

**EÖTVÖS LORÁND UNIVERSITY**  
**FACULTY OF EDUCATION AND PSYCHOLOGY**  
**DOCTORAL SCHOOL OF PSYCHOLOGY**

Head of Doctoral School: Dr. Zsolt Demetrovics, professor

**COGNITIVE DEVELOPMENT PROGRAM**

Head of Program: Dr. Judit Balázs PhD.

**LILLA SIPOS**

**MOTHER-INFANT INTERACTIONS IN PLAY SITUATION:  
THE RELEVANCE OF PERINATAL RISK  
AT THE AGE OF 12 MONTHS**

**Summary of the doctoral dissertation**

**Supervisor: Dr. Magda Kalmár, emeritus professor**

## **Introduction**

Understanding and predicting human behavior has been a central question in the history of mankind. To gain new insights into one of the most fundamental parts of human activities, we compare preterm and full-term babies' and mothers' behaviors in dyadic situations. As Cichetti and Beeghly has noted (1990. p. 30.) "We can learn more about the normal functioning of an organism by studying its pathology and, likewise, more about its pathology by studying its normal condition."

New-born infants are considered preterm if born earlier than 37 weeks of gestation and/or with birth weights less than 2500 grams. The prevalence varies depending on the demographic, economic and medical conditions (6-15%). Preterm infants are more likely to experience a developmental delay than their full-term peers. Prematurity is not an illness and does not unconditionally cause a developmental delay; however, preterm babies are at risk of impaired cognitive and social development (e.g. Joseph, 2016, de Jong, 2015). A preterm infant's developmental prospect depends on risk- and protective factors. Attempts to apply perinatal risk scales for understanding and predicting the long-term outcome of development have not been successful (Kalmár, 2007; Feingold, 1994). Subsequent attention turned to environmental factors such as socio-economic status and the quality of life (Aylward, 1990). Because the explanatory power of environmental factors was also found to be weak, the research focus turned toward mother-infant interactions (Westrup, 2014, Guralnick, 2012, Spittle és mtsai, 2012). Caregiver-infant interactions have been found to contribute to the developmental outcome through complex transactions between the infant characteristics and the maternal behaviors (Klein & Feldman, 2007; Landry, Smith, Swank, Assel & Vellet, 2001; Tamis-Lemonda, Bornstein & Baumwell, 2001; Magill-Evans és Harrison, 1999; Minde, Perrotta, & Marton, 1985).

Because of the too early interruption of the intrauterine maturation, preterm babies have to cope for survivor with a less developed central nervous system outside of the womb. This overburdens the weak nervous system.

Premature birth creates an atypical condition for mother-infant interactions, and the weaker self-regulation of the preterm baby requires a higher degree of adaptation from

the mother. On the other hand, mothers experiencing preterm labour are at higher risk to suffer from anxiety, depression, PTSD symptoms, fatigue. These are risk factors for sensitive responsiveness. It seems that hypersensitive infant meets a hypersensitive mother in the interaction.

A growing amount of evidence suggests that maternal behaviors toward premature babies may have differential characteristics, nevertheless, reported data on the behavior of preterm mothers are inconsistent (Minde, Perrotta, & Marton, 1985, Fiese, Poehlmann, Irwin, Gordon, & Curry-Bleggi, 2001, Feldman, 2003, Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986, Divitto, Goldberg, 1979, Goldberg, DiVitto, 1995, Bakeman & Brown, 1980). Various reasons may account for the inconsistency, e.g. the degree of immaturity, perinatal complications in the infant, the infant's age at the observation, and the context of interaction.

In addition, there are distinct ways in which data are derived from the observed events. The majority of studies on mother-infant interactions used global rating scales (Gunning & mtsai, 2004, Masur & Turner, 2001), which may be helpful in detecting certain features of the interaction but do not catch patterns in the sequences of behaviors. Micro-analytic (frame by frame) coding systems, in contrast, are suitable for recording bidirectional transactions (Bakeman, Deckner & Quera, 2005, Gottman & Ringland, 1981). In our research we present a comparative study on the early mother-infant relationship. Preterm and full-term babies' and mothers' behaviors were observed in dyadic situations and coded micro-analytically. Coded data were analyzed through formation of complex interaction networks and by identification of transition patterns between combined infant/mother states in order to capture key characteristics and differences in preterm and full-term infant-mother interactions. In-depth analysis of a vast observational material by our novel approach provides new insights into human interactions which could not be found by the conventional tools of psychology.

## **Methods**

### **Design**

The data presented and analyzed in the theses are a subset of the data from a prospective longitudinal quasi-experiment study aiming at detecting the determinants of developmental outcome of preterm children, conducted in ELTE Faculty of Education and Psychology, by Magda Kalmár, PhD.

### **Subjects**

Seventy-two infants and their mothers participated in the study. Thirty of these infants were born preterm, at 28 - 33 weeks of gestation (mean GA 30.9 weeks, *SD* 1.5 weeks), with birth weights of 800 - 1990 grams (mean BW 1437 grams, *SD* 260 grams). The children possessed no congenital abnormalities or obvious sensory deficits, and their perinatal course was free of severe complications. Their risk scores on the Parmelee Obstetric and Postnatal Complication Scales (Littman & Parmelee, 1978) ranged between 6-17 (mean 10.4, *SD* 2.9), and they were regarded by the neonatologists as low- to moderate risk babies. The male/female ratio was 47/53 (14 boys, 16 girls, none of the perinatal variables was related to gender).

The gestational age range for the preterm infants was chosen with certain considerations in mind. After 28 weeks of gestation, with good perinatal care and if the organism is otherwise healthy, the degree of maturation enables the central nervous system to adapt the vital autonomic processes to the extrauterine conditions without life-threatening difficulties. On the other hand, it is an extremely important period in the development of alertness and state regulation, and in this respect these preterms are expected to be still markedly different from the full-term neonates (Aylward, 1984). The ages of the preterm infants were corrected according to their expected birthday.

The comparison group of 42 healthy full-term infants (GA > 37 weeks, mean BW 3421 g, *SD* 374.3 g, range 2650-4350 g, 52 % boys, 48 % girls) and their mothers were selected from the subjects of the Budapest Parent-Infant Study (Gervai, 2005).

Demographic variables:

The two groups were matched on socio-economic and demographic variables (housing circumstances, education of mothers and fathers, occupation, maternal age), yet on one variable matching was not fully successful. Mothers of full-term babies had higher levels of education  $t(72)=-2.763$   $p=0.008$ . The mean age of the mothers was 28.3 years in the preterm group (range: 20-42), and 26.6 years in the comparison group (range: 19-34).

### **Procedure**

Mother-infant dyads were observed at the infant's age of 12 months in teaching and free play situation at home. Observational sessions were recorded on video by a female researcher. Each visit began with a familiarization period, lasting about 10 minutes. After that the mother was asked to play with her infant as she ordinarily would and to disregard the researcher's presence as much as possible. The observed mean-length of free play is 7 min., teaching play: 6 min.

### **Data collection**

Development of infants were measured by the Bayley Scales of Infant Development II. (Bayley, 1993).

The videotaped events were coded separately for the mother and for the infant using a mutually exclusive and exhaustive micro-analytic category system. The categories were developed by the author. The categories of the infant and the maternal behaviors were the following:

Infant: 1: *plays* (plays with a toy of his/her interest); 2: *explores* (searches for/approaches new toy); 3: *obeys* (complies with the mother's wishes without expressions of positive emotion); 4: *cooperates* (happily accepts and follows the mother's idea); 5: *disobeys* (actively opposes the mother's idea/command); 6: *neglects* (ignores mother or her ideas, does not comply with the mother's command but does not oppose explicitly); 7: *passive* (is not involved in any activity); 8: *other* (none of the above categories)

Mother: 10: *other* (none of the categories below); 11: *follows* (follows the infant's idea, she adapts herself to the infant, they focus on the same thing, mother is involved); 12: *enriches* (enriches the infant's play with her own idea, but does not change toy/game, elaborates the infant's play, shows a new aspect of how to use a toy); 13: *physically forces* (physically forces or prevents the infant from doing something); 14: *commands* (demands the infant do something); 15: *directs attention* (intrusively directs the infant's attention. She insists on her own idea, irrespective of the infant's involvement in doing something else); 16: *interrupts* (interrupts the infant's play activity with anything else other than directing the infant's attention to another toy, e.g. cleans the nose, adjusts clothes of the infant, etc.); 17: *passive* (not doing anything and being uninvolved); 18: *neglects* (not playing with the infant, and actively doing something else); 19: *insensitive* (any behavior not satisfying the infant's obvious need, expressing disappointment about the infant's behavior, or expressing developmentally unreachable expectation towards the infant); 20: *handles/manipulates toy* (not playing but manipulating the toy to promote the infant's activity, e.g. assembling a toy).

Inter-rater reliability was established by coding 14% of the sample by two independent coders. Time-unit kappa was based on whether the coders agreed with the behavior category within 2 seconds,  $\kappa = 0.82$ .

### **Main research questions**

- Is there difference in the interactional behavior of mothers of preterm, versus full-term infants, in the teaching and free play situation?
- Is there difference in the reactions given to the infants' certain behaviors between the two groups of mothers?
- Is there difference in the attention following and directing behavior between the two groups of mothers?

## **Results and Conclusions**

Two main types of interaction are outlined. In that one, where the mother let the infant decide upon the focus of his interest, infant plays more freely and does not neglect maternal initiatives. In the other type, mother tries to direct the focus of the infant, and additionally tend to be passive and neglect the infant. In such interactions, infant alternates between being compliant and neglecting the mother.

To catch out the role of prematurity in the dyadic interaction, we controlled for the potential relevant background variables (education of mother, perinatal variables), and for the influences of preterms' behavior and developmental level. Doing so, two maternal variables showed significant differences and these were the same in both situations: enrichment and neglect. Mothers of preterm infants enrich less, and neglect more the activity of the infant. These differences may provide less optimal conditions for the development of preterm infants.

Noteworthy result is when comparing maternal reactions when infants disobey. Maternal reactions are similar in free play: mothers use physical force or directions to control the opposing infant, whilst in teaching play control mothers rather comfort, console, or relent. Mothers never neglect or look at the infant passively when he disobeys. Another interesting finding is, when infant is passive. The typical maternal reaction is making interesting the toy previous played by infant, but preterm mothers in free play rather use their own idea to capture again the infant's attention.

In order to capture the dynamics in the interaction, network of behavioral transitions was extracted from the original data (using custom scripts in Matlab) by recording every change in the behavior of either the infant, the mother or both – if happening at the same time.

The most frequent behavioral transitions were the same in both groups. The “optimal” pattern when infant plays and the mother follows and occasionally enriches his/her activity occurred remarkably often in both groups, but significantly more often in the control group. In such cases the infant is given control over choosing what to play, with the mother staying involved in the interaction and helping maintain the infant's attention by occasionally enriching and elaborating his/her ideas. This maternal behavior is

favorable in various aspects: it (i) enhances the infant's focused attention by keeping him/her longer in a certain activity, (ii) enriches the infant's knowledge and repertoire of skills, (iii) allows the infant to experience that he is an able-to-act individual, and (iv) provides mutual joy and satisfaction in the interaction.

Mostly mothers adjusted to the infant's activity, but overall, both partners' contribution was needed to create a harmonious interaction by accepting each other's temporary leading role. The full-term infants spent more time playing their own ideas, and transitions occurred more frequently between playing, cooperating, exploring and obeying.

The previous, and contradictory findings that mothers of preterms would be either more (Bakeman & Brown, 1980; Crnic et al., 1983) or less (Goldberg & DiVitto, 1995; Minde et al., 1985) active than mothers of full-term infants, are partly supported by our results. Using network analyses on micro-analytic data rather suggests that during the interaction mothers may occasionally become both active (intrusive) and neglecting (disengaged). As a consequence, preterm infants often neglected their attention directing mother. In response, mothers either increased control over the infant by physical force or disengaged from them. These transitions were rarely followed by harmonious play, and even so, only after a prolonged period, presumably because both the infant and the mother got frustrated. The "tactic" to neglect, disengage, and exclude the intrusive mother from their world evoked increased efforts from the mother to get in touch again, establishing a circular vicious or power game. When mothers realized their failure, they themselves disengaged. Conversely, in the full-term group both partners stay involved and shared a mutual focus of attention almost all the time.

## **Conclusions and limits**

Our approach allowed an in-depth insight into the processes of interaction unattainable using the traditional methods of psychology. In addition to corroborating the existing view of the importance of preterm birth in mother-infant interaction, our findings supplemented the picture with additional details. In the context of mother and low to moderate risk preterm infant playing together the patterns of behavior did not differ from

the full-term dyads: infant playing or exploring with mother following, enriching or directing. Insofar as they differed from their full-term counterparts they were unfavorable as they rendered the interactions disharmonious (mother neglecting, directing or forcing the infant).

Future cross-cultural research with larger samples and perfectly matched groups is needed to confirm our conclusions. Also, longitudinal studies should clarify how the coupling of an over-sensitive infant with an intrusive/disengaged mother affects the infant's emotional, cognitive and behavioral development. The final aim should be to elaborate intervention techniques targeting the support of more adequate maternal behavior.

When we evaluate and generalize the results, we must keep in mind some aspects, which can narrow the validity of them. In this research, the relatively low number of participants is one of such limitation. Nevertheless, the sample size is according with the ordinary sample size of the research field of preterm infant-mother interactions. By thorough planning and implementation of statistical analyses researches with such sample size can lead to important findings as well.

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