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Early interaction between infants and their parents predicts social competence at the age of four

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ABSTRACT

Aim: To investigate the impact that the interaction between first-born children and their parents, from the age of 3 months, has on peer and social competence when the children are 4 years of age.

Methods: Fifteen families were videotaped in Lausanne Trilogue Play situations (child–mother–father interactions), when the children were three, nine, 18 and 48 months of age. The findings were then related to peer and social competence assessments carried out by preschool teachers when the children were four.

Results: There was a correlation between the parents' responsiveness and the child's capacity to initiate (make contributions to) turn-taking sequences in the family triad early in life. This, in turn, was associated with the child's later peer and social competence. At the age of 3 months, the child's contributions to the triadic interaction were interpreted by the parents as intentional communication. According to the preschool teachers' assessments, children who initiated turn-taking sequences at 9 months of age had better peer competence ($p = 0.008$) and social competence ($p = 0.028$) at 48 months.

Conclusion: The results highlight the opportunities that parents have to stimulate their child's later social competence. They also show that a Lausanne Trilogue Play situation can be used to identify competent children and children/families with communication deficits.

INTRODUCTION

From the moment they are born, babies have the capacity to respond to stimuli from the outside world, such as voices, different sounds, facial expressions, hugs, and touching and emotional reactions from their parents. A recent study by Moon et al. (1) found that even when they were still in the womb 'the ambient language to which foetuses are exposed starts to affect their perception of their native language at a phonetic level'. Similarly, when Farroni et al. (2) investigated 'the haemodynamic response in cortical areas of newborns (1–5 days old) while they passively viewed dynamic human or mechanical action videos', they found that face-to-face interaction stimulated cortical activity in the newborn brain. In 2013, Grossman reviewed 52 studies to explore 'The role of medial prefrontal cortex in early social cognition' and concluded that 'the human brain is fundamentally adapted to develop within a social context' (3). And the Rutter studies, of Romanian orphanage children adopted by families in England, are of great interest for both paediatricians and child and adolescent psychiatrists. They showed that lack of social support and stimulation, for example severe emotional neglect during the first 36 months of life, can result in quasi-autism, and/or an overactive/inattentive syndrome and/or mental retardation (4–6). When the results of the above studies are brought together, they strongly indicate that social interventions can stimulate brain development and the development of the child's mind. These, in turn, can be used to develop new treatment strategies for children living in social risk environments.

Earlier findings indicate that proto conversations between young infants and their mothers, and the tight mutual coordination of the timing of movements and facial expressions in that interaction, enable the mother to mirror the infants' mood and create a 'sense of shared experience' between the two (7).

When a child is around 9 months old, described as the nine-month revolutionary age by Tomasello (8), it begins to

Key notes

- Lausanne Trilogue Play situations were used to measure how communication developed between 15 children and their parents from three to 48 months.
- Children who initiated turn-taking sequences in the child–mother–father triad at 9 months showed greater social competence in preschool activities when they were 4 years of age.
- The findings indicate opportunities to stimulate later social competence, and possibly brain development, through early infant parent interactions.

use the child–mother dyad – or a dyad with another adult – to focus on something that is happening and brings it to the attention of the other party. The child uses nonverbal gestures to indicate to the other member of the dyad that he or she should tune in and focus on the event. The term 'joint attention' is usually used to describe this capacity.

The infant–mother dyad is essential in modern Western societies, and interest is growing in the study of the family triad, of infant mother and father, as today's fathers play a more important role in the care of babies and children (9,10). This interest is important, as longitudinal observations have found differences between infants growing up with couples who support each other as parents, compared with parents in conflict. Infants from good coparenting relationships engage more easily in interaction with both their mother and father and receive more sensitive and adjusted responses than infants who grow up with parents who are themselves in conflict (11).

The Lausanne Trilogue Play setting, developed by the Fivaz-Depeursinge group, provides a theoretical framework for the study of triangular relationships as part of normal interaction between the infant or child and its parents (11,12). The parents and baby are placed in separate seats in a triangle, with the parents' facing the baby. The baby is placed in a special chair, adjusted for comfort, that can provide three positions, facing either parent or between them. Observations begin when the family has become used to the setting and they are videotaped using two time-synchronised cameras – one facing the parents and one facing the baby. This chair can be used from when then infant is 8 weeks old until they begin walking. An adapted chair is then used until the child is 4 years old.

The parents are given tasks that cover each of the four possible configurations of a triadic relationship:

1 One parent plays with the infant in the presence of the other parent.
2 The parents switch roles.
3 Both parents play with the infant.
4 The parents interact with each other in the presence of the infant.

The instructions and setting for the three first tasks are designed to make the parents focus on the child. The Lausanne Trilogue Play is a good setting to study the triad, because it enables observation of all four of the subsystems described in family system theory. The method provides an opportunity to assess communication and social interactions in the triad between the mother, father, and infant and to relate these interactions to the child's later social capacity.

AIM

The overall aim of this study was to examine the development of a child's capacity to interact in a communicative way with other people, using a prospective method. The specific aim was to investigate the pattern of child–mother–father communication when children were between three and 48 months old and see how this capacity to communicate correlated with the child's peer competence and social competence at the age of 4 years, as measured by their preschool teachers.

METHODS

Participants

Midwives at a maternity healthcare clinic in a suburb of Stockholm were informed about the study and asked to give written information to all families visiting the clinic for the first time over a five-week period. Parents who could speak Swedish, were living together and expecting their first-born child were asked to participate. In Sweden, most expectant parents visit maternity healthcare clinics and fathers accompany mothers to some of the appointments.

According to the criteria, 22 consecutively informed couples visited the clinic during the five-week period and 20 agreed to take part in the study. One family did not want to take part in the study after the baby was born and only took part in the first interview during pregnancy. Because this occurred at an early stage of the data collection, another family was enrolled in the study. A total of 20 newborn babies, along with their mothers and fathers, entered the study and took part in the prospective, longitudinal series of observations.

The mean age of the expectant fathers was 30 years (range 24–42), and the expectant mothers had a mean age of 27 years (range 21–32). Nine of the 20 men and ten of the 20 women had completed college or university education. Five of the men and eight of the women had completed senior high school, and the remaining six men and two women had completed lower or compulsory school. Nineteen of the 20 men in the sample were of Swedish ethnic and cultural origin, and one man was originally from Australia. Eighteen of the 20 women were of Swedish ethnic or cultural origin, and one mother was originally from Finland and one from Brazil. Compared with today's average Swedish population, the mean age of the parents-to-be was as expected, but the level of education was higher. Forty per cent of the couples were married, and the rest were living together. It is normal in Sweden for committed, unmarried couples to live together and become parents.

Twelve of the infants in the study were boys, and eight were girls. One baby was born 10 weeks premature, and her age was corrected in the study. All of the other babies were born healthy: one via caesarean section and the others via vaginal delivery.

Average marital satisfaction, as determined by the Swedish version of the ENRICH Marital Inventory, showed that marital satisfaction was fairly high (13).

The lausanne trilogue play

The Lausanne Trilogue Play, as described above, was used to monitor whether and how communication, defined as a synchronised triadic interaction, would develop in the

family triad of child–mother–father among expectant parents recruited from the average population before the baby was born. The families were interviewed during pregnancy, and the triads were studied when the children were three, nine, 18 and 48 months old. Sets of toys are introduced at 18 and 48 months. At 18 months, we used wooden animals, a hand doll and a box with holes for sorting wooden objects of various shapes. At 48 months, we used a doll's house, together with furniture, mother, father, child and infant figures, some accessories, a dog, a cat and a car.

This study focused on part three of the play situation, in which all three – mother, father and infant – play together, to monitor the possible development of a reciprocal form of interaction between the child and its parents as a basis for the child's future capacity to communicate and be socially competent outside the family. One of the authors (MH) conducted the experiment.

The parents decided on the length of time that they wanted to interact in front of the cameras. The overall average time of the recordings for part three of the play was 3.7 min (SD = 2.1). At 9 months, the average time was about 1 min shorter than for the other ages.

The CPICS coding system

Two independent coders assessed the triads using the Child and Parents' International Coding System (CPICS). This coding system was developed to assess contributions, turn-taking sequences, turns, and affirmations using quantitative information and qualitative data from videotapes. It focuses on how the mother, the father, and the child contribute to establishing an interactive flow. A detailed description of CPICS has also been published, comparing 20 Swedish, 20 American, 20 Swiss-German-speaking and 20 Swiss-French-speaking families. The inter-rating agreement on the different categories using Pearson's correlation test was good, except for one category in the American families and two categories in the Swiss-German-speaking families. As cultural differences may exist in child–parent interactions, such categories are not used (14).

The current study

When the children were 3 months old, the first play sessions were analysed. The data were evaluated as important and suitable for statistical analysis of the longitudinal data set. The following quantitative variables (as defined in the CPICS manual) were extracted and have been used in this study: contributions, turns and turn-taking and affirmation.

Contributions

The term contribution was selected, instead of, for example, initiative, because the contribution could be intentional or non intentional. For example, when the child was looking at something with great interest, the parent acknowledged this and a sequence followed. Non intentional contributions were also coded, such as a neutral expression on the baby's face. The parent acknowledged the baby and explicitly verbalised the neutral expression that the baby displayed. Children's communicative contributions and parents' contributions were assessed using 11 well-described categories (Table 1).

Each contribution was registered for each member of the triad, and often more than one contribution was observed and registered at the same time. The numbers of contributions per minute were analysed, because the length of the video recordings varied.

Turn-taking sequences and turns

Two types of turn-taking sequences were observed. A turn-taking sequence can be a single contribution, followed by just an affirmation and a response, or it can be a series of events in which the dialogue goes back and forth, with many turns among the triad members. Turn-taking sequences can include the child and the parents, the child and one parent or just the parents.

To account for variations in the number of contributions that affect the number of turn-taking sequences, the turn-taking sequences were calculated per contribution.

The responses that the child and parents give within the same turn-taking sequence are called turns. Turns include contributions and affirmations. In task three in the Lausanne Trilogue Play situation, both of the parents' turns were registered. Turns were calculated per turn-taking sequence, because the number of such sequences varied, which influenced the number of turns.

Affirmation

Affirmations were analysed per minute because the length of the recordings varied. The total number of affirmations was used because, at all ages, it was difficult to determine what kind of affirmation was given. As there were only a few observations, and as interscorer reliability was not good, it was not possible to analyse verbal and nonverbal affirmations separately.

Preschool behavior questionnaire

The Preschool Behavior Questionnaire (PBQ), developed and validated for the use in Sweden, was used to assess the children's communication abilities at the age of four (15,16). The PBQ has 43 questions that fall into eight categories, which include peer competence and social competence. The preschool teachers, who were responsible for the children in this study, filled out the PBQ.

The longitudinal approach

During the 48 months that the study was running, four couples got divorced and one family moved from the Stockholm area. One girl developed an autism spectrum disorder; two children did not want to participate in the video sessions at 48 months, and another two children did not participate in the 18-month follow-up. Data from the preschool teachers were available on all children at the age of 4 years. However, complete data sets from all the assessments – at three, nine 9, 18 and 48 months – were only available for 15 triads of child, mother and father interactions. These data were analysed.

Table 1 Types of contributions, definitions and criteria according to CPICS, Child and Parent's Interaction Coding System in Dyads and Triads (10)

Types of children's contributions									
1. Positive face exp.	2. Negative face exp.	3. Neutral face	4. Seeks eye contact	5. Phys. movement	6. Attention to object	7. Attention to parent	8. Positive vocalisation	9. Negative vocalisation	10. Neutral vocalisation	11. Cough sigh, etc
Types of parent's contributions										
1. Positive face exp.	2. Negative face exp.	3. Neutral face	4. Seeks eye contact	5. Phys. movement	6. Initiates objects	7. Attention to child	8. Positive vocalisation	9. Negative vocalisation	10. Neutral vocalisation	11. Seeks inform about child's focus

Statistical methods

Inter-rater agreement was measured with Pearson's correlation coefficient. Friedman's test was used to evaluate changes over time within a group (children, mothers or fathers). The Mann–Whitney two-sample test was used for differences between groups. Spearman's rank correlation was used to analyse associations between continuous variables. A $p < 0.05$ was considered significant.

Ethical permission

This study, and the ongoing follow-up when the children are 14 years of age, has been ethically approved by the Ethical Committee at Karolinska Institutet (Dnr 95-289;00-050;01-447) and by the Regional Ethical Council in Stockholm (Dnr 2011/384-31/5).

RESULTS

The results show that a synchronised triadic interaction developed between the newborn infant and his or her mother and father in this small sample from the average population. The quality of the interaction seems to be best defined by the concepts of 'contributions' and 'turn-taking sequence'.

Contributions

Contributions per minute and development over time

The frequency of contributions was higher at 9 months than at three, 18 and 48 months ($p = 0.003$, 0.000, and 0.000, respectively). The frequency of contributions was also significantly higher ($p = 0.001$) at 3 months than at 48 months (Fig. 1).

Differences between the three members of the triad: mother, father and child

The children's contributions were significantly more frequent than those of the parents at each tested age (p for the differences at all ages 0.000). Differences between the parents were small and nonsignificant.

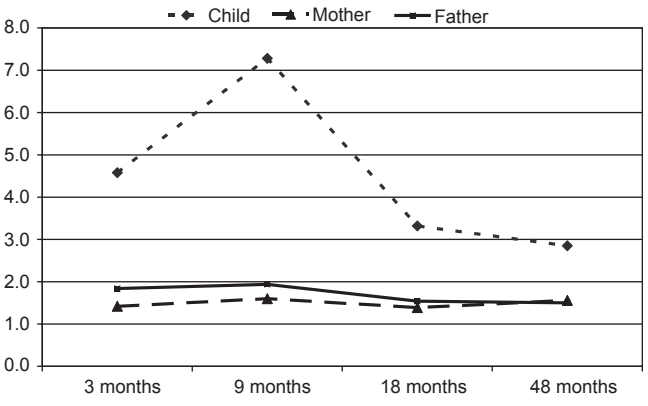

Figure 1 Mean number of contributions at each age of the child for each participant of the triad.

Types of contributions made by children

There were 11 types of child contributions that parents reacted to by using affirmation. At 3 months, neutral facial expression was followed in frequency by physical movement, whereas the infant rarely sought eye contact or used positive vocalisation. When the infant was 9 months old, the most common contribution was attention directed towards an object, followed by a neutral facial expression. Physical movements were also frequent, as was attention directed towards a parent by seeking eye contact (Table 2). Positive and negative vocalisations were now more frequent than neutral vocalisations. At 18 months, toys were part of the child's play and interaction and contributions that included attention directed towards an object were most common. Seeking eye contact had decreased to 0, which could be because of the toys, and the mean incidents of coughing, sighing and hiccupping decreased to 0.1. Positive and neutral vocalisation increased, while negative vocalisation decreased in frequency. At 48 months of age, positive and neutral vocalisation continued to increase. Coughing, sighing and hiccupping, which are definitely nonintentional behaviours, were almost nonexistent at 18 months. Clear communicative contributions, verbal and nonverbal, were now more common.

Table 2 shows how the different types of children's contributions changed over time. It also indicates the high levels of activity by the child at 9 months of age.

Turn-taking sequences and turns

There was an overall difference in the frequency of turn-taking sequences over time for the child ($p = 0.006$), but not for the parents. The child initiated fewer turn-taking sequences at 9 months of age, compared with the other ages ($p = 0.017$). For example, at 18 months, the child's attention to toys initiated turn-taking more easily.

The Lausanne Trilogue Play allows parents to decide how long they will interact with their child. To find out whether variations in the length of recordings of the play situation had biased the results, the mean contributions per minute and turn-taking sequences per affirmation were calculated for each age. This was carried out after cases under and over the median length of time at the respective ages were selected. In the case of the children, there were small, inconsistent differences between shorter and longer recordings for both variables. When it came to the parents' turn-taking sequences, there were slightly lower frequencies during longer recordings and slightly higher frequencies during longer recordings. The results suggest that after the corrections were performed, the variations in the length of the recordings had only small and unsystematic effects.

Affirmation

Parents used verbal and nonverbal ways to affirm and support their children's contributions. They used nonverbal affirmation more often than verbal communication at three and 9 months, and at 18 months, they started to use verbal affirmation.

Predicting peer competence and social competence at 48 months from turn-taking sequences at three, nine and 18 months

The variables in the eight categories of the PBQ, which include peer competence and social competence, were all tested in relation to contributions, turn-taking, turns and affirmation at three, nine and 18 months of age. The number of turn-taking sequences that followed a 'child contribution' at 9 months was related both to peer competence ($p = 0.008$) and to social competence ($p = 0.028$) at 4 years of age (Table 3).

DISCUSSION

The results support the hypothesis that there is a relationship between early contributions (initiatives) and turn-taking sequences and later social and peer competence during preschool activities when the children are 4 years old. Turn-taking sequences observed in the family triad following the child's contribution (initiative) seem to be a measure of a child's communicative capacity and/or social

Table 3 Spearman's correlations between number of turn-taking sequences at 3–18 months and peer competence and social competence at 48 months

	Peer competence at 48 months	Social competence at 48 months
Turn-taking sequences at 3 months	0.20 p = 0.229	0.26 p = 0.161
Turn-taking sequences at 9 months	0.59 p = 0.008	0.48 p = 0.028
Turn-taking sequences at 18 months	0.40 p = 0.070	0.34 p = 0.104

Table 2 Child contributions. Mean numbers of each type of contributions at 3, 9, 18 and 48 months

Age	1. Positive face exp.	2. Negative faceexp.	3. Neutral face	4. Seeks eye contact	5. Phys. movement	6. Attention to object	7. Attention to parent	8. Positive vocalisation	9. Negative vocalisation	10. Neutral vocalisation	11. Cough sigh, etc
3 months	1.5	2.5	9.2	0.6	7.0	7.0	4.0	0.6	2.7	2.7	1.9
9 months	5.0	2.0	12.2	0.4	9.6	13.2	7.2	2.2	2.3	1.8	1.6
18 months	3.3	1.5	1.5	0.0	6.1	14.3	3.8	3.0	1.7	3.7	0.1
48 months	3.0	0.1	9.8	0.0	1.0	13.0	6.4	5.5	0.3	5.0	0.2

competence inside the family. As shown in (Fig. 1), the child's activity supports Tomasello's suggestion of the nine-month revolutionary age, but it could also be interpreted by the explanation that parents with good coparenting skills allow their child to be the 'initiator' in the triadic communication (8). It is of particular interest that when the child is 9 months of age, their parents are most likely to react to the child's focus of attention by looking at an object or provide the child with affirmation and, in this way, initiate turn-taking. When the child's overall contributions at this age initiated turn-taking sequences in the triads, the children showed better social competence during preschool activities. It is not clear whether this finding was the result of some competent individual children having the capacity to initiate and take part in triadic turns or if it resulted from attentive, supportive affirming parents helping their children to take part in conversations but holding back and allowing the child free reign. However, the mutual responsiveness between the child and its parents is illustrated by one girl, not included in the analysis as noted earlier, who was active in the triadic interaction at 3 months, but lost this capacity during the coming months. Her contribution/turn-taking activity had disappeared by the age of 9 months. During the first 9 months of her life, her mother suffered from depression and could not be ideally supportive in early communication. The mechanisms behind such a decline of responsiveness must be further elucidated, as the girl developed an autism spectrum disorder, and at the age of four, her social competence was well below average (17–19).

There were positive correlations between the children's ability to perform turn-taking sequences at three, nine and 18 months and communicate with peers and generally relate to other people at 48 months. This was most evident during the nine-month play session, when the children's contributions were more frequent than other ages, as monitoring a three- to four-minute observation predicted the ability to communicate 39 months later. These results, together with the case report on the girl with autism spectrum disorder, may indicate that a play session at 9 months of age, assessed using the CPICS, can be used as a screening tool to identify children and families with communicative deficits.

Limitations of the study

This study had a small group of participants, including an attrition rate, and should be considered as a pilot study. At 48 months, there was complete data from 15 of the 20 original families. Other limitations include the varying length of the video recordings. However, when we analysed the performances of the families, the varying recording lengths did not indicate systematic effects on frequency differences regarding contributions per minute and on turn-taking sequences per contribution.

Comparisons with earlier findings relating to family theory and child development

Our results agree with previous findings relating to family theory and developing psychology. Stern, Trevarthen, Hsu and Fogel have described the importance of an active role of the parents in generating communication with the child and making the child an active partner (20–22). Trevarthen states that communication with two-month-old infants creates and maintains contact and that the language flows one way, from mother to infant. The 'mother's supportive interest and emotional shadowing' stimulates the infant's interest in the outside reality.

Tronick described similar effects and introduced the dyadic consciousness hypothesis to explain the intense connectedness and mutual dependence that characterises communication in the mother–infant dyad (23).

Our observational findings indicate how communicative connectedness smoothly shifts from one dyad to another within the triad and how parents cooperate to give their child space. This probably results in the child having a good capacity for social interaction, as described by McHale and Fivaz-Depeursinge (24). In a recent study of language-impaired preschool boys, and how they solved peer conflicts, their capacity to interact socially in turn-taking sequences was obviously important in avoiding and handling (25).

Although coparenting, the quality of coordination between adults in their roles as parents, was not the focus of this study, it may be a key variable in understanding how intimate interactions develop between parents and their children. A possible area for future research identified by our study is the parent's mutual competence to affirm the children's contributions into turn-taking sequences. Interest in the effects of coparenting has expanded beyond 'mother–child dyads' in an effort to understand children's socialisation (26–28). Variables on the 'family level', related to good quality coparenting, have been found to correlate with more positive behaviour and prosocial competence in children at 4 years of age (29). Similarly, Behar found correlations between 'high levels of hostile-competitive coparenting behaviour and low levels of family harmony' and 'hostile-aggressive' at the age of eight to 11 months and teacher ratings in preschool 3 years later (30).

Our results in relation to current findings on brain development

Our findings add to the results presented in 2013 by Moon et al. (1), Farroni et al. (2) and the overview by Grossman and his postulation that the brain 'is fundamentally adapted to develop in a human context' (3). They expand current knowledge, by highlighting the possibilities of stimulating brain development through 'child–mother–father' interactions using the different components of the Lausanne Trilogue Play. The play situation consists of four possible configurations of a triadic relationship and the stimuli are face-to-face expressions, language and sounds and emotional contact including hugs and touching. Some of these stimuli have been shown to play a role in brain development during foetal life and that, when they are lacking, emotional deprivation may result in deteriorating brain development. This suggests that the idea to use

interventions based upon the Lausanne Trilogue Play is probably not just speculative (4–6).

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