

What About The Children?

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RESEARCH SUMMARY

Chronic Trauma Impairs the Neural Basis of Empathy in Mothers: Relations to Parenting and Children's Empathic Abilities.

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This paper looks at the relationship of parenting skills to empathy in both mother and child. Families were observed for more than ten years and behaviour was coded at 4 time points. One of the tests for empathy was the response of brain activity to images of pain.

Levy et.al., in a previous paper (2018), showed that children and adolescents only exhibit alpha and beta oscillations in response to pain (an automatic response), whereas adults additionally produce gamma-band activity in the viceromotor cortex of the brain (a higher-order response). The viceromotor cortex region is in the frontal cortex and is an area of the brain known to have motor neurons (nerves) which control the organs in the abdomen or trunk such as heart, liver and intestine. Research by others showed that production of gamma oscillations is never seen in children and adolescents and cannot be detected until adulthood. This paper also confirms these findings.

In the current paper, they investigated the effect of an extreme example of children's Early Life Stress (ELS) on the **mother's** social brain. ELS is chronic stress experienced consistently and unpredictably across the first years of life. It has been shown many times to have negative effects in children: on their behaviour, susceptibility to mental illness, reactivity to stress and on pro-social behaviour (on developing social behaviour that benefits other people). Recent studies have also demonstrated negative effects of ELS on the development of children's social brain (being able to interpret thoughts of others).

Various forms of ELS can occur, for instance where there is death of a parent, change of partner, addiction, domestic violence, postnatal depression, earthquakes and follow-up tremors, famine and experience of war. In this research, families exposed to war-related trauma, an extreme form of ELS, were compared to a control group of families in a different part of the country.

These three hypotheses were presented:

- 1) that chronic stress was expected to reduce the amount of gamma brainwaves
- 2) that synchrony between a mother-child pair (dyad) would lead to higher-order empathy and predict more gamma activity. Parent-infant synchrony is when parent and child co-ordinate their gaze, observable expressions, posture and social communications into a matched dialogue that promotes positive engagement and mutual understanding.
- 3) that greater maternal viceromotor gamma, indicating greater maternal understanding of other's feelings and mental states, would predict better child pro-social skills, and link empathy in the maternal brain and patterns of mother-child synchrony to the child's empathic capacities.

Over two hundred families from two regions in Israel were studied. One group of families (148) lived in a zone of repeated war-related trauma. The severity of trauma exposure was

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evaluated from their answers to questions about whether their or a family member's home, was damaged by a missile attack, or a family member or a close friend was injured in an attack or during a military operation in Gaza.

The control group of mothers and children (84 non-exposed families) were from comparable towns in the greater Tel-Aviv area, matched in age, gender, birth order, parental age/education, maternal employment and marital status and pre-screened for other types of trauma.

During the first phase of the research, the combined total of 232 mothers and children (average age of children: 2.8 years) were observed for mother-child synchrony. The mother-child interactions were coded and averaged to give a score (Feldman, 1998). It included a score for empathy, mutual regulation/adaptation and appropriate expression.

As the study developed, the number of families participating decreased as some had moved away. During middle childhood, the families were revisited and the children underwent psychiatric diagnosis (not reported here).

At 9 years old, mother-child dyad synchrony was analysed again.

When the children were pre-adolescent (mean age of 11.8 years) there were 44 families in each group. Mothers underwent magnetometer array scanning (MEG) in a nearby Brain Research Centre. During the experiment, the area of the brain responding to images of pain or no pain was determined using a scanner. The wavelengths sampled were in the range 1 – 200 Hz. The experimenters wanted to know whether there were any differences in the characteristics of the brainwaves in the mothers when they responded to these pictures. The wavelengths of the brain responses, the source/position of the brainwaves in the brain and the time after stimulus were compared. The greatest responses were just after stimulation.

The children of these war-exposed and non-war-exposed families were also tested in early adolescence at aged 10 – 14. They were again tested for their empathy. The scoring system looked at interaction between mother-child, mutual regulation/adaptation, interactive fluency as well as supportive presence, positive affect, recognition, expansion, containment and appropriate expression.

The main findings from the MEG images and correlations were:

- When mothers were shown vicarious-pain pictures, some distributions of brain waves in the lower alpha and beta range (1-30 Hz) were induced which were the same in both the exposed (war-trauma) and control groups. This is the automatic empathy response. These alpha and beta waves were not present when the mothers were shown "no-pain" images.
- However, in the control group after stimulation, a statistically significant pattern of brainwaves was emitted in the high wavelength gamma range (100-130Hz) a short time after stimulation. This is the higher-order empathy response.
- The amount of gamma measured correlated inversely with the score for the degree of war trauma i.e. the greater the trauma the lower the empathy score.
- The amount of gamma activity in the mother was correlated with various scores for the children. Mother-child synchrony was positively correlated to maternal gamma signal. The control group had a statistically higher score of mother-child synchrony than the exposed (war trauma) group.

- There was a negative relationship of war exposure to maternal synchrony, indicating exposure to war decreases mother-child synchrony, which in turn “turns down” or “turns off” maternal gamma.
- Using a technique to locate the source of the gamma activity in the control group, it was traced to the left front of the vicermotor cortex. The probability of it coming from the Anterior Insula and Anterior Cingulate Cortex was high. These regions of the brain are known to be related to empathy. Just after pain stimulation, there was a response in this region, but only in the control and not the trauma-exposed group, whose empathy powers would appear to have been “turned down”.

Discussion

The findings agreed with the three hypotheses under test:

- 1) war-exposure significantly predicted lower mother-child synchrony. The average mother-child synchrony score i.e. an average for the combined scores of co-ordinated actions, gaze, posture and dialogue, was 34% lower than the average score for the control group.
- 2) mother-child synchrony had a significant effect on mother’s gamma activity. An increase of 1% in mother-child synchrony score was associated with an increase of 4% in maternal gamma activity.
- 3) maternal gamma activity significantly predicted children’s pro-sociality. An increase of 1% in gamma activity made a 3.71 increase in the pro-sociality “Strengths and Difficulties Questionnaire” (SDQ) score. However, contradictory to this, war trauma of itself did not significantly affect the child pro-sociality score, but it was the mother’s lack of sensitiveness which predicted decreased child pro-sociality.

Trauma has been previously shown to compromise synchrony and sensitive parenting, and the current findings were consistent with this result. It would therefore be reasonable to expect that pro-sociality in the war-exposed group would be lower. But there were no differences in pro-sociality between children who live in areas which are constantly under war and with stressful life routines, and those living in low-risk contexts. This may be because war is an external factor. In other cases which have been studied, with internal, intra-familial trauma/factors such as domestic violence, it seems that trauma does impact on pro-sociality. Further investigations are needed to test this hypothesis, comparing child pro-sociality in ELS contexts stemming from external versus intra-familial sources.

Gamma brainwaves relate to simultaneous processing of information from different brain areas. Under extreme stress, the mind cannot access gamma, and so mother-child synchrony is reduced and the empathy region in the mother’s brain is not triggered.

As mentioned earlier, the experience of growing up in war-trauma is an extreme type of early life stress. UNICEF suggest that one in five children globally are growing up in the context of ethnic, religious, national or tribal conflicts, amounting to approximately 530 million children world-wide.

In this situation, a suppression of gamma wavelengths has been recorded in the mothers as well as a reduction in their maternal empathy, sensitive parenting and synchrony to their children. Such mothers need more support in order to prevent negative effects later on in their adolescent children, and to improve each individual adolescent’s pro-social abilities and the quality of their relationships.

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