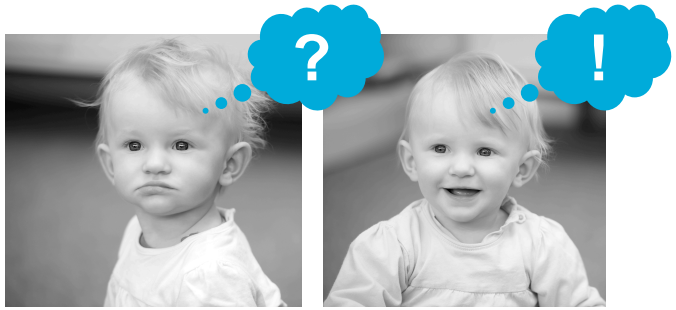
Experiment

Participants:

12 monolingual German-learning children between 2.5 and 4 years of age
(5 female)

The subjects were divided into the following age groups (4 children per age group):

- **age group 1** (age range = 2;8 – 2;10, mean age = 2;9)
- **age group 2** (age range = 3;1 – 3;4, mean age = 3;2)
- **age group 3** (age range = 3;10 – 4;0, mean age = 3;10)



Experiment

Set-up

- 2 hand puppets
- 1 doctor‘s bag
- 1 camcorder

Experiment

Procedure

Familiarization phase
hand puppet play

Test phase
elicited production/imitation task
(Crain & Nakayama 1987)

Experiment

Procedure

Familiarization phase
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Test phase
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Experiment

Procedure: Test phase

Elicited production/imitation task (Crain & Nakayama 1987):

- The child examined one of the hand puppets with instruments of the doctor's bag.
- The experimenter encouraged the child to address the hand puppet with DCLs and YNQs.

Experiment

Materials: Test phase

Stimuli:
16 target sentences (8 YNQs, 8 DCLs), direct/indirect speech, main/modal/copula verb in present tense, random order

(1) Target sentences for DCLs:

a. "*Bitte sag Max: Wir müssen das Bein verbinden*."
   Please tell Max: We have to bandage the leg.

b. "*Bitte sag Max, dass er bald wieder gesund ist*."
   Please tell Max that he will recover soon.

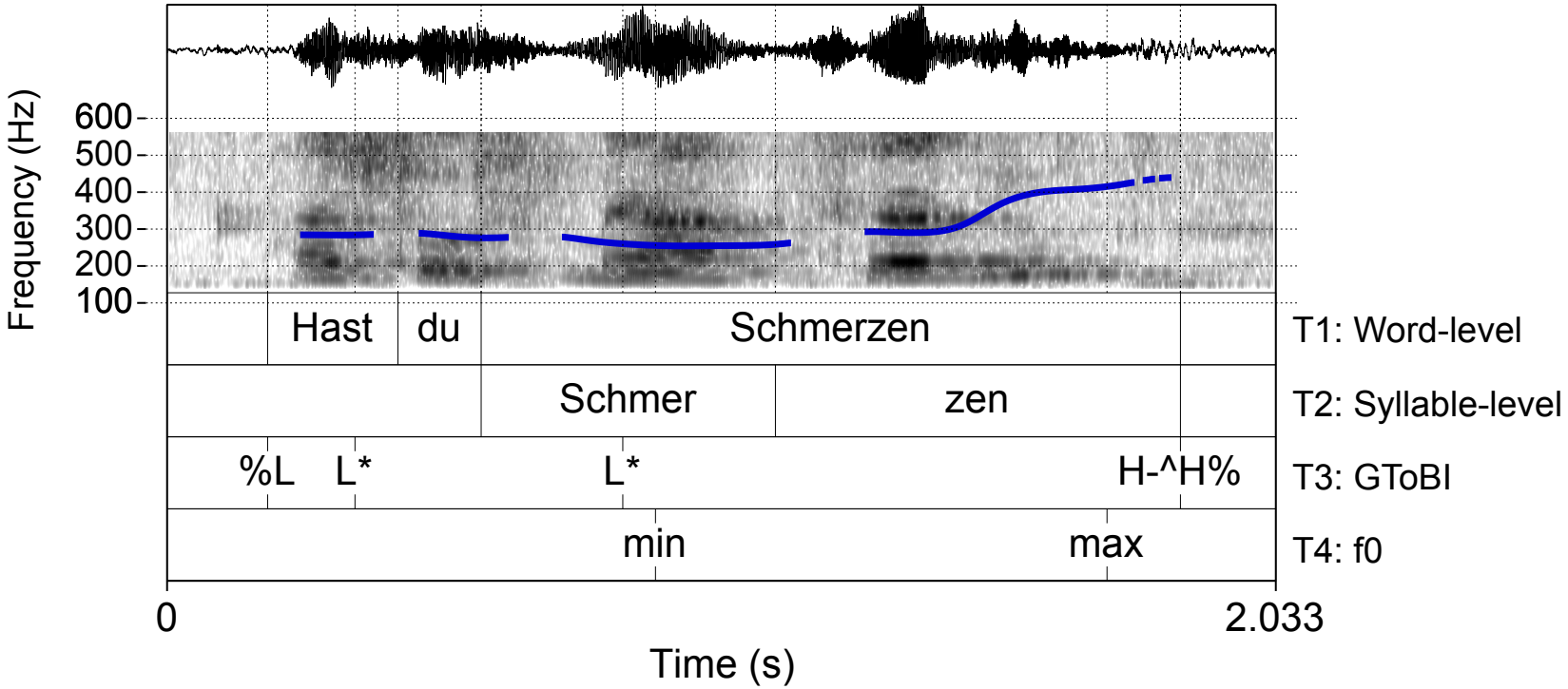
(2) Target sentences for YNQs:

a. "*Bitte frag Max: Tut das weh*?"
   Please ask Max: Does it hurt?

b. "*Bitte frag Max, ob er den Mund aufmachen kann*."
   Please ask Max whether he can open the mouth.

Experiment

Data analysis

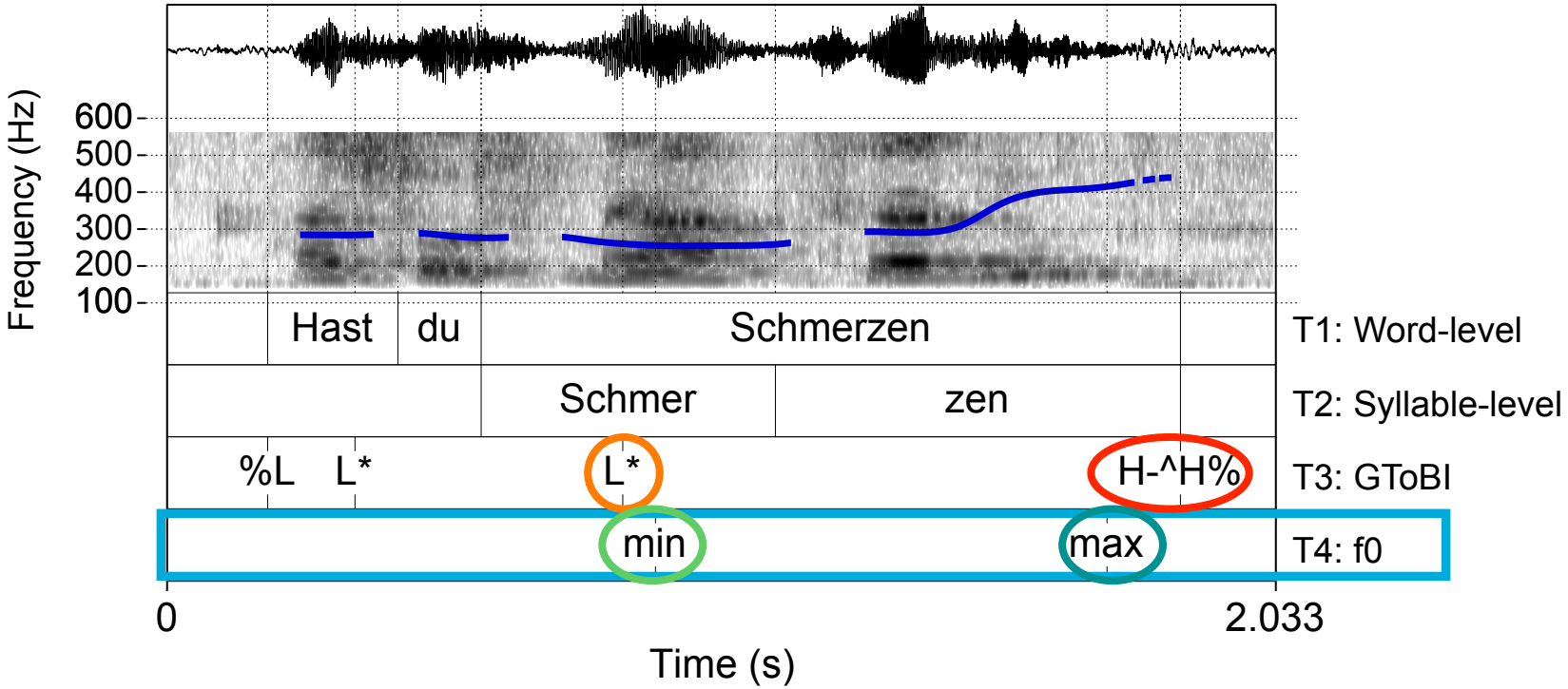


Lars (3;10)

‘Are you in pain?’

Experiment

Data analysis

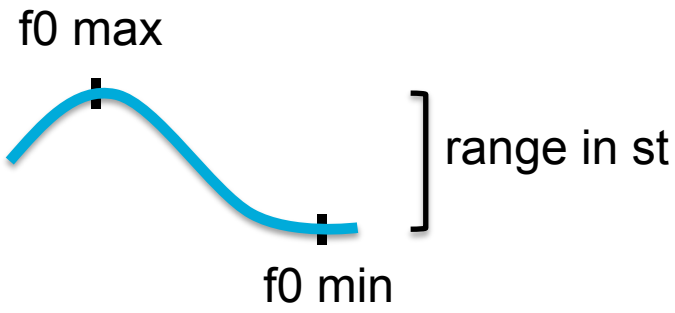


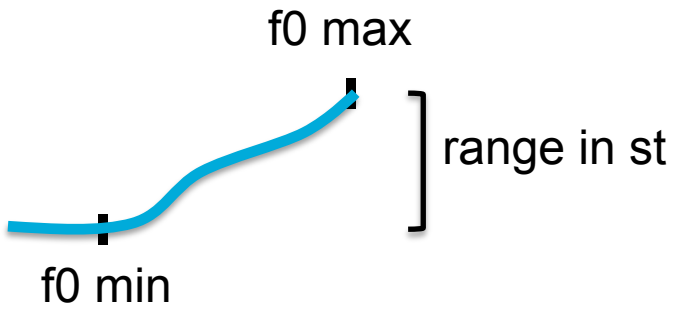
Tier 4: f0 between the final accented syllable and the right boundary tone

- **For pitch contour (rise/fall)**: f0 minima & f0 maxima were measured in Hz.
- **For pitch range:** The range was measured in semitones (st).

Experiment

Data analysis





falling contour

Willi (3;10)

Das machst du gut.
'You are doing well.'

rising contour

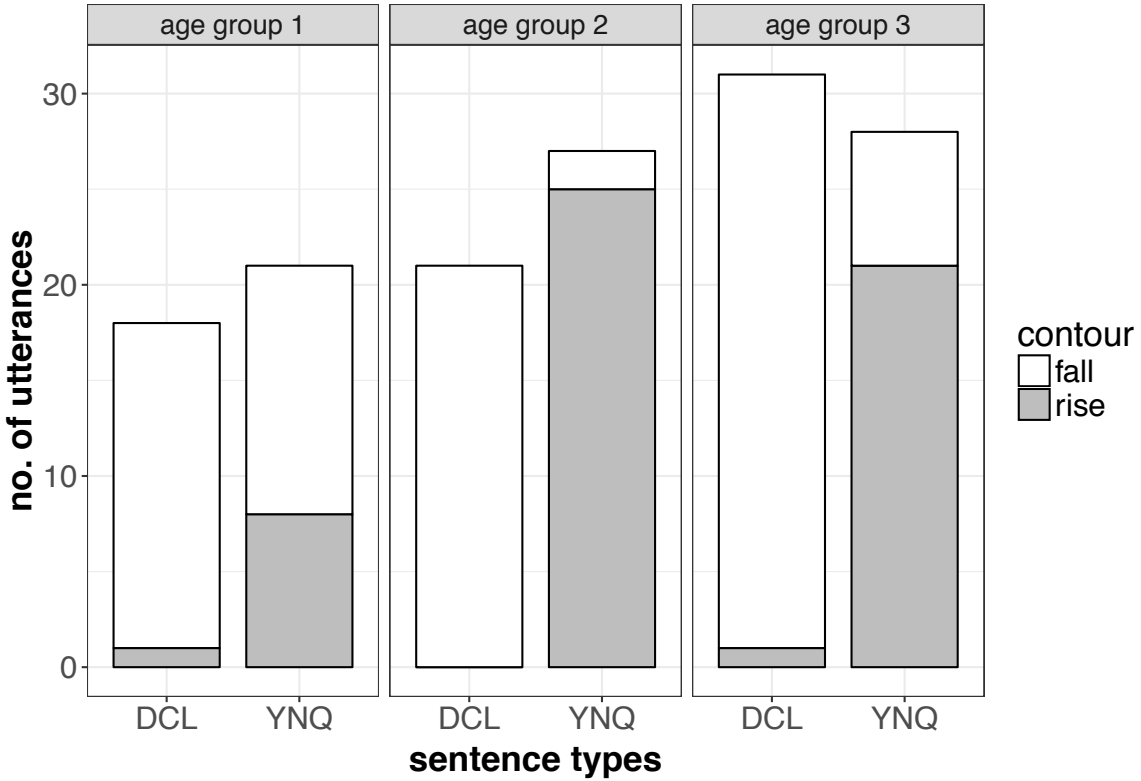
Lars (3;10)

Hast du Schmerzen?
'Are you in pain?'

Results: pitch contour

DCLs:
predominantly
falling contour,
independent of age

YNQs:
rising contour
more reliably in
3- to 4-year-olds



General linear mixed effect model (Jaeger 2008): DV: contour; IV = age group

glmer(contour ~ age group + (1 | subject) + (1 + age group | item), data = data set, family = “binomial”)

- significant differences of *contour* use between the youngest and the two older age groups in YNQs (1 vs. 2: p = 0.01, 1 vs. 3: p = 0.04)
- no significant difference between the two oldest age groups in YNQs (p = 0.2)

Results: pitch range

Linear mixed effect model (Baayen 2008): DV: range; IVs = contour, age group

lmer(range ~ contour * age group + (1 + contour | subject) + (1 + age group | item), data = data set)

- significant effect of *contour* (p = 0.03) → range in rises higher than in falls
- no significant effect of *age group* (p = 0.7)
- no significant interaction between *contour* and *age group* (p = 0.4)

Discussion: pitch contour

- DCLs are predominantly marked by a falling contour, independent of age.
- YNQs are marked by a rising contour more reliably in the two older age groups than in the youngest age group.

Aspects that may play a role:

- Perhaps, age group 1 is still uncertain about which intonational pattern to use.
- Perhaps, the production of rises requires more effort than the production of falls (see Lieberman 1967).
- Perhaps, age group 1 is able to produce a rising contour for YNQs, but cannot do that consistently.

Discussion: pitch range

- All children produced a higher pitch range for rises than for falls.
- The youngest age group was able to produce the same pitch ranges for YNQ intonation as the older children.

H2: Pitch range increases as a function of age. ✖

→ No evidence that age affects the realisation of pitch range for rises

H3: Rises are produced with a larger pitch range than falls from an early age on. ✔

→ Evidence that rises are produced with a larger pitch range than falls from an early age on

General Discussion

sentence type	age groups	pitch contour	pitch range
DCLs	all age groups	fall	smaller (4.59st)
YNQs	age group 1	fall and rise	larger (6.11st)
	age group 2	rise	
	age group 3	rise	

H1: German children use rising vs. falling contours to distinguish YNQs and DCLs from an early age on.

→ German children start using native-like intonation patterns fairly early.

→ Children do not have problems producing rises *per se*.
Rather, the youngest participants had problems selecting the appropriate contour for YNQs.

Future studies will address…

- how intonation and syntax interact in the acquisition of YNQs.
- the comprehension of rising and falling intonation in short sentences.

Thank you.
Questions or comments?

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H3: Rises are produced with a larger pitch range than falls from an early age on. ✔