Research Paper

The Role of Emotional Granularity in Vulnerability to Post-traumatic Stress Disorder

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ABSTRACT

Objective: Emotional granularity refers to the ability to recognize and distinguish between different emotional states, allowing individuals to respond appropriately to situations and manage their emotions more effectively. One of the main problems in post-traumatic stress disorder (PTSD) is the lack of clarity and emotional awareness that causes vulnerability to PTSD and the persistence of its symptoms. The present study aims to investigate the role of emotional granularity in vulnerability to PTSD.

Methods: The present study used a descriptive and correlational research design. The statistical population included PTSD patients referred to Roozbeh Hospital. The sample size of the research was 205 people. To collect data, the Mississippi scale for PTSD, positive and negative affect schedule (PANAS), difficulties in emotion regulation scale, and semantic similarities test were used. Also, multiple regressions were used to analyze data using SPSS software, version 26.

Results: The components of emotional granularity explain 32.7% of PTSD variance. Among the components of emotional granularity, the components of positive affect ($\beta=-0.312$), and semantic similarities ($\beta=-0.379$) had significant and inverse effects ($P<0.01$) on PTSD. Also, components of negative emotion ($\beta=0.304$), lack of emotional clarity ($\beta=0.382$), and lack of emotional awareness ($\beta=0.362$) had a significant and direct effect ($P<0.01$) on PTSD.

Conclusion: Emotional granularity is one of the essential factors in predicting vulnerability to PTSD because high emotional granularity is associated with greater clarity, awareness, and emotional differentiation. Low emotional granularity is associated with a need for more differentiation and emotional clarity and as a result, expressing emotions in the form of vocabulary.

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Highlights

● Individuals with greater positive emotional granularity and semantic similarities often report managing stressful situations more effectively.

● A higher level of negative emotional granularity, lack of emotional clarity, and lack of emotional awareness are factors that pave the way for involvement in post-traumatic stress disorder (PTSD).

Plain Language Summary

Emotional granularity is a key factor in predicting vulnerability to PTSD. The present study showed that high emotional granularity is associated with increased clarity, awareness, and differentiation of emotions. In contrast, low emotional granularity correlates with a lack of these qualities, leading to a more generalized expression of emotions.

Introduction

Emotion has a crucial role in the underlying causes of post-traumatic stress disorder (PTSD). Although over the past fifteen years, the importance of emotion and emotion management in PTSD research has increased in the past fifteen years, deficits in the experience and processing of emotions by individuals with PTSD and their role in the exacerbation and persistence of PTSD symptoms remain inadequately understood. As research on emotions has progressed, studies on the role of emotions in PTSD have also advanced. Research indicates that individuals with PTSD exhibit a distinct vulnerability to specific emotional and cognitive characteristics (Chu, 2024; Specker et al., 2024).

We hypothesized that exposure to trauma is everyday worldwide, but does not necessarily lead to PTSD, even though many may encounter trauma at some point in their lives (Fani et al., 2021). Previous studies have shown that various factors, incredibly emotional and cognitive ones, contribute to the development of PTSD in trauma-exposed individuals (Echeverri-Alvarado et al., 2020; Muñoz-Rivas et al., 2021). Traumatic experiences are evaluated through cognitive and emotional processes before being assessed as a significant threat, and due to individual differences in these processes, people seem to have different thresholds for trauma. Some individuals may be protected against clinical symptoms even after highly stressful situations, while others may be at increased risk (Muñoz-Rivas et al., 2021). Given the incapacity to regulate and dominate the traumatic event and the resulting emotional processing, it is conceivable that the recognition and level of comprehension of those emotions influences arousal levels and the resources available for encoding and processing excessively emotional memories, thereby influencing the evaluation of emotional and physiological responses during the event. According to Fayn et al. (2015) and Pitts et al., (2022) these results are valid for those with PTSD symptoms who are unable to sense and process emotions appropriately. As previously mentioned, PTSD develops after a very stressful and emotionally charged occurrence that is more severe than the average human experience and is traumatic for most people (Fine et al., 2023; Suvak et al., 2020). In this context, one component that significantly contributes to vulnerability to PTSD is emotional granularity.

According to Kashdan et al., (2015) and Pond et al. (2012), emotional granularity is an individual's ability to distinguish subtle differences across similar emotional states. The term emotional granularity was first used by Barrett, who referred to the same concept as emotional distinction (Barrett & Niedenthal, 2004). Recent studies suggest that emotional differentiation is conceptualized as recognizing, identifying, and labeling emotions distinctly and differentiating between similar emotional states (Pugach & Wisco, 2023; Tull et al., 2020). Pond et al. noted that both "emotional differentiation" and "emotional granularity" refer to the level of awareness and ability to classify discrete emotions (Pond et al., 2012). In other words, emotional granularity refers to an individual's ability to distinguish between emotional features.

In Figure 1, "valence" refers to emotional polarity, with positive emotions, such as joy, happiness, and calmness, and negative emotions, such as sadness and despair. On the other hand, "arousal" reflects the intensity of emotions, with stronger emotions, such as anger and excitement, and weaker feelings, such as fatigue and relaxation. In this framework, the emotional meaning of a word or sentence can be understood based on its placement on the valence-arousal grid.
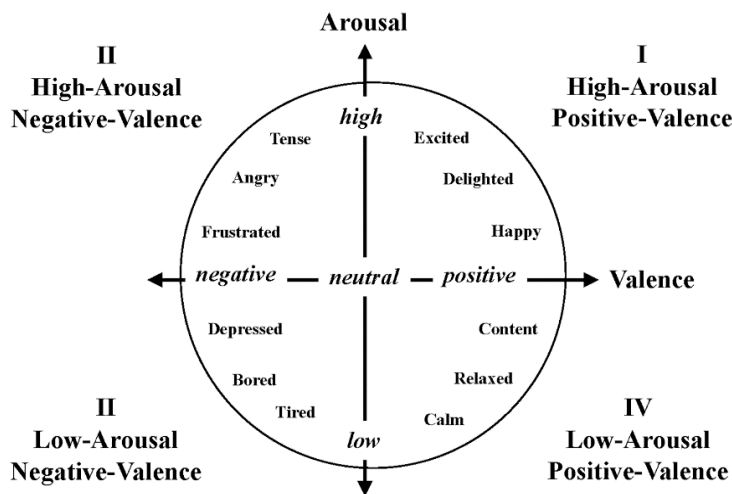
Figure 1. The model of emotions in terms of valence and arousal dimensions (Chang et al., 2019)

Individuals with high emotional granularity express their emotional states with greater detail (e.g. differentiating between similar emotional states such as "anger" and "frustration"), while people with low emotional granularity describe their emotional states in more general terms (e.g. "feeling bad," "depressed," or "content" versus "discontent"). Awareness of emotional states and perceiving them as distinct states enable individuals to adequately respond to situational demands and regulate emotions more effectively (Potthoff et al., 2023). According to many studies, higher emotional granularity protects psychological and physical well-being (Wilson-Mendenhall & Dunne, 2021). According to previous research on emotion labeling, amygdala activity is decreased when emotions are labeled in response to emotional inputs (Alexandra Kredlow et al., 2022). Consistent with these studies, research has shown that the ability to identify subtle differences in emotions and distinguish them is associated with reduced fear responses when facing a spider (Seah et al., 2020) and lower physiological reactions during public speaking (Kalokerinos et al., 2019). However, it is unclear whether differences in emotional granularity and verbal labeling among individuals stem from inherent disabilities or if some individuals are unaware of the distinctions between emotional features. Thus, the current research attempts to investigate the role of emotional granularity in vulnerability to PTSD.

Materials and Methods

In this cross-sectional study, using a convenience sampling method, 205 patients (62 men [30%]; 143 women [70%]) were recruited by an announcement from Roozbeh Hospital. Based on the study's objectives and previous research, 205 participants constitute the sample size with a 95% confidence interval and 0.85 power, using power and sample size calculators. Due to a 10% attrition rate, the sample size for the current study was expanded to 205 participants. Moreover, the formula suggested by Tabachnick and Fidell (2001) was used to determine the sample size necessary for a multiple regression analysis N≥50+8 m to calculate the sample size. As stated by Tabachnick and Fidell (2001), 30 participants are ideal for each predictor variable. Although five predictor variables exist in the current study, this study includes 150 participants (5×30=150). Table 1 presents the demographic characteristics of the participants. After the participants were informed of the research objectives, questionnaires were provided. The inclusion criteria included a diagnosis of PTSD by a psychiatrist and completion of a written consent form. The exclusion criteria included failure to complete the questionnaires after distribution, and having other psychiatric disorders (e.g. schizophrenia spectrum disorders and substance abuse).

Research tools

Civilian Mississippi scale

The civilian Mississippi scale is a 35-item self-report measure adapted from the original Mississippi scale for PTSD, which was based on diagnostic and statisti-

Karimpourvazifehkhorani, A., et al. (2025). Emotional Granularity and PTSD. *JPCP, 13*(1), 71-80.

73

Table 1. Baseline demographic variables and variables related to participants (n=205)

Variables		Mean±SD/No (%)
Age (y)		35.7±4.88
Sex	Male	62(30)
	Female	143(70)
Education	Diploma	82(40)
	Bachelor's degree	73(36)
	Master and PhD	50(24)
Marital status	Married/Cohabiting	104(51)
	Single	24(12)
	Divorced	77(37)
Social-economic status (SES)	Good	59(29)
	Moderate	79(39)
	Low	67(33)

cal manual of mental disorders-third edition (DSM-III) criteria to assess PTSD resulting from combat experiences (Keane et al., 1988). The civilian version, known as the C-Mississippi scale, evaluates PTSD due to various non-combat traumatic events. Responses are given on a 5-point Likert scale, with anchors, such as "not at all true/extremely true" and "never true/always true." To create the civilian version, eleven items were modified to replace references to military service with broader references to past experiences. For instance, the original item, "before I entered the military, I had more close friends than I have now," was changed to "in the past, I had more close friends than now." Additionally, four items were added in both versions to reflect updates in the DSM-III-R criteria, assessing symptoms, such as re-experiencing the trauma, psychogenic amnesia, hypervigilance, and increased arousal when exposed to reminders of the traumatic event. The test reliability, based on internal consistency, was reported as 0.92, split-half reliability was 0.92, and test re-test reliability was 0.91. The validity was assessed using concurrent validity with a peer test (PTSD checklist) at 0.82. In Iran, Goodarzi (2003) reported Cronbach's α and convergent validity of 0.93 and 0.82, respectively. Also, in the present study, Cronbach's α was 0.91.

Positive and negative affect schedule (PANAS)

Watson et al. (1988) developed a PANAS. It includes 20 items (10 for positive and 10 for negative affect) and measures the intensity of positive and negative emotions through self-reporting. PANAS was used to measure two main dimensions of mood: Positive and negative affect. The scale follows a Likert format, ranging from "strongly agree" (score 5) to "strongly disagree" (score 1). The internal consistency for positive and negative affect was reported as 0.86 and 0.87, respectively. The correlation of the positive subscale with the Beck depression inventory (BDI) was 0.36 and the negative affect subscale was 0.58 as a measure of concurrent validity. Bakhshipour and Dezhkam (2006) reported Cronbach's α for both subscales as 0.85 in Iran. The correlation of the positive subscale with emotional balance, psychological well-being, and social well-being was reported as 0.89, 0.43, and 0.43, respectively. The correlation of the negative subscale with emotional balance, psychological well-being, and social well-being was reported as -0.89, -0.43, and -0.46. In the present study, Cronbach's α for positive and negative affect was 0.83 and 0.81, respectively.

Difficulties in emotion regulation scale (DERS)

Gratz and Roemer (2004) created the DERS. This 36-item scale is scored on a 5-point Likert scale (one being very never and five being exceptionally usually). The

Karimpourvazifehkhorani, A., et al. (2025). Emotional Granularity and PTSD. *JPCP, 13*(1), 71-80.

complete questionnaire has a minimum score of 36 and a maximum score of 180. Higher scores indicate more serious issues with emotion regulation. This scale's dimensions include the inability to accept negative emotions, the inability to engage in goal-directed behaviors while experiencing distress, the inability to control one's impulses during distress, the lack of access to effective emotion regulation techniques, emotional awareness, and emotional clarity. Gratz and Roemer (2004) used factor analysis to validate the tool's construct validity. Additionally, they stated that the scale's internal consistency, as measured by Cronbach's α, was 0.93, with subscales scoring higher than 0.80, and test re-test reliability was 0.88. Mazaheri (2015) validated the construct of this tool using confirmatory factor analysis. Based on Cronbach's α, the reliability ranged from 0.79 to 0.92 for the overall scale. In this study, the reliability, based on Cronbach's α, was 0.94.

Semantic similarity task

To evaluate semantic similarities, we employed a paper-based version of the computerized semantic similarity test created by Barrett. In this task, participants rated the similarity between all possible pairs of 16 terms encompassing all emotional quadrants (e.g. combinations of valence and arousal). A total of 120 ratings were collected. The terms included in the study were afraid, aroused, calm, hopeless, eager, happy, nervous, lively, quiet, peaceful, sad, satisfied, sleepy, slow, tranquil and surprised. Participants were asked to rate the conceptual similarity of words based on their meanings. A 7-point Likert scale was used for rating (1=very different, 4=unrelated, 7=very similar). The ratings were analyzed using multidimensional scaling techniques outlined by Barrett (2004) to estimate the valence and arousal focus, which reflected how individuals integrate information about va-

lence and arousal in their mental representation of emotional language. The Cronbach's α for this task was 0.89.

Procedure

After choosing the research topic and obtaining the necessary permission from the Tabriz University Ethics Committee, participants were chosen based on predetermined inclusion and exclusion standards. They completed the pertinent questionnaires after being informed of the study's objectives and giving their signed consent. SPSS software, version 26 was then used to evaluate the gathered data. The questionnaires were anonymous and participants guaranteed the confidentiality of their data. Additionally, they were informed that participation was entirely voluntary.

Data analysis

We used stepwise multiple regression analysis to predict the dependent variables after calculating the correlations between the variables using Pearson correlation.

Results

The collected data was analyzed by descriptive and inferential statistics (multiple regressions) from SPSS software. The contents of Table 2 indicate that PTSD has a significant inverse relationship with positive affect (r=-0.246, P<0.01) and semantic similarities (r=-0.436, P<0.01). In other words, as positive affect and semantic similarities decrease, the likelihood of vulnerability to PTSD increases. Furthermore, PTSD has a significant direct relationship with emotional clarity (r=0.298, P<0.01), emotional awareness (r=0.451, P<0.01), and negative affect (r=0.443, P<0.01). Specifically, higher levels of emotional awareness and clarity, as well as

Table 2. Correlation matrix between PTSD and studied variables

Variables	1	2	3	4	5	6
PTSD	1					
Negative affect	-0.246**	1				
Positive affect	0.433**	-0.155*	1			
Lack of emotional clarity	-0.298**	0.195*	-0.159*	1		
Lack of emotional awareness	-0.451**	0.214**	-0.216**	-0.101	1	
Semantic similarities	-0.436**	0.259**	-0.221**	-0.102	-0.180*	1
Mean±SD	38.3±4.41	9.1±2.32	12.6±3.33	19.9±4.18	21.2±4.33	9.8±2.28

*Significant in 0.5 level, **Significant in 0.1 level.

PRACTICE in CLINICAL PSYCH⊙LOGY

Karimpourvazifehkhorani, A., et al. (2025). Emotional Granularity and PTSD. *JPCP, 13*(1), 71-80.

75

Table 3. Analysis of variance (ANOVA)

Model	SS	df	MS	F	P	R	R2	AdjR²	SE
Regression	15748.947	5	3149.78	14.207	0.01	0.58	0.337	0.313	14.89
Rituals	31039.71	140	221.712						
Total	46788.658	145							

Abbreviations: SS: Sum of squares; MS: Mean square; SE: Standard error.

negative affect, increase the likelihood of vulnerability to PTSD. Multiple regression analysis was employed to determine the relationships between predictor variables and the criterion variable; Table 3 presents the results. The assumptions of this method, including multicollinearity, independence of error terms, normality of variable distribution, and the Durbin-Watson and Kolmogorov-Smirnov tests, were examined and confirmed. The contents of Table 3 show that the F value (14.207) from the analysis of variance for the emotional granularity regression is significant at P<0.01, indicating that emotional granularity components explain 32.7% of the variance in PTSD. Table 4 presents the coefficients and t statistics predicting PTSD based on regression. Table 4 indicates that, based on beta coefficients and t values, among the emotional granularity components, positive affect (β=-0.312) and semantic similarities (β=-0.379) have a significant inverse impact on PTSD (P<0.01), suggesting that individuals who score lower on these components are more likely to develop PTSD. Additionally, negative affect (β=0.304), lack of emotional clarity (β=0.382), and lack of emotional awareness (β=0.362) have significant direct impacts on PTSD (P<0.01), indicating that individuals scoring higher in these components have an increased likelihood of vulnerability to PTSD.

Discussion

The results of this study indicated that emotional granularity can significantly predict vulnerability to PTSD, and the components of emotional granularity explained 32.7% of the variance in PTSD. The results showed that the lack of emotional awareness, as one of the components of emotional granularity, has a significant relationship with PTSD. Awareness of moods and emotions and understanding them as different states enable individuals to respond appropriately to the demands of the situation and regulate emotions more efficiently. A key benefit of high emotional granularity (or differentiation) is improved emotional regulation. (Muñoz-Rivas et al., 2021). In this regard, Pond et al. (2012) stated that emotional granularity contributes to the awareness and capacity to categorize different emotions (Tull et al., 2020). Moreover, recognizing the subtle differences between emotions and differentiating them is associated with reduced fear responses when facing fearful situations (Seah et al., 2020) and reduced physiological responses when speaking in front of an audience (Kalokerinos et al., 2019). From a neuropsychological perspective, labeling and describing emotions in response to emotional stimuli reduces amygdala activity, a crucial area for controlling and processing emotions (Alexandra Kredlow et al., 2022). Another result proved that the lack of emotional clarity leads to vulnerability to PTSD, meaning that the less aware individuals are of their emotional states, the higher their risk of developing PTSD. This result is consistent with other studies (Boden et al., 2013; Ehring & Quack, 2010) that suggest a positive relationship between lack of emotional clarity and anxiety disorders like PTSD. For instance, in Pinna (2011) and Cohen and Mendez (2009) study,

Table 4. Coefficients

Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients B	t	Sig.
Positive affect	-1.601	0.389	-0.312	3.984	0.01
Negative affect	1.41	0.356	0.304	3.12	0.01
Emotional clarity	1.871	0.399	0.382	4.182	0.01
Emotional awareness	1.671	0.391	0.362	4.104	0.01
Semantic similarities	-1.852	0.379	-0.379	4.944	0.01

adolescents with PTSD who reported higher emotional clarity and emotional regulation on mood trait scales showed lower levels of depression and anxiety.

On the other hand, every cluster of PTSD symptoms listed in the DSM-5 includes symptoms involving problematic emotional processing, including unpleasant emotions (Smidt & Suvak, 2015). Most contemporary studies have emphasized that PTSD includes multiple emotional states, such as shame, guilt, anger, and disgust (Barrett et al., 2001; Springstein et al., 2024). Consistent with these studies, one of the research results showed that the fewer positive emotions and the more negative emotions individuals experience, the higher the likelihood of vulnerability to PTSD. In this regard, Kashdan et al. concluded that PTSD is identified with a reduced capacity to experience positive emotional states (Kashdan et al., 2015). In other words, Litz (1992) demonstrated that individuals with PTSD may not experience fewer positive emotions. Still, the problem lies in their difficulty in evoking these emotions due to pervasive arousal and difficulty in regulating (or identifying) these emotions. Therefore, reduced emotional intensity and increased joy may be linked to challenges in regulating emotions. As previously mentioned, one potential advantage of high emotional granularity is the ability to regulate emotions more effectively (Hoemann et al., 2021; Zheng et al., 2021).

Another result of the study indicates that the performance in vocabulary and the semantic knowledge of words, as a key component of emotional granularity, play a significant role in predicting vulnerability to PTSD. Individuals with lower performance in semantic similarities and vocabulary are more likely to develop PTSD. Essentially, individuals require conceptual knowledge to integrate external senses (e.g. vision, hearing, touch) with internal feelings (pleasant versus unpleasant feelings and highly aroused bodily sensations). For example, when the concept of "fear" is more accessible than the concept of "anger" or other emotions, an individual may experience an unpleasant, highly aroused sensation as fear (Torre & Lieberman, 2018). Therefore, individuals need cognitive and conceptual knowledge to give meaning and label their emotions (Seah et al., 2020; Zohdi et al., 2022). Research has shown a relationship between the structure of an individual's emotional knowledge in terms of semantic knowledge and language and emotional granularity (Potthoff et al., 2023; Seah et al., 2020). Furthermore, these studies suggest that a high level of emotional granularity is partly the result of a well-developed cognitive map of emotions. Therefore, helping clients refine their emotional vocabulary to de-

scribe experiences more precisely can increase the efficacy of therapies for emotional disorders. In this regard, a current review of psychotherapy-related neuroimaging research found that regions involved in semantic encoding play a key role in emotional regulation and support the therapeutic process (Lukic et al., 2023).

According to Hoemann et al. (2019), emotional regulation is improved by "becoming more emotionally intelligent" or improving one's conceptual knowledge of emotions. Among the activities they recommended were traveling to new locations, tasting different foods, watching movies, and, most importantly, experiencing things that expand one's vocabulary (e.g. reading beyond one's regular tastes). As such, clients can engage in activities that expand their emotional-semantic knowledge, potentially increasing emotional granularity and, in turn, alleviating PTSD symptoms (Hoemann et al., 2019).

Conclusion

In summary, emotional granularity is one of the essential factors in predicting vulnerability to PTSD. Higher emotional granularity is associated with greater clarity, awareness, and differentiation. In contrast, lower emotional granularity is associated with a lack of emotional differentiation and clarity, leading to the expression of emotions in more general terms. Moreover, individuals with PTSD fear emotional arousal, regardless of whether the emotion is positive or negative; therefore, they may avoid positive emotions due to the psychological arousal they share with negative emotions, as well as avoiding negative emotions.

Limitations and future directions

Cross-sectional design: The cross-sectional nature of the study makes it harder to determine if emotional granularity and PTSD are causally related. Longitudinal research may help gain a better understanding of the directionality of these associations. Therefore, future studies should employ longitudinal designs to explore how emotional granularity influences PTSD development and recovery over time. This issue allows researchers to have a deeper comprehension of the role of emotional granularity as a predictor of PTSD onset or its progression.

Limited exploration of other factors

The study primarily focused on emotional granularity, but other elements, such as social support, coping strategies, and trauma history, may also play a vital part in PTSD vulnerability. Future studies should examine the

Karimpourvazifehkhorani, A., et al. (2025). Emotional Granularity and PTSD. *JPCP, 13*(1), 71-80.

77

PRACTICE in
CLINICAL PSYCHOLOGY

interplay between these factors and emotional granularity to offer a more nuanced understanding of PTSD risk. In this regard, future studies can examine potential mediators and moderators in the relationship between emotional granularity and PTSD. For example, examining how individual differences (e.g. coping styles, resilience) may strengthen or weaken the relationship between emotional granularity and PTSD symptoms will provide a more detailed understanding of this dynamic.

Ethical Considerations

Compliance with ethical guidelines

This research was conducted with authorization from the Ethics Committee of Tabriz University, Tabriz, Iran (Code: IR.TABRIZU.REC.1402.141).

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Authors' contributions

All authors equally contribute to preparing all parts of the research.

Conflict of interest

The authors declared no conflict of interest.

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78

Karimpourvazifehkhorani, A., et al. (2025). Emotional Granularity and PTSD. *JPCP, 13*(1), 71-80.

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79

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