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Evidence of an association between sign language phonological awareness and word reading in deaf and hard-of-hearing children

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ABSTRACT

Background and aims: Children with good phonological awareness (PA) are often good word readers. Here, we asked whether Swedish deaf and hard-of-hearing (DHH) children who are more aware of the phonology of Swedish Sign Language, a language with no orthography, are better at reading words in Swedish.

Methods and procedures: We developed the Cross-modal Phonological Awareness Test (C-PhAT) that can be used to assess PA in both Swedish Sign Language (C-PhAT-SSL) and Swedish (C-PhAT-Swed), and investigated how C-PhAT performance was related to word reading as well as linguistic and cognitive skills. We validated C-PhAT-Swed and administered C-PhAT-Swed and C-PhAT-SSL to DHH children who attended Swedish deaf schools with a bilingual curriculum and were at an early stage of reading.

Outcomes and results: C-PhAT-SSL correlated significantly with word reading for DHH children. They performed poorly on C-PhAT-Swed and their scores did not correlate significantly either with C-PhAT-SSL or word reading, although they did correlate significantly with cognitive measures.

Conclusions and implications: These results provide preliminary evidence that DHH children with good sign language PA are better at reading words and show that measures of spoken language PA in DHH children may be confounded by individual differences in cognitive skills.

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What this paper adds:

This paper introduces a new set of materials for assessment of phonological awareness across the language modalities of sign and speech in a Swedish context. It validates the materials for the Swedish version of the task and shows that the Swedish Sign Language (SSL) version can be successfully administered to deaf and hard-of-hearing (DHH) children who are attending Swedish deaf schools and are at an early stage of reading. Moreover, it shows for the first time that a better grasp of the phonology of SSL is associated with better Swedish word reading, thus generalizing results from a North American context. The task is quick and easy to administer and could easily be adapted for clinical use. The paper also discusses the pitfalls of assessing spoken language phonology in DHH children and provides evidence that such measures may be confounded by individual differences in cognitive skills.

1. Introduction

Reading is vital for academic achievement and social participation. Deaf and hard-of-hearing (DHH) children usually lag behind their peers with normal hearing in reading development (Mayberry, del Giudice, & Lieberman, 2011; Miller & Clark, 2011; Trezek, Wang, & Paul, 2011). However, it is as yet unresolved, despite several decades of scientific inquiry, which specific mechanisms cause this gap, and what can be done to close it. In the present work we address the role of language-modality specific phonological awareness (PA) in word reading. We introduce a new set of materials, the Cross-modal Phonological Awareness Test (C-PhAT) that can be used to assess PA in both Swedish (C-PhAT-Swed) and Swedish Sign Language (C-PhAT-SSL). In study 1 we validate C-PhAT-Swed in children with normal hearing. In study 2, we investigate how C-PhAT-Swed and C-PhAT-SSL are related to word reading in DHH children.

1.1. Phonological awareness and reading

PA usually refers to sensitivity to the sound structure of words (Wagner & Torgesen, 1987). Spoken languages include a finite set of sounds which are combined at the sublexical level to construct the words of a language; the language-specific patterning of these sounds comprises the phonology of that language. When children learn to read, a crucial step is learning to recode written symbols into the correct sounds (Ziegler & Goswami, 2005). Individual letters are matched with their corresponding phonemes, which can then be combined into longer sequences. This allows written words to be connected to the phonological forms of lexical items already established in long-term memory. When access to lexical items is successful, that is, when written words are efficiently decoded (Stanovich, 1982), the meanings of separate words are unraveled and comprehension of sentences and passages can be achieved. Children who are strong word readers typically also comprehend text better than relatively weaker word readers, especially at the early stages of reading development (Garcia & Cain, 2013; Ripoll Salceda, Alonso, & Castilla-Earls, 2014). A relationship between word reading and reading comprehension has also been established in DHH children (Hermans, Knoors, Ormel, & Verhoeven, 2008; Kyle & Harris, 2006, 2010; Transler & Reitsma, 2005; Wauters, Bon, & Tellings, 2006). Hence, learning to read single words is an important part of becoming a skilled reader, regardless of hearing status. Even though recoding written words into their sound structures is probably not the only way to access their meaning (Leinenger, 2014), PA is a robust predictor of word reading for hearing children (for reviews, see Melby-Lervåg, Lyster, & Hulme, 2012; National Institute for Literacy, 2008). Thus, it is important to understand the role of PA in word reading by DHH children.

1.2. Deafness and sign language phonology

Congenital deafness occurs in between 1 and 2 individuals per thousand live births. These days, the majority of children born deaf in developed countries are fitted with cochlear implants (CI), technical devices that convey electrical stimulation based on sound into the cochlear nerve, in most cases allowing differentiation of speech sounds and interpretation of auditory input (for a review see Kral & Sharma, 2012). Children with less severe hearing loss may be fitted with hearing aids (HA). Many DHH children achieve remarkable speech development with technical devices (Kral & Sharma, 2012) and achieve academically in mainstream schools. Others, however, do not develop functional levels of spoken language (Campbell, MacSweeney, & Woll, 2014). Irrespective of whether or not they develop spoken language skills, many DHH children rely on sign language communication at least in some situations (Campbell et al., 2014).

Despite the fact that signed languages are generated manually and perceived visually, they share abstract linguistic qualities with spoken languages that are generated orally and usually perceived aurally (for a review, see Emmorey, 2002). The finite set of sublexical manual-visual features that defines the signs in a sign language can be described as its phonology (Sandler & Lillo-Martin, 2006). Sign language phonology consists of five manual-visual parameters: handshape; location; movement of and within hand(s); orientation of the palm; and, nonmanual behaviors like facial gestures (Brentari, 2011). In relation to signed languages, PA refers to sensitivity to sublexical structure. This definition can be applied equally well to spoken languages.

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