

SENSITIVE STAGES IN FACE-TO-FACE INTERACTION IN THE FIRST TWO YEARS OF LIFE

Jeannette M. van der Stelt

1. INTRODUCTION

In previous issues of the Proceedings of our Institute several contributions have reported about a project concerning speech development and mother-child speech interaction of cleft-palate infants (most of them equipped with an oral plate), and of normal infants (Jansonius-Schultheiss, 1985; Jansonius-Schultheiss, 1987; Koopmans-van Beinum, 1987; Van der Stelt, 1985, Van der Stelt, 1987). This project is financed by the Netherlands Prevention Fund. Both Academic Hospitals of Amsterdam and two regional Cleft-Palate Teams have supported the project. (For more details see Koopmans-van Beinum et al., 1988: this volume).

We recall that the project is set up as a longitudinal, naturalistic multi-cases study with direct observation (video recordings) and questionnaires. The video recordings are transcribed using a multi-channel coding system for behavioural changes of mother and infant, separately, a system consisting of about 200 codes.

2. LITERATURE

In this report aspects of the development of face-to-face communication in two normal mother-infant pairs are presented. Since we are interested in speech development, which we suppose to start at the sensori-motor level, via cognitive levels to linguistic and social functioning, we have to do with nature and nurture as "life" forces. These forces are supposed to interact throughout the development. In the course of the development, various stages can be detected that are different with regard to the behavioural content. More and more age is seen as a "variable in development", rather than a "measure", since the interference of nature and nurture may be different per infant, and thus age does not describe the infant's abilities adequately. If, for example nature and nurture do not interfere optimally, the development may be delayed until a specific level of experiences is reached. Bornstein (1987) remarks that:

".....it is now commonplace to find phases (my underlining, VdS) in the development of many different psychological structures and functions that are unique in the evolving transaction between these two life forces. At certain times in their life cycles, many structures and functions become particularly susceptible to specific experience (or to the absence of that experience) in a way that then alters some future instantiation of that structure or function. So during such sensitive periods in development specific experiences dramatically influence eventual outcomes." (p.3).

In our report in the previous Proceedings (Van der Stelt, 1987) we signaled "conflict periods" for one mother-infant pair during the first six months of life. Those periods may be seen as demarcations of sensitive periods in the development in a way similar to

that indicated by Bornstein (1987). These periods "tend to occur early in the ontogenetic history of many systems across many species, during prenatal development or in infancy in the life course of human beings for example", (p. 10). Sensitive periods differ in their durations and effects, differ in when and how they influence development, which is probably related to the relative power of the two life forces.

Myers (1987) regards the infancy period (the first year of life) as an important one for the family-infant relationship. In contrast to animal bonding behaviour, in humans the post-partum period is not seen as critical for mother-infant bonding. So hospital policy to ensure mother-infant bonding immediately after birth cannot guarantee a development without problems, it is not an easy cure-all. We have to realise that there are two life forces at stake.

The importance of sensitive periods is not quite determined yet, but Bornstein (1987) thinks they buffer a system against later change in the self or in the environment, and thus the sensitive periods are an important adaptation to evolutionary influences. In this way it is stated positively. Inversely, (a lack of) certain experiences in sensitive periods could prevent a system from changing to desired adaptation when mature or substantially delay that development.

During the first two years of life several aspects of the face-to-face situation will change, like the duration of the face-to-face situation and the "reason why" an infant may look at someone's face. Likewise, the content of communication, the message, can change when the mother-infant pair grows accustomed to each other's face. Implicitly already stated by Bornstein(1987), we too suppose that early experiences influence the following stages in the development of a mother-infant pair.

In human communication movements are essential, since they can bridge a certain distance between two or more human beings. The way someone moves may reveal the way that person feels at that moment, nervous for example, although his speech may contradict that impression of nervousness. However, in speech communication the movements often must be coordinated to a certain degree, must be produced within a certain timespan, and in situations in accordance with habits of a community. Such "ritualised", at a higher level coordinated movements often have labels, "words", or "gestures". Using these labels in the presence of someone else often reproduces the notion of that "ritualised" movement or its components. Movements that are not perceived by someone else will have no communicative effects. Many movements have a visible as well as an audible aspect (e.g. clapping hands, speech, walking) and are as such highly effective in communication if used in a ritualised way.

Of course this is an oversimplification of all adult human communication, but it may be helpful if we are to find behavioural patterns in early mother-infant communication. Basic in our approach is that we believe that an infant composes a picture of the important, "ritualised" movements in communication, changing the picture periodically. This procedure is easy forgotten when communication has become fluent.

In the course of the development from sensori-motor level to cognitive and social levels, the infant needs an adult who is prepared to "co-operate" as a kind of external feedback system. In that way the infant learns to produce certain movements and to inhibit others. Few mothers expect to hear speech sounds from their infants right away, but they do expect other communicative movements such as smiles and gazes in the direction of their faces. In many ways they try to elicit those behaviours, expanding and varying them with regard to timing, duration, or form whenever the infant's selective attention can stand it. This mutual coordination of mother and infant may change with the developmental stages of the infant. At certain times the infant's internal feedback system is changing to another level of control. Detailed description of mother-infant interaction in each stage may reveal certain movement patterns of importance in

sensitive periods of the development of verbal communication. Changes in occurrence of the movements may have to do with changes in communicative effect of the movements. In very young infants tactile feedback can be important, while later on facial movements and speech overrule the tactile stimulation. Often redundancy is present in the sender-receiver situation when visible and audible aspects of behaviour are used simultaneously.

We will try to find movement patterns in the various stages in the first two years of mother-infant interaction in a quantitative way without going into detail of transcribed codes. In the condition that mother and infant are looking at each other's face, we suppose that facial movements are actually perceived as well as visible aspects of sound production. Equally we suppose that sounds are always fully perceived, visually and acoustically by the receiver.

3. METHOD

3.1. Recordings.

Video recordings of two mother-infant pairs were used, the infants were both girls. They were recorded for about 20 minutes bi-weekly during the first year of life and monthly during the second year. Of the first mother-infant pair all recordings have been transcribed, whereas from pair 2 only the monthly recordings were transcribed so far, although bi-weekly recordings during the first year of life are available. Only in the figures we deleted data of the bi-weekly recordings for pair 1 which we did use for interpretation.

The transcriptions covered, if possible, a continuous period of five minutes per recording, but sometimes recording was stopped because of distress of the baby, until recovery. This was the case in weeks 10, 12, and 26 for pair 1, and for pair 2 in weeks 12, 16, and 28. We then only had one-and-a-half to three minutes of transcription without interruption. After the first six months these distress situations did not appear anymore. The infant in pair 2 furthermore, was hospitalised when about 64 weeks old, and sound was lacking on the recording in week 104. Transcriptions thus are not available for those periods for pair 2.

3.2. Transcription.

As mentioned before (Van der Stelt, 1987; Koopmans-van Beinum et al., 1988) the video recordings are transcribed by means of a sixteen-channel coding system in which behavioural changes are coded in time for onset and end of that specific behaviour. In the channel "gaze direction of mother" (MV) for example, the onset of her looking at the infant's face is coded as "A at moment t1". A following shift in gaze direction from "face" to "body" then is coded as "L at moment t2". The time span between t1 and t2 corresponds to the duration of the behaviour "looking at face". So the onset of L occurs at the same moment as the end of A.

In such a "score" of temporal behavioural changes of mother and infant over the sixteen channels, we look for certain behavioural patterns over time, expecting to find behavioural patterns in different stages. In studies on infant development (Bornstein, 1987; Myers, 1987; Snow, 1987) "critical, or rather sensitive periods" are often mentioned as well as "plateaus", periods of no major changes in behaviour. And parents often report behavioural spurts after a period of illness, which may have to do with "nature and nurture" again in a new relation. As suggested above, the succession of

these periods as well as their quality might be important for the developmental process in infants. Per stage there is supposed to be a phase of expansion, regression and conflict between mother and infant (van de Rijt-Plooy & Plooy, 1988). Expansion then would mean an increasing variety of movements of mother and infant as well. Regression could mean that certain, highly qualified abilities that were present earlier, disappear in the infant, thus temporarily causing a conflict situation, in which behavioural "rituals" of the mother-infant pair disappear, showing a lack of movement synchrony (Condon, 1979). For each pair the preceding recordings are thus important for the detection of stages.

In the present study comparison of the two pairs is tricky, since only quantitative data are given. We must realise that they might follow different ways to more mature forms of verbal communication.

3.3. Data manipulation.

Kerkhoven (in progress) developed a computer program PROGRAAF, that enables us to manipulate our data without losing their temporal. If a certain behavioural pattern is formulated beforehand, the program reports on the occurrence of that pattern in the transcription and gives some simple statistics like duration of the pattern in the transcription and percentages of time the pattern is present in the transcription.

In this report on visual communication we selected "looking at face" in the channels "gaze direction" for mother and infant. This is explored for co-occurrence with behaviours in the channels "facial movements" and "sound production". We explored "head movements" as well, but only with regard to the notion of "blank face" (Trevarthen, 1977).

The first thing to do is to detect the stages of each mother-infant pair, their "critical periods" and their "plateaus" in the face-to-face situation. Of course certain behaviours are functional in one stage and less so in another. So interaction while looking at each other's face is probably quite different when infant, compared to that interaction when two year old, with regard to timing, duration, e.g. But as soon as "looking at each other's face" disappears, some other behaviour might become number one in the next stage. It is in this way that we will make a start with "visual" pattern detection in the transcription of movements in the video recordings.

4. RESULTS

4.1. Duration of face-to-face situation and the partners' contribution.

First we explored how long mother and infant were looking actually at each other's faces, since in literature this is reported to be very different from adult-adult communication (Schaffer, 1977). Especially in very young infants mother and infant continue to look at each other's face. The mother is almost constantly ready to intervene with the behavioural flow at appropriate moments, even when the infant is not looking at her.

In fig. 1 we see that during the first year simultaneous looking at each other's faces is nearly always determined by the infant's gaze direction. Mother is for a large amount of time looking at the baby's face, so that when the baby starts to look at her, they end up by looking at each other. In nearly all recordings we see a slight difference in the duration that the infant looks at the mother's face compared to the duration of the face-to-face situation, which possibly indicates that the mother is either "slow" in her

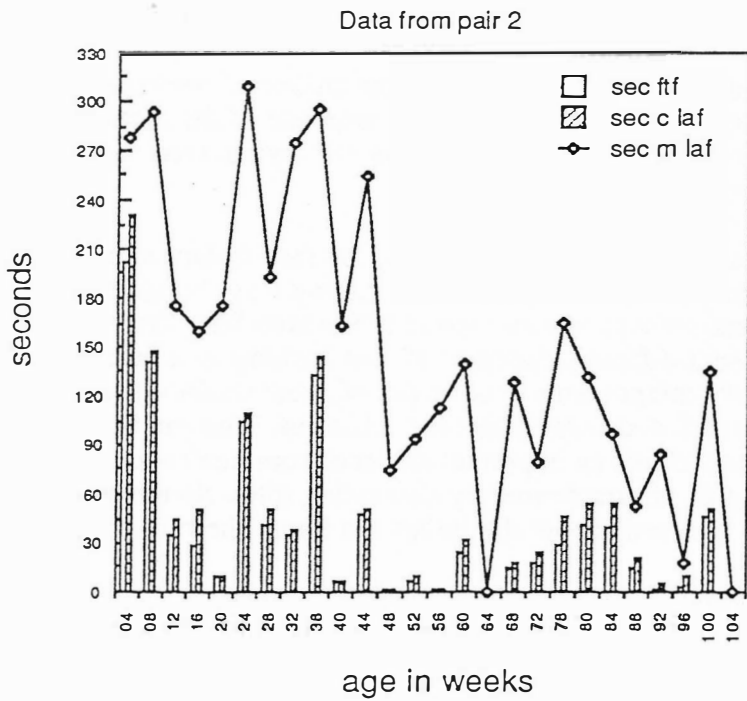
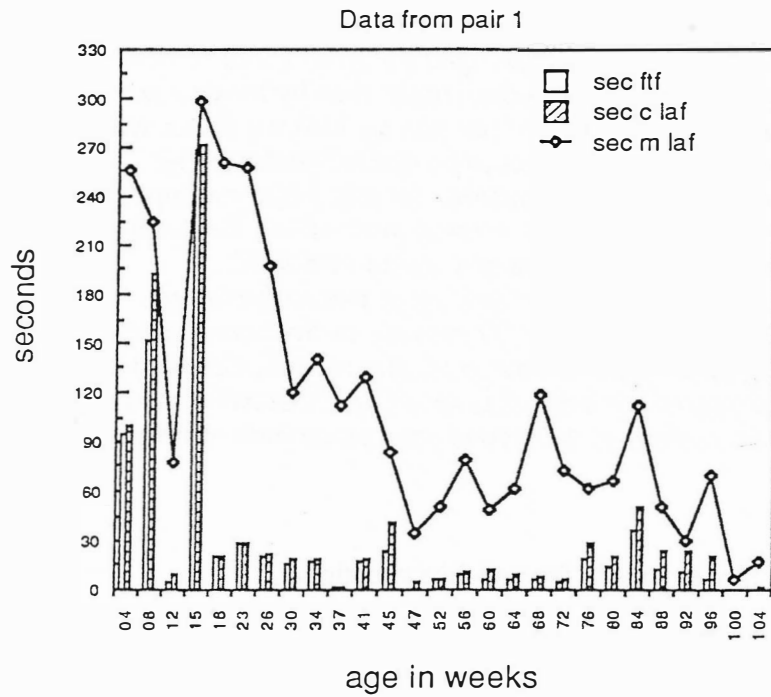


figure 1

Fig. 1. Duration in seconds of "looking at face" (laf) for two mother-infant pairs (girls) during the first two years of life.
 sec ftf = simultaneous looking at the face of the other,
 sec m laf = mother is looking at the baby's face,
 sec c laf = baby is looking at the mother's face.

reaction when the baby starts to look at her face, she may interrupt the situation, or she breaks up the face-to-face situation earlier than the baby does. This is the case for pair 2 in almost all recordings over the two years and for pair 1 a "rule" after week 76. An example could be that the mother is talking to the child about something and checks if the child is paying attention to her by other means than by looking at the face. Likewise the infant could check mother's behaviour just by looking at her without demanding extra visual information. This aspect has to be studied qualitatively.

Both pairs decrease face-to-face interaction, for pair 1 fairly abruptly around week 15 and for pair 2 after week 36. In the second year of life for both pairs there is an increased amount of face-to-face interaction around week 80.

After week 18 the infant of pair 1 is looking at her mother's face for only about 30 seconds per five minutes up to about 50 seconds in the period around week 80. The mother is decreasing the amount of time gradually as well, although more slowly than her child. In the first year of life infant 2 is spending about twice as much time as infant 1 looking at her mother's face. In the second year the amount of time is still higher than for infant 1.

4.2. Duration of no movements in face-to-face situations.

We wondered furthermore how much was "going on" when mother and infant were looking at each other's faces. From experiments (Trevarthen, 1977) it is known that a mother who no longer reacts with smiles or speech or head movements when the baby is looking at her, will cause distress reactions in the baby:

"..have found with eight-week-olds that failure of communication due to lack of response or paradoxical response of the mother may lead to expressions of confusion, distress and crying, inert dejection, or withdrawal into self." (p. 267).

We checked in our data how much of the time of the face-to-face situation, we had to do with the "blank face" situation. Thus, when nothing was changing in the channels facial movements, head movements and sound production for either mother or infant. Of course we suppose a different function of just looking at a face for infants and mothers. Sometimes the infant seems to be so full of attention for what is going on (the input side of the system), that movements are inhibited. This can be the case for the mother as well, but turn taking, an important aspect of communication which the infant must learn from an adult, is characterised by alternating roles. So the mother cannot be permit herself to be "puzzled" about the infant too long. She runs the risk to end up with a crying infant.

In fig. 2 durations of no movements in the three above mentioned channels are given in face-to-face situations over the two years for the two pairs. As we can see, mother 1 is right from the beginning hardly ever "silent", or "not moving". Almost constantly she is changing when infant 1 is looking at her face. Only in four recordings she is less active than infant 1 (weeks 08, 56, 68, and 96). As for infant 2 the picture is quite different; her mother is relatively often showing a "blank face" in their face-to-face interaction and this is not changing during the two years. The amount of time in week 04 goes up to 142 seconds for the infant and to 121 seconds for the mother ("overflow" is indicated by the arrow). When infant 2 is "silently" looking at her mother's face the mother seems to mirror that behaviour during the first year. In the second year this pattern has changed, in most recordings the mother is a little bit more active than the child.

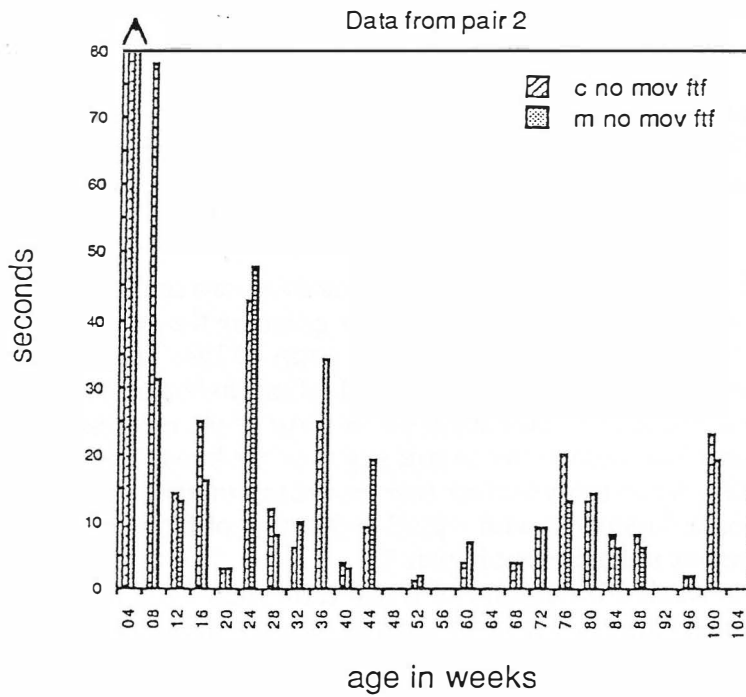
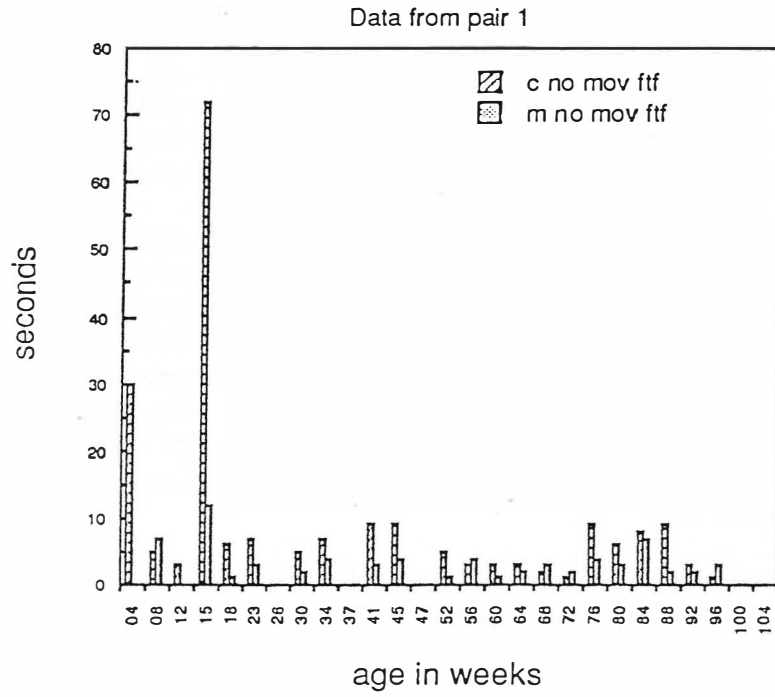


figure 2

Fig. 2. Duration in seconds of the time that mother and infant do not move for three transcribed channels: facial movements, head movements and sound production in the face-to-face situation.

c no mov ftf = child is not moving in the face-to-face situation, a "blank" face,
 m no mov ftf = mother is not moving in the face-to-face situation, a "blank" face.

Arrow in the graph for pair 2 indicates an "overflow" to 142 seconds for the infant and 121 seconds for the mother in week 04.

4.3.1. Facial movements in face-to-face situations.

Changes in facial expressions are well known in mother-infant interaction. Brazelton et al. (1977) studied these interactions in young infants up to the age of 20 weeks, determining strategies on both sides, such as initiation, orientation, and acceleration. In "acceleration" for example, the baby may smile, and then the mother returns the smiles after which the infant smiles for a prolonged period. These movements are prominent in that period.

Mothers often imitate the infant's facial expressions in a kind of turn-taking game while interpreting the expressions, or mothers exaggerate their own expressions. The play has to be integrated carefully with regard to the roles of the partners. Probably the "reason" is that the mother tries to keep the infant's attention directed towards herself. The infant is expecting some "attractive" movie and becomes unhappy if the "usual", "stereotyped" picture does not come up. The function of these exaggerated (but in infant-mother interaction "normal" movements), is not quite clear. The movements are rhythmical and synchronized, build-up of social expectancy (Trevarthen, 1977), which is probably perceived by the baby.

Fogel (1977) noticed that in face-to-face situations of mothers and infants it is the mother who creates the frame for their interactions. This framing may occur in other situations as well, for example when a child starts to explore the environment, it is the mother who is more or less "stationary" to allow the child to return to her. However in situations of mutual attention, when they are looking at each other's face, the content of their interaction, like

"... smiling and cooing, seemed to bear a somewhat more symmetrical relationship to each other than the one already described between mother and infant gazing." (p. 120).

In fig. 3 (duration of facial movements in face-to-face situations), we see for pair 1 that the face-to-face situation, which duration per recording is given by the graph, is nearly always "filled with facial movements" over the first two years of life. The duration of facial movements of mother (indicated by the square) and infant (indicated by the plus) almost equals the duration of the face-to-face situation. In most of the recordings of the first year the mother is somewhat more active mimically than the baby. The inverse is true in the second year of life. Apart from the first two recordings mother 1 and infant 1 do not differ very much (about 5 seconds) with regard to duration of facial movements. Fogel's (1977) symmetry seems to be present in pair 1.

For pair 2, especially up to week 36, duration of facial movements per recording of infant (the squares) and mother (the plus) is much smaller than the duration of the face-to-face situations, as given in the graph. When mother and infant are looking at each other's face for quite some time (weeks 24, 36, 44, and 60), it is the infant who is mimically more active than the mother, a difference of about 15 seconds in week 44. This pattern disappears after week 60 (except for week 84). In this pair too, there is a symmetry with the infant as leader in the first year, but facial movements often are lacking in face-to-face situations of pair 2.

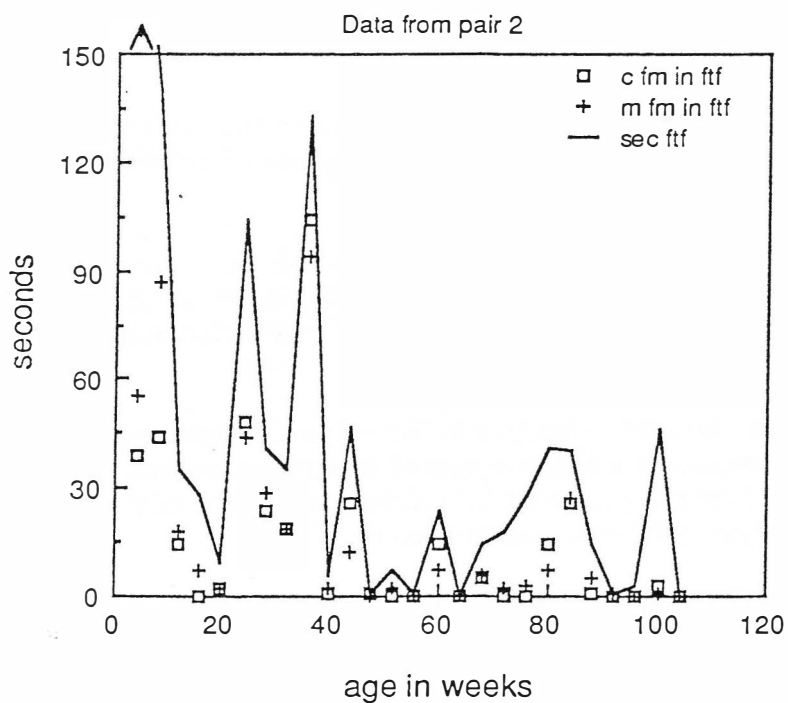
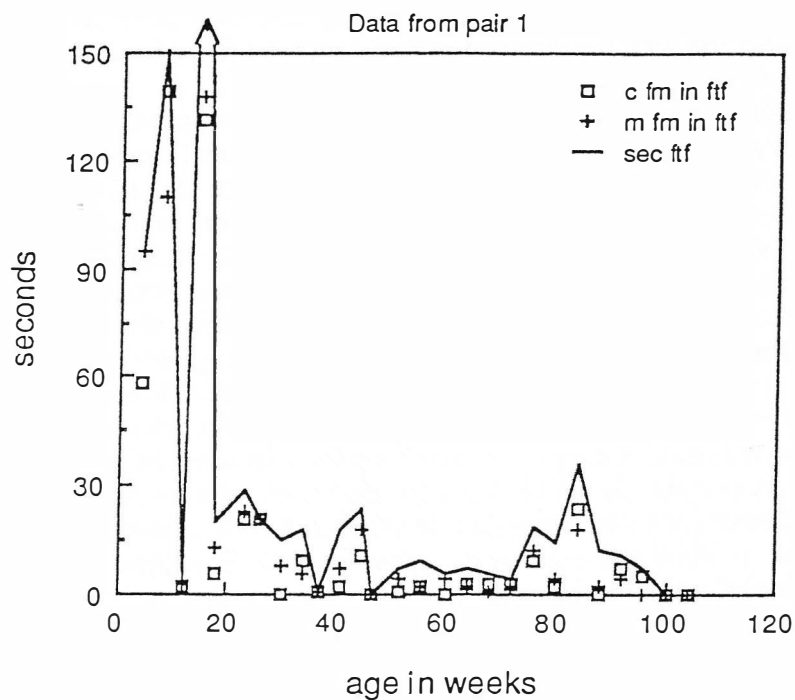


figure 3

Fig. 3. Duration in seconds of the time that mother and infant make facial movements in face-to-face situations per recording over the first two years. The graph indicates the amount of time of the face-to-face situations per recording.
 c fm in ftf = child makes facial movements in face-to-face situations
 m fm in ftf = mother makes facial movements in face-to-face situations
 sec ftf = duration in seconds of the time of face-to-face situations per recording.
 Arrow in the graphs indicates for pair 1 an "overflow" to 268 seconds in week 15, for pair 2 to 202, and 140 seconds in weeks 04 and 08 respectively.

4.3.2. Comparison of face-to-face situation and non-face-to-face situation.

In order to explore whether the child perceives the face-to-face situation as different from the non-face-to-face situation, we compared the duration of facial movements in the face-to-face situation with the duration of facial movements when mother and infant were not looking at each other's face.

For infant 1 the duration of facial movements in face-to-face situations was highest in week 08 with 140 seconds. When not looking at her mother's face she was mimically most active in week 26 (201 seconds, data not given in a figure). In several recordings there is an increase in facial movements during the second year in the situation that the child is not looking at her mother's face. In week 84 there is an increase in facial movements in the face-to-face situation as well. But the greater part of facial movements occurred in the situations that the child is not looking at the mother's face.

The same is true for infant 2 with the exception of the recording in week 36 when she is very active mimically (104 seconds) in the face-to-face situation. In the second year the duration of facial movements is about 10 seconds per recording for the greater part in the situation that she is not looking at her mother's face. In week 80 and 84 there is an increase in facial movements for infant 2 in both situations, like we found in infant 1.

With these quantitative data we cannot decide whether a child is differing between the two situations, since facial movements do occur in both situations. However, if for example a child looks at the mother with a cry face repeatedly, we may conclude that the child checks upon the effect. Possibly qualitative data per recording could reveal such use of facial movements in face-to-face situations.

4.4.1. Sound production in face-to-face situation.

Speech sounds produced by infants or their mothers in face-to-face situations have often been studied in several periods of the development, from different theoretical points of view. This is not astonishing since

".....verbal exchanges among older individuals is the means par excellence of communication. Yet vocalization in infancy has rarely been examined in an interpersonal context." (my underlining, VdS), (Schaffer, 1977, p. 292).

Stern (1974) made a start with it for infants from 3 to 4 months old, while Schaffer (1977) compared one-year-olds and two-year-olds. Various aspects, like turn-taking, "tuning in", types of sounds produced by infants, and "baby talk aspects" for the mother have been studied: references can be piled up.

In this report we assume that sound production, apart from being audible, has some visible aspects as well. So all utterances, regardless the way they are produced (indicated in the code used, especially for the infant's sounds), were included in the counting, since sounds and speech movements in face-to-face situations were supposed to reach the receiver. An utterance has its natural limits in the respiration cycle, almost traditional in the research on speech development of our Institute (e.g. Koopmans-van Beinum & Van der Stelt, 1985; 1986)

As we do not go into detail of transcription in this report, we just regard this channel as representing an alternation of sound production and periods of silence. Of course we realise that sounds of a two year old may consist of quite a lot of "words", but for now we prefer to disregard those linguistic aspects in favor of movement and coordination aspects.

In fig. 4 durations in seconds are given for the time that mother and child produce sounds in face-to-face situations over the two years.

The arrow in week 15 for pair 1 indicates that the face-to-face situation has a longer duration (268 seconds) than is represented in this figure. As can be seen, mother 1 is always more talkative than her child except in week 10 and week 30. Globally we may conclude that if the child produces a sound the mother responds or "expands" the utterances to a duration at least twice as long as the infant's in most of the recordings up to week 47, with exceptions in weeks 15, 18, and 30. From week 47 up to week 76 they produce sounds for about the same amount of time in face-to-face situations. This pattern changes in the following weeks when duration of face-to-face situations increases and the mother again is talking for more time than the child. But in face-to-face situations there are moments of silence, since the graph is not "filled" in the period around week 80.

Sound production is an important aspect in the face-to-face situations of pair 1, the mother doing most of the "talking".

The arrow for the first recordings of pair 2 indicates that the face-to-face situation has a longer duration than represented here: 202 seconds in week 04 and 140 seconds in week 08.

Sound production up to week 40 is not the main activity of pair 2 when looking at each other. The durations of sound production for mother and infant do not differ very much and in face-to-face situations pair 2 is often silent; the graph is not "filled" as much as in pair 1. In week 32 and 36 infant 2 is more "talkative" than her mother. From week 40 onwards to week 104 the durations are almost equal for mother and child, except for the period from week 76 to 84. In that period there is an increase in face-to-face situations as we have seen before.

4.4.2. Comparison of face-to-face situations and non-face-to-face situations.

We compared the amount of time spent on sound production in face-to-face situations with the amount of time of sound production in the situation that mother and infant are not looking at each other. We did so to explore if mothers "teach" their infant to produce sounds when looking at someone's face in order to instruct by means of both the visual and the auditive channel mutually. Data are not given in a figure.

The mothers did use sound production in the face-to-face situation, probably unconsciously using the visible aspects of sound production in communication with their infants, but they spoke quite a lot too when not looking at the infant's face. Of course sounds produced by the mother in the non-face-to-face situation still can be directed towards the child in those situations where she comments on manipulation of toys, for example. Furthermore, the mothers often commented on their babies while looking at the other people in the room. These types of sound production can be selected when going into details of the transcription, which is not the object of this report.

The infants however, produced sounds for a larger amount in the non-face-to-face situation with exception of week 08 for both of them and week 15 for infant 1. Both girls then produce sounds especially in the face-to-face situation. Detailed exploration of the transcriptions may reveal if certain sounds are directed towards the mother such as cry sounds.

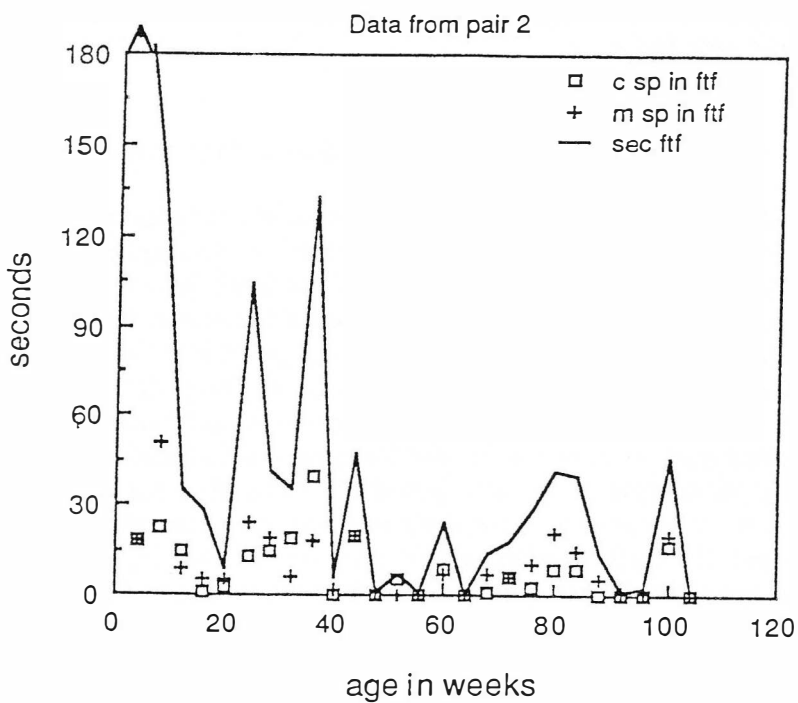
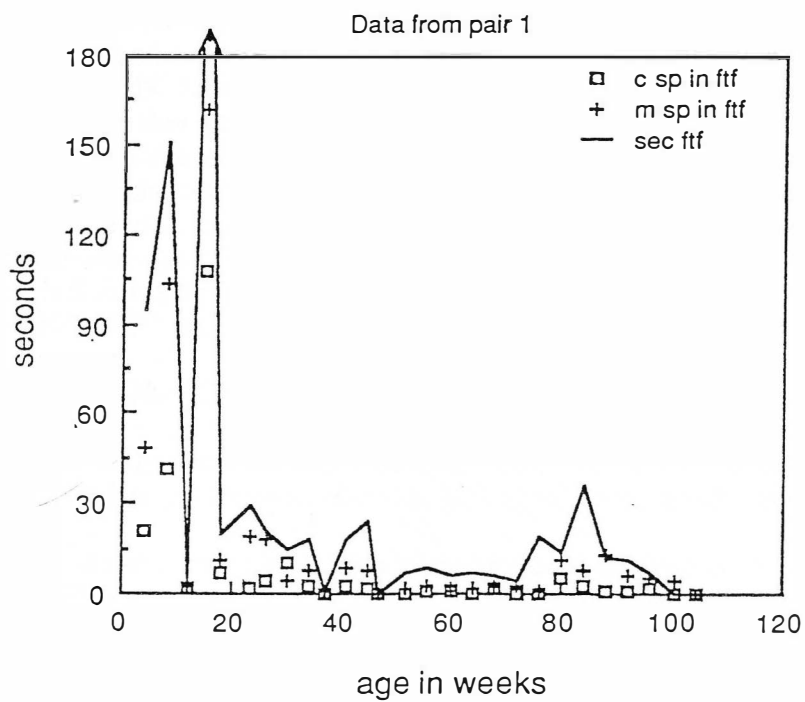


figure 4

Fig. 4. Duration in seconds of sound production in face-to-face situations for two mother-infant pairs per recording during the first two years of life. The graph indicates the duration of face-to-face situations per recording.
 c sp in ftf = child's sound production in face-to-face situations,
 m sp in ftf = mother's sound production in face-to-face situations,
 sec ftf = duration of face-to-face situations per recording.
 The arrow indicates an "overflow", see text under 4.3.

4.5. Onset of face-to-face situations and breaking them up.

Fogel (1977) and Stern (1974), among others indicate that there is a relationship between gaze direction of mother and infant in such a way that the mother is almost always looking at the baby even when the baby is not looking at her. We found similar patterns over the period of two years as can be seen in fig. 1. But we wondered whether it was always the mother who starts to look at the child's face and the infant who breaks up that situation. Possibly this aspect may change when the infant grows older, since shifts in gaze direction in adults are important with regard to turn-taking aspects.

Several combinations of starting and breaking-up behaviours in mother and infant gaze direction are possible, like simultaneously starting to look at the other's face, followed by simultaneously breaking the situation up or mother starting first and breaking up first too. In this report we give numbers for starting and breaking up as scored by mother and baby separately.

Starting the face-to-face situation:

The mother, for example is looking at the baby's face, the baby turns to her mother and they are looking at each other for some time. In this case the mother scored a point as starter of that face-to-face situation. Likely the infant scored when she was looking at her mother's face and subsequently mother turned to the baby.

Breaking up the face-to-face situation:

The person who changes gaze direction from the partner's face first, which results in gaze direction shift of the partner as well, scores a point for breaking up the face-to-face situation. So either mother or baby may break up that situation. We counted the number of face-to-face situations per recording of approximately five minutes, and checked who started it and who broke it up.

Most of the time the mother outnumbers her infant with regard to the number of times that she was already looking at the baby's face, when the child turns towards the mother's face. For pair 1 this was not the case in week 16 (not represented here in fig. 5, since only monthly recordings are given for pair 1), 47, 72, and 92. This was the case for pair 2 only in week 48. Infant 1 and her mother scored equal in week 8, 14, 43, 54 (14, 43, and 54 again not represented), 60, and 88, which means that the infant at those times relatively often was looking at her mother before the mother was looking at her. In pair 2 this did not occur.

With regard to breaking up the face-to-face situation we found, as can be expected, that most of the times it was the baby that looked away from the mother. In pair 2 this was true in all recordings, whereas infant 1 and her mother broke up equally often in weeks 8, 60, and 72, which means that when the baby turned away from the mother the mother did not continue to look at the baby. The mother broke up the face-to-face situation more often than the infant 1 did in week 15, 84, and 88. These data for pair 1 may indicate that the shift in gaze direction has a communicative function, if the pair ends up by looking in the same direction

Babies often interrupt their looking at mother's face for short periods, and they can do so while mothers continue to look at the baby's face. Infant 1 did so until about week 34 and this behaviour reoccurred in weeks 76, and 80. Data are not given in a figure. Infant 2 interrupted the face-to-face situations until week 44, and it reoccurred in weeks 78, 82, and 86. The mothers looked away from their babies' faces, while the babies continued to look at the mother's face, only in weeks 4 and 8. That was clearly the period that the babies would keep her in sight at all costs, so that mothers could permit themselves to turn away for some fractions of seconds.

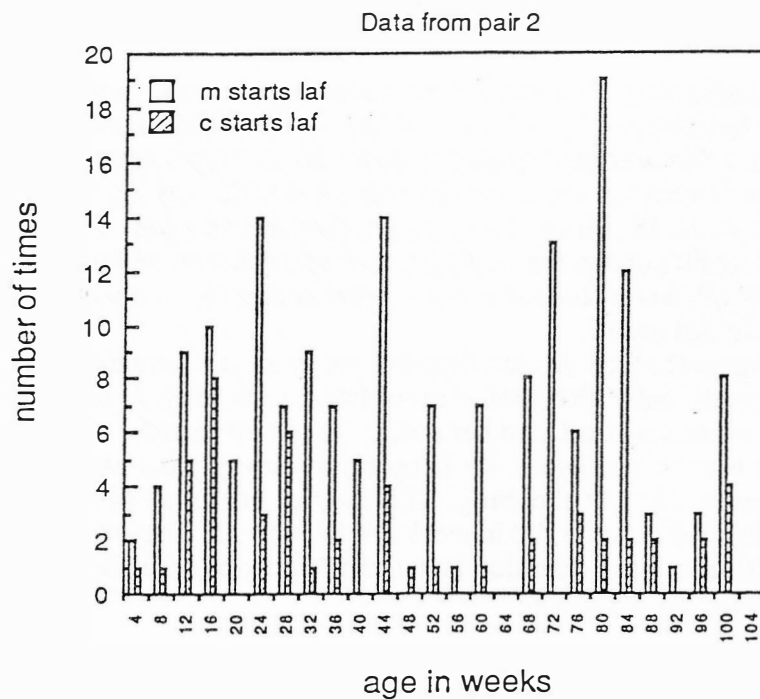
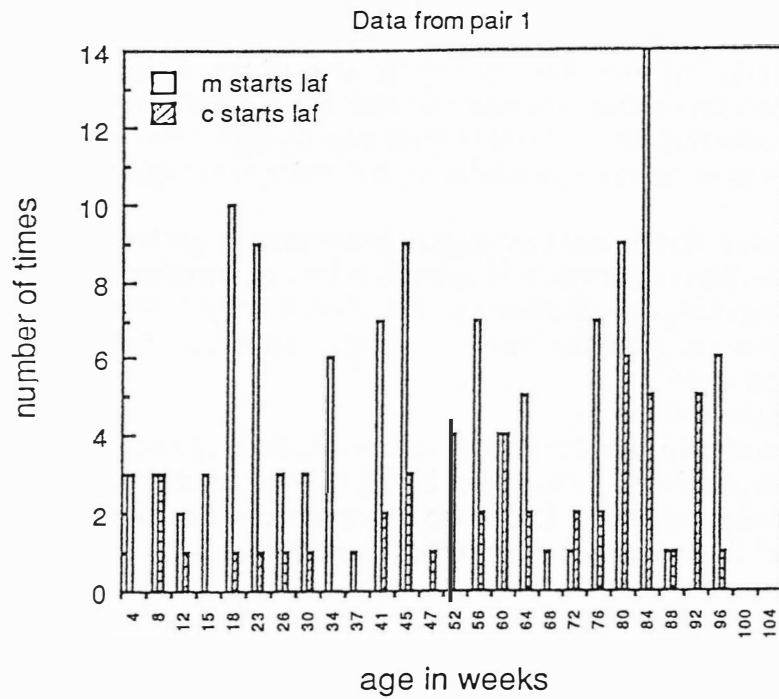


figure 5

Fig. 5. Number of times either mother or baby started to look at the other's face which behaviour resulted in a face-to-face situation, because the partner turned to look at the face too.

m starts laf = mother starts to look at the baby's face
 c starts laf = child starts to look at the mother's face.

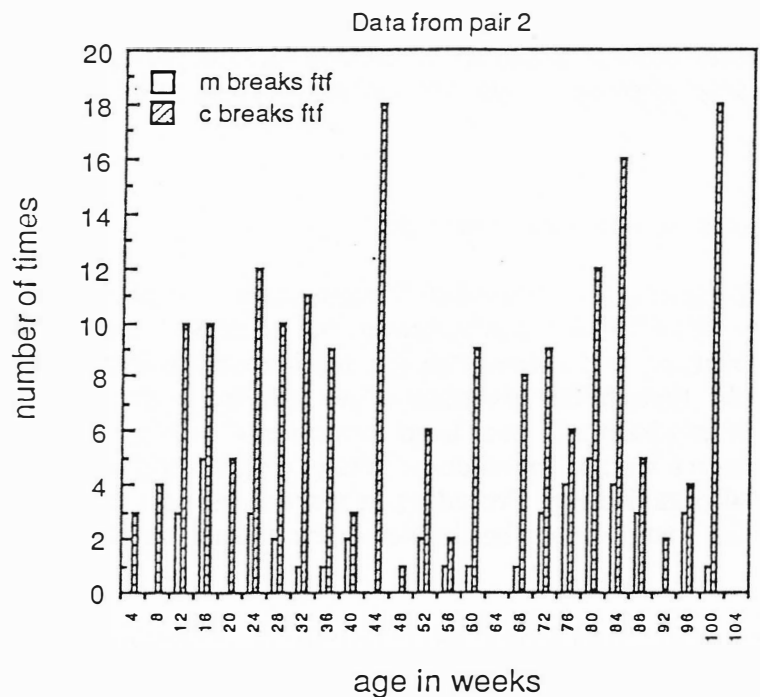
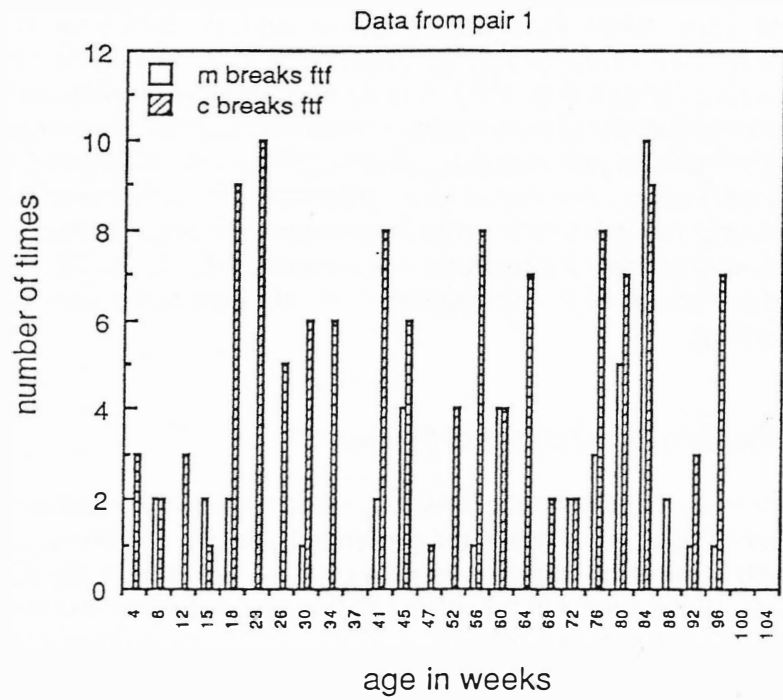


figure 6

Fig. 6. Number of times either mother or baby breaks the face-to-face situation off by means of a shift in gaze direction away from the face of the partner, who subsequently does likewise.

5. DISCUSSION

5.1. Durations of the transcriptions.

Several problems arise when interpreting above results, problems inherent to observational data in which time or age are considered to be a variable and not as a measure. Per recording the duration of the face-to-face situation is different, even the transcription may cover less than five minutes. It would be nice to calculate percentages of time for certain behaviours per recording, but comparing two subsequent recordings then must be done with care, since one must keep in mind that duration of face-to-face situations and transcription itself may differ in duration. For both mother-infant pairs we observed obviously changing situations around week 10, 12, 16, 26, and 28, just with regard to duration of the transcription: we did not have five minutes of uninterrupted recording.

5.2. Face-to-face situations in the course of development.

Face-to-face situations usually have a specific, often emotionally coloured role in communication: looking at each other for prolonged periods of time is normal for people in love; then a lot of information is sent over. Mothers with their infants are often regarded as people in love. On the other hand, looking at someone may have the function of monitoring that person's behaviour: infants are seen to turn their head away when the mother is too much stimulating. Furthermore the infant then may stop moving. This behaviour is seen in mothers as well when she not directly understands what the child may want. Probably the receiver-function of looking at someone inhibits other movements of the receiver. These situations may indicate periods when the pair is looking for a new way of co-operation, the inhibition being more prominent in the infant.

5.3. Face-to-face situations without movements.

In our data facial movements are transcribed "continuously", the neutral face however is suppressed in the PROGRAAF-manipulations. So when no facial movements are given in the transcription, this means that the mother or the infant has a neutral expression, a "blank" face. When duration of no activity in the channels "facial movements", "sound production", and "head movements" is high in the infant, we assumed that to indicate a kind of "monitoring" phase, which could be related to a new level of neurological organization. Preceding to that recording we expect a kind of regression in behaviour, but this must be checked in the detailed transcription.

5.4. Facial movements and sound production in face-to-face situations.

As mentioned above, we think that facial communication by means of sound production and facial movements is securing for an infant especially in the first 16 weeks, with a kind of "rehearsal" period afterwards up to week 48 (as seen in pair 2). Depending upon the quality of the previous period with regard to facial movements and sound production a pair may continue "to accumulate visual information". Sound production in the period around week 84 seems to be less important in the face-to-face situation which may have to do with prominence of the audible aspects of sounds.

5.5. Starting and breaking up the face-to-face situations.

Looking at figures 5 and 6, especially in the first year of life there seems to be an unspoken rule: "Mother, if you start to look at my face, I may turn my head off first. And even if I start this face-to-face situation, I may break up first." But both mother and infant do forget the rule at times!

5.6. More detailed exploration of the transcriptions.

As durations of the codes per channel are not taken into account yet (which may be possible by using the program HIST, see Koopmans-van Beinum in this volume), in combination with certain criteria, timing, or turn-taking aspects are not explored. Some behavioural patterns for example, could be characterised by onset of smiling, sound production and head movements, within a quarter of a second followed by smiling for a prolonged period. Some of these aspects the child may have "learned" much earlier. Furthermore, sequential analysis over several channels may reveal reasons why mother and infant start or break off the face-to-face situation. Sound production may turn attention to the partner which may direct gaze direction as well. Gaze direction could trigger facial movements, etc.

Until now no reliability scores are given with regard to detailed transcription. Only changes in movements account for the transcriptions. We assume that at that level transcriptions will not differ very much. When looking at details of transcription we could choose a level of interscore-reliability determining codes to be included in statistics or not.

Of course facial movements and sound production are not mutually exclusive, both occur often at the same moment, together with head movements as well. So graphs for sound production and facial movements should be looked at as overlay-graphs as well. These data would give percentages of time spent doing two things at a time. The data for pair 1 would not change very much, since the "blank face" does not often occur in that pair. If in pair 2 facial movements and sound production do not occur simultaneously, but in a sequence, this means that the "blank face"-periods are not as long as they seem to be now.

5.7. Are there stages in the face-to-face interaction?

In general the infant's contribution to the face-to-face situation change at about the same ages (weeks 12/16, 18/20, 37/40, 47/48, 76/76 for infant 1/infant 2 respectively), and there is a quantitative difference between pair 1 and pair 2. In pair 1 we see inactivity (see figure 2), a "monitoring phase", in the infant in week 04 and 16 (not represented in the graphs), whereas the mother is very active with regard to movements in the three channels. After that week both mother and child do change at least in one channel in the face-to-face situation for quite some time. This could mean that the period up to week 18 is fairly important for "facial communication" and its imprinting effects upon the infant: looking at someone has to be combined with smiles and sound production! In pair 2 this pattern of just looking at the mother is present for a prolonged period, may be because the mother is fairly inactive herself. Around week 20 they are both active in the three channels, but the following period up to week 48 seems a repetition of the first period, with the difference that here the infant is more active than the mother, possibly evoking that kind of behaviour in the mother.

For both pairs again there seems to be a sort of "monitoring phase" from week 72 to 88 for mother and child equally.

Since we analysed only transcriptions at a four-week interval for pair 2 it is possible that a more precise onset for the stages found in pair 1, will be found in pair 2 as well if all recordings are transcribed. For the moment we assume that there are five stages in the two years, starting at different moments for the two pairs.

Several aspects in the total communication between mother and infant may be important in the formulation of stages in the infant's development. So the stages still have a speculative aspect as long as other channels and the details of the transcription are not taken into account. Once stages are defined more globally we will have to check their occurrence in other mother-infant pairs.

Stage 1: from birth to 8/8 weeks (pair 1/pair 2 respectively), in which a close face-to-face situation (about 20 cm.) with regard to distance is prominent. This situation is mainly created by the mother, since she can actively change that distance. Probably, tactile stimuli are important as well as body movements, while the infant is able to perceive gross changes in the visual communication.

Stage 2: from 10/12 weeks onward to weeks 18/20, when the infant can fixate his eyes on the mother, since head movements are now controlled by the infant. Thus the distance between mother and infant can be larger, and probably "facial communication" including mouth movements is the main topic.

Stage 3: from 18/20 weeks to weeks 47/48 in which "facial communication" may be rehearsed and in which period object manipulation is starting. This however can not be concluded from the data presented in this paper. We can only see that the face-to-face situation almost disappears at the end of the stage, and that sound production and facial movements still occur in the face-to-face situations.

Stage 4: from weeks 47/48 to 76/72 represents a kind of "plateau" in facial communication for both pairs. Probably object manipulation and locomotion are more important in that stage. This has to be checked in the data on psycho-motor development of the children.

Stage 5: from weeks 76/72 to 100/92 in which stage a revival of "facial communication" seems to be present, probably more initiated by the infant than by the mother as can be concluded from fig. 1.

These stages of course are highly speculative, since only quantitative data are used without statistical "smoothing techniques". We have the impression that stage 3 might be composed of two stages, since both pairs decrease inactivity around week 30. But analysis of more details may prove this feeling to be correct or not. Aspects like expansion, followed by regression in the number and types of coded behaviours, as well as conflictuous mother-infant interaction, then could be helpful when detecting sensitive stages in communication, often elaborated in adult-adult communication.

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