



Research article

PERSONALITY TRAITS RELATED TO NEGATIVE EMOTIONALITY IN INDIVIDUALS WITH DIFFERENT HANDEDNESS

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Abstract:

The relationship between handedness and personality traits neuroticism, anxiety, and irritability has been studied among 208 Greek adults aged 19 to 63 years. Participants completed standardized self-reported questionnaires: the Neuroticism scale of the EPQ-R, the Trait scale of the STAI, and the Aggressive Irritability subscale of the BDHI. Handedness was assessed by means of a performance test. The results revealed significant differences only in neuroticism scores across handedness groups, with left-handed participants scoring significantly lower in neuroticism than both right-handed and mixed-handed individuals. No significant group differences were found for anxiety or irritability, despite the observed tendency of lower levels on both traits in left-handed group.

Keywords: gender differences, neuroticism, anxiety, irritability, negative emotionality

Introduction

Handedness, broadly defined as the preferential use of one hand over the other, serves as a salient marker of cerebral lateralization, whereby cognitive and emotional processes is asymmetrically distributed across the two hemispheres. Typically, right-handed individuals display stronger left-hemisphere dominance, particularly in domains such as language, logical reasoning, and motor control, while left-handed individuals are more likely to exhibit right-hemispheric dominance or more symmetrical (bilateral) brain functioning (Knecht et al., 2000; Toga & Thompson, 2003). This neurodevelopmental divergence provides the theoretical basis for examining the potential associations between handedness and key emotional personality traits, including neuroticism, anxiety, and irritability.

The right hemisphere of the brain plays a central role in emotional processing, autonomic arousal, and affect regulation. All these domains closely tied to traits such as neuroticism and anxiety (Davidson, 2004; Gainotti, 2012). Individuals with atypical or reduced lateralization, more frequently observed among left-handed or mixed-handed individuals, may thus experience heightened affective sensitivity or decreased regulatory control. This has led to hypotheses suggesting that non-right-handedness could be associated with a greater propensity for emotional instability, mood variability, and increased susceptibility to negative affective states.

Handedness and Neuroticism

Neuroticism is characterized by mood lability, emotional reactivity, and a predisposition to experience negative emotions such as anxiety, sadness, and irritability. Some empirical studies

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have reported elevated neuroticism scores in left-handed individuals, suggesting a potential link between atypical lateralization and emotional vulnerability (McManus, 2002; Wright & Hardie, 2012). Neuroimaging research supports the notion that reduced hemispheric specialization, common in left-handed populations, may result in less efficient emotional regulation due to a more distributed cortical processing network (Szaflarski et al., 2002). Additionally, sociocultural pressures, such as the stigmatization of left-handedness or forced hand-switching during childhood, may exacerbate stress and reinforce neurotic tendencies (Beaton, 2018; Coren, 1992).

Genetic and hormonal factors are also implicated in this relationship. The partial heritability of both handedness and neuroticism suggests potential shared genetic pathways, although specific mechanisms remain under investigation (Brandler et al., 2013). Prenatal exposure to testosterone, which has been linked to both left-handedness and affective sensitivity, may also contribute to this developmental trajectory (Beauchaine & Tackett, 2020).

Handedness and Anxiety

The association between handedness and anxiety similarly rests on the neurobiological premise that reduced or atypical hemispheric lateralization affects emotional processing. The right hemisphere's prominent role in vigilance, threat detection, and emotional arousal positions individuals with stronger right-hemispheric activation, or bilateral engagement, as potentially more reactive to anxiety-provoking stimuli (Gainotti, 2012). Experimental findings have occasionally supported this theory, indicating higher trait anxiety and physiological arousal in left-handed individuals under stress (Demaree et al., 2005; Wright & Hardie, 2012).

Psychosocial experiences further compound this relationship. In a world largely configured for right-handers, left-handed individuals may encounter chronic micro-stressors – from poorly designed tools to subtle social biases, which can act as persistent anxiety triggers. Early negative experiences, such as pressure to conform to right-handed norms, may contribute to emotional insecurity and anxiety-related behaviours. Thus, handedness may indirectly relate to anxiety through both biological sensitivity and the accumulation of environmental stressors.

Handedness and Irritability

Although less extensively studied, irritability (a trait defined by low frustration tolerance and frequent emotional outbursts) may also be influenced by handedness through similar neurocognitive and psychosocial mechanisms. The Right Shift Theory (Annett, 1972) posits that deviations from typical left-hemispheric dominance, as seen in left- or mixed-handed individuals, are associated with more variable affect regulation, potentially leading to increased emotional reactivity. At the neurobiological level, irritability has been linked to hyperactivity in emotional processing in the amygdala and dysregulation in the prefrontal cortex. Functioning of these two regions may differ according to cerebral lateralization.

Based on the discussion above, we may conclude that, according to modern understanding, handedness may serve as an indirect indicator of emotional disposition, particularly in relation to neuroticism, anxiety, and irritability. In this context, the present study was designed to examine the relationships between handedness and the personality dimensions

of neuroticism, trait anxiety, and aggressive irritability, all of which are closely associated with negative emotionality.

Method

A sample of 208 Greek adults participated in the study. Participants ranged in age from 19 to 63 years ($M = 36.44$, $SD = 10.43$), and the sample comprised 131 women and 77 men.

The following standardized self-report questionnaires were used for the assessment of personality traits of neuroticism, anxiety and irritability: the Neuroticism scale of the Eysenck Personality Questionnaire – Revised (EPQ-R; **Eysenck, Eysenck, & Barrett, 1985**), the Trait scale of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983), and the Aggressive irritability subscale of the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957).

Handedness was evaluated using ten everyday tasks that are minimally influenced by formal training or societal pressure to conform to right-hand use. Each task was scored according to hand use: left-hand use received a score of -1, and right-hand use a score of +1. A Manual Asymmetry Quotient (Qma) was calculated for each participant. Scores were interpreted as follows: +71 to +100: Right-handed; -71 to -100: Left-handed; -70 to +70: Mixed-handed.

Results

Handedness Differences in Neuroticism

An ANOVA was conducted to assess differences in neuroticism between groups with different handedness. The results revealed the following mean scores on the Neuroticism scale (Table 1):

Table 1.

Mean Neuroticism Scores by Handedness

	N	Mean	Std. deviation	Std. Error
Right handers	96	12.10	4.84	.494
Mixed handers	80	12.42	5.25	.586
Left handers	32	9.81	5.26	.930
Total	208	11.87	5.12	.355

As shown, the left-handed group exhibited the lowest neuroticism scores, while the mixed-handed group showed the highest. The differences between groups were statistically significant ($F_{(2, 205)} = 3.219$, $p = .042$).

Post hoc multiple comparisons revealed significant differences between the left-handed group and both the right-handed group ($p = .028$) and the mixed-handed group ($p = .015$). No significant differences were found between the right- and mixed-handed groups ($p = .676$).

The distribution of participants by neuroticism level within each handedness group is presented in Table 2.

Table 2.

Distribution by Neuroticism Level and Handedness

Groups	Level of Neuroticism					
	Low		Normal		High	
	N	Percent	N	Percent	N	Percent

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Right-handers	17	17.7	64	66.7	15	15.6
Mixed-handers	12	15.0	52	65.0	16	20.0
Left-handers	11	34.4	19	59.4	2	6.2
Pearson Chi-Square; Cramer's V	$\chi^2_{(4)} = 7.604, p = .107$; Cramer's $V = .135$					

Although the left-handed group had the highest proportion of participants with low neuroticism and the lowest with high neuroticism, these differences did not reach statistical significance ($\chi^2_{(4)} = 7.604, p = .107$; Cramer's $V = .135$).

Handedness Differences in Anxiety

An ANOVA was also conducted to examine differences in anxiety among the three handedness groups. Table 3 presents the results:

Table 3.

Mean Anxiety Scores by Handedness

	N	Mean	Std. deviation	Std. Error
Right-handers	96	41.52	9.16	9.935
Mixed-handers	80	43.15	9.56	1.069
Left-handers	32	40.62	12.38	2.189
Total	208	42.01	9.86	.684

Although the mixed-handed group reported the highest anxiety and the left-handed group the lowest, these differences were not statistically significant ($F_{(2, 205)} = 0.967, p = .382$).

Post hoc comparisons also revealed no significant differences between the left-handed group and either the right-handed ($p = .657$) or mixed-handed groups ($p = .223$), nor between right- and mixed-handers ($p = .582$).

The distribution of participants by anxiety level within each handedness group is presented in Table 4.

Table 4.

Distribution by Anxiety Level and Handedness

Groups	Level of Anxiety					
	Low		Normal		High	
	N	Percent	N	Percent	N	Percent
Right-handers	9	9.4	53	55.2	34	35.4
Mixed-handers	5	6.2	47	58.8	28	35.0
Left-handers	7	21.9	16	50.0	9	28.1
Pearson Chi-Square; Cramer's V	$\chi^2_{(4)} = 6.345, p = .175$ Cramer's $V = .124$					

There were noticeable differences in the percentage of participants with low anxiety, especially in the left-handed group. However, the distribution differences were not statistically significant ($\chi^2_{(4)} = 6.345, p = .175$; Cramer's $V = .124$).

Handedness Differences in Irritability

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Another ANOVA was conducted to evaluate group differences in irritability scores. The findings are shown in Table 5:

Table 5.
Mean Irritability Scores by Handedness

	N	Mean	Std. deviation	Std. Error
Right-handers	96	2.46	1.91	.195
Mixed-handers	80	2.31	2.12	.237
Left-handers	32	2.28	1.48	.262
Total	208	2.37	1.93	.134

The analysis indicated no statistically significant differences in irritability scores across the three groups ($F_{(2, 205)} = 0.189, p = .828$). Nonetheless, the left-handed group had the lowest average score.

Post hoc comparisons confirmed no significant differences between left-handers and right-handers ($p = .637$), left-handers and mixed-handers ($p = .939$), or between right- and mixed-handers ($p = .596$).

The distribution of participants by irritability level within each handedness group is presented in Table 6.

Table 6.
Distribution by Irritability Level and Handedness

Groups	Irritability			
	Absence of Irritability		Presence of Irritability	
	N	Percent	N	Percent
Right-handers	91	94.8	5	5.2
Mixed-handers	71	88.8	9	11.2
Left-handers	31	96.9	1	3.1
Pearson Chi-Square; Cramer's V	$\chi^2_{(2)} = 3.324, p = .190$; Cramer's $V = .126$			

Although not statistically significant, it is worth noting that the mixed-handed group had the highest proportion of participants displaying irritability ($\chi^2_{(2)} = 3.324, p = .190$; Cramer's $V = .126$).

Discussion

Present study aimed to investigate the relationship between handedness and key emotional personality traits, namely neuroticism, trait anxiety, and aggressive irritability, in a general adult Greek sample. Drawing from both neurobiological and psychosocial perspectives, the study sought to determine whether manual preference could serve as a factor influencing the formation of personality traits, that are closely related to negative emotionality.

Contrary to several previous findings, the results revealed that left-handed participants reported significantly lower neuroticism scores than both right-handed and mixed-handed individuals. This finding diverges from previous studies suggesting that non-right-handedness is

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linked to increased emotional instability, including higher neuroticism and affective dysregulation (Bishop, 1990; Davidson, 2004; Satz & Green, 1999).

The lower levels of neuroticism we found challenges the hypothesis that atypical or reduced cerebral lateralization necessarily predisposes individuals to greater emotional vulnerability. While past research has suggested that mixed- or left-handedness may reflect less lateralized neural organization and thus poorer emotion regulation (Gainotti, 2012; Davidson, 2004), our data suggest that left-handedness might be associated with more stable emotional functioning, at least in terms of neuroticism. One possible explanation is that left-handed individuals develop compensatory strategies or exhibit distinctive neural adaptations that mitigate emotional reactivity. Such an interpretation aligns with more recent neuroplasticity models.

With respect to trait anxiety, although the mixed-handed group reported the highest mean scores and the left-handed group the lowest, these differences were not statistically significant. These our results do not contradict the results of previous studies that have explored how handedness may relate to anxiety. In fact, their findings often varied depending on the type of anxiety being measured. For example, Wright and Hardie (2012) observed that while left- and right-handed participants had similar baseline anxiety levels, left-handers showed increased anxiety under stress, indicating a difference in how they react to immediate challenges. On this basis the researchers concluded that left-handed individuals may respond with greater anxiety in unfamiliar or high-pressure situations, though they do not necessarily experience elevated anxiety as a stable personality trait. Similarly, research by Lyle, Chapman and Hatton (2013) found that anxiety levels were higher in left-handed participants, especially among female participants, during the first trial of a novel task, though these levels tended to drop with repeated exposure.

Earlier work, such as that by Davidson and Schaffer (Davidson & Schaffer 1983, cited in Wright & Hardie, 2012), proposed that individuals who prefer their left hand may experience generally higher levels of trait anxiety. Although this claim has been referenced in later literature, it has not always been replicated in newer, more rigorously designed experiments. More recent studies also emphasized the importance of handedness consistency over the direction of preference. For instance, Lyle and colleagues (2013) noted that people with a strong preference for either hand tended to report more anxiety than those with inconsistent handedness.

Also, there was no consistent evidence that left-handedness alone was linked to clinical anxiety disorders. A review by Ocklenburg et al. (2023) pointed out that while some small-scale associations have been observed, particularly in relation to specific types of anxiety, such as phobias, the relationship seems to be complex and may be influenced by additional factors such as age, gender, or neurological development. This suggests that handedness is just one of many possible influences on anxiety, rather than a reliable predictor on its own.

Regarding aggressive irritability, the groups did not differ significantly. While previous studies have found greater impulsivity, hostility, or affective lability among mixed-handed individuals (Cherbuin & Brinkman, 2006; Gonzalez & Nelson, 2001), our data showed no

statistically meaningful variation in irritability scores across handedness groups. Nevertheless, the mixed-handed group had the highest percentage of individuals classified as irritable, warranting further investigation with larger samples.

The study's use of neutral, everyday manual tasks to assess handedness strengthens the ecological validity of the findings and reduces the influence of societal biases favoring right-hand use (Papadatou-Pastou et al., 2008). This supports the idea that hand preference, when carefully assessed, may reflect deeper neurodevelopmental patterns rather than superficial behavioral habits.

The present study has some limitations. The use of self-report instruments introduces potential biases related to self-perception and response tendencies. It is also possible that unmeasured variables, such as handedness consistency, family history of mental health conditions, could moderate the observed relationships. Future studies should overcome these limitations.

In conclusion, our results provide partial support for the hypothesis that handedness is related to emotional personality traits. Specifically, lower neuroticism among left-handers contradicts earlier assumptions of greater emotional vulnerability in this group. While no significant differences were found in anxiety or irritability, the overall pattern encourages further examination of how neural asymmetry and hand preference intersect with emotional regulation. Future studies should integrate neuroimaging, developmental, and genetic approaches to clarify these complex relationships.

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