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Interaction patterns of mothers of children with different degrees of hearing: Normally hearing children and congenitally hearing-impaired children with a cochlear implant

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ABSTRACT

Objectives: This study targets to analyse mother–child interactions in two groups of children with different hearing levels: normally hearing children (NH) and congenitally hearing-impaired children with a cochlear implant (CI). Mothers of hearing-impaired children are shown to use less speech in interactions with their children than mothers of normally hearing children. We aim to investigate whether this observation also holds for mothers of CI children.

Methods: Transcriptions of spontaneous conversations of ten CI children and ten NH children were analysed. We examined whether mothers responded to their children's utterances and whether they repeated or incorporated them in their own follow-up. Conversations were analysed in two consecutive stages, namely a prelexical stage and a lexical one.

Results: Mothers of CI children responded significantly more often to their children's utterances in both the prelexical and lexical stage. They also incorporated their children's utterances more often, however this was only significant in the lexical stage. The type of child utterance was an important trigger for the amount of mothers' responses. All mothers responded significantly more often to lexical utterances in the lexical stage. In the prelexical stage, however, precanonical utterances received the same amount of responses as canonical babbles. Nevertheless, all mothers incorporated canonical babbles more often than precanonical vocalisations in the prelexical stage and lexical utterances more often in the lexical stage.

Conclusions: First, mothers of CI children are more responsive to their children's utterances suggesting that they are aware of their children's hearing status. Second, type of child utterance is an important trigger for both mothers' response level and mothers' type of response in the prelexical and lexical stage.

1. Introduction

The aim of this paper is to analyse mother–child interaction in two groups of children with a different degree of hearing: normally hearing children (henceforth: NH children) and congenitally hearing-impaired children with a cochlear implant (henceforth: CI children). How mothers[1] of CI children interact with their children has scarcely been investigated so far. Because CI children are hearing-impaired, it is possible that the characteristics of the interaction patterns of their mothers will reflect those of mothers with hearing-impaired children who have no CI (henceforth: HI children). However, the CI children studied here are implanted at a young age and have "restored hearing". This could result in similar reaction patterns in mothers of CI children as in mothers of NH children. It is even possible that mothers of CI children respond more frequently to their children's utterances to provide more input since they are aware of their children's relative lack of auditory input. Because frequent and elaborate mother–child interaction has been shown to be quintessential for children's language development [1,2], it is crucial to investigate these interaction patterns in an atypical group such as CI children.

Interaction patterns of mothers of HI children and mothers of NH children show similarities, but also differences. Mothers of HI children use less speech, more gestures, and more attention-getting touches than mothers of normally hearing children [3]. Furthermore, mothers of HI children use significantly more self-repetitions than mothers of age-matched hearing children at 2 and

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[1] We use mother as a generic term for the speech of mothers, fathers, primary caretakers/caregivers and adults. Yet, we are aware that there might be differences in the child-directed speech used by mothers and fathers.

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5 years of age [4]. Interestingly, mothers of HI and NH children do not differ significantly in the frequency of initiating conversations and in the frequency of using verbal and nonverbal utterances [5]. Thus, mothers of HI children communicate with their children to the same extent albeit with less speech.

Interactions between normally hearing mother–child dyads have been widely investigated and are shown to be crucial for children's language acquisition [6,7]. Several aspects of parental input are considered to be predictors of children's later language development. For instance, the amount of speech (input) children receive is associated with the size of their receptive and productive vocabularies [8–10]. Children with more talkative mothers understand and acquire words at a faster rate than children of less talkative mothers. Thus, the amount of input plays a crucial role in children's lexical development.

However, not only the amount of input is important, also the variation in child-directed speech has an influence on children's later language development. For instance, both maternal lexical richness, i.e. the use of different word types and word tokens, and syntactic complexity (as measured by mean length of utterance) have a positive effect on the lexical development of two-year-olds [9]. Morphological complexity as well as lexical diversity of mothers' language positively influence the morphological complexity of the children's speech [11]. Thus, variation in child-directed speech is reflected in children's own speech.

In addition to the amount of input and the variation in the input, also interactional factors, such as contingent replies, i.e. immediate reactions to children's utterances, have a positive influence on children's language development. For instance, the amount of contingent replies has been shown to be beneficial for the age at which children produce their first words [2]. Furthermore, children of more responsive mothers achieve the 50-word stage earlier and engage in combinatorial speech, i.e. combining words into sentences such as "mommy ball", at a younger age than children of less responsive mothers [2]. Thus, there seems to be a clear relationship between the contingency of responses and children's language development.

Taken together, several characteristics of maternal input, such as the amount of speech, variation in speech and contingency of replies have beneficial effects on children's later language development. But no research has ever systematically investigated whether mothers of CI children respond to their children's utterances in a comparable way as mothers of NH children. It is possible that mothers of CI children are more responsive in order to provide them with more fruitful input.

In this paper, we will analyse how mothers interact with their children in two consecutive developmental stages: the prelexical stage immediately preceding the lexical stage during which the children's first words are acquired. In the first two years of life, children move from precanonical utterances over canonical babbling to conventional words [12,13]. Precanonical vocalisations are utterances that appear in different forms such as a repetition of a single vowel, e.g./a a/or a combination of consonants without a vowel/ps/. These vocalisations have no adult target word [14,15]. Around the age of 7 to 10 months children achieve an important milestone in speech development when they start to produce canonical babbling [15,16]. Just like precanonical vocalisations, canonical babbles have no adult target, but they differ from the precanonical ones in sound and form: utterances such as/bababa/ not only sound like adult words, they also consist of adult-like syllables, such as a consonant-vowel sequence [12,13,15]. Around the age of 12 months, children start to produce identifiable lexical items or words [16–18], though they express these words with a lot of variation [19]. A child may for instance produce the word *ball* as/bɑbɑ/,/bɑ/or/bɑl/, but these instances of the word *ball* are recognised as the word *ball* by their mothers.

In the transition from the prelexical to the lexical stage, children continue to produce prelexical vocalisations, but the balance between prelexical and lexical utterances twists [20]. With age the number of prelexical utterances decreases and the number of lexical utterances increases [20,21]. Around the age of 20 months, NH children start producing significantly more lexical than prelexical utterances, though prelexical vocalisations remain present [20]. In the first two years of life, the balance in children's utterances thus changes from more "primitive" (prelexical) to more "mature" (lexical) productions.

As children's productions change over time from predominantly prelexical to lexical, their mothers' responses evolve as well [22,23]. Mothers tend to respond to their children's most "mature" vocalisations: when babbles enter the children's repertoire, mothers predominantly respond to those more "mature" utterances. When children start producing lexical utterances, mothers predominantly respond to them and incorporate (part of) them far more often than the more "primitive" vocalisations [24]. Do mothers of CI children have the same dynamics when interacting with their children? Or are mothers of CI children 'happy' with every utterance, regardless of the maturity, and more responsive to all types of child utterances? Are incorporations of their children's previous utterances equally present in mothers of CI and NH children?

Briefly, the current study investigates the following two research questions: (1) is there a difference in mother–child interaction depending on the child's hearing status?; and (2) are mothers influenced by the type of child utterance in both quantitative and qualitative aspects of their responses? We will answer these questions in two linguistic stages, i.e. a prelexical and early lexical stage.

2. Method

2.1. Participants

The data analysed in the present paper are part of the CCLC (CLiPS Child Language Corpus), which contains transcribed video- and audio-recordings of 40 normally hearing and 10 congenitally HI children with a cochlear implant. All recordings were made in the children's homes and consisted of spontaneous interactions between the children and their primary caretakers. The video-recordings lasted between 50 and 120 minutes. Of each recording a sample of 20 minutes in which the child was most vocally active was transcribed using the CHAT transcription conventions [25]. All parents were normally hearing, Dutch-speaking, and of middle-to-high socioeconomic background. At the moment of the recording parents had signed a statement of informed consent, but were not aware of the aim of the present study. This study received approval from the ethical committee.

The CI children were recorded monthly from the moment their device was activated up to 30 months after implantation. All children were implanted below the age of 20 months. More detailed information about the CI children is provided in Table 1: the children's hearing loss with and without hearing aids (HA) and with CI are provided, as well as their age at implantation and at activation. The cause of deafness was in six cases genetic of which five were mutations in the connexine-26 gene. In the other four cases the cause of deafness is unknown.

From the CCLC database, the transcriptions of 10 NH children and their parents were randomly selected. *Kind & Gezin* (the Flemish infant welfare centre) checked the children's hearing approximately three weeks after birth as part of a nation wide neonatal screening program. These mother–child dyads were also followed monthly, starting when the child was between 6 months and up to 24 months. These children are monolingual