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Morphosyntactic correctness of written language production in adults with moderate to severe congenital hearing loss

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ABSTRACT

Objective: To examine whether moderate to severe congenital hearing loss (MSCHL) leads to persistent morphosyntactic problems in the written language production of adults, as it does in their spoken language production.
Design: Samples of written language in Dutch were analysed for morphosyntactic correctness and syntactic complexity.
Study sample: 20 adults with MSCHL and 10 adults with normal hearing (NH).
Results: Adults with MSCHL did not differ from adults with NH in the morphosyntactic correctness and syntactic complexity of their written utterances. Within the MSCHL group, the number of morphosyntactic errors in writing was related to the degree of hearing loss in childhood.
Conclusions: At the group level, MSCHL does not affect the morphosyntactic correctness of language produced in the written modality, in contrast to earlier observed effects on spoken language production. However, at the individual level, our data suggest that adults who acquired their language with more severe auditory limitations are more at risk of persistent problems with morphosyntax in written language production than adults with a lower degree of hearing loss in childhood.

1. Introduction

For adults' participation in daily life, adequate communication in both speech and writing is important. Writing differs from speech as it can be planned and changed through revision before someone reads it. Whereas typically developing children acquire full mastery of spoken language without explicit instruction, mastery of written language requires formal instruction. In alphabetic writing systems, phonological awareness plays an important role. Because the acquisition of a spoken language, the development of

Abbreviations: CHL, congenital hearing loss; MLU, mean length of utterance; MSCHL, moderate to severe congenital hearing loss; NH, normal hearing; PTA, pure tone average

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phonological skills, and the comprehension of oral instructions all depend on auditory perception, development of literacy is at risk in people who are born with hearing loss (Moeller, Tomblin, Yoshinaga-Itano, Connor, & Jerger, 2007). Thus far, little is known about the long-term effects of *moderate to severe* congenital hearing loss (MSCHL) (i.e., mean thresholds between 41 and 95 dB HL (BSA, 1988)) on writing achievement in adults. Therefore, in addition to earlier published data on the effect of congenital hearing loss on the *spoken* language production of an adult population with MSCHL (Huysmans, de Jong, van Lanschot-Wery, Festen, & Goverts, 2014), the main research question addressed in this study is whether MSCHL has a similar impact on the morphosyntactic correctness of Dutch language production in the *written* modality in the same study population. To answer this question, the performance of a group of adults with MSCHL is compared to the performance of a reference group with adults with normal hearing (NH). In addition, we examine whether there is a relation between morphosyntactic correctness in writing and the degree of the adults' congenital hearing loss.

For children with congenital hearing loss (CHL), the development of oral language is at risk. The linguistic area of morphosyntax was found to be most vulnerable when language is acquired with degraded auditory input (e.g., Tomblin et al., 2015), while deficiencies in phonology, lexicon, and pragmatics were reported in children with CHL as well (see Moeller et al., 2007; for an overview). Difficulties in phonology and morphosyntax were shown to persist into *adolescence* in a population with mild to moderate CHL (Delage & Tuller, 2007), while an earlier study in the adult population of the current study showed that morphosyntactic problems in the production of spoken language appear to persist into adulthood (Huysmans et al., 2014).

Research in children showed that inter-individual differences in the consequences of hearing loss on linguistic abilities can (partly) be explained by the 'inconsistent access account': Factors that define the extent to which access to and perception of language is affected, predict individual language outcomes (Moeller & Tomblin, 2015). In a large study in children with mild to severe hearing loss, the severity of the hearing loss in childhood was shown to be one of these factors, as well as the outcomes of auditory rehabilitation (Tomblin et al., 2015). In studies with adolescents (Delage & Tuller, 2007) and adults (Huysmans et al., 2014), the severity of the hearing loss in childhood was related to the participants' morphosyntactic abilities, i.e., participants with a higher degree of CHL compared to others showed more difficulties in their linguistic performance. Because language production requires the deployment of the same morphosyntactic knowledge in both modalities and the current study concerns the same study population as in Huysmans et al. (2014), we expect the degree of CHL to be also associated with morphosyntactic correctness in the *written* modality.

Our previous research, based on the same population of adults with MSCHL as in the study of this paper, showed specific difficulties in their grammar of spoken Dutch, such as the correct use of determiners in an obligatory context (definite articles *'de'* and *'het'* (the)), present tense markers (2nd and 3rd person singular verb suffix *'-t'* and plural verb suffix *'-en'*), and adverbs (e.g., pronominal adverbs and the Dutch adverb *'er'* (which cannot unequivocally be translated into English)) (Huysmans et al., 2014). These findings were confirmed in a second study (Huysmans et al., 2016), which additionally showed that the difficulties in the spoken language production of adults with MSCHL were likely to be attributed to auditory limitations during language acquisition, and not to perceptual limitations at the moment of testing. This conclusion was drawn from the finding that adults who acquired hearing loss *after* childhood performed within the range of NH adults, in spite of having a similar hearing loss at the time of testing as the adults with MSCHL (Huysmans et al., 2016). A first factor that could account for the observed errors in the spoken language production of adults with MSCHL, was auditory perceptual salience (i.e., the relative ease with which linguistic structures may auditorily be perceived from the input). Huysmans et al. (2014) placed all Dutch bound and free morphemes on which errors were observed on a 'perceptual salience continuum'. The perceptual salience of each morpheme was based on the average value on four factors, calculated following Goldschneider and DeKeyser (2001: 23): phonetic substance (i.e., the average number of phones in the allomorphs of a morpheme), syllabicity (i.e., the presence or absence of a vowel in the surface form), total relative sonority (i.e., an average sonority score for the allomorphs of a morpheme, based on the sonority hierarchy by Laver (1994, p. 504)), and stress (i.e., the possibility for a morpheme or its allomorph to receive stress). It was shown that the types of errors that occurred significantly more often in the spoken language of the adults with MSCHL all concerned free and bound morphemes that were at the lower end of the perceptual salience continuum. The data further showed that within the paradigm for verb inflection in the present tense, the adults with MSCHL produced most errors in the use of the least salient marker, i.e., the use of the non-syllabic 2nd and 3th person singular verb suffix *'–t'*. This *'–t'* suffix was often omitted or substituted by the more salient plural verb suffix *'–en'*. Within the paradigm for noun pluralisation in Dutch, which uses the suffixes *'–s'* and *'–en'*, adults with MSCHL made more errors in the use of the less salient plural morpheme *'–s'* than in the use of the more salient morpheme *'–en'*. In the context of hearing loss, the suffixes *'–s'* and *'–t'* may specifically be hard to perceive because the limited bandwidth of hearing aids affects the perception of high-frequency speech sounds (Stelmachowicz, Pittman, Hoover, Lewis, & Moeller, 2004). In line with research for the English language (McGuckian & Henry, 2007; Svirsky, Stallings, Lento, Ying, & Leonard, 2002), these findings indicated that grammatical markers that are low in auditory perceptual salience are at risk when acquired with degraded auditory input. However, perceptual salience is not the sole factor accounting for specific error patterns in the language of people with hearing loss. Research in children with CHL (aged 6;0 to 13;9 years) in French showed that a second factor accounted for morphosyntactic difficulties, i.e., the computational complexity that is involved in the use of particular morphemes (Tuller & Jakubowicz, 2004 (cited in Tuller & Delage, 2014)). In French, definite articles (*'le'*, *'la'*, *'les'* (the)) and third person direct object pronouns (*'le'*, *'la'*, *'les'* (him/her/them)) are identical in their phonological form, but differ in the computational complexity to use them correctly. The children with mild to moderate CHL only showed difficulties with the morphemes that needed a more complex linguistic computation, i.e., with the direct object pronouns. Thus, this finding showed that computational complexity is another factor accounting for difficulties. In the data of our previous research (Huysmans et al., 2014), grammatical complexity could account for errors in the correct use of Dutch pronominal adverbs. These are constructed by combining an adverb like *'er'* or *'daar'* (there) and an adposition (e.g., *'erin'* (there_in) or *'daarnaast'* (there_next to)). In the