

The influence of Emotional Intelligence on Group Malevolent Creativity: Evidence from fNIRS hyperscanning

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Research Article

Keywords: Emotional Intelligence, Group malevolent creativity, Hyperscanning, Inter-brain synchrony

Posted Date: October 27th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11056729/v1>

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Additional Declarations: No competing interests reported.

Abstract

The relationship between emotional intelligence and creativity is a hot topic in the fields of emotion and innovation; but previous research has paid little attention to how emotional intelligence influences the group creative process, particularly this specific form of creativity known as group malevolent creativity. We employed functional near-infrared spectroscopy hyperscanning in 60 dyads (120 participants) to investigate the effect of emotional intelligence on group malevolent creativity and its neural mechanisms. Results revealed that emotional intelligence can reduce group malevolent creativity; groups with high emotional intelligence exhibited greater inter-brain synchrony (IBS) in the prefrontal cortex and right temporoparietal regions. Furthermore, IBS increments were negatively correlated with malevolent creativity; the pattern of IBS increments in the prefrontal cortex mediated the relationship between emotional intelligence and group malevolent creativity. Our findings suggest that emotional intelligence may attenuate the emergence of group malevolent creativity, and this effect is accompanied by enhanced inter-brain synchrony in the prefrontal-right temporoparietal region. This study revealed the neural interaction basis underlying the association between emotional intelligence and group malevolent creativity, offering a new perspective on understanding the complex relationship between emotional intelligence and malevolent creativity.

1. Introduction

Creativity, which is conceptualized as the capacity to produce original, functional ideas or outputs (Runco & Jaeger, 2012; Sternberg & Lubart, 1998), may be deployed for either constructive or destructive ends. The latter is referred to as “malevolent creativity,” which refers to the deliberate application of creative thinking to cause physical, psychological, or material harm to others (D. H. Cropley et al., 2008, 2014; Harris et al., 2013). The original intent behind this type of creativity is malevolent destruction; it deviates from socially accepted values, thereby amplifying risks to personal and societal loss (Gill et al., 2013). Meanwhile, numerous prototypical behavioral manifestations of malevolent creativity rarely stem from discrete individual behaviors; instead, they are deeply embedded within salient group identities and intergroup conflict contexts. For example, terrorist attacks are mostly carried out by groups (Ligon et al., 2018). Consequently, to maintain social stability and ensure public safety, understanding how to mitigate malevolent creativity and its potential consequences is imperative (A. J. Cropley, 2010). This requires identifying critical influencing factors influencing malevolent creativity (e.g. situation of unfairness, emotional intelligence, and motivational tendencies) and elucidating the underlying mechanisms driving its emergence (Gill et al., 2013; Gutworth et al., 2018; Hao et al., 2020; Harris et al., 2013).

Within the framework of positive psychological resources, emotional intelligence - defined as individuals' capacity to perceive, comprehend, and modulate intrapersonal and interpersonal emotions as well as to facilitate thinking (Mayer & Salovey, 1997) - is likely to be associated with the manifestation of malevolent creativity. The integrated model of creativity and deviant behavior developed by Meshkova and Enikolopov (2018) posits that high emotional intelligence serves as a vital protective factor that constrains the transformation of individuals' creative potential into harmful conducts. Furthermore, this

model is applicable to the analyses of antisocial creativity at both individual and group levels, thereby laying the theoretical foundation for the present study to examine the association between emotional intelligence and malevolent creativity from a group-based social psychological perspective.

However, previous empirical studies have produced inconsistent findings regarding the impact of emotional intelligence on malevolent creativity. Harris et al. (2013) reported a significant negative correlation between emotional intelligence and malevolent creativity at the individual level. Specifically, individuals with higher emotional intelligence tend to generate fewer malevolent creative ideas. The study further indicated that individuals with low emotional intelligence are more prone to externalizing their negative cognitions. First, they failed to recognize that their deviant creative ideations violate social norms; second, they lacked empathy for others' emotions. Consequently, such individuals are more likely to develop malevolent ideations, which ultimately manifested as elevated levels of malevolent creativity. In addition, at the group interaction level, existing studies have documented that high-emotional-intelligence groups outperform their low-emotional-intelligence counterparts in the accurate perception, comprehension, and management of their own emotions (Fulmer & Barry, 2004). Such groups tend to adopt positive and cooperative coping strategies when confronted with interpersonal difficulties. In contrast, individuals with lower emotional intelligence struggled to effectively manage negative emotions and were prone to adopting passive and confrontational coping strategies (Ayoko et al., 2008; Jordan & Troth, 2004), which in turn led to more malevolent creative behaviors. Another study also found that higher emotional intelligence can curb malevolent creativity (Cheng et al., 2021; Li et al., 2022). Conversely, some research yielded non-significant associations between the two constructs, and that conscientiousness and empathy may actually be the contributors to the reduction of malevolent creativity (Zhou et al., 2024). These inconsistent findings suggest that the influence of emotional intelligence on malevolent creativity cannot be characterized as a simplistic and uniform effect; instead, it represents a complex phenomenon that has not yet been fully elucidated.

This complexity suggests that focusing merely on overt behaviors may make it difficult to uncover the essence of the relationship between emotional intelligence and malevolent creativity. Studies have found that the core abilities of emotional intelligence are grounded in the neural substrates of the prefrontal cortex, and damage to the prefrontal cortex impairs the perception, integration, comprehension and regulation of emotional information (Krueger et al., 2009). Additional fMRI studies have further found that trait emotional intelligence shows a significant correlation with the strength of functional connectivity between the medial prefrontal cortex (mPFC) (Takeuchi et al., 2013). Martín-Aguiar et al. (2026) have reported that emotional intelligence is supported by a complex and extensive brain network, which primarily facilitates the integration of cognitive and affective processes and significantly involves structures typically associated with social cognition. Parallel to emotional intelligence, the emergence of malevolent creativity also requires the involvement of the prefrontal cortex. fNIRS studies have found that most regions within the prefrontal and temporal lobes (e.g., the right dorsolateral prefrontal cortex (rDLPFC), and right angular gyrus) were activated during the malevolent creativity task (Qiao et al., 2023). Furthermore, neural activation in the right middle occipital area (rMO) was weaker during the malevolent creativity task relative to benevolent creativity, and the neural coupling between the right frontopolar

cortex (rFPC) and rMO was also reduced (Qiao et al., 2022). Based on the above empirical evidence, we propose that emotional intelligence may exert an effect on the generation of malevolent creativity by modulating neural activity associated with social cognition.

Although previous studies have revealed the behavioral influences and corresponding neural bases of emotional intelligence on malevolent creativity. Nevertheless, limited by traditional experimental approaches, scarce studies have examined group interaction scenarios to investigate how emotional intelligence affects inter-brain synchrony during group members' malevolent creative tasks. Accordingly, our study employs functional near-infrared spectroscopy hyperscanning to investigate the neural mechanisms underlying the effect of emotional intelligence on group malevolent creativity, with the aim of addressing the following three questions: First, can emotional intelligence reduce the generation of group malevolent creativity? Second, in the malevolent creative tasks, do high-emotional-intelligence groups exhibit lower production of malevolent ideas, and is this accompanied by elevated levels of inter-brain synchrony? Third, what mediating role does inter-brain synchrony play between emotional intelligence and malevolent creativity?

2. Methods

2.1. Participants and experimental design

We first recruited 223 healthy, right-handed adult participants. This study was conducted in two stages: the scale administration stage and the experimental stage. At the scale administration stage, every participant was required to complete the Emotional Intelligence Scale (WLEIS) via an online questionnaire. The participants were divided into two groups based on their scores: one group showing high emotional intelligence, and the other serving as the low emotional intelligence group. According to the recommendation of top and bottom 27% of the overall score distribution (Kelley, 1939), the high emotional intelligence group comprised individuals from the top 27% of high scorers, while the low emotional intelligence group consisted of participants from the bottom 27% of low scorers (Gao et al., 2022; Zhang & Li, 2025). At the experimental stage, the participants were asked to complete two tasks (see Section 2.2 for detailed information).

Prior to the formal experiment, all participants reported having normal or corrected-to-normal vision and were unacquainted with their assigned partners to ensure that all interactions began from a neutral baseline. All participants provided written informed consent in accordance with the Declaration of Helsinki after being informed of their right to withdraw from the experiment unconditionally at any time. Each participant was compensated 20 RMB for their involvement in the session, which lasted approximately 30 minutes.

This study utilizes a 2 (emotional intelligence group: high vs. low) × 2 (task type: AUT vs. MCT) mixed-design experimental design. Emotional intelligence group served as the between-subjects variable, while task type served as the within-subjects variable. A prior power analysis was conducted using G*Power

3.1, which indicated that a mixed-design ANOVA would require at least 34 participants of samples to detect a moderate effect size ($f = 0.25$) at a significance level of 0.05 and 80% power (Faul et al., 2007). Therefore, the sample size of 60 dyads in this study provides sufficient statistical power.

2.2. Experimental procedure and Collaborative Tasks

Upon arrival, participants first completed a series of pre-experiment questionnaire independently to assess baseline differences among individuals. The experimenter then read out the experimental instructions to participants and guided each dyad to organize and record the final solutions derived from their group discussion on the collaborative task. After fitting the fNIRS caps, a 3-min resting-state period was recorded simultaneously for both participants to establish a neural baseline for subsequent analyses. Dyads then engaged in two primary collaborative tasks, with the order counterbalanced across dyads to mitigate potential fatigue or practice effects. Each task lasted 10 minutes, with a 1-min rest period between tasks to ensure the participants remained in a stable state (see Fig. 1A and 1C).

The tasks included the Alternative Uses Task (AUT), in which each dyad was required to collaboratively report on unconventional uses for a button. This task was a complex divergent thinking test that effectively predicts an individual's innovative performance in real-world scenarios and is currently widely used in creativity-related behavioral experiments and neuroimaging studies (Fink et al., 2009; Runco & Acar, 2012; Runco & Okuda, 1991). The other task was the Malevolent Creativity Task (MCT), which is adapted from the Real-Life Situation Task and requires each dyad to generate as many originality and malevolent solutions as possible to a specific open-ended practical problem (Hao et al., 2020). The specific malevolent scenario used in this study was quoted from Qiao (2019): "Wang has had a secret crush on someone for a long time, but a romantic rival emerges unexpectedly. Please come up with creative ways to undermine the rival's image." Meanwhile, the AUT paradigm was adopted to test whether the characteristics of interpersonal neural interaction are specific to group malevolent creative behaviors. After all collaborative tasks were completed, participants uniformly completed the post-experiment questionnaire.

2.3. Behavioral and control variable analysis

To quantify the outcomes of the creative collaboration, group performance on the MCT task was assessed along three standard dimensions: fluency, originality, and malevolence (Cheng et al., 2021; Qiao et al., 2022; Zhang et al., 2024). Fluency was defined as the total count of unique and appropriate ideas generated by the dyad. Originality was defined as the degree to which a perspective is novel, and malevolence was referred to as the degree of harm caused by a generated viewpoint. For the AUT task, responses were scored on two dimensions: fluency and originality. To ensure objective and reliable scoring, we recruited eight trained raters and adopted the consensus evaluation method (Song & Shi, 2005). Each rater independently evaluated each idea on a 5-point Likert scale (1 = not fluency/original/malevolent at all, 5 = highly fluency/original/malevolent). Four of them evaluated the MCT task, while the other four evaluated the AUT task; the final scores were calculated by averaging the raters' ratings. The intraclass correlation coefficients (ICC) for this method indicated satisfactory inter-

rater reliability (Fluency: $ICC_{MCT} = 0.89$, $ICC_{AUT} = 0.86$; Originality: $ICC_{MCT} = 0.88$, $ICC_{AUT} = 0.84$; Malevolence: $ICC_{MCT} = 0.89$).

To rule out alternative explanations and verify the validity of random assignment, we performed control analyses on multiple potential confounding variables. Specifically, we conducted a series of independent-samples t-tests to examine baseline differences between the two emotional intelligence groups across core individual-difference variables. These included creative potential, openness personality trait, as well as cooperative and competitive personality dispositions. We used the Runco Ideational Behavior Scale (RIBS; Runco et al., 2016) to measure the frequency of daily creative ideation. The Openness dimension of personality was measured with the Chinese Big Five Personality Inventory–Openness Subscale (Dai et al., 2004). Participants’ cooperative and competitive tendencies were assessed via the Cooperative and Competitive Personality Tendency Scale (CCPTS; Xie et al., 2006). Beyond baseline traits, we also compared post-test subjective ratings and used the Cooperation Questionnaire (Shen & Benson, 2016), the Conflict Scale (Johnson et al., 2006) and the Familiarity Scale (Li, 2021) to measure levels of cooperation, conflict and familiarity during the task. In addition, the Malevolent Creativity Behavior Scale (MCBS; Hao et al., 2016) was adopted to assess malevolent creative tendencies. The Dirty Dozen-12 (DD12) was used to measure dark personality traits (Geng et al., 2015), and the Honesty-Humility Inventory (Ho-Hu) was administered to quantify moral personality traits (Lee & Ashton, 2004; Gong, 2013). All scales demonstrated acceptable internal consistency in the current experiment, with Cronbach’s α coefficients no less than 0.70.

2.4. fNIRS data acquisition and preprocessing

We employed the NirSmart-5000A system (Danyang Huichuang Medical Equipment Co., Ltd., China) to continuously acquire and record cerebral cortical hemodynamic responses from both participants during the experimental task. The system consists of a near-infrared light source and avalanche photodiodes as detectors, with wavelengths of 730 nm and 850 nm, respectively, and a sampling rate of 11 Hz. Raw optical density data were converted to relative concentration variations of oxygenated hemoglobin (HbO) and deoxygenated hemoglobin (HbR) using the modified Beer–Lambert Law (Scholkmann et al., 2014). Given robust evidence from abundant fNIRS research that HbO exhibits a higher signal-to-noise ratio and stronger coupling with cerebral blood flow fluctuations, we restricted all subsequent analyses solely to HbO signals (Jiang et al., 2012). Prior research has confirmed associations between the prefrontal cortex, right temporoparietal regions and creative generation as well as social interaction (Lu et al., 2019; Xue et al., 2018); accordingly, these areas constituted our main regions of interest. For each participant, we attached two optode arrays atop the target cortical areas. A 3×5 probe array (7 emitters, 8 detectors, 3 cm inter-optode distance) with 22 channels covered the prefrontal cortex, whereas a 3×3 probe array (5 emitters, 4 detectors, 3 cm spacing) containing 12 channels was positioned over the right temporoparietal cortex (see Fig. 1B).

The HC_Calculate function was used to perform preprocessing on the raw near-infrared data of the participants, aiming to eliminate global noise and improve data quality. Brain signals recorded during

resting and task periods were included in subsequent analyses. To precisely extract task-specific evoked neural activities, we performed temporal segmentation on the dataset. Specifically, the first and last 10 seconds of resting-state data and the first and last 30 seconds of task-state data were discarded. This procedure removed signal interference induced by irrelevant cognitive processes and ensured the purity and validity of the analyzed data.

2.5. fNIRS data analysis

We employed the wavelet transform coherence (WTC) algorithm to calculate the inter-brain synchrony between the two participants (Grinsted et al., 2004). WTC is particularly beneficial for non-stationary signals like fNIRS data, as it can reveal localized, transient phase-locking behavior. WTC was calculated on the HbO time series across all channel pairs for each dyad. To isolate the most informative frequency band, we adopted a data-driven approach. In this step, IBS values were first averaged across the two tasks and the resting state to generate a unified overall synchrony metric for each dyad. Then, the IBS increments were quantified as the task-state signal minus the resting-state signal. Fisher's z transformation was applied to the IBS increments to normalize their distribution prior to statistical analyses (Chang & Glover, 2010; Cui et al., 2012). Subsequently, one-sample t -tests against a test value of zero were conducted on IBS increments within the 0.01–0.7 Hz frequency band during the MCT task for both groups (corrected threshold: $p < 0.0005$; Nozawa et al., 2016; Pan et al., 2018). This analysis aimed to screen valid frequency bands that significantly reflected the effect of emotional intelligence on group differences in malevolent creativity. To rule out physiological noise including cardiac signals (typically > 0.7 Hz) and ultra-low-frequency systemic fluctuations (< 0.01 Hz), this particular frequency bandwidth was selected (Molavi & Dumont, 2012; Tong et al., 2011). Since the purpose of this analytical step was merely to locate bands of interest rather than to obtain conclusive results, further statistical corrections were not performed (Zheng et al., 2018). Eventually, the range of the significant frequency band was identified at 0.0101–0.3049 Hz.

For the subsequent analyses, we re-conducted one-sample t -tests against a test value of zero on IBS increments from all 34 channels within the target frequency band for both groups. Independent-samples t -tests were further applied to compare IBS increments of the 34 channels between the high and low emotional intelligence groups, and false discovery rate (FDR) correction was applied to all p -values at the significance level of $p < 0.05$. Lastly, we adopted Pearson product-moment correlation to explore the associations of IBS increments with three dimensions of group malevolent creativity: fluency, originality, and malevolence.

3. Results

3.1. Experimental manipulation and control variable testing

To ensure that the observed outcomes were attributable to the grouping based on emotional intelligence levels rather than confounding variables, we first examined potential group differences in baseline indicators and posttest subjective evaluations. Independent-samples t -tests revealed no significant

baseline differences across key demographic and individual difference variables, including creative potential, openness personality trait and dispositions for cooperative and competitive personality (all $ps > 0.05$). Similarly, no significant between-group differences emerged in posttest subjective ratings of cooperation, conflict and familiarity, malevolent creative tendencies, dark personality traits and quantify moral personality traits (all $ps > 0.05$). These results confirmed the success of our random assignment and indicate comparable subjective experiences across conditions.

3.2. Behavioral performance

We initially examined the effect of emotional intelligence on group malevolent creativity. Then, we conducted an independent-samples t-test on the malevolence scores of the MCT task, with emotional intelligence set as the between-subjects independent variable. Subsequently, we entered task type as an additional independent variable and performed a two-way repeated measures ANOVA on the scores of malevolent creativity performance (originality and fluency).

The results revealed a significant between-group difference in the malevolence dimension of group malevolent creativity between the high and low emotional intelligence groups, $t_{(58)} = 5.01, p < 0.001$, Cohen's $d = 1.29$. Specifically, the MCT malevolence score of the low emotional intelligence group ($M = 3.42, SD = 0.97$) was significantly higher than that of the high emotional intelligence group ($M = 2.24, SD = 0.84$). For the originality and fluency dimensions of malevolent creativity, significant interaction effects of emotional intelligence $\times$ task type were observed. In terms of originality, the interaction effect of emotional intelligence $\times$ task type was significant, $F_{(1, 58)} = 85.09, p = 0.001$, partial $\eta^2 = 0.60$, the main effects of emotional intelligence and task type were not significant. Simple effect analysis indicated that in the AUT task, the low emotional intelligence group obtained significantly lower originality scores ($M = 2.41, SD = 0.39$) than the high emotional intelligence group ($M = 3.51, SD = 0.70, p < 0.001$, Cohen's $d = -1.94$). By contrast, during the MCT task, the low emotional intelligence group showed significantly higher originality scores ($M = 3.44, SD = 0.72$) than their high emotional intelligence counterparts ($M = 2.70, SD = 0.70, p < 0.001$, Cohen's $d = 1.04$). With regard to fluency, the emotional intelligence $\times$ task type interaction was also significant, $F_{(1, 58)} = 16.76, p = 0.001$, partial $\eta^2 = 0.22$. The main effect of emotional intelligence was non-significant, while the main effect of task type was significant, $F_{(1, 58)} = 6.28, p = 0.02$, partial $\eta^2 = 0.10$. Follow-up simple effect tests demonstrated no significant group differences in fluency scores between the low emotional intelligence group ($M = 3.05, SD = 0.76$) and the high emotional intelligence group ($M = 3.29, SD = 0.75$) under the AUT task ($p > 0.05$). For the MCT task, the low emotional intelligence group attained significantly higher fluency scores ($M = 3.21, SD = 0.91$) than the high emotional intelligence group ($M = 2.63, SD = 0.82, p = 0.01$, Cohen's $d = 0.67$). (see Fig. 2)

3.3. Interpersonal brain synchronization results

We performed one-sample t-tests against a reference value of zero on IBS increments during the MCT task for both groups within the frequency band of interest, with false discovery rate (FDR) correction

applied for multiple comparisons. The results revealed several valid channels where IBS increments were significantly higher than zero in both groups within the predefined frequency band of interest.

Subsequently, independent-samples t-tests with FDR correction were conducted to compare MCT-period IBS increments between the high and low emotional intelligence groups, taking emotional intelligence as the between-subjects independent variable. The results showed that there were significant group differences in IBS increments across multiple channels between the two groups (see Table 1 for details). Overall, the IBS increments in the low emotional intelligence group ($M_{\text{average}} = -0.03$, $SD_{\text{average}} = 0.08$) were significantly lower than those in the high emotional intelligence group ($M_{\text{average}} = 0.02$, $SD_{\text{average}} = 0.075$). (see Fig. 3A, 3B & 3C)

Table 1
Independent-Samples t-test Results for IBS increments between the two groups during the MCT Task

Channel	Low EI group ($M \pm SD$)	High EI group ($M \pm SD$)	<i>t</i>	<i>p</i> _FDR	Cohen's <i>d</i>
CH1	-0.02 ± 0.06	0.01 ± 0.05	-2.21	0.03	-0.57
CH2	-0.01 ± 0.05	0.02 ± 0.05	-2.66	0.01	-0.69
CH9	-0.01 ± 0.06	0.03 ± 0.07	-2.02	0.049	-0.52
CH14	-0.06 ± 0.12	0.02 ± 0.10	-2.95	0.005	-0.76
CH15	-0.01 ± 0.07	0.02 ± 0.06	-2.02	0.048	-0.52
CH16	-0.0006 ± 0.06	0.03 ± 0.05	-2.47	0.02	-0.64
CH17	-0.05 ± 0.09	0.01 ± 0.13	-2.08	0.04	-0.54
CH18	-0.07 ± 0.15	0.0038 ± 0.10	-2.11	0.04	-0.54
CH19	-0.01 ± 0.07	0.03 ± 0.08	-2.06	0.04	-0.53
CH22	-0.06 ± 0.13	0.0036 ± 0.08	-2.29	0.03	-0.59
CH23	-0.03 ± 0.06	0.03 ± 0.10	-2.65	0.01	-0.68
CH25	-0.01 ± 0.05	0.03 ± 0.04	-3.00	0.004	-0.78
CH26	-0.007 ± 0.07	0.04 ± 0.07	-2.35	0.02	-0.61
CH34	-0.04 ± 0.08	0.009 ± 0.07	-2.66	0.01	-0.69

3.4. The correlational results between brain and behaviors

To further investigate the functional implications of these inter-brain synchrony effects, we conducted Pearson correlation analyses between IBS increments and group malevolent creativity indicators (fluency, originality, and malevolence) for the low and high emotional intelligence groups. Among all

channels showing significant inter-group differences, IBS increments at CH2, CH9, CH15, CH16, and CH34 were significantly negatively correlated with indicators of group malevolent creativity. Specifically, for CH2, IBS increments exhibited significant negative correlations with all three MCT dimensions (originality: $r = -0.29, p = 0.02$; fluency: $r = -0.28, p = 0.03$; malevolence: $r = -0.36, p = 0.005$). For CH9, IBS increments were significantly negatively associated with originality and malevolence scores (originality: $r = -0.28, p = 0.03$; malevolence: $r = -0.30, p = 0.02$). For CH15, significant negative correlations were detected between IBS increments and originality as well as malevolence scores (originality: $r = -0.28, p = 0.03$; malevolence: $r = -0.35, p = 0.006$). For CH16, IBS increments correlated negatively and significantly with originality and fluency scores (originality: $r = -0.32, p = 0.01$; fluency: $r = -0.26, p = 0.048$). For CH34, only the correlation between IBS increments and malevolence scores reached significance ($r = -0.29, p = 0.03$). (see Fig. 3D)

3.5. Investigating the mediating role of IBS in the relationship between the emotional intelligence and malevolent creativity

During the MCT task, taking the emotional intelligence as the independent variable, the IBS increments of all significant channels as the mediator variable, and the behavioral scores of malevolent creativity as the dependent variable, a mediation effect analysis was conducted using Hayes' PROCESS macro model 4. The results indicated that emotional intelligence significantly positively predicted IBS increments at CH22 ($B = 0.0253, SE = 0.0123, t = 2.0563, p = 0.0443$). Firstly, we examined the combined effect of the emotional intelligence and the CH22 IBS increments on three indicators of malevolent creativity: originality, fluency, and malevolence. These results indicated that both the emotional intelligence ($B = -0.4220, SE = 0.1661, t = -2.5406, p = 0.0138$) and CH22 IBS increments ($B = 5.4748, SE = 1.7096, t = 3.2024, p = 0.0022$) significantly predicted the originality scores. Further analysis showed that the total effect of emotional intelligence on originality was non-significant ($B = -0.2833, SE = 0.1727, t = -1.6408, p = 0.1062$), whereas the direct effect reached significance ($B = -0.4220, SE = 0.1661, t = -2.5406, p = 0.0138$). This pattern suggested a negative direct influence of emotional intelligence on originality, which was suppressed by the mediating variable. Bootstrap analysis (5000 samples) showed that the indirect effect of emotional intelligence on originality scores through the CH22 IBS increments was significant ($B = 0.1387, BootSE = 0.0786, BootLLCI = 0.0067, BootULCI = 0.3138$). The Bootstrap confidence interval for the fully standardized indirect effect also did not include zero ($B = 0.2044, BootSE = 0.1188, BootLLCI = 0.0098, BootULCI = 0.4694$). In summary, these results supported a full mediation effect of CH22 IBS increments in the association between emotional intelligence and originality scores.

Secondly, emotional intelligence ($B = -0.7664, SE = 0.2165, t = -3.5393, p = 0.0008$) and CH22 IBS increments ($B = 6.2418, SE = 2.2288, t = 2.8005, p = 0.0070$) both exerted significant predictive effects on malevolence scores. Further analysis revealed that the total effect of the emotional intelligence on malevolence was significant ($B = -0.6083, SE = 0.2210, t = -2.7520, p = 0.0079$). The direct effect was also significant ($B = -0.7664, SE = 0.2165, t = -3.5393, p = 0.0008$), indicating that the reduction in malevolence was primarily driven by the direct path of emotional intelligence, while the mediator exerted a weak suppressing effect. Bootstrap analysis based on 5,000 resamples demonstrated a significant

indirect effect of emotional intelligence on malevolence through CH22 IBS increments ($B = 0.1581$, $\text{BootSE} = 0.0959$, $\text{BootLLCI} = 0.0053$, $\text{BootULCI} = 0.3813$). The Bootstrap confidence interval for the fully standardized indirect effect also did not contain zero ($B = 0.1751$, $\text{BootSE} = 0.1076$, $\text{BootLLCI} = 0.0057$, $\text{BootULCI} = 0.4269$). Taken together, CH22 IBS increments partially mediated the link between emotional intelligence and malevolence scores. (see Fig. 4)

4. Discussion

This research examined the influence of emotional intelligence on group malevolent creativity and adopted functional near-infrared spectroscopy (fNIRS) to explore the inter-brain neural interaction mechanisms underlying this relationship. The primary behavioral finding was that low emotional intelligence groups scored significantly higher on originality, fluency, and malevolence in the harm-oriented Malevolent Creativity Task (MCT) compared with high emotional intelligence groups; while in the ordinary divergent thinking task (AUT), the originality performance of the high-emotional-intelligence group was more advantageous. Previous studies have documented that individuals with high emotional intelligence possess stronger empathic skills, moral affective reactivity, and social cognitive processing. When completing explicitly malevolence-oriented creative tasks, these traits may serve as protective factors that are associated with reduced generation and elaboration of malevolent ideas. This mechanism may account for their poorer performance on malevolent creativity (Ge et al., 2026; Gutworth et al., 2018; Harris et al., 2013). Furthermore, a comparative analysis based on the RIBS and MCBS scales revealed no significant between-group differences in group malevolent creative potential across the high and low emotional intelligence groups. This finding eliminated the interference of baseline group creative potential in behavioral differences between groups, further verifying the negative effect of emotional intelligence on malevolent creativity. It also provided important practical references for the early warning and management of group malevolent behaviors in fields including cybersecurity and competitive intelligence (A. J. Cropley, 2010; Ligon et al., 2018). Accordingly, we conclude that emotional intelligence can reduce the generation of malevolent creativity, which addresses the first research question of this study.

To investigate the neural underpinnings of the influence of emotional intelligence on malevolent creativity, we focused on a standard metric of neural coupling: average inter-brain synchrony (IBS). The findings indicated that during the MCT task, the high emotional intelligence group exhibited larger increments in inter-brain synchrony across multiple channels in the right temporoparietal and prefrontal regions compared to the low emotional intelligence group. Moreover, the IBS increments of the aforementioned brain regions during MCT showed systematic negative correlations with the behavioral performance of group malevolent creativity. This finding further supported the link between IBS and reduced malevolent creativity from the perspective of neural-behavioral coupling. Hartmann et al. (2024) revealed that the right temporoparietal junction (rTPJ) is significantly activated when processing others' pain information. Moreover, the neural activation intensity of this brain region could directly modulate individuals' subjective empathic perceptions of others' suffering. The high emotional intelligence group exhibited stronger inter-brain synchrony (IBS) within this region, suggesting that when group members

devise malevolence-oriented scenarios, the brain region responsible for representing others' pain and processing empathic responses exhibits synchronized neural coordination. This might imply that when one group member conceives of directing malevolence toward a target, the temporoparietal junction of the other members synchronously evaluates the emotional consequences of such behavior. The empathic representations of multiple members regarding the victim's painful experiences exhibit high temporal coupling, forming cumulative emotional constraints. Ultimately, this collective emotional mechanism may be associated with reduced elaboration and implementation of malevolent schemes. Knoch et al. (2006) pointed out that the prefrontal cortex plays a crucial regulatory role in cognitive control and the maintenance of fairness norms. The enhanced inter-brain synchrony of the prefrontal region among high emotional intelligence groups suggests that group members establish a more effective coordinated regulatory network in terms of cognitive control and impulse inhibition, which may be associated with reduced group-level generation of malevolence-oriented ideas. Specifically, whenever any single member proposes potentially malevolent conceptions, other group members rely on the highly coordinated neural synchrony within this brain region to carry out cognitive appraisal and moral judgment on these proposals, potentially reducing the likelihood of collective endorsement of such schemes.

Qiao et al. (2023) demonstrated that neural coupling between the prefrontal cortex and temporoparietal regions decreases when individuals generate malevolent creativity, especially in harm-inflicting or prank-based scenarios. Such decoupling corresponds to individuals' disregard for the victim's suffering and the release of antisocial impulses. In contrast, high emotional intelligence groups exhibited elevated inter-brain synchrony patterns during the malevolent creativity task. This phenomenon suggests that when members of high emotional intelligence groups jointly devise malevolence-oriented plans, the prefrontal system responsible for cognitive control and moral monitoring and the temporoparietal system subserving empathic processing and social cognition do not show functional decoupling; instead, they maintain tight coordinated activation. This finding may also imply that high emotional intelligence does not simply eliminate the capacity to generate malevolent ideation but rather effectively decrease the spread and escalation of malevolent ideas within the group by strengthening inter-brain neural synchrony across regions associated with moral cognition and empathic processing, thereby addressing the second question raised in our study.

Mediation analyses further revealed that the association between emotional intelligence and group malevolent creativity did not follow a single pathway, but rather operated through the mediating effect of inter-brain synchrony (IBS). Firstly, emotional intelligence significantly and positively predicted the IBS increments in CH22, indicating that high emotional intelligence groups exhibited stronger interpersonal neural coupling during interaction, which further validated the IBS findings of the present study. Secondly, emotional intelligence yielded significant negative direct predictive effects on both the originality and malevolence of malevolent ideas. In other words, high emotional intelligence groups generated fewer malevolent contents during ideation, which was consistent with previous views on emotional intelligence decreases antisocial behavior (Harris et al., 2013). Notably, the IBS increments in CH22 significantly and positively predicted the originality and malevolence of malevolent ideas. This

indicated that elevated neural coupling in this channel during group interaction corresponded to higher levels of malevolent creativity. Furthermore, the indirect effect of emotional intelligence on originality and malevolence via the IBS increments in CH22 was significant. It revealed that the influence of emotional intelligence on group malevolent creativity operated through two opposing pathways: a direct negative pathway and a weak indirect positive pathway mediated by increased inter-brain synchrony within CH22. These findings indicate that the neurocognitive processes underlying the influence of emotional intelligence on group malevolent creativity require further investigation.

Several limitations warrant consideration. First, the Malevolent Creativity Task (MCT) adopted in this study required participants to generate ideas intended to harm others under a designated scenario. Although this experimental setting can effectively elicit malevolent ideation, it may still diverge from real-world malevolent creative behaviors (Kapoor & Kaufman, 2023). Second, all participants recruited in our study were college students. However, the manifestation and severity of malevolent creativity vary across demographic groups. For example, in organizational management contexts, malevolent creativity may manifest as workplace retaliation or sabotage, and its neural mechanisms may differ from those observed in laboratory settings. Future research can extend these findings to more ecologically valid contexts, which would facilitate a more comprehensive understanding of the dynamic relationship between emotional intelligence and malevolent creativity.

5. Conclusions

This study innovatively demonstrated that emotional intelligence can reduce the generation of group malevolent creativity. Specifically, high emotional intelligence groups exhibited lower production of malevolent ideation, and this effect was accompanied by elevated inter-brain synchrony (IBS); such increments in IBS were negatively correlated with malevolent creativity performance. Secondly, the association between emotional intelligence and group malevolent creativity is not solely direct. While the direct effect is negative (i.e., decreasing malevolent creativity), the indirect effect via IBS increments is positive (i.e., facilitating), forming a suppression pathway that runs counter to the direct effect. These findings provide a reference for understanding the cognitive neural mechanisms underlying group malevolent creativity.

Declarations

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Statements & Declarations

Funding: The author(s) declare that financial support was received for the research and/or publication of this article. This work was supported by the Hainan Provincial Education Science Planning Key Topics (No. QJZ202412011).

Competing Interests: The authors have no relevant financial or non-financial interests to disclose.

Author Contributions: All authors contributed to the study conception and design. Conceptualization, data organization, fund acquisition, and project management were all carried out by Ning Liu. Material preparation, data collection and analysis were performed by Sainan Ren and Run Li. The first draft of the manuscript was written by Sainan Ren. The drawing, final writing and review were all completed by Run Li. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data Availability: The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number (s) can be found: https://osf.io/2r3zn/overview?view_only=691975b3e27d44528c8cc38139b0db1b

Ethics approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Hainan Normal University School of Psychology the Psychology Research and Ethics Committee (ID: 202400116).

Consent to participate: Informed consent was obtained from all individual participants included in the study.

Consent to publish: The authors affirm that human research participants provided informed consent for publication of the images in all figures.

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Figures

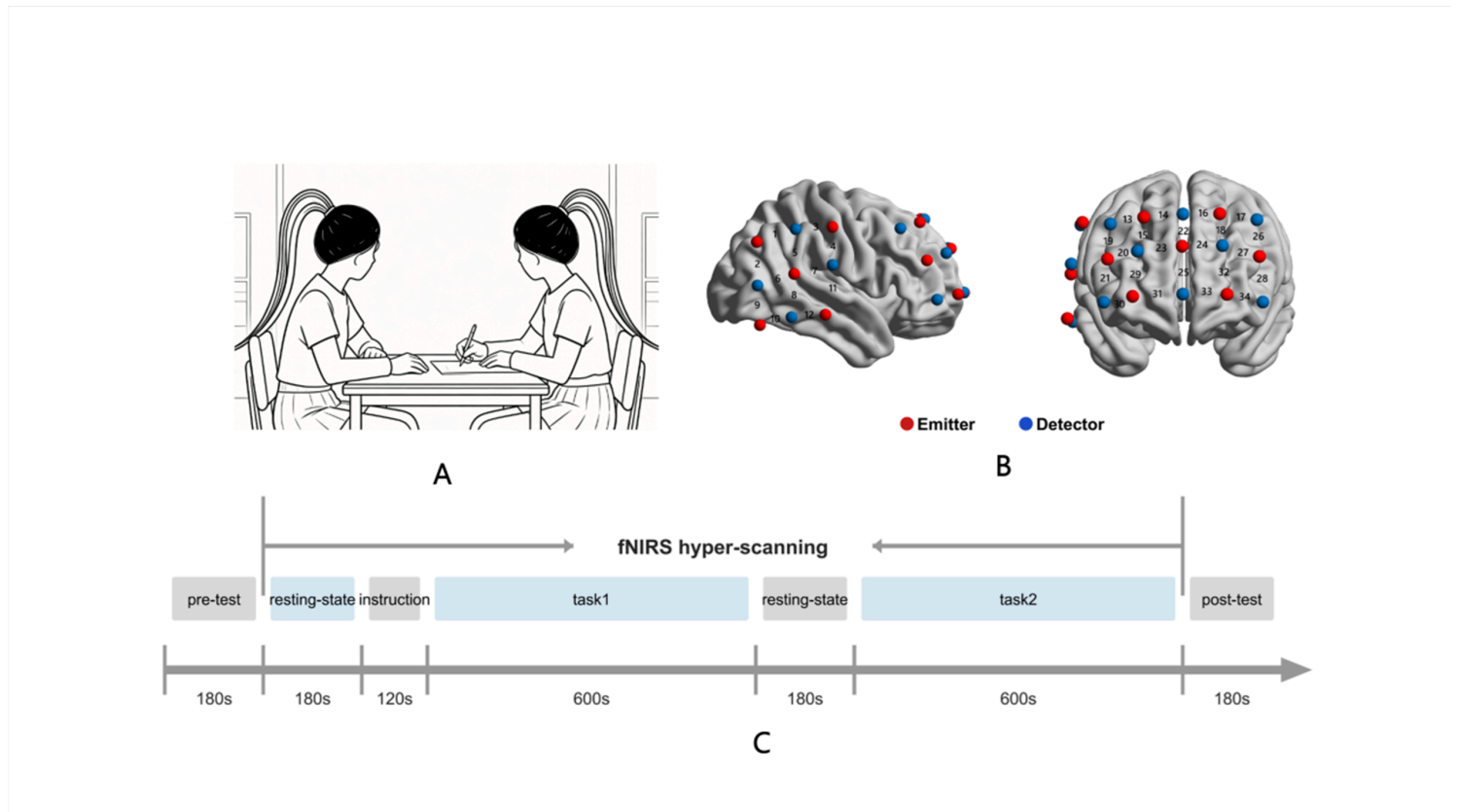


Figure 1

Experimental design, fNIRS setup and experimental procedure. (A) Schematic diagram of the dyads collaborative environment. (B) Configuration of the fNIRS probes in the prefrontal and right temporo-parietal regions. (C) Timeline of the experimental procedure.

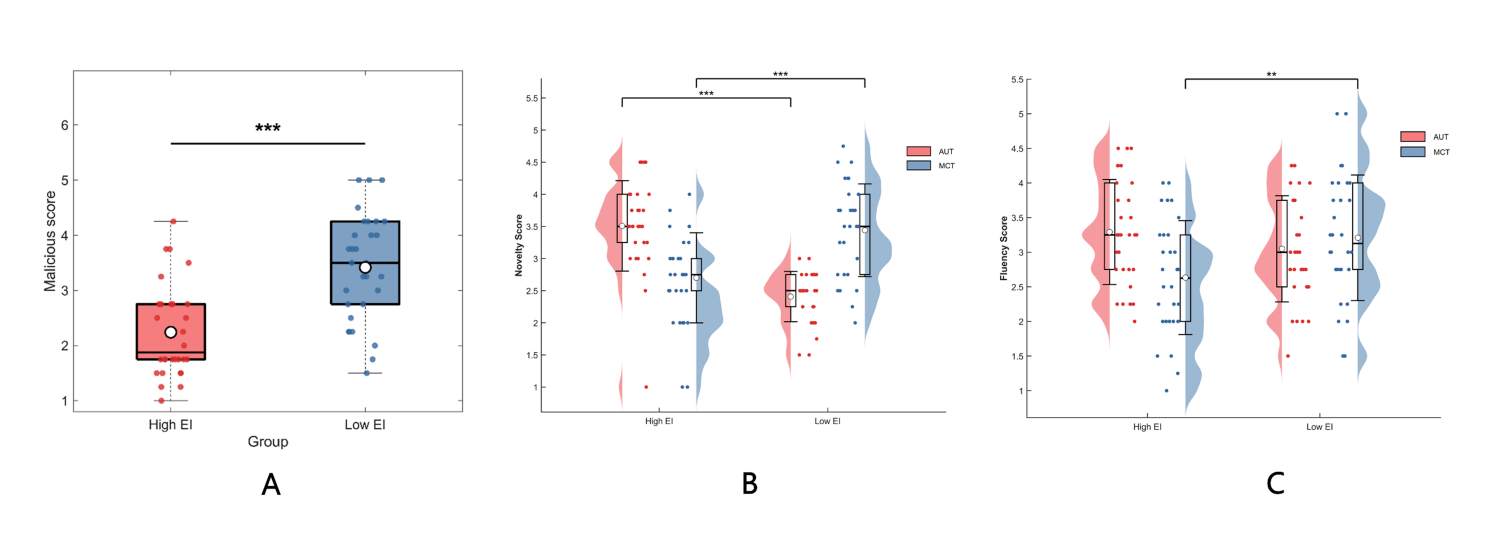


Figure 2

Behavioral results. (A) Results of the independent samples t-test comparing groups with high and low emotional intelligence on the malevolence in the MCT task. (B, C) Results of a two-way repeated measures ANOVA for emotional intelligence $\times$ task type on the originality and fluency dimensions. Box plots show the median (centre line), interquartile range (box edges) and minimum to maximum values (whiskers), individual data points are overlaid. Whilst violin plots and scattered points illustrate the distribution of the data; hollow circles represent group means. ** $p < 0.01$; *** $p < 0.001$.

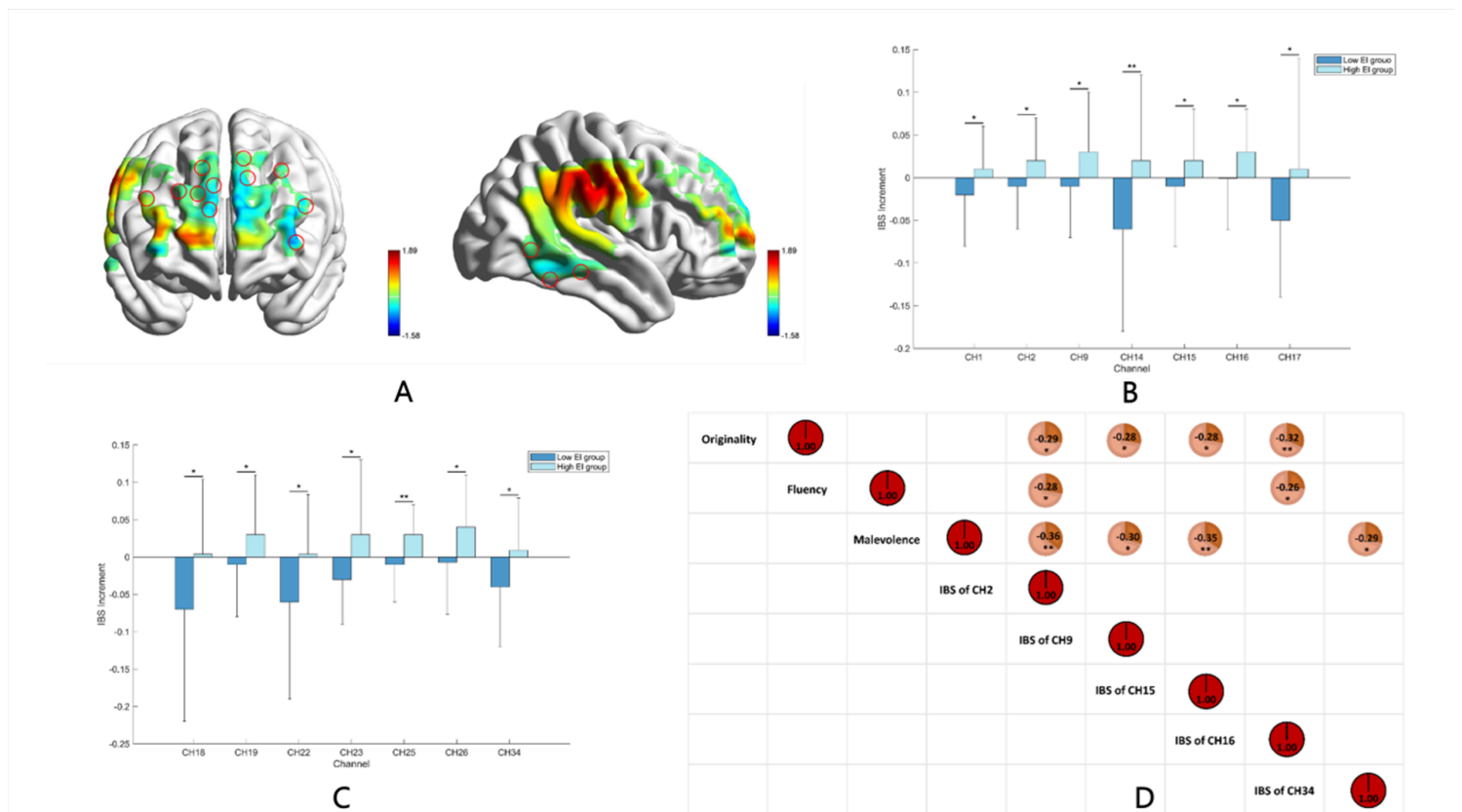


Figure 3

Results of independent-samples t-tests for inter-brain synchrony and Pearson product-moment correlation analyses. (A) Independent sample t-test brain map of IBS during MCT period. (B, C) Results of independent-samples t-tests for IBS increments between the high and low emotional intelligence groups during the MCT task; the IBS increments in the low emotional intelligence group were significantly lower than those in the high emotional intelligence group across all 14 channels. (D) Correlation results between originality, fluency and malevolence scores and IBS increments; the area and the numbers on the pie slices represent the strength of the Pearson correlation. * $p < 0.05$; ** $p < 0.01$.

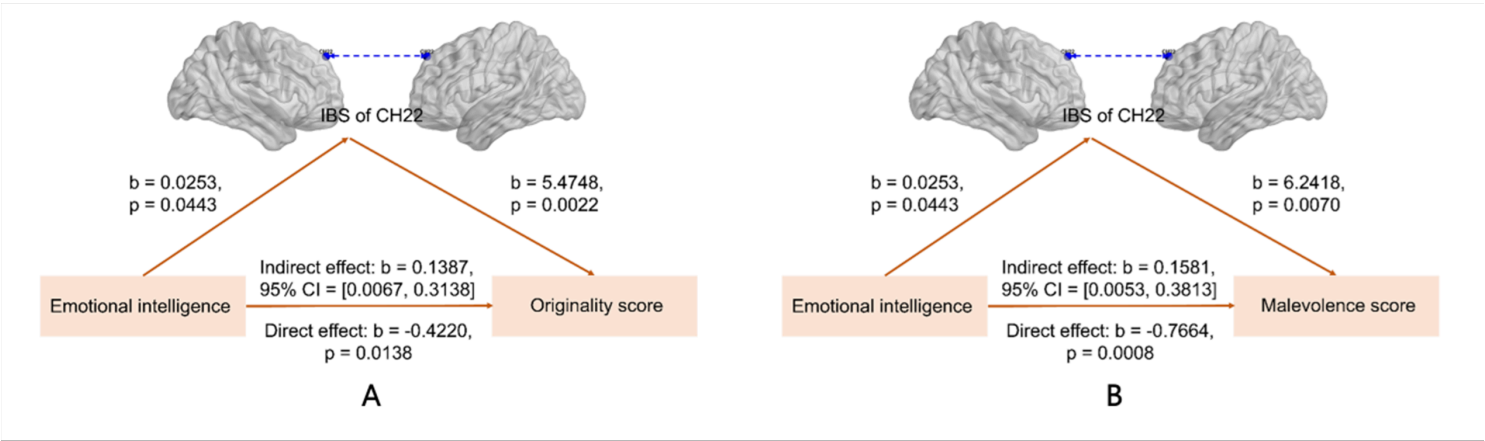


Figure 4

Results of the mediational analysis of emotional intelligence, IBS increments and indicators of malevolent creativity. (A) Results of the mediational analysis of emotional intelligence, IBS increment for CH22 and originality during the MCT task; (B) Results of the mediational analysis of emotional intelligence, IBS increment for CH22 and malevolence during the MCT task.