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# Acquisition of who-question comprehension in German children with hearing loss

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ABSTRACT

For children with sensorineural hearing loss the ability to understand *wh*-questions might be particularly challenging because they often have only restricted access to spoken language input during optimal periods of language acquisition. In previous research it has been suggested that this restricted input during critical stages in language acquisition might lead to syntactic deficits that persist into adolescence. In this study we want to pursue this issue by investigating the comprehension of *wh*-questions in German children with bilateral sensorineural hearing loss. We report results of a *who*-question comprehension task in a group of 21 3- to 4-year-old German hard-of-hearing children compared to a group of age-matched children with normal hearing. The group data and individual performance patterns suggest that the syntactic comprehension difficulties observed in some, but not all, of the children with hearing loss reflect a delay in the acquisition of *who*-question comprehension rather than a persistent syntactic deficit. Follow-up data elicited from a subgroup of children confirm this supposition.

## 1. Introduction

*Wer schubst den Jungen?* ('Who pushed the boy?') or *Wen schubst der Junge?* ('*Who does the boy push?*')*?* An intact hearing is one of the prerequisites to understand such *wh*-questions that are essential to communicate properly in everyday conversations. However, for young children with a sensorineural hearing loss (HL) this prerequisite is not given due to the malfunction of the inner ear or the auditory nerve. Before the establishment of newborn-hearing screenings a sensorineural HL was often diagnosed and treated quite late, often only during the third or fourth year of life (see e.g. for English Yoshinaga-Itano, Coulter, & Thomson, 2001; for German Neumann et al., 2006). Still, there are children with late diagnosis due to a progressive or late onset HL (see e.g. Rose, 2011). However, a timely intervention might be a crucial factor for an unimpaired language development, given the concept of a critical or sensitive period for language acquisition. According to such a concept, the optimal time window relevant for acquiring morphosyntactic aspects of a language is likely to be closing as early as age four due to maturational changes in the brain (Meisel, 2011). Based on empirical evidence on child second language acquisition Meisel claims that language acquisition is substantially affected if the learner's first exposure to a language happens after this optimal period. If hard-of-hearing children have only restricted access to spoken language input within this period, problems in language acquisition and morphosyntax in particular might, hence, also be expected for these children. Since phonemes that serve to express morphosyntactic information are often not

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perceived adequately in subjects with sensorineural HL (even with digital hearing aids), one would expect the morphological as well as the syntactic development not to proceed normally in children with HL (see Moeller et al., 2010; Svirsky, Stallings, Lento, Ying, & Leonard, 2002; or Hennies, Penke, Rothweiler, Wimmer, & Hess, 2012 for further discussion). Due to this degraded intake, the investigation of language comprehension abilities is particularly interesting in children with HL.

Over the last decades, research on children with HL has focused primarily on children with profound HL (i.e. with a HL of 90 dB or higher according to ASHA guidelines, American Speech-Language-Hearing Association (ASHA), 2015) and a Cochlear Implant (CI) (e.g. Nicholas & Geers, 2007; Szagun, 2004) rather than on children with a mild-to-severe HL (i.e. 26–70 dB HL, American Speech-Language-Hearing Association (ASHA), 2015) who are generally fitted with hearing aids (see e.g. Tomblin et al., 2015; for overview Moeller, Tomblin, Yoshinaga-Itano, McDonald Connor, & Jerger, 2007; Tuller & Delage, 2014). Studies that focused on children or adolescents with mild-to-severe HL have found evidence for a delayed language development compared to control groups with normal hearing (NH) in tests of general linguistic performance (e.g. Borg et al., 2007; Hansson, Sahlén, & Mäki-Torkko, 2007; Tomblin et al., 2015). More fine-grained and cross-language investigations on particular aspects of language in this population are still rare, but those existing point to particular problems in the area of morphosyntax (e.g. Delage & Tuller, 2010; McGuckian & Henry, 2007; Norbury, Bishop, & Briscoe, 2001; Penke, Wimmer, Hennies, Hess, & Rothweiler, 2016).

Regarding sentence comprehension, a number of studies reported problems in comprehending or judging complex sentences, such as *wh*-questions, topicalized sentences, passives or relative clauses in children and adolescents with HL (e.g. Friedmann & Szterman, 2006, 2011; Tuller & Delage, 2014 including data of Delage & Tuller, 2010; Volpato & Adani, 2009). Other studies, in contrast, found age-appropriate performance in standardized tests on sentence comprehension (Briscoe, Bishop, & Norbury, 2001; Hansson, Forsberg, Löfqvist, Mäki-Torkko, & Sahlén, 2004; Halliday & Bishop, 2005; Norbury, Bishop, & Briscoe, 2002). These conflicting results might be due to a number of potentially influencing factors. Thus, studies have not always differentiated between different types of hearing devices (hearing-aid or CI) and encompassed children and adolescents with very different degrees of HL (from mild to profound) and a wide range in age. For example, the study by Friedmann and Szterman (2006) investigated subjects with sensorineural or combined (including conductive) HL of moderate to profound degree, encompassing subjects wearing hearing aids as well as children with CI. Subject factors like age, the type and degree of HL and the type of hearing device are, however, likely to affect language acquisition in children with HL (see Tuller & Delage, 2014). For instance, Einholz, Wimmer, Hennies, Rothweiler, and Penke (2015) found that the type of hearing device, i.e. hearing aid or CI, affects language outcomes in children with HL differently, possibly because the two types of hearing devices use different types of amplification of the incoming speech signal: whereas a CI replaces the function of the inner ear and directly stimulates the auditory nerve, hearing aids only increase the amplitude of a signal. Another factor is the age at intervention with hearing devices. A number of studies report positive effects of early diagnosis and intervention. Children fitted with hearing aids or CI within their first year of life show considerably better performance in language tasks than children whose HL has been diagnosed and treated in the second year of life or later on (see e.g. Friedmann & Szterman, 2006, 2011; Kennedy et al., 2006; Neumann et al., 2006; Tomblin et al., 2015; Yoshinaga-Itano, Coulter, & Thomson, 2001; but cf. Tuller & Delage, 2014). Moreover, studies often differ with respect to the methodology used. With regard to the studies on sentence comprehension listed above it is, for instance, noteworthy that studies using more global standardized language tests (e.g. TROG in Briscoe et al., 2001) reported age-appropriate results in children with HL in contrast to the severe problems that were observed by researchers using specifically designed experiments (e.g. a picture pointing task as in Friedmann & Szterman, 2011) that may be more sensitive in identifying a specific impairment. As the presently available studies differ with respect to the abovementioned factors, it is difficult to evaluate conflicting results on syntactic comprehension obtained in different studies investigating the syntactic abilities in children with HL.

Another relevant question related to problems with the comprehension of complex sentences observed in some children with HL is if children are merely delayed in their development or if these deficits persist into adolescence. Data from longitudinal studies that could shed more light on this question are rare. To our knowledge, the only recent work is by Delage & Tuller (Delage & Tuller, 2010; Delage, 2008; Tuller & Delage, 2014) who presented longitudinal data from spontaneous speech on the production of complex embedded sentences of school-aged French-speaking children with mild-to-moderate HL (age 6–9 years). At second testing, two years later, these children displayed an increase in the use of embedded sentences compared to the first testing. This was in contrast to a group of older children with HL (age 9–11 years) showing a stagnation over this time period compared to age-matched children with NH. Based on these findings, Delage and Tuller (2010) conclude that morphosyntactic impairments in children with HL can improve, but that these children do not catch up with hearing age-matched peers. This conclusion is supported by data from a group of adolescents with HL still showing deficits (Delage & Tuller, 2007).

Taken together, the issues whether or not the comprehension of complex sentences is affected in children with HL and if observed problems are due to delays in language development or due to permanent syntactic deficits needs further investigation. We will explore these issues by investigating the comprehension of *wh*-questions in German children with HL.[2]

### *1.1. Studies on wh-questions in children with HL*

To date, there are only a few studies that have explicitly tested the production and/or comprehension of *wh*-questions in populations with HL. Most of these studies considered older subjects (school children, adolescents or young adults) with profound HL. Quigley and colleagues, for example, tested a large sample of 450 English speaking children and adolescents with profound HL (ages 10–18) (Quigley, Wilbur, Power, Montanelli, & Steinkamp, 1976; Quigley & King, 1980). These subjects participated in a written test

[2] Note that parts of the study have previously been presented in the proceedings of the GALA conference 2015 (Wimmer, Rothweiler, Hennies, Hess, & Penke, 2015).