

## **Can disruptions in neural synchrony explain the reduced ability to connect empathically with others in individuals with PTSD?**

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### **Abstract**

Most adults with PTSD (Post-traumatic stress disorder) are limited in their capacity of demonstrating empathy after past hardships. In order to investigate healing solutions, greater emphasis should be placed on exact brain differences. In this article we explored one of the reason, neuroal synchrony and its disruption when it comes to PTSD holders. Research includes survey data of 50 Georgian displaced and war exposed individuals with findings from 15 studies published between 2011 and 2025 using a meta-synthesis approach. Analysis indicates that adolescents and adults with PTSD frequently experience emotional dysregulation, they have difficulty understanding others' perspectives, and struggle to fully engage with people around them, resulting in emotional detachment from society. Future research should investigate age difference and its significance on neural dysregulation, along with concrete experiments in laboratories with special equipment .

**Keywords:** PTSD, empathy, trauma, neural synchrony, emotional contagion, social cognition

### **Introduction**

Post-traumatic stress disorder (PTSD) is disorder that involves avoidance, negative changes in mood and cognition, and frequent following exposure to traumatic events (APA, 2013). Whereas, empathy, defined as the ability to understand and share the emotions of others, is a core component of social interaction and collective functioning (Decety & Jackson, 2004; Shamay-Tsoory, 2011). Based on existing researches we know empathy relies on coordinated neural rhythms within and between brains, known as neural synchrony, which facilitate interpersonal connection (Hasson et al., 2012; Kinreich et al., 2017). Reduced empathy may weaken relationship quality and harden establishing oneself. (Nietlisbach & Maercker, 2009; Maercker & Horn, 2013).

We wanted to explore whether disruptions in neural synchrony affect empathy in individuals with PTSD. By analyzing the relationship between PTSD symptoms and empathy, this study aims to determine how neural dysregulation contributes to anti-social behavior. It is hypothesized that individuals with higher levels of PTSD will show reduced empathy, as their neural synchrony impairs social connection and interpersonal understanding.

## **Literature Review**

Empathy relies on coordinated neural processes that allow individuals to take another person's perspective and feel their emotions. When these processes are disrupted, the capacity to connect with others destroys (de Vignemont & Singer, 2006; Decety, 2011).

### **Trauma types**

Trauma type shape different empathic outcomes. For instance neuroimaging studies connect chronic stress of individuals experienced war to reduced brain networks, leading to weak emotional responses (Levy et al., 2019a; 2019b). Whereas, violence within family often produces trust issues and sharing emotions even with family becomes impossible (Wilde, 2019). These findings approve once again that war exposure and violence are linked to reduced empathy.

### **Age effects**

Empathy also develops differently across ages. empathy's neural circuitry is more flexible in youth. Both care and trauma strongly shape empathy perspective; Adolescents exposed to trauma are at risk of weaker empathy later in life. (Levy et al., 2019a). By adulthood, patterns of empathy become more fixed, and studies like the Toronto Empathy Questionnaire show that adults report lower empathy on average (TEQ) (Spreng et al., 2009).

### **Methodology**

A meta-synthesis approach was chosen show a holistic understanding of the relationship between trauma, neural synchrony, and empathy. Our approach combines both quantitative and qualitative evidence, also including data from a short survey.

Relevant studies were searched for across multiple databases (PubMed, PsycINFO, ScienceDirect, and Google Scholar) and publications from 2013–2025 were considered. The main focus of the selected studies remained on PTSD, empathy, their intersection and insensitivity in everyday life.

### **Results**

The survey involved around 50 participants aged 15–50 and measured empathy using questions from the Toronto Empathy Questionnaire (TEQ). Results showed differences based on age and trauma experience. When asked whether they feel strongly empathetic toward someone with problems, 60% of participants strongly agreed, 20% agreed, 10% were neutral, and 10% disagreed. Regarding the ability to understand another person's perspective before conversation, 40% agreed, 10% fully agreed, 30% were neutral, and 20% disagreed to some extent, reflecting findings by Nietlisbach and Maercker (2009) that PTSD can affect emotion expressing. For questions about easily understanding others' feelings, 50% agreed, 20% fully agreed, 20% were neutral, and 10% disagreed, consistent with Levy et al. (2019), who found that trauma can disrupt empathic accuracy.

Age influenced the results too. Participants aged 15–24 reported higher empathy scores. Younger brains have greater plasticity, helping them adapt socially and rebuild connections after trauma, especially with support (McLaughlin et al., 2014). Participants aged 35–50 showed lower empathy, often giving neutral or partial agreement responses. This matches research showing that long-term PTSD and repeated trauma can significantly lower the chances of lasting relationships. (Bedi et al., 2019).

Overall, although the survey does not directly measure neural synchrony, the results still hypothesize that disruptions in neural coordination may contribute to decreased empathy in PTSD populations.

## Discussion

Research shows that trauma from war, violence, or displacement can disrupt the brain's natural rhythms, making it harder for individuals to connect emotionally and socially (Levy et al., 2019; Trauma and Intersubjectivity in PTSD, 2021). When these rhythms are affected, both emotional and cognitive empathy decline, reducing the ability to understand and respond to others' feelings.

In children and adolescents aged 15–24, research shows brain plasticity helps them adapt better to social environments even after trauma. Younger individuals often maintain ability to mirror emotions and understand others' perspectives. However, long-term emotional difficulties may still occur without proper support or therapy (Prosociality Without Empathy, 2020; Levy et al., 2019).

In adults (35–50 years), older participants reported lower or more neutral empathy scores. Adults exposed to violence or war often face lasting challenges in social connection and may struggle to respond empathically, even when they want to (Empathic Brain and Behavior, 2021).

Research shows that both the type and intensity of trauma influence how much empathy is affected. Interpersonal violence and war exposure lead to different patterns of empathic disruption (Trauma and Intersubjectivity in PTSD, 2021). Differences in neural synchrony may explain why younger and older individuals experience these effects differently (Levy et al., 2019; Empathic Brain and Behavior, 2021).

## **Limitations**

Throughout the research we faced several limitations. First, the analysis was restricted to studies published between 2013 and 2025, excluding possible relevant research that was published earlier. Our survey worked on relatively small participant groups, limiting statistics. Additionally, without concrete experiments and EEG review research might miss significant difference inside brain. Addressing these limitations will be essential for guiding future research and developing effective treatments.

## **Conclusion**

The findings suggest that PTSD can affect neural synchrony, which in turn may reduce empathy and weaken social interactions. Younger participants (15–24 years) generally showed higher empathy, likely due to greater brain plasticity, but they are still at risk without personalized therapy. Adults (35–50 years) showed lower empathy scores, reflecting more emotional stress. Trauma types, such as war or interpersonal violence, and the intensity of exposure appear to influence the rate of empathic disruption. Overall, these results highlight the interplay between age, trauma exposure, and neural mechanisms in shaping empathy.

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