

# FACIAL AND GAZE BEHAVIOUR IN MOTHER - INFANT INTERACTION

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## 1. SCOPE OF THE RESEARCH PROJECT

Early diagnosis of pathology is an important topic in applied developmental research. Early speech development in cleft palate infants has not yet been described (see Jansonius in this Volume), although the children are seen often medically during the first year of life. With regard to "normal" infants many behaviours could develop differently.

The influence of an orthodontical device (to regulate the jaw position preoperatively) on the speech development of 12 cleft lip-, jaw-, and palate infants is studied by means of a multi-single case design.

A "control group" of 6 mother-infant pairs, selected upon a medically normal pregnancy, labour, and birth is studied likewise. On one of these control pairs will be reported in this paper.

## 2. INTRODUCTION

"Psychology, of all the sciences, may be the most interactive; the study of elements per se the least fruitful. Slowly the models for studying human behavior have begun to reflect this. Models for the acquisition of knowledge (Piaget being the most representative of this class), the development of interpersonal relationships (for example Lewis, 1972) reflect the realization that only through interaction we can study, without distortion, human behavior" . p. 21.

It is no longer new to consider mother and infant in an interactional model. From conception onwards they are mutually modulating their behaviours, and they influence flows in both directions. Many behaviours often only occur in the interactional situation of mother and infant, and thus the behaviours must be studied in the presence of the other person. As Stern (1974) for example states the behaviours of mothers represent unusual variations of normal adult behaviour, while infant behaviours often are thought of as being determined organically.

However, since the seventies it has become more and more clear that mother and infant are communicating in very subtle and systematic ways. For long the mother was awarded with the principle role ( a "baby talk register"). The infant's role in the systems was only guessed, and speech development was studied with certain prejudices or (social, psychological, medical, linguistic, etc.) hypotheses in mind. But in the development of communication the underlying principles for vocal and non-vocal exchange of information are not clear yet.

Very often in research on (speech) development specific changes in the behaviour of infants grouped on basis of their ages are described; these changes, related to age are supposed to represent principles of development. Since many factors (different for each

mother-infant pair) are of influence on mother-infant interaction, single case research designs and statistics have been developed. As a precursor of single case designs, Simon (1968) summarized his review of literature on speech development by saying:

"Even with these careful selections and summaries however confusion remains. A quick scanning of the reports might seem to indicate that each child studied went his own way, with slight regard to so-called sequences or norms." p. 24.

In group research, sex or age is often a very important "independent" variable. However in developmental studies it is important to consider "aging" no longer a "cause" of development: it has become a variable of the mother-infant system. In developmental terms: norms defined as age-behaviour relations are questioned, since ranges are wide. The onset of a phonetically well defined behaviour in infants ("canonical" babbling) on which was reported by the instructed mothers, varied from 18 to 48 weeks in a group of fifty infants (Van der Stelt & Koopmans-van Beinum, 1986).

Presently researchers interested in development have started to study mother-infant systems even in prenatal situations, in naturalistic settings, in interaction by means of direct observation. In a way this is a return to zero (prejudices), disregarding many psychological, medical, and linguistic hypotheses. The amount of data gathered may seem to be a chaos, but as soon as we would know what is controlled in the behavioural stages of mother-infant systems, the systems would appear to be "orderly" and qualitative "norms" could be defined. Then early diagnosis of many "disorders" is possible and therapeutic interventions can be developed.

In our view the onset of sound production is the development of coordination between respiratory, phonatory, and articulatory movements. Sound production in infants is probably controlled physiologically at first, but even in that stage mutual influences in the mother-infant system are not yet described systematically. As sound production in infants results from many, more or less coordinated body movements, and since body movements are perceived proximally and distally, speech development is embedded in the development of vocal and non-vocal communication of the mother-infant system in relation to every-day situations.

"Clearly even newborns can perceive qualities of human communication, at one level, with considerable refinement. The infant less than two months old appears to perceive emotion in maternal vocalizations, as well as in body contact and movement generated by the mother." (Trevarthen & Marwick, 1986, p 303.).

The function of early non-vocal communication for the development of speech is not clear yet. Very likely, the systems will go through stages and/or periods of system specific behaviours which may have to do with for example the mother-child's anatomical, neurological, psychological, and social characteristics. We assume that timing and frequency of changes in the system are important issues.

Comparison of sequential recordings of one mother-infant system might show periods of major and minor changes, possibly separated by conflictuous, non-systematic interaction, for example when the mother does not yet recognize new capacities of the infant.

In pathological situations the system might show up problems while interacting: it is crucial to be able to describe them qualitatively and to recognize the problem early.

In this report facial and gaze data are given for one mother-infant system from birth to eight months of life. In interactional studies of an early date (Stern, 1974; Lewis, 1969) mother-infant interaction as facial and gaze dialogues have been described. These dialogues are possibly rhythmical precursors of conversations, teaching the infant turn-taking aspects (Bruner, 1977).

### 3.METHOD

We have set up the study as a longitudinal direct observation study during the first two years of the infants' life. Mother and infant are videotaped (20 minutes) using two cameras in home settings in monthly visits. Three of the six normal infants in this study are videotaped biweekly during the first year. On one of these children will be reported below.

Of course we had difficulties in keeping the schedule: the infants happened to be ill, the family went on holidays, cameras were stolen, etc, etc. So recording dates may vary a little as can be seen in table I.

The mothers were informed about our preoccupation with sound production, and our need to have good view of both the mother and the infant in play and feeding situations. No instructions were given about how they should interact. Background information on medical history and psycho-social aspects is gathered by means of questionnaires, tests, and medical examinations.

A multi-channel coding system is developed, transcribing gaze, facial, tactile, speech-, head-, arm-, leg-, and body movements, and proximity of mother and infant. In this taxonomy mother's speech and infant sound production is transcribed by means of about 100 terms. The "gaze channel" and the "facial channel" each have 7 mutually exclusive behaviours. Per channel only one code applies at one moment. In total the coding system consists of about 200 terms.

A system of computerised input of transcription data has been developed to minimise time consumption of micro-analysis: transcription of five minutes videotape coding mother and infant behaviours separately takes eight to twelve hours. The computerised input stores behavioural codes linked with unique video-frame numbers (time of occurrence). In these "scores" we are looking for the timing aspects, frequency of changes, co-occurring or sequential behaviours, and patterns of interaction.

### 4. RESULTS

We have decided to transcribe 300 seconds of the play situation micro-analytically. In table I percentages are given for the time that either mother or infant were not codable or displayed 'other' behaviour during the observation of their gaze and facial behaviour.

The recordings indicated with \*, \*\*, and + are very special with regard to circumstances. Especially in very young infants distress may occur when the infant is not in close contact with the mother. Whenever such a distress situation occurred the video recording was interrupted and we tried to record mother and infant in another situation. Of course we then had a recording with relatively bad observation of some behavioural channels. We banked on it that over a period of two years a few minutes would not interfere too much with the overall pattern.

Sometimes the infant was not in the mood for playing, with the effect that we have recorded only a few minutes of the 'play'-situation.

When transcribing the tapes it happened that the defined behavioural codes did not apply to what we observed. In that case we used the category "other" and we commented on the behaviour verbally in the 'speech' column.

TABLE I. Percentages of time that gaze or face behaviour was not observable (N O Gaze, N O Face) or was categorized as 'other' for biweekly observation periods up to 300 seconds per period. Age is given in weeks and days.

\* observation interrupted because of distress after 60 seconds.

\*\*observation in ventral-ventral contact.

+ observation interrupted because of distress after about 150seconds.

AGE	N O Gaze		N O Face		Other	
	m	i	m	i	m	i
02.1	81	100	88	17	-	-
04.3	1	-	1	-	-	-
06.3	5	5	5	8	-	-
08.4	3	-	3	1	-	-
10.1*	-	-	-	-	-	-
10.1**	-	3	-	3	-	-
12.3+	8	-	28	-	-	3
14.3	7	8	11	12	-	-
15.1	-	-	-	-	-	-
16.3	1	-	1	-	-	-
18.3	1	2	1	2	-	-
23.1	-	2	-	9	-	-
24.3	-	-	-	29	2	-
26.3	-	11	-	21	-	-
28.4	5	-	9	-	-	-
30.3	-	2	-	-	-	-
32.3	-	1	-	-	-	-
34.4	-	7	-	46	-	-

Gaze directions of mother and infant are coded into seven categories (A, L, V, W, P, D, and Q) plus a code for bad observation (O) as explained above. Below the definitions of the codes are given.

- A = looking at the face of the partner, (lo-at-fa)
- L = looking at body or hand/arm, (lo-at-bo)
- V = looking at object, (lo-at-ob)
- W = looking away or around, no fixation, (lo-away)
- P = looking at one of the persons present, (lo-at-ps)
- D = eyes are closed (eyes clo)
- Q = other behaviour (explained above)

Whenever a change in gaze direction was seen while transcribing the video tapes these "continuous" codes were replaced by the next most adequate. So when the mother was looking around (to find a toy, for example) this was coded as W started at time x00. The moment she looks at the object is coded as V starting at time x65. While presenting the object to the baby she looks at the face and code A is used at time x95. Thus frequencies of behaviours, sequences, co-occurring behaviours, and their durations can be calculated, for mother and infant separately as well as for their interactions. In table II total time in seconds is given per code per observation period.

TABLE II. Gaze directions ('not codable' and 'other' ignored) for one mother-infant pair in seconds per observation period (in most cases 300 seconds) per age of the infant. See text for explanation of column headings. Age is given in weeks+days.

\* observation interrupted because of distress after 60 seconds.

\*\* observation in ventral-ventral contact.

? infant seemed to fixate on photographs on the wall.

+ observation interrupted because of distress after about 150 seconds.

GAZE AGE	lo-at-fa		lo-at-bo		lo-at-ob		lo-away		lo-at-ps		eyes clo	
	m	i	m	i	m	i	m	i	m	i	m	i
02.1	15	-	-	-	6	-	27	-	7	-	-	-
04.3	255	100	10	-	-	-	10	125	2	-	-	1
06.3	245	-	30	-	-	-	5	159	7	-	-	98
08.4	220	192	8	-	8	52	13	51	11	-	23	-
10.1*	40	1	10	5	-	3	-	35	5	2	-	9
10.1**	1	-	41	-	-	203?	211	86	33	-	-	-
12.3+	77	10	4	30	-	-	2	-	5	-	-	27
14.3	197	9	15	14	-	-	48	255	-	-	-	7
15.1	298	255	-	7	1	11	1	11	2	-	-	3
16.3	281	253	7	1	4	12	2	30	2	-	-	-
18.3	258	21	21	39	4	19	4	123	9	94	-	-
23.1	258	30	27	61	-	-	7	141	2	74	18	-
24.3	230	31	19	-	7	58	5	198	-	-	1	-
26.3	197	22	18	16	3	5	-	78	4	52	-	4
28.4	156	22	2	15	91	136	16	54	16	73	2	1
30.3	120	19	61	26	104	167	5	44	10	39	-	-
32.3	124	24	95	18	65	198	3	47	4	6	2	-
34.4	113	19	108	37	14	122	30	90	2	10	2	-

Facial expressions of mother and infant are coded into seven categories as well (H, Y, F, V, G, N, and Q) plus a code for bad observation (O). The definitions of the codes are as follows:

- H = cry face
- Y = exaggerated mouth movements
- F = frowning
- V = question face
- G = smile face
- N = neutral face
- Q = other expression

Whenever the facial expression of the mother or the infant changed, one of the codes was used. So when the mother for example looked at the infant's face the change in gaze direction could be followed by a change in facial expression from neutral to smile face. In tables II and III we only give an impression of the total time that a certain behaviour occurs.

TABLE III. Facial expressions ('not codable' and 'other' ignored) for one mother-infant pair in seconds per observation period (in most cases 300 seconds) per age of the infant. See text for explanation of column headings. Age is given in weeks+days.

\* observation interrupted because of distress after 60 seconds.

\*\*observation in ventral-ventral contact

+ observation interrupted because of distress after about 150 seconds.

FACE AGE	cry face		mouth mov		frowning		quest fa		smile fa		neutral	
	m	i	m	i	m	i	m	i	m	i	m	i
02.1	-	114	14	-	-	1	1	-	7	-	8	33
04.3	-	34	267	153	-	29	-	3	18	-	4	57
06.3	-	-	195	31	-	17	2	-	49	-	25	198
08.4	-	-	30	78	9	50	9	51	167	102	75	12
10.1*	-	15	4	2	-	-	2	-	20	-	36	38
10.1**	-	18	3	35	-	12	-	13	16	-	270	214
12.3+	-	29	6	-	-	-	15	-	5	-	33	66
14.3	-	16	-	65	2	19	-	6	50	2	215	156
15.1	-	-	-	21	-	80	12	3	141	32	147	165
16.1	-	-	15	110	-	-	12	-	199	-	73	187
18.3	-	-	3	1	-	23	5	15	119	3	166	22
23.1	-	-	14	35	-	8	3	23	175	78	125	144
24.3	-	-	179	24	-	2	5	54	92	30	17	100
26.3	-	75	118	-	-	3	52	2	24	69	28	-
28.4	-	4	18	3	-	25	-	-	153	37	83	230
30.3	-	-	2	-	-	-	6	-	100	12	190	146
32.3	-	-	18	12	-	13	1	-	222	13	58	258
34.4	-	-	4	-	-	-	-	-	57	1	231	152

These very global numbers do suggest that there are three moments of changes in gaze behaviour and facial expressions: week 8, week 18, and week 28 preceded by "conflictuous" interactions in week 6, week 14, and week 26.

The period up to week 8 can be characterized by the infant's switching from looking at face and looking away. This phenomenon has been described in literature (Stern, 1974) and it is interpreted as regulation of the visual input. The recording in week 8 is characterized by much "looking at face" behaviour on both sides, the mother introducing objects and laughing quite a lot (eyes clo), changing her facial expression very often. A kind of test with regard to visual stimulation of the infant. The infant can stand it, and is responding with many different facial expressions. In week 6 the infant is having a cold. This recording is in a way "conflict-interaction" with regard to gaze direction since no turns are taken. The infant turns her head to one side, probably only perceiving the actions of her very stimulating mother with one eye! But facial expression remains neutral.

The next period up to week 18 can be characterized as one of much visual interaction: looking at each others faces without looking away. We got about one month of bad observation, because of distress and other problems as described above, but in week 15 and 16 the pattern from week 8 is present again. The visual interaction is very clear in week 16 when the infant is looking at her mother's face with only one or two interruptions, slowly imitating her mother's mouth movements. In week 18 the infant looks away, at persons in the room: she is ready for the environment. Week 14 is "conflictuous" with regard to gaze behaviour in relation to facial expressions (see table III).

The third period up to week 28 is the period of visually scanning of the room by the infant. The mother is still looking at the infant's face in order to follow what the infant is looking at. This will probably show up clearly when data on mother's speech are available as well: in her speech codes utterances about looking behaviour of the infant are used. In week 28 objects start to play a major role. Mother looks at them too, or at the infant's hands that are manipulating the objects. Interaction in week 26 is "conflictuous" again: the infant is not looking around very much, showing a cry face. The mother is puzzled, smiling seldomly, visually questioning the infant.

## 5. DISCUSSION

The total time per coded behaviour per observation time over an age period of 34 weeks suggests that at least three moments of major behavioural changes can be detected for gaze and facial behaviour in this mother-infant system.

It will be important to qualify these periods further with regard to co-occurrences of certain behaviours within the system and the partners alone. For gaze changes of the mother for example we found sequences of "looking at face", "looking at body", "looking at face", "looking at object", and again "looking at face", indicating that she is scanning the infant's situation with the face as a "base-camp". When the infant is older the sequence becomes more complex. For facial expression changes similar sequences are found in the infant: "frowning"- "neutral"- "frowning", etc. Although the infant is smiling only 1 second in recording 34.4 she exhibits the same sequence as her mother: "smile"- "neutral"- "smile".

A next step in the analysis is checking if looking at each other's face co-occurs with smile face more often than can be expected upon the occurrence of the behaviours separately. We then may assume that the system uses these changes communicatively. We further schedule to analyse how many changes in the different channels are actually perceived by the partner.

The timing and durations of the behaviours, interruptions, initiative and silences per channel are other aspects of the system interaction that we plan to analyse. Within such patterns we will have to check if there is a certain preference for specific behaviours and how these specific behaviours are coordinated in later development.

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