Mother-Child Attunement, Anxiety, and Exploration in Ten-Year-Old Children

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Abstract

The purpose of this study was to examine whether mother-child differences in anticipatory arousal (SRR) prior to task situations – considered as an indicator of psychobiological attunement – can provide information on children's self-reported anxiety (test anxiety, manifest anxiety). Results of two experiments with 18 and 36 mother-child dyads, confirm the hypothesized U-shaped relationship between attunement and anxiety. As expected, the same or similar levels of arousal correspond to low anxiety. The second experiment included in addition investigations of children's social anxiety, dependence, and exploratory behavior (exploring an unfamiliar room when blindfolded). Results indicate that social anxiety and attunement are related only in boys. Regressions of exploration distance and dependence on arousal differences revealed linear effects within girls. Girls cover more distance in their exploration and are more dependent when mothers, compared to children, exhibit higher anticipatory arousal. Results for girls also reveal that maternal dominance in a cooperation task increases with growing misattunement.

Introduction

In addition to cognitive-affective structures, psychophysiological processes are intertwined with the attachment organization of the organism. For this reason, attachment is also described as a relationship that develops between organisms as they become attuned to each other (Field, 1985; Field et al., 1992). According to this conception, psychobiological attunement arises through mutual provision of meaningful stimulation and through reciprocal modulation of arousal level. Attunement accordingly includes the process of counterbalancing between two personal systems in the sense of interpersonal homeostasis.

The present investigation's key assumption is based upon this concept of interpersonal homeostasis in attachment relationships. Physiological incongruence between child and attachment figure (especially in stress-
inducing situations) is synonymous with psychological unavailability of the attachment figure. Even though the significance of physical proximity decreases with the increasing age of the child, the psychological availability of the attachment figure and its function as a "secure base" remains important (Bowlby, 1969; Ainsworth et al., 1978). Maintenance of psychophysiological homeostasis between personal systems represents thus a prerequisite of felt security. Felt security is engendered inter-individually, and it means the absence of anxiety.

### Research Questions

A main part of the present investigation is concerned with the issue of whether mother-child attunement corresponds to school children's self-reports on anxiety. I hypothesized that attuned children experience less anxiety in stress-producing situations than children who are not attuned to their mothers. Anticipatory physiological responses of mothers and children prior to experimental situations in which the child has to solve age-appropriate tasks serve as the basis for testing this hypothesis.

Divergent response patterns, which arise as a result of mothers' and their children's deviating interpretations of the situations, were used as an indicator of a mother's unavailability as a secure base (study 1 and study 2). The deviation in responses (positive and negative difference values) should yield a U-shaped relation to children's anxiety, whereby the lowest levels of anxiety should be found in the area of correspondence, or attunement (Figure 1).

### Exploratory behavior and dependence

A further pivotal aspect of the attachment system is exploratory behavior - the antithetical counterpart of attachment behavior (Ainsworth, 1990). Attachment theory views felt security (that is, the simultaneous deactivation of attachment behavior) as the necessary condition of exploratory behavior. A reliable, emotionally available mother serves as a secure base for the child from which it can explore its environment (Ainsworth et al., 1978; Sroufe & Waters, 1977). Following
attachment theory and the concept of the secure base, it was hypothesized that exploratory behavior is highest in the case of congruent physiological response patterns.

Because exploration requires a certain degree of independence from the attachment figure, study 2 will also examine whether we actually find the least amount of dependence in the case of balanced interpersonal homeostasis.

A relationship characterized by Maternal dominance misattunement will probably cause a mother to use more measures meant to regulate and modulate. In other words, the greater the balance in the interpersonal homeostasis, the less probable it is that the mother will dominate. Study 2 will examine whether dominating behavior in mothers in a cooperative task increases with greater disturbance of psychophysiological balance.

Study 1

METHOD

The first study served as a pretest of the main hypothesis. Data on mothers were gained in an experiment carried out just prior to their children’s entry into first grade\(^1\). A second investigation four years later yielded data on the children.

Subjects

Data pertaining to 18 mother-child dyads were available for evaluation. The average age of mothers as their children entered school was 35.8 years. Two of the mothers were university graduates; the others were equally distributed over other types of schooling. All of the children (9 girls and 9 boys; 11 first-born children; 3 only children) lived with both parents up to the time of the study.

Procedures

**Task situation 1.**—Mother and child were seated at a small table in the laboratory in such a way that the mother could observe her child's behavior. After the course of the experiment was explained in a short introductory talk, the electrodes were attached. Mothers were then instructed to merely observe their children during the subsequent tasks and to avoid making any movements or showing other reactions. The test phase comprised two parts: an anticipatory phase and a task phase. During the anticipatory phase of 25-30 seconds, the experimenter gave the mothers a standard introduction in which behavioral instructions and general information about the child's tasks was given.

**Task situation 2.**—The children, who were now in fourth grade, were tested in the laboratory in the absence of their mothers. The child sat at a table with the experimenter. Before and during the task situation, the children's skin resistance responses were measured. In the anticipatory phase (again 25-30 seconds in duration) the experimenter gave the child instructions identical to those given to the mothers in the prior experiment.

**Measures**

**Skin resistance response.**—Finger electrodes were fastened to the non-dominant hand (fore and middle finger, distal phalange). Employing a constant current, skin resistance responses were measured with a sensitivity of $0.1k\Omega/s$ (apparatus SOM Biofeedback 280). The apparatus displays the responses on a ten-point scale. This scale was recorded on videotape. Responses were coded at two-second intervals, whereby response peaks and also any zero values were calculated.

**Anxiety scales.**—The children's level of anxiety was assessed by means of the subtests test anxiety (TA) and manifest anxiety (MA) of the AFS [Anxiety Questionnaire for School-Age Children] by Wieczerkowski, Nickel, Janowski, Fittkau, & Rauer (1974).

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2The particular tasks were of no consequence to the study. In their mothers’ presence, the children copied various geometric figures, solved a Piaget-type conservation task and put together a 7-piece puzzle.

3In order to avoid movement artifacts, the experimenter presented tasks to the children on cards, and the children had to memorize the answers. The four tasks were: 1) recall the content of a short text, 2) retain the memory of two geometric figures, 3) retain three rows of numbers, 4) find the correct order of pictures in a picture story.
RESULTS (Study 1)

Average response values in mothers (ranging from 0.16 to 5.81, skewness 0.08) and children (ranging from 0.77 to 5.08, skewness 0.003) were not intercorrelated \( (r = .24, p > 0.30) \). Special data transformations as recommended for psychophysical measurements (Levey, 1980) were not deemed necessary. No significant correlations between anticipatory responses and anxiety scores were found (mothers' responses and test anxiety: \( r = .03 \); and manifest anxiety: \( r = -.02 \); children's responses and test anxiety: \( r = -.16, p > 0.50 \); and manifest anxiety: \( r = -.21, p > 0.39 \)). Values were converted into standardized \( z \) scores, and differences (mother minus child) were calculated. Difference values ranged from -2.01 to +2.24 (skewness: -0.04). Negative difference values result when children's arousal is higher; positive differences express higher arousal in mothers. Values close to zero indicate correspondence independent of arousal level.

In order to test the main hypothesis, regressions with linear and quadratic terms were computed. Neither of the two linear terms even approached the significance level, TA: \( R^2 = .025, p > 0.29 \); MA: \( R^2 = .017, p > 0.50 \). The quadratic term, however, made a clear contribution with regard to test anxiety \( (R^2 = .51, p < 0.01) \) and manifest anxiety \( (R^2 = .65, p < 0.001) \). These results confirm the postulated U-shaped relationship between the difference in anticipatory arousal and children's anxiety.

Due to the small number of subjects and the lengthy interval between the two measurements, a second investigation was conducted with a new sample.
Study 2

METHOD

Subjects

Subjects were selected from a group of intact, two-parent families which had lived in the same city (Zurich) since the birth of their children. Of 41 mothers asked by telephone to participate, 36 agreed to take part in the experiment. The sample comprised 20 mother-daughter and 16 mother-son dyads. The age of the children ranged from 10.4 to 11.0 ($M = 10.5$) years; the age of mothers ranged from 34 to 49 years ($M = 39.7$ years).

Procedures

Task situation 1.—Situation 1 consisted of the same procedure used in the first study. The only difference was that these children were given new tasks appropriate to their age group, which they performed in the presence of their mothers. Again, only the responses in the anticipatory phase were relevant to the evaluation.

Task situation 2.—The children were told that the second set of tasks was to be completed without their mothers being present. In order to emphasize the fact of separation, the experimenter escorted the mother out of the room. The child was left alone in the room for a short interval. Then the electrodes were attached to the child's fingers. At this point the anticipatory phase began, with the same measurements and instructions as in study 1. Tasks were identical to those in situation 2 in the first study.

Exploration task ("blindfolded exploration").—The children were told to search for unfamiliar objects in an unfamiliar room. There were ten objects placed at random in the room (a frame with three wooden rods, large rings, two books, and so on). The children were told that they would be blindfolded in order to make the task more difficult. The mothers now accompanied their children to the room. When the children heard a tone, they were to start out from a marked starting point. Neither the experimenter nor the mother gave the child any directing hints. Two minutes later, a tone signalled the end of the exploration.

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4Tasks: 1) self description "this is the way I am", 2) copying a mosaic pattern with blocks, 3) simple addition problems, 4) puzzle, 5) Piagetian questions on animism.
Cooperative task "maze".—In this task we observed the frequency with which the dyads gave verbal instructions to each other in order to coordinate their actions in a goal-corrected way. Mother-child pairs sat down facing each other. The cooperation board (see "apparatus" below) was placed on the table between them.

Apparatus

Cooperation board.—The experimental apparatus in the cooperative task maze was a modified version of Shapira and Madsen's (1974) cooperation board (Figure 2). Four strings were attached to a small plastic disk. One of the strings contained an electrical wire connected to a contact point on the bottom of the disk. In the corners of the wooden board, the strings were pulled through eyelets. Each person pulled on two strings to guide the disk along the line path. If the partners coordinated their actions well, it was possible to keep the contact point moving along the line. The copper plate and contact point were connected to a battery and a buzzer. Whenever the contact point left the insulating paper strip, a circuit was formed, and the buzzer registered the mistake.

Measures

Exploratory behavior.—The room to explore measured 4.0 by 4.5 meters. The children were not aware of its size prior to exploration. The floor was divided into squares of 50 by 50 cm. Videotaping from a heightened position allowed the determination of exploration distance, that is the number of squares through which the child moved.

Verbal admonitions.—All comments subjects made to regulate the behavior of the other were recorded separately for mother and child. Such verbal admonitions included orders like "pull!", "hold it!", "wait!", "faster!" or whole sentences ("You have to pull a little more up there!", "You should stop pulling so hard!"). Recoding by two different coders showed agreement for the mothers of .95 and for the children of .96. In order to obtain the average number of verbal admonitions per minute per person, the frequencies were divided by the time required and multiplied by 60.

Anxiety scales.—As in Study 1, the children were administered the test anxiety and manifest anxiety scales. In addition, social anxiety was assessed. Of the 28 items in the subtest "social anxiety" of the
"Sozialfragebogen für Schüler" (Petillon, 1984), we used the eight most selective items. The 8-item version reached a Cronbach's Alpha of .90.

**Dependence.**—This subtest of the Personality Questionnaire for Children (Seitz & Rausche, 1976) measures dependence, particularly upon parents, and obedience towards adults in the sense of acquiescence. The scale includes 10 items, the possible scores range from 0 to 10 points.

**RESULTS (Study 2)**

### Anticipatory Arousal and Anxiety

As in Study 1, arousal of mothers and children in the anticipatory phase were not correlated ($r = 0.04$). There were also no significant correlations between arousal and the anxiety scales (children: test anxiety $r = .03$; manifest anxiety -0.05; social anxiety .11, $p > 0.50$. The differences of the z-standardized arousal values ranged from -2.73 to +2.64 (skewness -0.08). In spite of high intercorrelations among the three measures of anxiety (from .59 to .78), the relationship between arousal differences and anxiety were calculated in three separate regressions with linear and quadratic terms. In addition, separate analyses were carried out for girls and boys.

Table 1 shows $R$-squares for the linear and quadratic terms of these individual regressions. For all three anxiety scales, the quadratic term yielded a significant contribution. As the beta weights carried positive signs, the U-shaped relation between arousal differences and anxiety values was confirmed in this sample as well. While manifest anxiety reached a significant quadratic term only in the entire sample and $R$-squares are the same for boys and girls in test anxiety, social anxiety stood in a stronger relation to arousal discrepancy in the case of boys.

### Exploratory behavior and dependence

Comparison of means showed no significant differences in the exploratory behavior of girls ($M = 21.9$) and boys ($M = 25.1$), $t(34) = -1.17$, $p > 0.20$ and in dependence (girls $M = 6.6$, boys $M = 6.5$, $t = 0.14$). For the
entire sample, correlation between the two variables remained insignificant ($r = .22$). For the exploration distance observed and for self-reports on dependence, regression on arousal difference yielded significant linear terms within girls (Table 1). Among girls, exploration distance was positively correlated with dependence ($r = .55$, $p < 0.05$). This was not the case for boys ($r = -.05$). (For examples of exploratory behavior see Figure 3).

**Regulating admonitions and dominance in mothers**

Admonitions given by mothers and children were not significantly correlated ($r = .24$), but mothers issued more commands than children ($t(35) = 3.61$, $p > 0.01$), and these were directed equally to girls ($M = 1.60$) and to boys ($M = 1.66$). The subtracted number of children's admonitions from mothers' admonitions indicate mothers' dominance. This index shows the expected U-shaped curvilinear relation to arousal difference only in mother-daughter dyads (Table 1). The lowest value of the curve lies at 0.12, and its X-value is -0.06 ($X$ at $Y$-minimum = $-b_1/2b_2$, whereby $b_1 = 0.0475$ and $b_2 = 0.378$). A more mutual, counterbalanced type of regulation between mother and daughter is therefore found in dyads showing the same degree of arousal. As arousal difference increases, mothers become more dominant over girls. This result applies only to the index and not to the average frequency of verbal admonitions (see admonitions in Table 1). Even though the results here are not significant for boys, the negative sign of the beta weight does tend to suggest that there is a reversed U-shaped relation here, with decreasing dominance in mothers as arousal differences increase. The curve maximum among boys lies at 1.69.

**Conclusions**

The results of both studies confirm the hypothesized relation between interpersonal homeostasis and children's anxiety. Especially apparent is the correspondence of test anxiety with the psychophysiological arousal differences.
Observation of interpersonal homeostasis does not require (as Study 1 shows even more clearly) that events be simultaneous. Internal working models operate per definition independently of the immediate proximity of attachment figures.

It seems reasonable to assume that the areas of great arousal difference represent insecure attachment. If we consider the U-shaped curve for anxiety, then a reversed U-shaped curve would express attachment security, with a maximum of security within the middle area. We could then consider the absolute difference values as a "continuum of felt security" (Cummings, 1990).

In spite of the high intercorrelation of anxiety scales used, results of the second study include a gender-specific differentiation in terms of social anxiety. Social anxiety is only in boys significantly dependent upon mother-child attunement.

Exploratory behavior as observed in the study was not subject to differences in arousal as expected. However, in girls, significant linear relationships with exploratory behavior and with dependence, and positive correlation between exploration and dependence were found. At first glance, it seems possible that better exploration is simply the consequence of obedience in fulfilling a task. With a view towards adaptive self-regulation, exploratory behavior, in a relationship fostering dependence, serves the additional function of regulating distance to the dominant attachment figure. In insecurely attached individuals, exploratory behavior thus could be effective as a conditional strategy (Main, 1990).

Analysis of mothers' dominance yielded a remarkable gender-specific difference, in spite of the fact that mothers issued the same average number of verbal admonitions to girls and boys. The least amount of dominance was shown by mothers in dyads having greater physiological balance. With an increasing negative or positive arousal discrepancy, mothers' verbal instructions increased. Dominant behavior in mothers of girls thus does not simply fit a traditional role or gender stereotype. Only when there is decreasing attunement, do mothers exhibit more dominating control over their daughter's behavior.
Future research will have to examine more systematically the areas in which attunement and misattunement result in gender-specific differences. Future investigations need also to discover if, and to what degree, temperamental dispositions and experience in other contexts (such as school) influence individual responses independently of attachment history and contribute to disturbance of interpersonal homeostasis between mother and child.

References


ANXIETY

AROUSAL DIFFERENCE (MOTHER-CHILD)

Compared to mothers: higher arousal in children
Compared to children: higher arousal in mothers

Attuned dyads

Attachment figure ("secure base")

unavailable available unavailable

ANXIETY

AROUSAL DIFFERENCE (MOTHER-CHILD)

Fig. 1.—Expected relationship between mother-child attunement and anxiety in children

Fig. 2.—Cooperation board used in the maze task
Child 1

Test anxiety  12
Manifest anxiety  9
Dependence  10

Anticipatory arousal prior to task situation
mother:  5.38
child:  2.33

Child 2

Test anxiety  13
Manifest anxiety  11
Dependence  5

Anticipatory arousal prior to task situation
mother:  0.82
child:  3.77

Fig. 3.–Two examples of exploratory behavior (girls)
"Goal-corrected behaviors" at the cooperation board
The co-experimenter explains the exploration task