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THE EARLY ACQUISITION OF SPEECH COMMUNICATION*

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Abstract

Speech communication problems in two year olds are often thought to originate from previous deviant mother-infant interaction, especially when physical or mental causes for the problems are absent. This study attempts to find a basis for this idea. Split-screen monthly video-recordings of two normal mother-girl pairs were made in naturalistic home settings. Their vocal and behavioural development is described by means of a multi-channel ethological method. Mother and infant are seen as a unique dynamic sensori-motor system exchanging movements that selectively acquire communicative meanings. Three characteristics of human communication systems are studied: visual and auditory intersubjective tuning, transmission of intentions, and vocal turntaking by the mother upon speech motor landmarks of the infant. The two pairs differed in their interaction styles during the first six months already, explaining further developmental processes. At the age of two one girl started a speech therapy period of about three years, the other girl was a precocious talker. Evaluation of interactions at risk is suggested and discussed.

1. Introduction

The main theme of the 13th Congress of the International Society for Human Ethology (ISHE) was concerned with 'Cognition, Communication, and Evolution' with a special emphasis on direct observation of human behaviour: methodological and theoretical issues. Presentations treated topics like gender advertisement, mate selection, non-verbal communication, ontogenetic development of communication including twin studies, psychiatry, and human-environment interactions. Of course 'Language and Evolution' was given quite some attention too, focusing on several of the hundred factors involved in phylogenetic and ontogenetic language evolution, as suggested by Wind (1983).

The ontogenetic development of speech communication has been studied mainly by means of the discrete alphabetic notation of the (speech) sounds produced by infants. More and more this method is replaced by a more continuous registration of sound production, thus opening doors to the inclusion of audible emotional aspects in the study of speech development. The recent handy cameras for recording on video permit

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The paper is based on the Ph.D. thesis "Finally a Word, a sensori-motor approach of the mother-infant system in its development towards speech", Van der Stelt (1993).

the researcher to analyse visual and audible aspects in mother-infant interactions and to interpret the inter-relatedness and coherence of these datasets .

Bonding between mother and baby now is considered to be basic in many developmental processes, and the development of speech communication in infancy is no longer restricted to the sound production-perception domain. Ethologists take Wittgenstein's "Don't think but look" literally and they have chosen to describe their subjects in the naturalistic environment. Direct observation of mother-infant systems has demonstrated that non-verbal communication supports the developmental processes towards communication in the sound domain.

Bloom (1983) noticed that:

> ".... Research in language acquisition can be characterised by the several dualities that have emerged from appeals to different explanatory models: the cognitive/linguistic, the biological/social, and the descriptive/explanatory. The task in the generation ahead is to cut through the tensions that created these dualities to arrive to a theory of language that integrates and subsumes them..." (p. 884).

The study of the acquisition of language in infants has focused mainly on the cognitive-linguistic aspects, on language in the sense of competence instead of language behaviour or performance. In the developmental stage of language this method is clearly adult-centred and thus justifies terms like *pre*-linguistic or *pre*-verbal. A child-centred point of view on language acquisition must rely on the description and interpretations of movements in mother-infant interaction, since the underlying principles in a behavioural development towards speech communication are not yet know. With regard to the onset of language development, Narasimhan (1996) states that:

> "..what is acquired is not 'language' in the sense of some abstract knowledge, but language behaviour as a performable skill." (p. 9).

Our ethological approach of the development of speech communication during the first years of life of an infant, including visual aspects, is more or less founded on the idea that early communication in general has to do with the transmission of movements between persons instead of transmission of linguistic meaning (e.g. Van der Stelt, 1993).

2. The purpose

Our early work on infant sound production (e.g. Koopmans-van Beinum & Van der Stelt, 1979, 1986) aimed at a physiological description system, appropriate for the changes in non-cry sound production during the first year of an infant's life. Wasz-Hockert et al. (1968) had studied birth cries, pain, hunger, and pleasure cries mainly diagnostically in relation to features of health or disorders in new-boms. Theoretically, developmental linguists at that time still had to deal with a Language Acquisition Device, with Jakobson's theory about sounds of the world, and with the dispute about an infant's discontinuous or continuous development towards speech. The possibility to register vocalisations of young children on audio tape for a prolonged period enabled us to study the development of (speech) sound production in a *motor-phonetic* way.

Perception experiments after acoustic segmentation of the infant cry and non-cry sounds were performed and these revealed for example that *segments* of pain or pleasure cries were not distinguishable. These sounds could only be identified correctly

when the entire respiratory inspiration-expiration cycle was given. In our description system for infant sound production, this respiratory cycle thus became the physiological unit for the segmentation of an infant's sound stream. Within this unit we described the phonation patterns, and the types and places of articulatory movements that have their onset in the first year of infant life. In the course of that year infants learn to co-ordinate step by step respiratory, phonatory, and articulatory movements which results in the production of speech-like sounds. With regard to the increasing complexity of sound production, speech motor milestones demarcate some six stages (e.g. Koopmans-van Beinum & Van der Stelt, 1979, 1986).

In a group of fifty healthy infants followed longitudinally from 3 to 12 months of age, the onset of babbling, which is the starting point of the fifth stage, appeared to vary enormously (Koopmans-van Beinum & Van der Stelt, 1981). The first infant to babble was 18 weeks old, and the last one was 48 weeks, with a mean age for the onset of babbling of 31 weeks. Such a range can be explained by genetics ("The father of the baby was not talking before three years of age!") or by motor-developmental preferences of the baby ("He is busy learning to walk.").

In older children without mental or medical deficiencies, a delayed speech development often is said to originate from problems in mother-infant interaction. One of the purposes of a longitudinal study on cleft-palate and normal infants, which started in 1984, is to evaluate the influence of mother-infant interaction upon the development of speech communication during the first two years of life (e.g. Koopmans-van Beinum, Van der Stelt & Jansonius-Schultheiss, 1984). In this study we included the non-verbal aspects in mother-infant interaction, hypothesising that during the development of their communication system the two persons involved negotiate about the meaning of their movements.

3. Subjects

We have selected two normal and healthy mother-daughter pairs from a control group of six which participated in the longitudinal study on the influence of an oral plate on the speech development and speech interaction of mothers and cleft-palate babies during the first two years of life (Koopmans-van Beinum, et al., 1984; Koopmans-van Beinum, Jansonius-Schultheiss & Van der Stelt, 1990). The two mother-girl pairs are normal with regard to pregnancy, labour, and post-natal medical history. They were selected because of quite different interaction styles, present right after birth.

During the first two years of life the children's social, educational, and medical histories were collected by means of questionnaires on daily routines, psychomotor development, illnesses, feeding procedures, eruption of teeth, and new sounds recognised by the parents. They had several neurological examinations, as well as inspections by a paediatrician and by an audiologist. The development of the two children is regarded to be socially as well as physically normal, although both girls at times have been ill in the period studied.

The different interaction styles in the two pairs have been evaluated only with regard to their impact upon speech-communicative aspects. When two years of age the two girls differed considerably with regard to their performances in speech communication. One girl started soon after her second birthday with a speech therapy period of about three years, the other girl then was already a precocious talker.

4. Micro-analytic transcription of video-recordings

In each monthly video-recording five minutes of uninterrupted mother-infant interaction were chosen for further analysis. Since an outside observer of a mother-infant pair cannot know beforehand which movements will have a communicative function in that specific pair, we have chosen to transcribe, over the two-years period, *all* occurring movements in a micro-analytic way for the two persons separately.

We differentiated between in total eight categories of movements per person, the so-called *channels* like gaze direction, sound production, touch, mimical movements, head movements, hand/arm movements, body movements, leg movements (for the baby only), and changes in mother-infant proximity. The onsets and offsets in time of the various movements per channel have been transcribed and represented on sixteen lines. The transcription system consisted of about 200 different codes which are categorised per channel. The time axis for changes in the mother's gaze direction might contain for example an alternating sequence of 'looking at the baby's face' and 'looking at the baby's hands', incidentally interrupted by 'looking at another person in the room'. Similarly, the changes in the infant's gaze direction were described. Thus, moments of face-to-face contact were found whenever the mother was looking at the baby's face and the baby was looking at the mother's face simultaneously. The channel 'mother-sound-production' had about 30 codes for the mother's utterances, subdivided into categories as shown in Figure 3. The infant sounds are categorised with regard to manner and place of sound production (Van der Stelt & Jansonius-Schultheiss, 1990).

The basic aspects of human communication, intersubjective tuning by means of the distance channels, transmission of visual and audible intentions, and (in this study) turntaking by the mother upon landmark sounds of the baby (Van der Stelt, 1993, see Figure 2) are defined by means of combinations of different codes and are described in section 6.

5. Sensori-motor transmission model

Five minutes mother-infant interaction resulted often in a data file with more than 600 onsets and offsets of movements of the two persons separately. Clearly, not every movement of one person is always perceived by the partner. When the baby is looking around she will not notice the onset of a smile on her mother's face. Looking back at her mother's face the baby may see the smiling expression, but only the baby's memory for facial expression can link sequenced visual images of her mother's facial expression. In the sensori-motor model of interaction given in Figure 1, we have formulated the criteria for transmission of movements from one person to the other, and vice versa neglecting a memory function in both persons involved.

The human eye clearly has a sensory as well as a motor function in communication, and therefore it occurs on both sides in the model. Only when the mother is looking at the baby's face, she can notice when the child starts to change its gaze direction and in that manner she can follow the shift in attention of the baby. With regard to the human ear we have decided that sounds produced by one person are always perceived by the other person as well as by the sound producer herself. Transmission of sounds from sender to receiver and vice versa thus is considered to be a 100 % secured.

For this ethological study of the early acquisition of speech communication we have focused on the transmission lines between the areas indicated in grey. The triangles represent the *sensory* functions, the ovals stand for the categories of *movements*, and the continuous lines represent the *transmissions* studied with regard to basic aspects in communication.

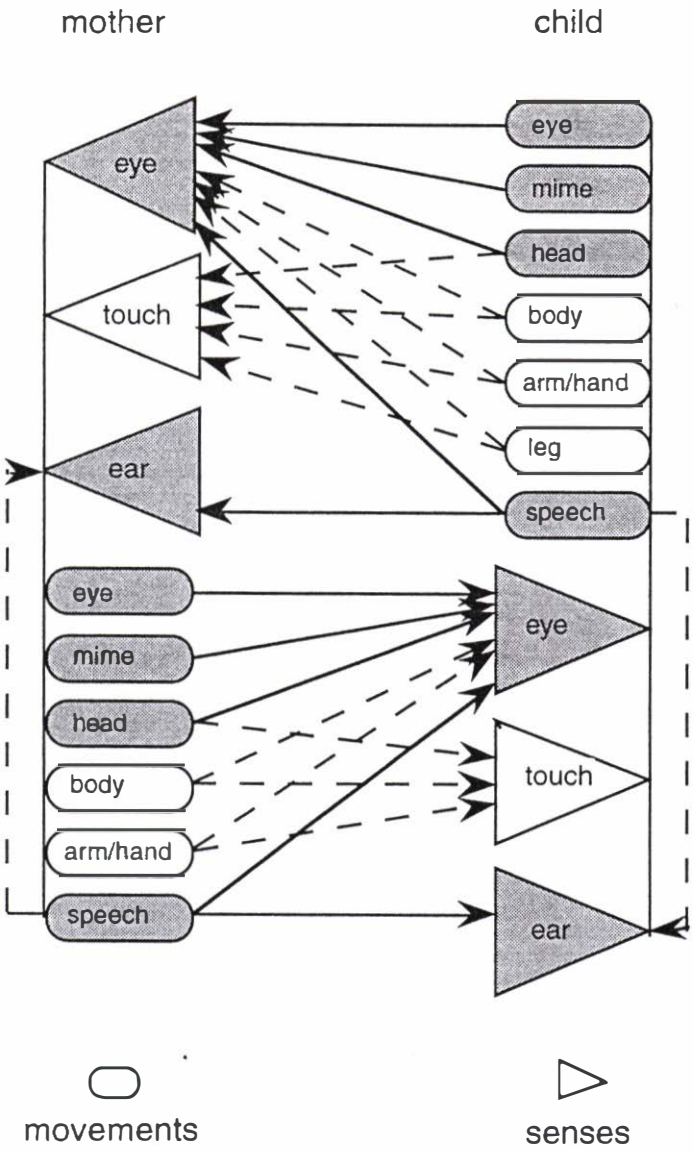

Figure 1. Sensori-motor transmission model (Van der Stelt, 1993, p. 49). Constraints for the transmission of movements are described in section 5.

6. Definitions

Human communication systems are often represented in the model of Denes and Pinson (1973), with the sender, the medium transmitting the message and the receiver in which tuning between sender and receiver is assumed implicitly, and most of the time in the sound domain only. First of all, with regard to the ontogenetic onset of speech communication, Bullowa (1979) quite correctly pointed at the less obvious properties of human communication systems that come before the transmission of a message.

> "The two persons must learn to be *tuned* (my italics) upon each other just like a receiver to a carrier wave of a radio station." (p. 16).

Furthermore, in early mother-infant interaction speech communication is not conventionally limited to the sound channel alone (as in adults, using a telephone or talking in the dark, for example). Tuning via the distance senses eye *and* ear must be present for a speech-communicative message to be transmitted from sender to receiver. Bullowa (1979), describing normal communicative development, pointed at the two above mentioned distance channels by stating that:

> "What moves may be sound waves set in motion by the vocal apparatus or it may be some visible part of the body." (p. 23).

Summarising we may conclude that intersubjective tuning, transmission of intentions, and turntaking can be considered as basic aspects of all human communication systems. We have chosen to measure ethologically the ontogenetic changes within a mother-infant pair with regard to these three basic aspects. A mother-infant system thus may proceed towards speech communication in their particular manner, allowing for a 'family style' of speaking.

In view of the transmission model described in section 5, we have selected specific codes for behaviours of mother and infant separately which in their co-occurrence can be regarded as communicative either via the visual, the auditory, or both channels.

The first aspect is *intersubjective tuning* between mother and baby, which was measured as the percentage of time of face-to-face contact, of vocalisation in unison, and of face-to-face contact plus simultaneous sound production in five minutes of transcribed interaction per recording.

The second aspect is the *transmission of intentions* between mother and baby, measured as the percentage of time of mimical and head movements during face-to-face contact (visual messages), of sound production during face-to-face contact (audible messages), and of simultaneous visual and audible messages per person in five minutes of transcribed interaction per recording.

The third aspect is the *mother's turntaking upon infant landmark sounds*, measured as the proportion of the number of infant sounds with a mother's turn to the total number of infant landmark sounds per recording.

7. Results

The results of the ethological analysis of mother-infant behaviour demonstrated a difference on the three basic communicative aspects between the two pairs. For certain aspects the differences were present during the first five months and disappeared thereafter. For others they occurred mainly after the fifth month. In view of the developmental processes between mother and baby we hypothesise that these early differences influenced the later performances of the children with respect to the quality of their speech-communicative behaviours. We want to stress that general conclusions about the results of this study,like 'a stimulating mother' or 'a not-responsive infant', do not apply. The upbringing, feeding patterns, and styles of speech communication change per family and we, as observers, must respect their choices.

The differences between the scores of the pairs on the aspects of speech communication in the sequences of the recordings have been analysed for significance by means of the sign test. The monthly recordings of the two pairs are matched for the age of the babies. Whenever *all* monthly recordings of one pair, for example, show a higher amount of sound production than the matched recordings of the other pair, this difference is taken as very significant. Below, the significant differences found are given.

7.1 Intersubjective tuning

Face-to-face tuning is different for the two pairs. After the fifth month the percentage of time of face-to-face contact per recording is significantly lower for the good speaker than for the poor speaker. This means that after the fifth month the latter girl continued to look at her mother while communicating which may have consequences for the book-reading interactions for example. These are more instructive when visual and audible information can be processed in parallel.

Alternated sound production between persons is related to the give-and-take-turns in conversations, while crying-soothing or laughing together usually occur simultaneously as an emotional exchange. Vocalisation in unison during the first five months of life was more frequent for the good speaker than for the poor speaker. In this respect we may conclude that the presence of an initial emotional bonding of mother and baby by means of simultaneous vocalisations as well as the shift to alternating sound production is basic to later speech performance of the child. Alternated sound production, already present during the first five months, is perhaps too difficult for a young baby who still is learning to relate the interpersonal turns and to bridge the silence between the turns.

The duration of intersubjective tuning of mother and baby using the two distance channels simultaneously is larger during the first five months and smaller thereafter for the good speaker compared to the poor speaker. Also, for each of the pairs, the number of times that they looked at each other while 'talking' was calculated per recording. In the case of the poor speaker this number was higher than for the good speaker in 13 out of 14 recordings *after* the fifth month. Affect attunement in the auditory as well as the visual domain usually disappears after the first four to five months of mother-infant life (e.g. Stern, Hofer, Haft & Dore, 1985; Ginsburg & Kilbourne, 1988) which possibly is related to the onset of parallel processing.

7.2 Transmission of intentions

Transmission of intentions from one person to another is only possible when these persons somehow are 'in contact'. In this study the sender of intentions can either be the mother or the baby, whereas the 'message' is transmitted audibly and/or visually. We have compared the duration of intentions transmitted by the children as well as the number of intentions per recording. Similarly, the two mothers have been compared.

For the visual intentions transmitted during the first five months by the good speaker to her mother we found that the overall durations were longer than for the poor speaker and her mother in that period. The numbers of visual intentions per recording were not significantly different for the two babies. Probably, the poor speaker transmitted relatively 'short' visual intentions. With regard to visual intentions of the mothers to the babies, no difference was found during the first five months, but a significant one over all recordings of the first two years. This is explained by the observation (section 7.1) that the poor speaker and her mother, in comparison to the good speaker pair, continued to have more face-to-face contact after the fifth month and they thus had more possibilities to transmit visual intentions.

The two children did not differ with regard to the durations of audible intentions transmitted to their mothers nor in numbers per recording over the two years. The mothers always transmitted more audible intentions than their children which is quite what one would expect from a 'teacher of the mother tongue'. During the first five months, and thereafter as well, the mother of the good speaker scored a higher *percentage of time* in seconds per recording for audible intentions than the mother of the poor speaker. The *numbers* of audible intentions per recording however were not

different for the two mothers. So probably the mother of the good speaker made longer or more sentences per transmitted audible intention than the mother of the poor speaker.

The mother and the baby also transmitted intentions to each other that are combinations of the visual and audible intentions. This was the case when, during face-to-face contact, head movement, mimical movements, and sound productions occurred simultaneously. The mother of the good speaker transmitted these combined visual and audible intentions to her daughter significantly for more time per recording than her daughter did to the mother. Mother and daughter in the other pair did not differ from each other in this respect. Between pairs comparison with regard to the combined intentions showed that neither significant differences were found for the children nor for the mothers.

We concluded that the mother of the good speaker is quite explicit in her transmission of intentions, especially in the first five months. The mother of the poor speaker has a style which is more equal to her daughter's, mainly reflecting the transmitted intentions. A young infant with obvious visual 'messages' is easier to interpret for a mother than an infant with quickly passing facial expressions. The mother's responsive behaviour can be more consistent in the first case than in the latter. Although an infant under five months does not yet understand the adult meaning of the mother's audible intentions, these moments are ideal for speech sound instruction in general. The infant gets used to sounds and can relate the seen facial and mouth movements with the auditive perception of various sound qualities. However, ambiguity of the mother in relating her facial expression and the emotional quality of her sound productions can elicit negative affect in the baby which was demonstrated by the blank face experiments (e.g. Genta, Tartabini, Costabile & Zamberlan, 1986). An early orientation of the infant towards the mother's audible intentions may facilitate later speech communication performances.

7.3 Turntaking upon infant landmark sounds

Turns taken by the mother upon landmark sounds of the baby are thought to guide the infant towards the sound productions of the mother tongue. These successive sound productions - yet staying in tune by means of timing, prosodic, and content cues, is basic to human speech communication (e.g. Van der Stelt, 1983; Fernald, 1992). The first occurrences of the infant's landmark sounds are spread in time over the first year, and thereby represent the speech motor development as a gradually more and more complex co-ordination of respiration, phonation, and articulation.

Four groups of landmark sounds of the infant have been studied with regard to turntaking by the mother (see Figure 2): laryngeals, simple articulations, babbling sounds, and words. The time-lapse for turntaking by the mother was set per recording, thus accounting for progress towards the adult timing of turns. Furthermore, we expected that the production of a new landmark sound causes in the mother a decrease in turns upon the previous landmark. Any utterance of the mother (see for categories Figure 3) that occurred during an infant landmark sound or within the time-lapse after the sound was considered an acceptable turn.

Percentages are calculated for the *landmark sounds with turns* per total number of sounds of that group per recording for both pairs. The subsequent recordings of the pairs are compared and analysed by means of the sign test. With regard to three out of the four sound categories (laryngeals, simple articulations, and words) the two mothers differ significantly in turntaking. The mothers did not differ with regard to turntaking upon babbling sounds.

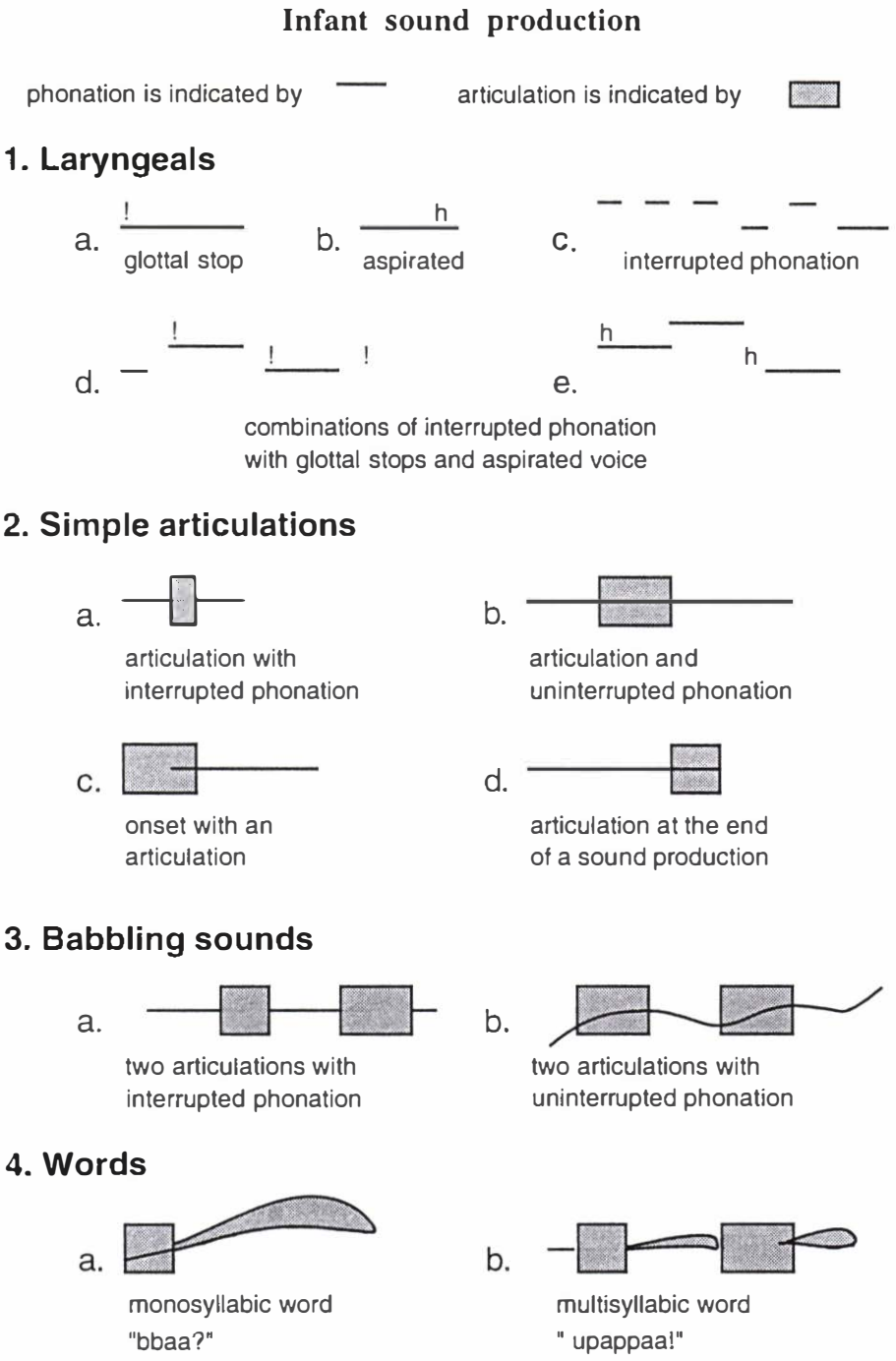

Figure 2. Four out of five landmark sounds in speech motor development of the first year of life (adapted from Van der Stelt, 1993, p. 134) that have been studied with regard to turntaking by the mother.

From birth onwards, the mother of the good speaker took turns upon the all landmark sounds with an overall mean of 70 % of the infant sounds. The mother of the poor speaker took turns with an overall mean of 27 % of infant sounds, mainly because she only started to take turns when her daughter began to babble, from week 32 onwards.

The results for taking turns upon the first two landmark sounds are given in Figures 4 and 5. For the four categories turntaking is summarised in the text below.

Mother Sound Production

1. Infant sounds

a. rising intonation	b. falling intonation
'Say it again, wawawa?'	'You're quite right!'

2. Infant body behaviour

a. rising intonation	b. falling intonation
'Trying to stand up?'	'Oh, you fell down!'

3. Mother actions

a. rising intonation	b. falling intonation
'Want another one?'	'That's for you!'
'Who is there?'	'Say bye-bye.'

4. Infant directed, rituals

game sounds: coucou
calling the infant's name
t-t-t-t, mmm

5. Other sounds

not codable
directed to other persons in the room

Figure 3. Pragmatic categories of the mother's utterances.

Laryngeals

The *laryngeals* are the first non-cry sounds that infants produce from an early age onwards by means of glottal movements during one expiration only. The sounds are relatively short in duration, and can be produced as a very weak sound. Some of them are mainly aspirated, the others are produced mostly as a series of glottal stops per expiration (e.g. Figure 2, number 1). The two infants produced these sounds already in the first recording. The frequencies of laryngeals of the two infants per recording, and the frequencies of laryngeals with a mother's turn are given in Figure 4.

The mother of the good speaker has taken turns upon the laryngeal sounds of her baby significantly more than the mother of the poor speaker (61.8 % of the total number of laryngeals versus 22.7 %).

Simple articulations

The *simple articulations* occurred in the two infants from the second recordings onwards, and are characterised by one single articulatory movement during phonation in one expiration. The articulatory movement may occur at the beginning, in the middle, or at the end of an utterance (e.g. Figure 2, number 2). Phonation can be interrupted during the movement, or is not interrupted. The frequencies of the simple articulation sounds of the two infants per recording, and the frequencies of these sounds with a mother's turn are given in Figure 5.

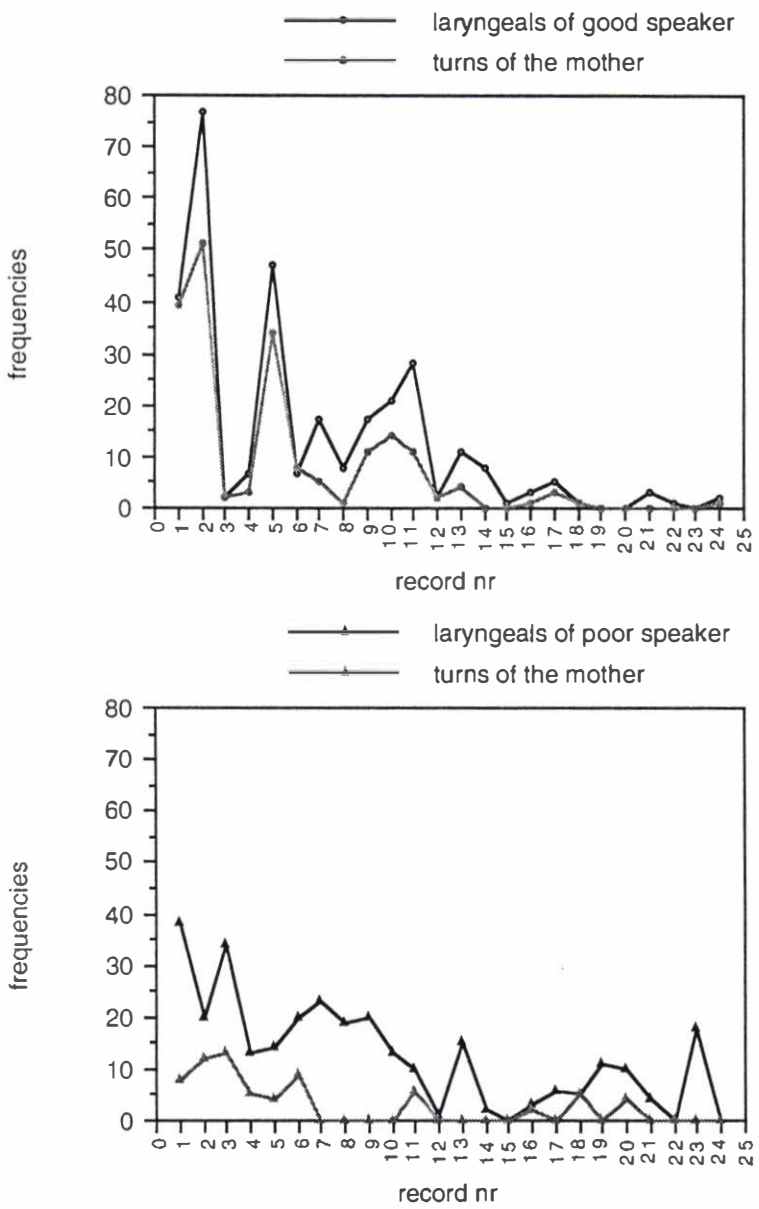

Figure 4. Frequency of laryngeals produced by the two infants (continuous lines) and the frequency of laryngeals upon which the mothers have taken a turn (dashed lines) per recording over the two years.

The turntaking behaviour of the two mothers upon the simple articulations of the infants was similar to that following laryngeal sounds. The mother of the good speaker was significantly more active in taking her turns after the baby's simple articulations than the mother of the poor speaker. The total number of simple articulations in the recordings over the two years was 115 for the good speaker, of which 87 caused a mother's turn (of the total number this represents 75.7 %). The poor speaker produced more frequently simple articulations: 432 in the two years, but only 24 of them (5.6 % of the total number) resulted in a turntaking pattern of her mother. In the period between the seventh and the 15th recording the infant produced quite a lot these simple articulations, yet the mother hardly responded within the time-lapse. This child thus did not receive feedback on these sound productions.

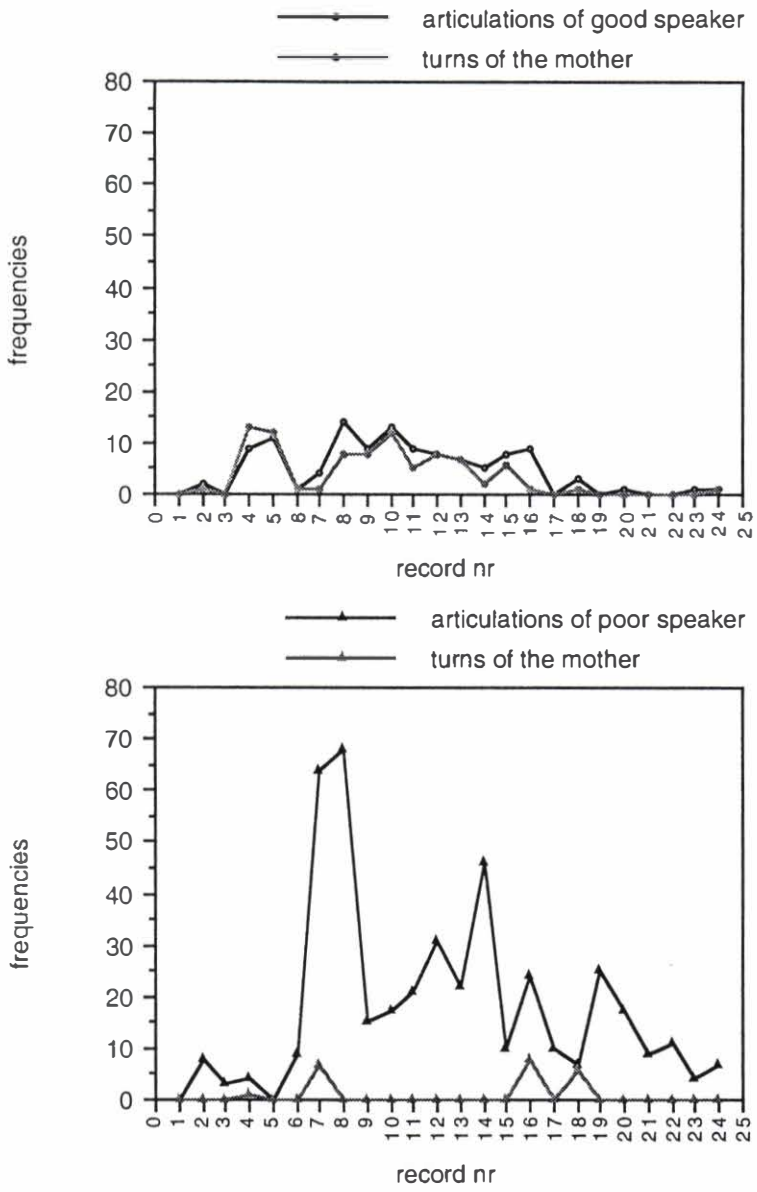

Figure 5. Frequency of simple articulation sounds produced by the two infants (continuous lines) and the frequency of simple articulation sounds upon which the mothers have taken a turn (dashed lines) per recording over the two years.

Babbling

In a group of fifty normal infants the onset of babbling sounds is found to vary between week 18 and week 48 (Van der Stelt & Koopmans-van Beinum, 1986), with a mean age of 31 weeks. For both girls in this study babbling was *recorded* in week 32, but these sounds may have occurred for the first time in the four weeks previous to that recording. These sounds contain at least two articulatory movements per utterance, which are either repetitive or variegated (e.g. Figure 2, number 3). Phonation can be interrupted or not interrupted.

The results of the comparison of the two pairs for the percentages of the babbling sounds with turns per total number of babbling sounds is *not* statistically different. In the recording of week 32 the good speaker produced five babbling sounds and the poor speaker 22. Babbling sounds resemble 'first words' and the sounds appeared to be

fairly adequate in drawing the mother's attention. The total number of babbling sounds produced by the two infants in the recordings over the two years is 44 for the good speaker, of which 29 (65.9 % of the total number of babbling sounds) caused a turn taken by the mother. The poor speaker produced 245 babbling sounds, and her mother took a turn upon 134 babbling sounds (which is 54.7 % of the total number).

Words

The words usually have their onset in the second half of the first year, and are mono-, bi-, or multisyllabic sounds with a fairly consistent form and meaning (e.g. Figure 2, number 4). The first words occurred in the 11th month for the good speaker, and in the 12th month for the poor speaker.

The two mothers differ with regard to turntaking upon words produced by the infants. In 11 recordings out of 12, the good speaker pair had a higher percentage of words *with* turns than the poor speaker pair. The good speaker has produced a overall total of 300 words in the recordings over the two years, of which 231 were followed by a turn of the mother (which is 77 % of the total number of words). The poor speaker uttered an overall total of 143 words, and her mother has taken a turn upon 70 of them (which is 49 % of the total number).

8. Conclusions

Mothers and newborns show their mutual attention by means of all their senses. During the first five months the distance between mother and baby gradually becomes larger and the influence of the ear and the eye for being-in-touch increases. Intersubjective tuning and mutual transmission of intentions via these distance channels set the stage for communication by means of sounds only. In a way, there are many moments in this first period that are quite usefull for explicit speech instruction: the baby looks at the mother, he can see her mouth movements and hear her voice. As a neonate already the baby is capable to move in synchrony with adult speech rhythms (e.g. Condon & Sander, 1974).

For the development of speech communication, initially the visual channel is important because eye movements of infant and mother have a more or less equal quality. The mother can follow obvious changes in infant gaze direction which facilitates interpretation of the infant's orientation and attention shifts. The mutual transmission of (audible and visual) intentions can become more and more coherent in various situations. After that first period speakers can start to use the distance channels in parallel which is efficient for labelling and pointing in book-reading situations for example. With regard to the vocal-aural channel, mothers better take the early landmark sounds of their infants 'seriously' by responding to these sounds with a turn. Thus the mother constructs a pseudo-dialogue and the infant becomes aware of the alternating sound productions and the later speech sound-meaning relations.

Speech-communicative interaction styles of mother-infant pairs are different, because both mother and baby can focus on many aspects and topics in various situations. Furthermore, genetics, socio-cultural settings, and the histories and attitudes of the parents have their impact as well. Mothers can, for example, interpret mainly the prosodic features or react upon the segmental qualities of their infants sounds which may have effect on the types of first words of children (Van der Stelt, 1983a; 1983b; Nelson, 1973). Most of the time, parents are successful speech instructors.

The outcome of the developmental process partly depends on infant characteristics, on the level of anxiety of the mother, and on the quality of the mother-infant interactions. Even when a baby has severe problems, such as an extreme premature

birth or a complete cleft palate, the efforts of parents can be fruitful, despite the severeness of the child's handicap. The handicap as such does not predict the outcome of the developmental process alone (e.g. Wijnroks, 1994). On the other hand, when the mother suffers from a post-natal depression or her own traumatic upbringing, the infant's development may be less smooth with effects on the quality of speech-communicative behaviour extending into the school settings (e.g. Van de Rijt, Van der Stelt & Plooij, 1996). Interaction and instruction in school settings largely relies on speech communication and children with a delay have difficulties in keeping up with the group.

Interactions at risk may profit from early interventions establishing bonding and (speech) communication between mother and infant. Preferably, these interventions are offered as early as possible, thus preventing deviant patterns of interactions to become fixed. Focus on the quality of intersubjective tuning, on the mutual transmission of intentions, and on turntaking characteristics can be applied in various problematic situations, because these aspects underly all human communication. Irritable infants, know as 'cry-babies', can calm down more easily when the mother learns 'to stimulate less' and just hold her baby (Van den Boom & Hoeksma, 1994). Sometimes mothers transmit too many or too few messages, time their turns not adequately, or forget to adapt to the developmental level of the infant. By means of simple instructions for the mothers about their communicative behaviours such as Observe, Wait, and Listen (the Hanen-program for older children with communicative problems, e.g. Watson, 1993; Manolson, 1992) which normally occur in mothers who inspect their newborn, and supported by video demonstrations the communication can become a pleasurable experience again both for mother and child. In this manner interaction can prevent aggravation of the individual problems of mother and infant as well.

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