Acquisition of syntactic question types in children who are hard-of-hearing

Mark VanDam & Kellie Jean Carns

mark.vandam@wsu.edu | labs.wsu.edu/vandam
Department of Speech & Hearing Sciences
Elson S. Floyd College of Medicine
Washington State University

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Research Questions

1. **Are there fewer overall questions addressed to hard-of-hearing or typically-developing toddlers?**
2. **How does the syntactic complexity of presented question type differ between hard-of-hearing and typically-developing toddlers?**
3. **Does exposure to questions impact the quantity of child question use?**

Background

Talkers have been shown to present simpler, less complex syntactic forms to listeners who have immature or disordered language (Lombard, 1911). There is debate concerning what impact, if any, this altered input may have on childhood development of speech and language. This is especially so for populations with disorders, such as children with hearing loss. The present work attempts to document the syntactic input to children with hearing loss compared with their typical peers.

Children who are **hard-of-hearing (HH)** have been documented to have delays in syntactic question production and comprehension and show a greater degree of variability in syntactic skills as compared with **typically developing (TD)** peers (Shirmer, 1985; Blamey, 2001). Parents have been shown to alter the content of child-directed speech based on children's linguistic abilities in families with preschoolers who are TD (Goodnow & Collins, 1990; Rowe, 2008) and HH (VanDam & De Palma, 2015). Thus, both syntactic input and output has been shown to be associated with dyadic talker and listener characteristics.

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Method

Participants

43 families: TD (n=14), HH (n=29). The sample was 58% girls (mean age = 29.8 months) The HH children wore hearing aids (BEPTA = 47.8 dB HL; SD = 11.7 dB; range = 24-70 dB) and had no other known disabilities. All children but one were identified as HH early, with intervention averaging 5.1 months of age. All children were involved in a larger longitudinal study.

Materials

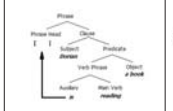
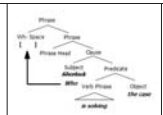
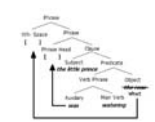
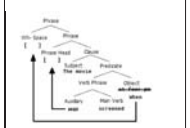
Audio was collected using the LENA system (Language ENvironment Analysis; LENA foundation, Boulder, CO) and custom software developed in MATLAB. A small wearable recorder collects up to 16 hours of audio.

Procedure & Data Analysis

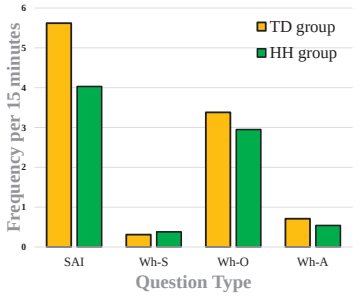
Each of the 43 families contributed a whole-day audio recording during a typical family day. Recordings were processed by LENA automatic speech recognition (ASR) software. Recordings were automatically segmented and labeled for talker and conversational detail. For each recording, the 3 non-adjacent 5-minute segments with the greatest number of conversational turns were excised and transcribed using CLAN (MacWhinney, 2000). 645 total minutes were transcribed by two transcribers. Transcription reliability was assessed by correlations > .77 for all variables of interest (Matalone et al, 2015).

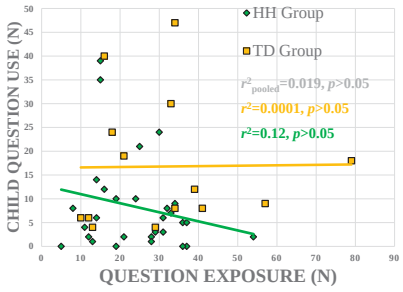
Clan transcriptions were coded for syntactic constructions of questions. Questions formed by intonation-alone, tag construction, or apparent/contextual questions in interrogative or other syntactic form were considered in the total Question Exposure variable, but not individually considered. Together, these question types contributed less than 1% of total data.

Syntactic complexity of questions

TYPE	Subject-auxiliary inversion	*wh*-subject	*wh*-object	*wh*-adjunct
ABBREV	SAI	Wh-S	Wh-O	Wh-A
EXAMPLES	*Is Bob hungry for lunch at noon?* *Is Dorian reading a book?*	*Who is hungry for lunch at noon?* *Who is solving the case?*	*What is Bob hungry for at noon?* *What was the little prince watering?*	*When is Bob hungry for lunch?* *Where is Captain Ahab chasing a whale?*
COMPLEXITY	<less>			<more>
SYNTACTIC TREES				

Results





Variability among factors between groups were not different.
Hearing satus, BE-PTA, SES, sex, est. MLU, were not correlated to question syntax variables.

Conclusions

We do not show a difference in the quantity of questions to which HH children were exposed compared to their TD peers, although the mean rate of exposure to each question type trended lower in the HH group. Secondly, there was no relationship between the quantity of questions to which a child was exposed and the quantity the child produced in either group or in the pooled group.

On the one hand, these findings are somewhat surprising, given fairly extensive evidence in the literature documenting reduced performance in a number of linguistic domains for children with hearing loss, and in particular showing relationships between language input, language use, and outcomes in a population with hearing loss (Huttenlocher et al, 2002; Huttenlocher et al, 1991; Blamey, 2001; Nicholas & Geers, 2006; Ambrose et al, 2014; VanDam et al, 2015).

On the other hand, the findings reported here are from a population of children with access to modern intervention including early identification, improved technology, and advantageous educational and policy approaches to children with hearing loss. The observed lack of difference here between TD and HH children may be a positive sign of the success of intervention with children with hearing loss. At the same time, it should be noted that despite lack of statistical difference between the groups, HH trended lower on all measures observed here.

References

Ambrose, S. E., VanDam, M., & Moeller, M.P. (2014). Linguistic input, electronic media, and communication outcomes of toddlers with hearing loss. *Ear & Hearing, 35*(2): 139-147.

Bedore, L. M. & Leonard, L. B. (1998). Specific language impairment and grammatical morphology: A discriminant function analysis. *Journal of Speech, Language, and Hearing Research, 41*(5), 1185-1192.

Berent, G. P. (1996). Learnability constraints on deaf learners' acquisition of English wh-questions. *Journal of Speech and Hearing Research, 39*, 625-642.

Blamey, P. J. et al. (2001). Relationships among speech perception, production, language, hearing loss, and age in children with impaired hearing. *Journal of Speech, Language, and Hearing Research, 44*(2), 264-285.

Bloom, L., Merkin, S., & Wootton, J. (1982). Wh- questions: Linguistic factors that contribute to the sequence of acquisition. *Child Development, 53*(4), 1084-1092.

Friedmann, N. & Szterman, R. (2006). Syntactic movement in orally-trained children with hearing impairment. *Journal of Deaf Studies and Deaf Education, 11*(1), 56-75.

Friedmann, N. & Szterman, R. (2011). The comprehension and production of Wh-questions in 27 deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education, 16*(2), 212-235.

Geers, A. E. & Hayes, H. (2011). Reading, writing, and phonological processing skills of adolescents with 10 or more years of cochlear implant experience. *Ear and Hearing, 32*(1), 98-108.

Hadley, P. A., Rispoli, M., Fitzgerald, C., & Bahnsen, A. (2011). Predictors of morphosyntactic growth in typically developing toddlers: Contributions of parent input and child sex. *Journal of Speech, Language, and Hearing Research, 54*(2), 549-566.

Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). Language input and child syntax. *Cognitive Psychology, 45*, 337-374.

Jakubowicz, C. (2011). Measuring derivational complexity: New evidence from typically- developing and SLI learners of L1 French. *Lingua, 121*(3), 339-351.

Koehlinger, K. M., Van Horne, A. J. O., & Moeller, M. P. (2013). Grammatical outcomes of 3- and 6-year-old children who are hard of hearing. *Journal of Speech, Language, and Hearing Research, 56*, 1701-1714.

MacWhinney, B. (2000). *The CHILDES Project: Tools for Analyzing Talk*. 3rd Edition. Mahwah, NJ: Lawrence Erlbaum Associates

Matalone, H., Stoddard, C., Bookhout, T., & Carns, K. (2015, April). Transcription reliability of the speech of preschoolers with hearing loss. Poster presented at the *National Conference for Undergraduate Research (NCUR)*, Cheney, WA.

McGinty, A. S., Justice, L. M., Zucker, T. A., Grose, C., & Skibbe, L. E. (2012). Shared-reading dynamics: Mothers' question use and the verbal participation of children with SLI. *Journal of Speech, Language, and Hearing Research, 55*(4), 1039-1052.

Moerbeal, D. M. & Ingram, D. (1973). The development of base syntax in normal and linguistically deviant children. *Journal of Speech, Language, and Hearing Research, 16*, 330-352.

Rowland, C. F., Pine, J. M., Lieven, E. V. M., & Theakston, A. L. (2003). Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech. *Journal of Child Language, 30*(3), 609-635.

Santelmann, L., Berk, S., Austin, J., Somashekar, S., & Lust, B. (2002). Continuity and development in the acquisition of inversion in yes/no questions: Dissociating movement and inflection. *Journal of Child Language, 29*(4), 813-842.

Schirmer, B. R. (1985). An analysis of the language of young hearing-impaired children in terms of syntax, semantics, and use. *American Annals of the Deaf, 130*(1), 15-19.

VanDam, M., & De Palma, P. (2015). Fundamental frequency of child-directed speech using automatic speech recognition. *IEEE Proceedings of the Joint 7th International Conference on Soft Computing and Intelligent Systems and 15th International Symposium on Advanced Intelligent Systems*, Kitakyushu, Japan.

VanDam, M., Oller, D. K., Ambrose, S. E., Gray, S., Richards, J. A., Xu, D., Gilkerson, J., Silbert, N. H., & Moeller, M. P. (2015). Automated vocal analysis of children with hearing loss and their typical and atypical peers. *Ear & Hearing, 36*(4): e146-e152. doi: 10.1097/AUD.0000000000000138