[1]University of Bremen, [2]University of Cologne, [3]University Medical Center Hamburg-Eppendorf

The acquisition of finite verb morphology in hearing impaired children

Eva Wimmer[1,2], Martina Penke[2], Johannes Hennies[1,3], Monika Rothweiler[1], Markus Hess[3]

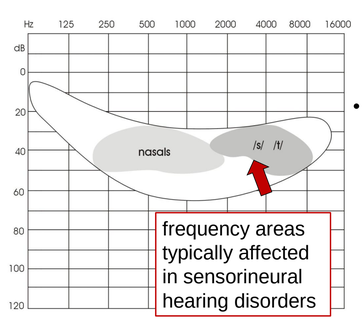
Introduction

Children with hearing impairment

- to date little is known about language acquisition in children with permanent hearing impairment (HI)
- intact hearing is important for an unimpaired language acquisition
- HI children have only restricted access to spoken language input during the ‚critical' years for acquisition - despite modern hearing aids

➡ **deficits in language acquisition are expected**

Phoneme perception difficulties due to HI



‚speech banana', based on Fant (2004), Lindner (1992)

- coronal consonants like /s/ and /t/ are more difficult to perceive than nasals

Subject-verb-agreement in German

	Present Tense forms of *lachen* (laugh)
1.Sg.	lach-(**e**)
2.Sg.	lach-**s(t)**
3.Sg.	lach-**t**
1.Pl.	lach-(**e**)**n**
2.Pl.	lach-**t**
3.Pl.	lach-(**e**)**n**

The coronal consonants **/s/, /t/** and **/n/** mark subject-verb-agreement in German.

Aims of the study

Do children with moderate HI have deficits in the acquisition of finite verb morphology?

Do difficulties in perceiving specific speech sounds lead to
- omissions in HI children's language production and
- deficits in acquiring the agreement system in HI children?

Predictions

nasals (/n/, /m/) ⟷ **/s/, /t/**

- unimpaired in perception
  ➡ unimpaired in production
  ➡ no difficulties in acquiring the inflectional marker -n

- impaired in perception
  ➡ impaired in production
  ➡ difficulties in acquiring the agreement markers *–s(t)* and *-t*

Method

Subjects

group	sex	Age at first testing	IQ*	Hearing level unaided	ASFT (aided speech field thresholds)	Age at onset of HA fitting
HI (n=19)	11f, 8m	ø 3;11 (3;2-4;10)	101 (78-120)	ø 57 dB (32-78)	ø33 dB (20-50 dB)	ø 1;7 (0;3-4;0)
TD (n=19)	9f, 10m	ø 3;10 (3;0-5;0)	106 (86-124)			

Hearing impaired (HI) children:

- moderate hearing loss
- congenital hearing impairment due to bilateral sensorineural hearing loss
- monolingual German, no sign language input
- no other physical or cognitive impairments

Typically developing (TD) children

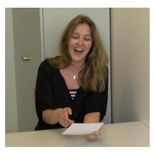
- normal language development according to standard test (SSV, Grimm 2003)
- monolingual German
- normal hearing, no physical or cognitive impairments

*IQ scores measured by standardized nonverbal intelligence screening (Tellegen et al. 2007)

Video description task

- **Method**: Elicitation task: description of action depicted in 30 short silent video scenes
- actions performed by a single child, two children or investigator

target: ‚Du lach**st**'
(you are laughing)



- 30 video scenes, contexts:

– *s(t)* (2.p.sg.), e.g. Du lach**st** (‚you are laughing'): *n* = 10
– *t* (3.p.sg.), e.g. Der Junge koch**t** (‚the boy is cooking') *n* = 10
– *n* (3. p.pl.), e.g. Die Kinder tanze**n** (‚the children are dancing') *n* = 10

Picture naming

- **method:** naming of objects on picture cards

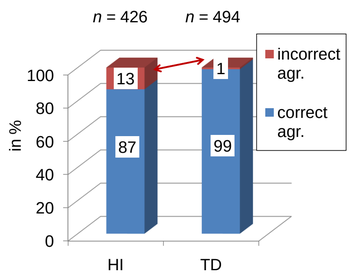
experimenter: What's this?
target: Ei**s** (‚ice cream')

- **target nouns:** simplex nouns, stems ending in (/s/, /t/, /n/)
- 18 objects
- contexts (*n* = 22):

– /s/ e.g. Ei**s** (‚ice cream'): *n* = 8 (2 /ts/)
– /t/: e.g. Hu**t**,(‚hat') *n* = 8 (2 /st/)
– /n/: e.g. Kuche**n** (‚cake') *n* = 6

Results

Video task: correctness scores

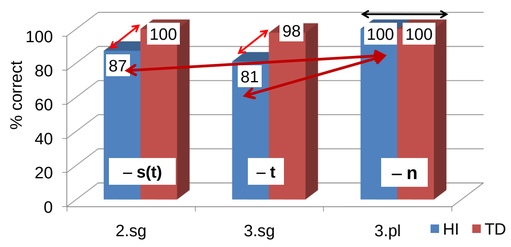


criteria for analyzable utterances:
- ✓ related to the picture
- ✓ overt subject
- ✓ only main verbs
- ✓ > 6 analyzable utterances per child

HI children: significantly more agreement errors (omissions and substitutions) than TD children (*MWU*: $p = 0.000$).

Video task: Obligatory context analysis

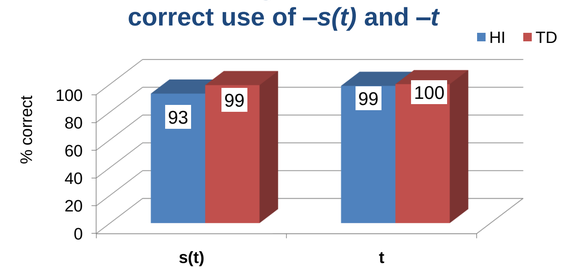
Correct responses for the different verbal affixes



HI children:
- significantly more errors in contexts for verb forms on *–s(t)* and *–t* in contrast to *–n (Wilc.*: each p < 0.05)
- correctness scores for *–s(t)* and *–t* differ significantly from TD group (*MWU*: each p < 0.01)

Video task: Analysis of occurrence

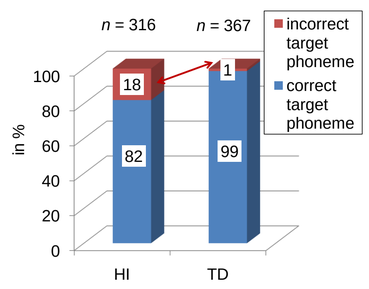
correct use of *–s(t)* and *–t*



If a suffix *–s(t) or –t* is used, it is nearly always applied correctly by HI children.

➡ **HI children have acquired the morphosyntactic content of the agreement morphemes *–s(t)*, *–t* and *–n***

Picture naming task: correctness scores



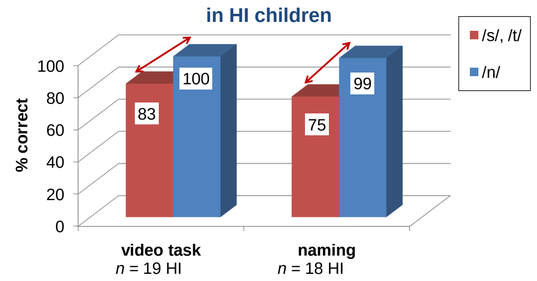
criteria for analyzable utterances:
- ✓ target noun clearly recognizable
- ✓ failures and incorrect namings not analyzed

‚correct' scoring if target consonant was realized

HI children: significantly more incorrect realizations of target nouns than TD children (*MWU*: $p = 0.000$).

Comparison of results in both tasks

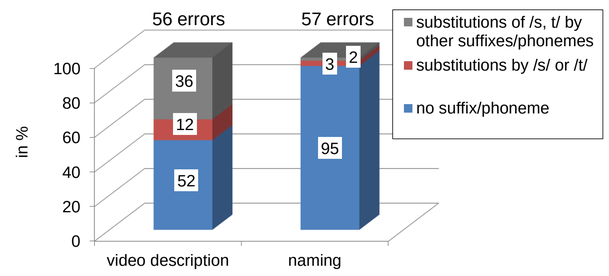
correctness scores for words with word final /s/ and /t/ vs. /n/ in HI children



Parallel performance pattern in both tasks: significant difference in correctness scores between words ending in /s/ or /t/ and words ending in /n/.

Error types produced by HI children

in video description and naming task



Majority of errors in HI children: omissions of phonemes /s/ and /t/ in both tasks.

➡ **Omissions of /s/ and /t/ are related to the acoustic properties of these phonemes - independent of their morphosyntactic function (agreement marker or stem final consonant)**

Discussion

- ✓ Have HI children acquired the subject-verb-agreement system? **Yes!**
- ✓ Is there a correspondence between results in the video description task where the phonemes /s/ and /t/ function as agreement markers and the picture naming task where they do not carry morphosyntactic content? **Yes!**
  - – s/ and /t/: omitted or substituted by other phonemes
  - – nasals: reliably produced whether or not they constitute affixes or stem final consonants
- ➡ The likeliness to avoid the production of an inflectional ending is not related to the morphosyntactic content of these affixes, but to the acoustic properties of the phonemes expressing these affixes.

Conclusion

- ➡ The data indicate that the production of inflectional morphology is selectively affected in German children with moderate HI.
- ➡ The observed agreement errors are not due to a deficit in acquiring the morphosyntactic content expressed by inflectional affixes, but due to problems in *perceiving* and *processing* the relevant phonemes used as inflectional affixes.

Our study provides an example for the remarkable resilience of language acquisition in the face of degraded input.

References

Fant, G. (2004): Speech related to pure tone audiograms. In: G. Fant (ed.): *Speech acoustics and phonetics: selected writings*. Dordrecht [u.a.]: Kluwer, 216-223.

Hennies, J., Penke, M., Rothweiler, M., Wimmer, E. & M. Hess (submitted): Testing the Phonemes relevant for German Verb Morphology in Hard-of-Hearing Children: The FinKon-Test. *Logopedics Phoniatrics Vocology*.

Lindner, G. (1992): *Pädagogische Audiologie: Ein Lehrbuch zur Hörerziehung*. Berlin: Ullstein Mosby.

Penke, M., Wimmer, E., Hennies, J., Rothweiler, M. & M. Hess (2011). *The acquisition of finite verb morphology in hearing impaired children.* Unpublished manuscript.

Tellegen, P.J. & J.A. Laros (2007): *SON-R 2½-7. Non-verbaler Intelligenztest.* [German standardization by P.J. Tellegen, J.A. Laros & F. Petermann]. Göttingen: Hogrefe.

Acknowledgements

This study is part of our research project funded by the DFG (German Research Foundation) - RO923/1-1, HE 2869/6-1