

# Synchronous Interactions Foster Empathy

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Journal of Experimental Neuroscience

Volume 13: 1–2

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DOI: 10.1177/1179069519865799



**ABSTRACT:** Despite growing interest in the neuroscience of empathy, very little is known about the developmental processes that foster the neural maturation of an empathic response. Here, we suggest that the synchronous interaction shapes and fosters the ability to empathize with others. We argue that this intriguing relationship between synchrony and empathy expands beyond the mother-child relationship to social relationships in general. It will be important to further explore this relationship in more social settings and to probe the biological mechanisms, which may underlie it. Advancing research on the relationship between these two social processes may support the work of practitioners, psychologists, and educators in moderating the devastating outcomes of mental disorders and promoting social maturity and growth.

**KEYWORDS:** Neuroimaging, neuropsychology

**RECEIVED:** June 13, 2019. **ACCEPTED:** June 26, 2019.

**TYPE:** Commentary

**FUNDING:** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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**COMMENT ON:** Levy J, Goldstein A, Feldman R. The neural development of empathy is sensitive to caregiving and early trauma. *Nat Commun.* April 23, 2019;10(1):1905. doi:10.1038/s41467-019-09927-y. PubMed PMID: 31015471; PubMed Central PMCID: PMC6478745. <https://www.ncbi.nlm.nih.gov/pubmed/31015471>

There has been a rising interest in the neuroscience of empathy in the past 15 years. Yet, the developmental and behavioural processes that sustain the neural maturation of empathy remain to be determined. Behavioural synchrony is a good candidate to be linked with empathic processing. Synchrony is defined as a process by which, for instance, parents resonate and adapt to their child's nonverbal signals and verbal communications. By comparison, empathy is the process by which a person resonates and tunes to others' affective and cognitive states. Hence, the experience of synchrony, particularly in the context of the mother-child relationship from infancy and onward, provides an initial template for the child's later resonance with the distress, feelings, and thoughts of others.<sup>1</sup>

In our recent paper,<sup>2</sup> we show that the degree of synchrony between mother and child, observed longitudinally throughout the first decade of child's life, shapes the extent of empathy with which the child's brain responds to the distress of others at the transition to adolescence. We recently found that the neural empathic response undergoes significant developmental maturation from childhood to adolescence and finally to its adult state. Importantly, we also found that the link between synchrony and the neural empathic response is not restricted to children's empathic brain. In another recent paper,<sup>3</sup> this time focusing on the mother brain, we found that the mother's empathic response can also be explained by the experience of mother-child synchrony over time. The findings are particularly interesting given that the empathic response in the mother's brain relies on very different neural mechanisms than the mechanisms sustaining empathy in the child's brain: whereas the child's empathic response depends on alpha rhythms in sensorimotor areas, adults' empathic response is supported by gamma oscillations, a rhythm that defines activity in the adult brain. These findings

led to speculate that the important experience of social synchrony is not limited to the developing brain but defines a broader lifelong phenomenon that likely plays a key role in the 'eusociality' (hyper-sociality) of the human species.

Our findings suggest that the repeated experience of mother-child synchrony may mould the neural mechanisms that support empathy. Of course, such speculation should be taken with caution given that this is a longitudinal study that describes associations between synchrony and empathy and does not describe a causal link between these 2 phenomena. In the current state of the literature, it is more plausible to assume that children who experience mother synchrony in early childhood also grow to become more empathic to others, both behaviourally – as we have previously shown,<sup>4</sup> and at the neural level – as demonstrated in the current study. As such, it would be very interesting in the future to test the causal relationship between these 2 core social processes.

What may be the neural mechanism by which mother-child behavioural synchrony fosters the ability to synchronize with another brain? Could it be that behavioural synchrony may yield neural synchrony which in turn might explain the empathic response? In a recent study, we found that during moments of behavioural synchrony, mother and child's brains synchronize in the superior temporal sulcus (STS),<sup>5</sup> a neural hub of social processes and behavioural mirroring. Importantly, this co-wiring between mother and her child predicted empathic interaction between the two. Hence, these findings from a different sample lend further support to the multifaceted relationship between synchronous interaction and empathy and suggest that neural synchrony may be one possible mechanism supporting this relationship.

Could this intriguing relationship between synchrony and empathy expand beyond the mother-child relationship? In another study, this time probing 2 ethnic groups of



adolescents, we found 2 types of relationship between the 3 independent processes.<sup>6</sup> First, a decrease in empathic brain response towards members of the outgroup was associated with increased hostility (towards outgroups) during dyadic interaction. Hostility and empathy are two opposite social processes so this finding is in line with our premise. Second, the brains of adolescents synchronized with each other during the empathic response, and this synchrony was associated with a decrease in empathy towards outgroups during dyadic interaction. Third, the decrease in empathic brain response towards outgroups was associated with increased levels of oxytocin, a neuropeptide strongly related to social phenomena, in general, and to synchronous interactions, in particular. Altogether, these findings further consolidate our conceptual model suggesting multiple links between synchronous interactions and the construct of empathy. The findings further suggest that the relationship between the two constructs is not limited to the mother-child interaction but extends to social interactions among humans which are sensitive to group membership. Notably, despite the variety of neural mechanisms sustaining the empathic response as a function of age groups, the relationship between empathy and synchronous interactions remains unchanged.

Finally, the capacity to engage in synchronous interactions can sometimes be compromised due to mental disorders. In such cases, we would expect the capacity for empathy to be affected as well. For instance, children of mothers who suffered postpartum depression experience lower synchrony with their mothers throughout infancy and early childhood, show reduced empathic behaviour, and in adolescence, their neural empathic response to others' pain is compromised.<sup>7</sup> Likewise, in our previously discussed studies, we also showed that permanent life stress impairs synchronous interaction and, in parallel, affects the ability to empathize both in children<sup>2</sup> and their mothers.<sup>3</sup> In another study, this time on adult combat veterans, we found that exposure to acute combat-related stress changes the perception of synchronous interaction,<sup>8</sup> further supporting the notion that behavioural synchrony is sensitive to conditions of chronic or acute stress.

In sum, in this commentary, we raise the interesting possibility that synchronous social interactions and the behavioural capacity for empathy and its neural underpinnings are intimately and biologically intertwined in a multifaceted way. We present here data that support this conjecture and show that it may be relevant across age groups and social contexts. In the future, it will be important to further explore this relationship in more social settings and to probe the biological mechanisms which may underlie it. Such understanding may then be used by practitioners, psychologists, and educators to moderate the devastating outcomes of mental disorders and to support social maturity and growth.

### Author Contributions

JL and RF wrote this commentary.

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