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Electrophysiological and Behavioral Markers of Empathy-Mindfulness Associations in Novices: Evidence for "Empathic Affectfulness"

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Abstract

Objectives. This study explored how trait and state mindfulness relate to empathic traits in Indian novice meditators, using behavioral and electroencephalography (EEG) measures. **Methods.** Two independent samples were utilized. Sample 1 (n = 580) provided self-report data assessing empathy, mindfulness, and personality traits. Sample 2 (n = 97) underwent Ānāpānasati-based meditation, wherein EEG-based neural oscillations and self-reported feedback were assessed. **Results.** Trait mindfulness was positively associated with perspective taking (PT) and negatively with personal distress (PD), independent of personality traits. State mindfulness showed feeble associations: discontinuity of mind (DOM) correlated positively with PD and prefrontal cortex (PFC) beta power, while theory of mind (TOM) positively related with PT. PT was also linked to a lower PFC gamma; thereby, both PT and PD possibly reflected impedance towards novice meditative states. Post hoc, empathic affectfulness (EA)—conceptualized as "PT minus PD"—emerged as a potential marker of affect-conscious empathy, showing modest state-wise association with lower DOM and PFC beta-gamma activity, and strong positive interrelationship with trait mindfulness. **Conclusions.** PD consistently demonstrated negative correlations with mindfulness. In contrast, PT, although positively associated with EA and trait mindfulness, seemed to hinder novice meditation by promoting unnecessary mentalizing in state contexts. Overall, the empirical findings supported EA plausibly as a novel mechanism.

Keywords: trait empathy; trait mindfulness; state mindfulness; ānāpānasati-meditation; electroencephalography (EEG)

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Introduction

Empathy and mindfulness are among the most prominent constructs in psychological research, influencing well-being, interpersonal relationships, and prosocial behavior (K. W. Brown et al., 2007; K. W. Brown & Ryan, 2003; Telle & Pfister, 2016). Empathy encompasses the ability to understand and share the feelings of others, facilitating social connections and emotional communication (He et al., 2022). Mindfulness, on the other hand, refers to the practice of maintaining a moment-to-moment awareness of experiences, thoughts, and emotions in a nonjudgmental manner.

Defining Trait Empathy, State Mindfulness, and Trait Mindfulness

Empathy is the ability of individuals to perceive and respond to the thoughts and emotions of others. Trait or dispositional empathy refers to a consistent personality characteristic that reflects this ability (Himichi et al., 2021). Trait empathy is typically categorized into two main components: emotional empathy, which involves the often automatic experience of sharing others' emotions, and cognitive empathy, which is the conscious ability to recognize and understand others' thoughts and feelings (Goldman, 2011). These components were further divided by Davis (1983) in a four-dimensional structure: perspective taking (PT), empathic concern (EC), personal distress (PD), and fantasy (FS). PT reflects the cognitive ability to adopt another's viewpoint, facilitating understanding and communication. EC pertains to the emotional capacity to feel compassion and concern for others, motivating prosocial behavior. PD involves self-oriented emotional responses, such as anxiety or discomfort, in reaction to others' distress. FS measures the tendency to identify with characters in fictional scenarios, indicating imaginative empathy.

Mindfulness is the ability to be aware of and attentive to the body, thoughts, environment, sensations, and feelings (K. W. Brown & Cordon, 2009). It may be a personality trait (i.e., trait mindfulness) but also temporarily achieved via an activity as meditation (i.e., state mindfulness; Goilean et al., 2023). Trait mindfulness (TMIND) encompasses five primary subdimensions, as evaluated through the self-report Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). These subdimensions include observing (OBS), which involves noticing internal and external experiences; describing (DES), which pertains to labeling experiences with words; acting with awareness (AA), which refers to engaging in tasks with full attention; nonjudging of inner experience (NJ), which entails refraining from evaluating thoughts and feelings; and nonreactivity to inner experience (NR), which involves allowing thoughts and emotions to pass without impulsive reactions. Baer et al. (2006) proposed that these facets collectively shape an individual's mindfulness and influence emotional regulation and well-being.

Similarly, state mindfulness (SMIND) can be tested along different dimensions of resting-state cognition (Brahmi et al., 2025a; Diaz et al., 2013). One widely used measure, the Amsterdam Resting State Questionnaire (ARSQ), evaluates seven key dimensions: discontinuity of mind (DOM), which reflects mind wandering and distractions; planning (PLN), which captures future-oriented thinking; comfort (CMF), assessing physical and emotional ease; sleepiness (SLP), indicating drowsiness or the urge to sleep; somatic awareness (SOA), which measures awareness of bodily sensations; self (SLF), reflecting self-focused attention; and theory of mind (TOM), which gauges thoughts about others' perspectives. These factors collectively provide insight into the dynamic and fluctuating nature of SMIND during nonmeditative, restful periods (Diaz et al., 2014).

The Interrelationship Between Empathy and Mindfulness

Although these constructs have been established to be distinct, research indicates a complex relationship between them (Wallmark et al., 2013). Mindfulness practices, particularly those involving meditation, have been shown to enhance empathy by fostering greater emotional awareness and regulation (Fulton & Cashwell, 2015; Jones et al., 2019). For instance, mindfulness-based interventions have demonstrated moderate effects in improving empathy among healthy populations, with longer and more intensive interventions yielding stronger outcomes (Cheang et al., 2019; Hu et al., 2022; Liberman et al., 2024; Silveira et al., 2023). Additionally, studies suggest that certain facets of mindfulness, such as OBS and AA, are positively correlated with cognitive empathy, while facets like NR may be inversely related to emotional empathy (Cooper et al., 2020; Fuente-Anuncibay et al., 2020; Himichi et al., 2021).

While mindfulness-based practices have been widely studied for their effects on empathy and related psychological outcomes, the underlying nuanced mechanisms, particularly in novice meditators within specific cultural contexts like India, remain underexplored (Hu et al., 2022; Lim et al., 2015). In the Indian context, mindfulness practices like yoga and meditation are integral to cultural and spiritual traditions (Anālayo, 2021; Kirmayer, 2015). Therefore, research has begun to explore how these practices influence psychological traits; for example, a study found that yoga and meditation practitioners exhibited higher levels of empathy and self-transcendence compared to nonpractitioners (Sarathe, 2022). However, more comprehensive studies on broad Indian populations remain scarce (Fuente-Anuncibay et al., 2019). Therefore, the present study aims to bridge the gap by investigating the associations between novice mindfulness and empathy within the Indian cultural settings.

The Present Research

This research aimed to examine how trait and state mindfulness are associated with trait empathy in a large Indian novice meditator sample. First, the association between trait empathy and trait mindfulness was explored, while accounting for the influence of individual personality traits; and later, gender and academic inclination. Second, the study examined the relationship between trait empathy and state mindfulness using self-reported behavioral data collected from participants during a tri-stage Ānāpānasati-based meditation intervention (Brahmi et al., 2024a; Brahmi et al., 2025b). Lastly, this study explored EEG-based spectral powers recorded during the same tri-stage meditation intervention to look at the neural correlates of novice SMIND and its association with trait empathy.

Methodology

Participants

This study included two separate samples: Sample 1 (*n* = 580) took a series of asynchronous self-report questionnaires, and Sample 2 (*n* = 97) was involved in an in-person evaluation. The research adhered to the ethical guidelines of the Indian Council of Medical Research (ICMR) and received approval from the Institute Ethics Committee of the Indian Institute of Technology, Delhi (IEC-IITD; Proposal No. P021/P0101). All participants provided informed consent prior to their participation in the study.

Sample 1. A total of 580 respondents (50.17% female; mean age = 22.52 years; *SD* = 4.45 years) affiliated with Indian universities at various levels and proficient in English were recruited using purposive and snowball sampling techniques. They completed three self-report questionnaires online, namely: the Interpersonal Reactivity Index (IRI), FFMQ, and International Personality Item Pool Big-Five Factor Markers (IPIP-BFM). They also provided basic demographic information, including gender and academic streams (STEM and non-STEM), to act as additional controls.

Sample 2. A total of 97 predominantly male novice meditator students (90 males) were recruited through convenience sampling with the same eligibility requirements as Sample 1 to ensure comparability (mean age = 24.59 years, *SD* = 5.18 years). Of this, 87 consented to concurrent EEG examination (82 males). This in-person sample began with a stress-inducing arithmetic task for 30 min, simulating the daily life stressors, followed by a tri-stage meditation intervention inspired by an ancient mindfulness technique called Ānāpānasati (Brahmi et al., 2025a; Sivaramappa et al., 2018, 2019). Subsequently, it involved a resting state (RS: 5 min), followed by a period of breath counting (BC: 5 min), and lastly a silent breath focus (BF: 8–10 min) stage. SMIND was then measured via the ARSQ.

Instruments

Behavioral Self-Report Questionnaires. Participants in Sample 1 completed three behavioral measures. The IRI was used to measure trait empathy and its four subscales (Davis, 1980). It was chosen for its established application and satisfactory psychometric properties in the collectivistic context (Brahmi et al., 2024b; Siu & Shek, 2005). The reliability coefficients Cronbach's α and McDonald's ω for the subscales in Sample 1 were found to be PT (α = .619, ω = .656), FS (α = .719, ω = .737), EC (α = .676, ω = .68), and PD (α = .646, ω = .663). Further, TMIND was assessed using the five dimensions of the FFMQ (Baer et al., 2013). Use of the FFMQ in literature supports examining the impact of mindfulness-based interventions and the structural differences influenced by individual meditation experience (Baer et al., 2006; Bohlmeijer et al., 2010; Lilja et al., 2012). Cronbach's α and McDonald's ω for the subscales in Sample 1 were OBS (α = .732, ω = .740), DES (α = .805, ω = .808), AA (α = .859, ω = .859), NJ (α = .831, ω = .832), and NR (α = .726, ω = .729). The total TMIND score (α = .814, ω = .823) also exhibited strong reliability.

To control for personality traits, the IPIP-BFM was employed, which assesses extraversion (EX), agreeableness (AG), conscientiousness (CT), neuroticism-inverted (or emotional stability, N'), and openness to experience (OC; Goldberg, 1992). The IPIP-BFM is a well-validated instrument with prior studies in Indian personality research (Arora & Rangnekar, 2016; Brahmi et al., 2024b). Cronbach's α and McDonald's ω for the personality subscales in Sample 1 were as follows: EX (α = .786, ω = .788), AG (α = .689, ω = .72), CT (α = .699, ω = .702), N' (α = .815, ω = .823), and OC (α = .726, ω = .742).

Lastly, the ARSQ was employed on Sample 2, posteriori the completion of the tri-stage intervention to assess SMIND (Diaz et al., 2013). The questionnaire integrates insights from cognitive psychology, neuroimaging, and research on the default mode network (Buckner et al., 2008; Smallwood & Schooler, 2006). Additionally, it has been utilized in apriori studies involving Indian novice meditators (Brahmi et al., 2024a; Brahmi et al., 2025a). Cronbach's α and McDonald's ω for its seven dimensions in Sample 2 were as follows: DOM (α = .64; *ω* = .66), TOM (α = .661; *ω* = .675), SLF (α = .654; *ω* = .709), PLN (α = .773; *ω* = .783), SLP (α = .796; *ω* = .811), CMF (α = .813; *ω* = .824), and SOA (α = .596; *ω* = .608).

Overall, all the subdimensions of all the employed self-reports had demonstrated satisfactory interitem reliability and construct validity within the two samples through Jamovi's Factor module, making the data fit to proceed (T. A. Brown, 2015; Cronbach, 1951; Pruzek, 2005; Revelle, 2024).

Electroencephalography (EEG). EEG data were recorded using Brain Products' Recorder Software (v1.25.001) and EasyCap system, employing a 64-Ag/AgCl electrodes configuration aligned with the extended International 10–20 system, at a sampling rate of 500 Hz (Homan et al., 1987). The impedance levels of the electrodes were consistently maintained between 5 and 15 kΩ across the three experimental stages in Sample 2. FCz served as the reference electrode and AFz as the ground. Signals were amplified using a LiveAmp (Brain Products) and filtered with a third-order sinc low-pass filter (.01–131 Hz).

Preprocessing and spectral analyses were conducted using MATLAB R2021a and EEGLAB v2023, employing the Artefact Subspace Reconstruction-Independent Component Analysis (ASR-ICA) methods (Delorme & Makeig, 2004; Plechawska-Wójcik et al., 2023). Notably, only the middle two-thirds of meditation segments were selected (Rodriguez-Larios et al., 2020), and data were downsampled to 250 Hz. An IIR-Butterworth bandpass filter (1–60 Hz) and a line noise removal Zapline notch filter (50 Hz) were then applied (de Cheveigné, 2020). Further, artefact correction was achieved employing the ASR-cleandata method (Chang et al., 2020). Therein, channels with spectral power deviating more than ± 3 standard deviations were omitted. Subsequently, ICA decomposition, IC labeling, and IC rejection were conducted to eliminate noise with labels exceeding 0.5 (Chang et al., 2020; Pion-Tonachini et al., 2019). Lastly, interpolation was conducted on bad channels and the online reference channel (FCz), reprocessing the EEG data, whereafter mean-mastoid rereferencing was applied to all channels.

Spectral power indices were extracted from the preprocessed-rereferenced data using EEGLAB's eegstats plugin (Version 1.2), which applied a Fourier transformation to convert signals from the time to the frequency domain. Average power (dB/Hz) was computed per participant and across all channels for each of the three stages of the tri-stage paradigm. These analyses focused on five frequency bands, delta (1–4 Hz), theta (4–8 Hz), alpha (8–13 Hz), beta (13–30 Hz), and gamma (30–60 Hz); over three brain regions, the midline default mode network (DMN), the prefrontal cortex (PFC), and the occipital region (OCC), as follows:

- OCC Electrodes: O1–2, Oz, PO3–4, POz (Elvsåshagen et al., 2014)
- PFC Electrodes: FP1–2, AF3–4, AFz, F1–F4, Fz (Michels et al., 2010)
- DMN Electrodes (excluding PFC): CP1–CP4, CPz, P1–P4, Pz, PO3, PO4, POz, Oz (Fomina et al., 2015)

Statistical Analysis

The associations between trait empathy and trait mindfulness in Sample 1 were examined using correlation and linear regression. Additionally, to assess whether these associations were confounded by personality traits (Brahmi et al., 2023; Persson & Kajonius, 2016), it was controlled by using hierarchical regression (Toto et al., 2014). The significance level was adjusted to .0125 for the multiple comparisons, given the four IRI subscales, through Bonferroni correction in the analyses conducted.

The interrelationships between empathic traits and state mindfulness in Sample 2 were investigated similarly. Herein, Bonferroni corrections again adjusted the significance threshold to .0125 for the four concurrent tests. Lastly, in Sample 2, the EEG spectral correlates associated with state mindfulness were examined for interrelationships with empathic traits. Notably, EEG spectral correlates were considered during the BF-stage only, towards assessing state mindfulness, as the RS and BC stages were conceptually priming stages towards the final Ānāpānasati-based BF stage (Brahmi et al., 2025a). Further, these spectral correlates were considered a unified factor when applying Bonferroni corrections to avoid overly conservative significance levels owing to the large number of comparisons. Significance thresholds were accordingly adjusted, with alpha set at .0125 given the four empathy subscales' comparisons. Due to the male-dominated nature of the Sample 2, despite prior research indicating an absence of statistically significant gender differences in trait and state mindfulness, these analyses were considered exploratory (Brahmi et al., 2025a).

All of the correlations (Pearson's), linear regression, hierarchical regression analyses, and post statistical assumptions' validation were executed in R-Jamovi utilizing "car" package (Fox & Weisberg, 2018; Richardson & Machan, 2021); barring in Sample 2, which employed robust correlations, based on percentage bend algorithm, executed in WRS2 package in R (Mair & Wilcox, 2020), accounting for the ill-effects of skewed data distributions and outliers.

Results

Associations Between Trait Empathy and Trait Mindfulness (Sample 1)

Correlations and Linear Regression Analyses. Correlation and regression analyses examined the associations between trait empathy dimensions and trait mindfulness facets (Table 1). The TMIND was significantly positively correlated with PT and EC, and negatively correlated with PD. Among the subdimensions, OBS, DES, and AA were the most consistently and positively associated with empathy components, particularly PT and EC. Conversely, PD showed strong and widespread negative associations across most mindfulness dimensions, suggesting that greater dispositional mindfulness is linked to lower levels of distress in emotional empathizing contexts. Overall, these patterns suggest that higher trait mindfulness is broadly associated with enhanced cognitive empathy, particularly PT, and reduced affective overwhelm, as reflected in lower PD (Harari et al., 2010).

Linear regression analyses supported these findings. TMIND significantly predicted each empathy dimension, with the largest proportion of variance explained for PD. The individual trait mindfulness facets also emerged as significant predictors across multiple empathy outcomes. Notably, PT was positively predicted by OBS, DES, and AA, while PD was negatively predicted by all subscales of trait mindfulness besides OBS. Together, these findings indicate that cognitive empathy is generally positively associated with trait mindfulness, particularly in terms of PT. In contrast, affective empathy shows a more complex pattern: while EC is modestly enhanced by mindfulness, PD is substantially reduced, suggesting a buffering effect of novice TMIND on emotional empathic reactivity.

Table 1
Coefficients of Correlation and Linear Regression Conducted Between Trait Empathy Dimensions and Trait Mindfulness Dimensions

Dimensions of Trait Mindfulness		Dimensions of Trait Empathy			
		EC	PT	FS	PD
TMIND	R^2	0.0858***	0.118***	0.0876***	0.241***
	r	0.133**	0.265***	−0.086*	−0.452***
	β	0.133***	0.265***	−0.0856*	−0.452***
OBS	*r*	0.148***	0.244***	0.202***	−0.031
	β	0.157***	0.1635***	0.2136***	−0.0101
DES	*r*	0.177***	0.228***	−0.001	−0.276***
	β	0.139***	0.1476***	0.0168	−0.1619***
AA	*r*	0.136***	0.136***	−0.164***	−0.335***
	β	0.152***	0.1524***	−0.1133*	−0.1712***
NJ	*r*	−0.052	−0.046	−0.195***	−0.372***
	β	−0.121**	−0.0831	−0.1142*	−0.2991***
NR	*r*	-0.071	0.186***	−0.026	−0.155***
	β	−0.153***	0.1057*	−0.131**	−0.1791***

Note. * $p < .05$; ** $p < .0125$; *** $p < .001$ (After the Bonferroni corrections, only the *p*-values having ** and *** were taken as significant, as the significance threshold was set at .0125). TMIND implies OBS + DES + AA + NJ + NR. TMIND = trait mindfulness, OBS = observing, DES = describing, NJ = nonjudging of inner experience, NR = nonreactivity to inner experience, AA = acting with awareness, EC = empathic concern, PT = perspective taking, FS = fantasy, PD = personal distress.

Hierarchical Regression Analyses. To assess whether the mindfulness trait explains unique variance in trait empathy beyond broad personality traits, hierarchical regressions were conducted using the IPIP-BFM as control variables in Step 1, followed by the trait mindfulness subcomponents in Step 2 (Table 2). TMIND contributed small yet significant additional variance in the prediction of PT, FS, and PD. Looking at the individual facets, PT remained significantly and positively predicted by TMIND and specifically by NR. In the case of PD, the addition of trait mindfulness explained a meaningful reduction in distress, with NJ and TMIND emerging as significant negative predictors. Also, FS related positively with OBS, however, not with the TMIND. These findings suggest that the capacity to understand others' perspectives is linked to the novice's ability to remain nonreactive to internal states, while a less judgmental attitude is associated with a diminished experience of emotional empathetic distress.

Table 2
Hierarchical Regression Conducted Between Trait Empathy Dimensions and Trait Mindfulness Dimensions After Controlling for Personality Traits

		Dimensions of Trait Empathy			
		EC	PT	FS	PD
Step 1 R^2 (%)		39.8***	22.8***	14.7***	29.7***
Step 2 R^2 (%)		40.9***	26.9***	18.3***	33.4***
ΔR^2 (%)		1.18*	4.02***	3.61***	3.61***
β for Dimensions of Trait Mindfulness	OBS	0.0352	0.0732	0.15***	−0.00331
	DES	0.0567	0.0657	−0.0782	−0.0926*
	AA	0.0801	0.0908	−0.0627	−0.05664
	NJ	−0.0472	−0.0556	−0.0844	−0.17413***
	NR	−0.0718	0.1442***	−0.0785	−0.06741
	TMIND	0.0426	0.1656***	−0.0844	−0.2142***

Note. * $p < .05$; ** $p < .0125$; *** $p < .001$ (After the Bonferroni corrections, only the *p*-values having ** and *** were taken as significant, as the significance threshold was set at .0125). TMIND implies OBS + DES + AA + NJ + NR. The given beta values are exclusive betas calculated after controlling for personality traits. TMIND = trait mindfulness, OBS = observing, DES = describing, NJ = nonjudging of inner experience, NR = nonreactivity to inner experience, AA = acting with awareness, EC = empathic concern, PT = perspective taking, FS = fantasy, PD = personal distress.

Post Hoc Statistical Analysis. The statistical analysis conducted to investigate the interrelationships between trait empathy and trait mindfulness revealed significant correlations, specifically between trait mindfulness and the PT and PD dimensions of trait empathy. Moreover, the positive association of PT and the negative association of PD with trait mindfulness persisted even after accounting for personality traits, highlighting a distinct relationship between these factors (Figure 1). Subsequent post hoc statistical analyses were considered by combining these facets as PT minus PD, which was later named empathic affectfulness (EA). Bonferroni corrections were applied, herein, adjusting the significance levels to .008 for six independent tests.

Post hoc analyses found significant positive correlations between EA and all the dimensions of trait mindfulness, including the composite TMIND (Table 3). Linear regression analysis further supported these influences, with TMIND explaining substantial variance as a positive significant predictor. Additionally, hierarchical regression revealed that all mindfulness dimensions accounted for substantial variance, controlling for personality, gender, and academic choices; with ΔR^2 = 4.06% for OBS + DES + AA + NJ + NR and ΔR^2 = 3.66% for TMIND, the latter serving as a significant predictor of EA (β = .26204, Padj < .008). These results indicate the role of novice TMIND in promoting empathic understanding of others and alleviating emotional distress, consequently underlining the emergent phenomenon of EA (Birnie et al., 2010).

Table 3
Coefficients of Correlation and Linear Regression Conducted Between Empathic Affectfulness and Dimensions of Trait Mindfulness, Besides and Beyond the Influence of Personality Traits, Gender, and Academic Choices

Dimensions of Mindfulness (N = 580)	Correlation Coefficient (r) with EA	β Towards EA	Exclusive β Towards EA
OBS	0.18***	0.113**	0.04956
DES	0.347***	0.213***	0.10947**
AA	0.33***	0.222***	0.09961*
NJ	0.24***	0.163***	0.09046*
NR	0.232***	0.198***	0.14179***
TMIND	0.498***	0.4972***	0.26204***

Note. * $p < .05$; ** $p < .01$; *** $p < .008$ (After the Bonferroni corrections, only the p-values having *** were taken as significant, as the significance threshold was set at .008). TMIND implies OBS + DES + AA + NJ + NR. EA implies PT minus PD. The exclusive β is calculated after controlling for personality traits, gender, and academic choices. EA = empathic affectfulness, OBS = observing, DES = describing, NJ = nonjudging of inner experience, NR = nonreactivity to inner experience, AA = acting with awareness.

Interrelationships Between Trait Empathy and State Mindfulness (Sample 2)

Correlations and Linear Regression Analyses. Correlation and linear regression analyses explored the associations between trait empathy and novice state mindfulness facets. Although no correlation results survived Bonferroni correction, three moderate associations emerged at the uncorrected threshold (Table 4). Specifically, PT showed a positive correlation with TOM, and PD was positively associated with DOM. Additionally, SMIND composite scores (Brahmi et al., 2025b) were negatively correlated with PD, suggesting that greater present-centered awareness may buffer against affective reactivity and emotional overwhelm. Linear regression supported these findings, with TOM significantly predicting PT (R^2 = 6.75%, p = .01, β = .26) and DOM predicting PD (R^2 = 6.29%, p = .013, β = .251).

These patterns, although weak, indicate that empathic traits of PT and PD may have impacted novice SMIND, owing to overemphasized perspectivation and mental restlessness, respectively. Due to weak results in correlation and linear regression, further hierarchical regression was not pursued.

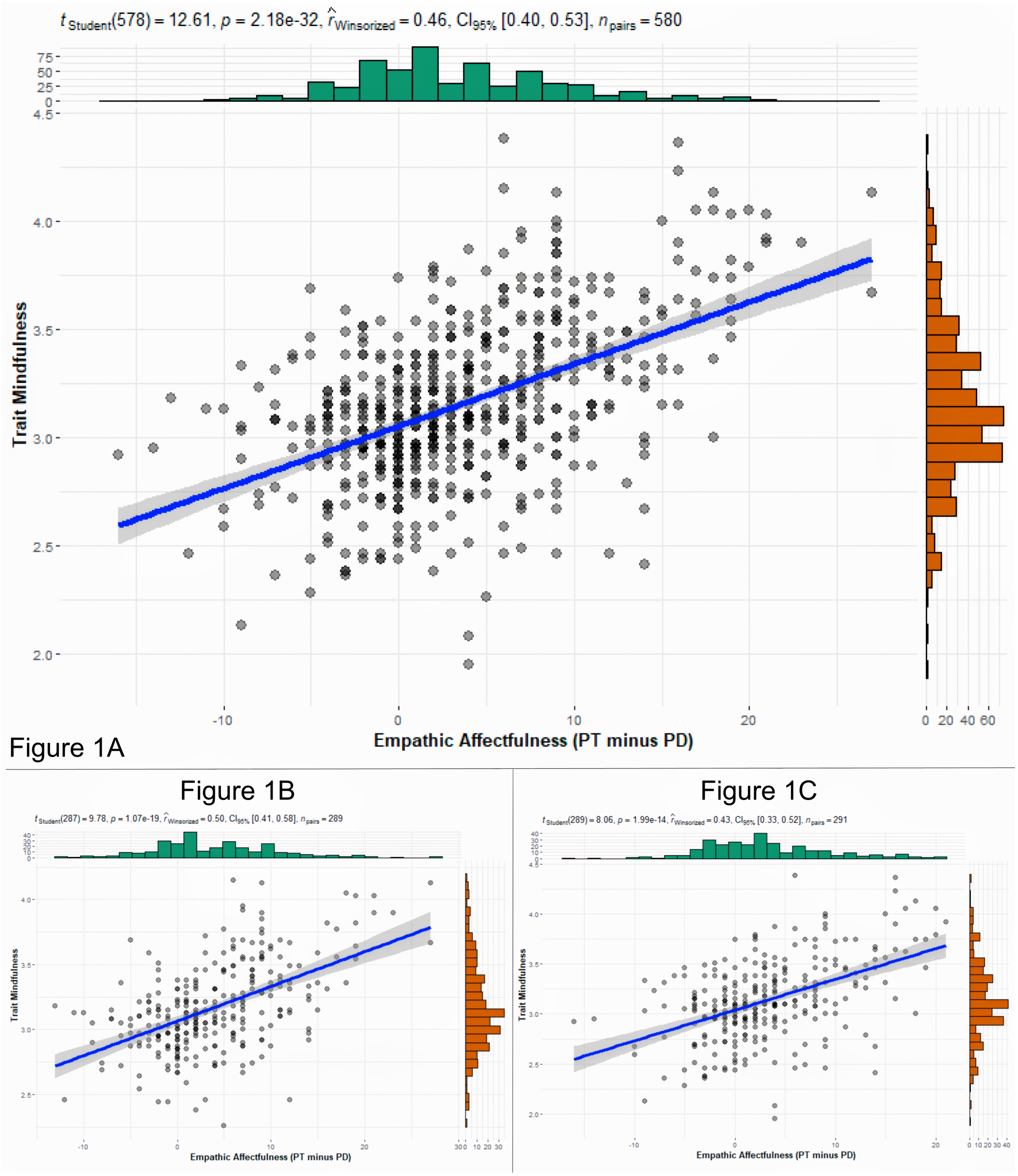
Post Hoc Statistical Analysis. Based on the observed associations of PT-TOM and PD-DOM, post hoc analysis was conducted, finding a negative association between EA (PT minus PD) and DOM (β = −.29, R^2 = 8.42%, p = .004). Furthermore, a partial correlation exploration revealed a significant negative association between EA and DOM ($r_{partial}$ = −.255, p < .001), post controlling for the residual empathy factors, and other state mindfulness subdimensions. The findings suggest that fragmented thoughts, as observed during meditation, are inversely associated with the novice's mindful capacity to empathize with others without being emotionally overwhelmed.

Associations Between State Mindfulness' EEG Spectral Correlates and Trait Empathy (Sample 2)

Exploratory analyses revealed no significant associations between trait empathy and EEG spectral correlates of state mindfulness at the corrected level (α = .0125). However, PT marginally correlated negatively with PFC gamma power (r = −.255, p = .0158), and this was considered in the context of the present analysis.

Post Hoc Statistical Analysis. Upon post hoc analysis, both the high frequency spectral powers in the PFC region associated negatively and significantly with EA (PFC-β: r = −.25, p = .0182; PFC-γ: r = −.266, p = .0118). Besides, given that self-reported DOM during the BF stage of the intervention was revealed to be negatively correlated with EA, an association of positive nature was further observed between PFC beta power and DOM (r = .293, p = .0053). No such association was observed between TOM and PFC gamma power, to mirror the observed self-reported association of PT-TOM.

Figure 1. *Scatter Plots With Marginal Histograms Illustrating the Correlation Between Trait Mindfulness and Empathic Affectfulness (EA).*



Note. Scatter plots with marginal histograms illustrating the correlation between trait mindfulness and EA (Computed as PT minus PD) in (A) Total sample (*N* = 580; Males = 289; Females = 291), (B) Males-only (*N* = 289), and (C) Females-only (*N* = 291).

Marginal histograms along the right and top axes visualize the distributions of trait mindfulness and EA, respectively, using parametric statistics. Plots were generated using '*ggstatsplot*' (Wickham et al., 2007) and '*ggplot2*' (Patil, 2024) via the '*ClinicoPath*' *Jamovi* Module (Balcı, 2020).

Table 4
Correlation Coefficients (r) Between State Mindfulness and Trait Empathy

		Dimension of Trait Empathy			
		EC	PT	FS	PD
Dimension of State Mindfulness	DOM	0.029	−0.166	0.012	0.251*
	TOM	0.084	0.26*	0.153	0.054
	SLF	0.072	0.081	0.112	0.092
	PLN	0.022	−0.009	−0.031	0.121
	SLP	−0.022	0.054	−0.019	0.137
	CMF	−0.127	0.087	0	−0.175
	SOA	0.023	0.029	0.05	0.027
	SMIND	−0.078	−0.049	−0.052	−0.229*

Note. * $p < .05$; ** $p < .0125$; *** $p < .001$ (After the Bonferroni corrections, only the p-values having ** and *** were taken as significant, as the significance threshold was set at .0125). SMIND implies CMF + SOA–TOM–DOM–SLF–PLN–SLP. EC = empathic concern, PT = perspective taking, FS = fantasy, PD = personal distress, DOM = discontinuity of mind, TOM = theory of mind, SLF = self, PLN = planning, SLP = sleepiness, CMF = comfort, SOA = somatic awareness.

The findings implied that a higher EA and PT was related to reduced high-frequency (beta-gamma) and gamma activity, respectively, in the PFC region during novice breath-focused meditative states. In continuation of the EA-DOM negative association, EA was linked inversely to both DOM and PFC beta power, while the latter two associated positively.

Discussion

This study examined the interrelationships of trait empathy with trait and state mindfulness in novice Indian meditators, employing a trait-only behavioral-only Sample 1 and a mixed trait-state Sample 2 with a combined neurobehavioral approach. The findings shed light on the role of novice mindfulness, both as a stable trait and as a transient state, in modulating empathetic traits.

Novice Mindfulness Traits, Empathetic Traits, and the Emergent EA Mechanism

The correlational and regression results in Sample 1 unveiled significant negative and positive associations of empathic traits of PD and PT, respectively, with novice TMIND, after controlling for personality trait effects. Furthermore, the novice TMIND's dimensions of NR and NJ were independently interrelated, sans personality traits, given their positive and negative associations with PT and PD, respectively. Therefore, novice TMIND is significantly associated with an enhanced ability to adopt others' perspectives (PT) and a reduction in self-oriented empathic distress (PD). This mechanism was termed as EA, and similar empirical results have been observed in Western samples (Cooper et al., 2020; Fuente-Anuncibay et al., 2019; Kingsley, 2009). This aligned with previous research indicating that mindfulness fosters greater emotional regulation and cognitive flexibility, which are essential for affective empathy (Fulton & Cashwell, 2015; Jones et al., 2019).

Upon post hoc investigation in behavioral-only Sample 1, towards the EA variable curated as "PT minus PD," persistent evidence was observed in correlation and hierarchical regression analyses, the latter controlling for academic choices, personality, and gender factors. Therefore, in these findings, EA emerged as a plausible novel mechanism, associated robustly with novice TMIND, reflecting the empathetic capacity to perspectivize and share others' mental states without becoming emotionally overwhelmed by them. Overall, on the basis of EA's positive association with TMIND, its naming reflected the underlying rationale, wherein *empathic* denotes enhanced perspectivizing, while *affectfulness* captures an attunement to, rather than entanglement with, the concomitant affective distress. Finally, regarding the EA's internal mechanisms, hierarchical regression indicated in Sample 1 a NR-PT-NJ-PD-EA nexus, wherein TMIND's subdimensions of NR and NJ were associated with EA's configuration with a favorable PT and an attenuated PD, respectively.

Novice State Mindfulness, Empathetic Traits, and EA

While SMIND assessed in Sample 2 demonstrated limited predictive power in its analyses, nontrivial patterns emerged that support the idea of momentary mindfulness functioning as a modulator rather than a predictor of empathic responses (Fuente-Anuncibay et al., 2019). Specifically, yet weakly, during the breath-focus stage of the SMIND intervention, TOM was positively correlated with PT, whereas PD was correlated positively and negatively with DOM and overall SMIND, respectively. Despite the feeble results, findings pointed to the idea that elevated empathic traits of PT and PD may have impacted novice SMIND, owing to the overemphasized perspectivation and mental restlessness, respectively (Brahmi et al., 2025b; Diaz et al., 2014). Lastly, EA's negative robust association with DOM was found post hoc, further strengthening its positive correspondence with mindfulness state- and trait-wise, overall, behaviorally. Since a lower DOM is indicative of reduced mind-wandering (Hoseinian et al., 2019). The associations of TOM-PT and DOM-PD, as well as their relationship with EA, thus emphasize the importance of present-centered awareness (K. W. Brown & Ryan, 2003).

Overall, an absence of strong correlational findings in self-reported SMIND may be due to the unstable nature of novice meditative states, as novices frequently exhibit variability in applying their trait-level mindfulness to actual meditation experiences (Baer et al., 2006). Nevertheless, behavioral findings across both samples indicated that novice trait and state mindfulness were moderately yet consistently associated with the empathic dimensions of PT and PD.

The EEG-based SMIND assessment observed feeble yet significant associations: EA's negative relation with PFC beta-gamma powers, PT's negative association with PFC gamma power, and DOM's positive interrelation with PFC beta powers. Besides, gamma enhancement has been traditionally linked to long-term mindfulness expertise, especially for Vipassana-type interventions, similar to the one used herein (Braboszcz et al., 2017; Cahn et al., 2010). Thereupon, a possible explanation could be that a lower empathic perspectivising trait might aid the novice meditators to be more aware of their breaths, since self-report also indicated, albeit weakly, the positive association of TOM and PT. Thus, plausibly hinting that a high PT and EA may entail increased mentalizing in daily life but may be detrimental during meditative focus in novices (Brahmi et al., 2025b). Further, the interrelation of a reduction and an increase in PFC beta powers with EA and DOM, respectively, might entail that a higher EA trait is reflected by lesser cognitive interference and relative ease in disengaging from distractive thought patterns. In literature, the role of PFC beta oscillations is unclear in meditative contexts, however, its decrease has been associated with long-term meditation expertise (Lee et al., 2018). Therefore, given the DOM-EA-PFC beta triangulation in the present sample, these oscillations might indicate a less effortful meditative breath-focus for novices with a higher EA trait.

Nevertheless, the SMIND neurobehavioral results should be interpreted with caution, given their small effect sizes, gender-skewed sample, and exploratory nature, warranting further validation through longitudinal or qualitative-based research designs.

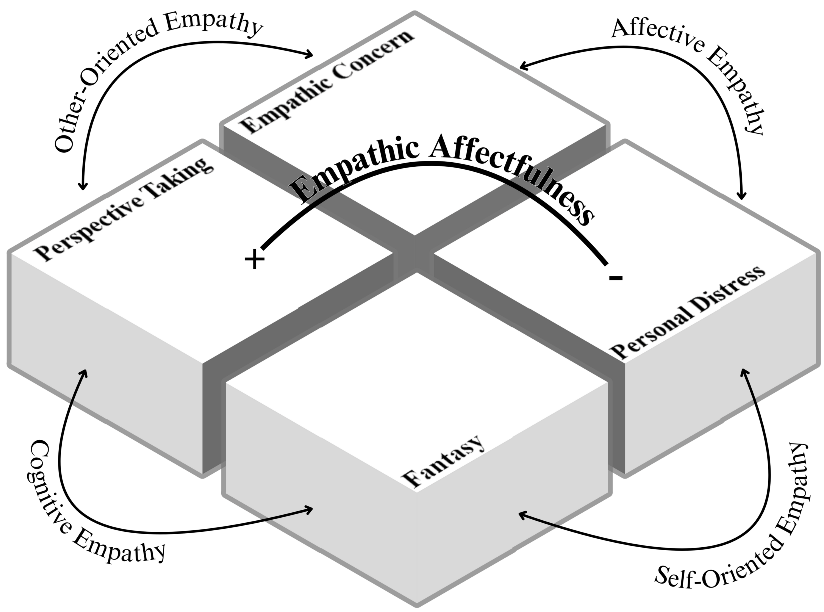
EA: Regulating Empathetic Overdrive

Across both samples, the construct of EA—operationalized as the difference between PT and PD—emerged as a possible stable and meaningful empathic regulatory mechanism in novice mindfulness. Trait-level findings suggested that EA, as a novice mindfulness mechanism, not only supported other-oriented cognitive mentalizing (PT) but also buffered against empathic overdrive in the form of emotional overwhelm (PD). These findings resonate with models of emotional regulation in empathy, such as those proposed by Decety and Jackson (2004), which highlight the role of emotion regulation in empathic engagement. Interestingly, although SMIND showed limited predictive power behaviorally, DOM—a key facet indicating mental fragmentation—was inversely associated with EA both at self-report and EEG levels. The convergence of lower DOM, lower PFC beta activity, and higher EA underscores a possible novice neurocognitive mechanism, wherein EA-based empathic regulation is linked to a less fragmented mental state and reduced frontocortical effort during meditative engagement. However, heightened TOM was observed to be related to a higher PT trait, which in turn triangulated with a greater EA and a lower PFC gamma activity. Thereby, suggesting PT-EA to be related with poorer meditation-focused novice states, owing to TOM-based interference, as meditation is essentially an exercise in mental emptying (Rodriguez-Larios et al., 2020).

The novice mindfulness-empathy functional interdependence, as reported in the trait and state sample, possibly indicated that EA is not a static trait but a dynamic process influenced by momentary cognitive states (Fuente-Anuncibay et al., 2019). Overall, EA offers novel novice mindfulness mechanisms for understanding adaptive empathy, beyond the existing dimensional structure by Davis (1983; Figure 2).

In clinical settings, the concept of EA could be valuable for understanding and mitigating burnout among caregivers, therapists, and educators, who are often exposed to intense emotional experiences (Cooper et al., 2020; Salvarani et al., 2019; Simon et al., 2018). Mindfulness-based interventions thus may be particularly effective in building emotional boundaries while maintaining empathic engagement, promoting both emotional resilience and the capacity for compassionate care (Cheang et al., 2019; Goswami et al., 2024; Hoseinian et al., 2019). EA abilities would also be crucial in professions that require sustained emotional labor, and cultivating EA may serve as a protective factor against PD (Asuero et al., 2014; Verweij et al., 2016).

Figure 2. *Empathic Affectfulness as a Novel Mechanism Within Davis' Dimensional Structure of Trait Empathy (1983).*



Conclusions, Limitations, and Future Work

This study examined the interrelationships between trait empathy and novice mindfulness using neurobehavioral measures. Trait mindfulness—particularly NR and NJ—was positively associated with PT and negatively with PD, respectively, independent of personality traits. SMIND showed weaker associations: DOM correlated positively with PD and prefrontal beta activity, while TOM correlated positively with PT. Overall, PD showed negative associations with both trait and state mindfulness, whereas PT was positively linked in the trait context but showed inverse associations in the state mindfulness context. As PT itself was also linked to reduced prefrontal gamma activity, suggesting that while PT facilitates mentalizing, it may interfere with novice meditative focus. Post hoc trait-level analysis identified EA—the difference between PT and PD—as a potential mechanism of emotionally conscious empathy. Even though its link to SMIND was not very strong, EA was connected to lower prefrontal beta activity and DOM, suggesting its association with focussed meditative states. Crucially, EA showed substantial predictive validity, since it was evident in both trait and state mindfulness samples, underscoring the plausible role of novice mindfulness in fostering affect-conscious empathy.

Further, these results contribute to a growing understanding of mindfulness not only as a facilitator of empathy but also as a buffer against empathic overarousal, even in novices. Both design-wise and empirically, the study has several limitations that warrant caution, since it espouses an exploratory mechanism. Firstly, the construct of EA is novel and operationalized post hoc; its validity and boundaries require further theoretical refinement and empirical validation. Next, the use of novice meditators, limited gender diversity in the EEG sample, and a cross-sectional design limited generalizability and causal inferences towards EA. Further, SMIND was assessed using a brief, single-session intervention that may not adequately capture the complexity of meditative states in real-world practice; however, the intervention did include workload induction, apriori to its onset. Besides, the EEG results, though promising, were exploratory with small effect sizes and should be interpreted accordingly. Additionally, replications across cross-cultural samples, contemplative traditions, and population subgroups (as clinical and care-giving contexts) are essential to assess EA's generalizability, although similar results have been reported in Western samples before (Cooper et al., 2020; Fuente-Anuncibay et al., 2019; Kingsley, 2009). Lastly, the integration of additional neuroimaging techniques, synchronization- and source-based EEG analyses may offer a more comprehensive understanding of the neurophysiological basis of EA.

Overall, the present study offered an initial conceptual and empirical framework for EA, encouraging its continued investigation as a potentially meaningful mechanism at the intersection of mindfulness and empathy.

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Author Declaration

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