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# Psychopathic personality traits stress immunity and social potency moderate the relationship between emotional competence and cognitive functions in depression

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**Background:** Psychopathic personality traits (PPT) and depression have both been shown to worsen emotional and cognitive functions. Moreover, PPT and depression share similar underlying neuronal circuits tapping into the emotional and cognitive domains. However, little is known about the influence of PPT on emotion and cognition in individuals with depression.

**Objectives:** This study aimed to examine the correlative relationships and moderating role of PPT in the association between emotional competence and cognitive functions in individuals with depression.

**Methods:** Data from 373 individuals diagnosed with depression (158 males, 215 females) were examined within a cohort study. Subjects filled out validated questionnaires surveying PPT and emotional competences. Furthermore, a comprehensive neuropsychological test battery was administered.

**Results:** Correlation analyses revealed a significant positive association between emotional competence and cognitive functions. Further, negative associations between emotional competence and the PPT “Blame Externalisation” and “Careless Nonplanfulness,” as well as positive associations with psychopathic “Social Potency” and “Stress Immunity” were found. Moderation analyses indicated a significant positive influence of psychopathic “Stress Immunity” and “Social Influence” on the relationship between emotional competence and cognitive functions.

**Conclusion:** The findings highlight the importance of integrating PPT in depression research. Considering PPT in depression treatment could also facilitate the therapeutic process by identifying individual traits as resilience-strengthening or potentially harmful factors for depressive symptomatology. This study represents a stepping stone for further research regarding the role of personality traits in psychiatric disorders and their treatment.

## KEYWORDS

psychopathic personality traits, stress immunity, social potency, depression, cognitive functions, emotional competence, affective disorders, personality

## 1. Introduction

Depression is an affective disorder encompassing depressed mood, diminished interests and joy, deteriorated cognitive function, and accompanying vegetative symptoms, such as sleep or appetite disturbances (1). Depressive symptoms are thus mainly found in emotional and cognitive domains. For example, recent research indicated that individuals with depression show reduced emotional reactivity to aversive stimuli (2), difficulties in emotion regulation (e.g., 3, 4), or a negative response bias toward facial emotion expressions (5). At the same time, better abilities to regulate emotions have been connected to greater resilience to depression following traumatic experiences (6). Regarding cognitive functioning, there is accumulating evidence suggesting cognitive deterioration in individuals with depression; for example, depression has been associated with cognitive deficits in executive function, attention (7), psychomotor speed, learning, visual memory (8), working memory, and long-term memory (9). The connection between cognitive functioning and emotion in depression has also been examined. A review across several studies on depression, cognition, and emotion regulation indicated cognitive biases (in attention, memory, and cognitive control) toward negative stimuli in depression, which lead to an impaired ability in reinterpreting situations more adaptively (e.g., reappraisal) and instead an increased use of maladaptive cognitive strategies (e.g., rumination; 3). Depressive symptoms can be assigned to many different aspects, factors contributing to their development are, for example, environmental aspects (e.g., childhood abuse and stressful events) and heritability (1). Nevertheless, no single mechanism can fully explain all aspects of depression, thus several factors need to be considered in its etiology. Personality traits have been shown to contribute to the development of depression (e.g., 10).

Psychopathic personality traits (PPT) are characterized by affective, behavioral, and interpersonal features, such as egocentricity, non-sympathetic behavior, and a tendency to violate social and legal norms (11). They circumscribe many of the same traits found in antisocial personality disorder (APD), which is recognized by early antisocial actions, recklessly disregarding other's rights, and a continuous demonstration of impulsive and irresponsible behavior. In addition to the characteristics seen in APD, PPT comprise affective and interpersonal qualities, such as superficial charm, deceptive, and manipulative behavior toward others, callousness, and lack of guilt, empathy, or remorse. Thus, most individuals with pronounced PPT fulfill the criteria for APD, but not all individuals diagnosed with APD meet the criteria for PPT (12). Notably, PPT criteria are found in APD, but can also be retributed to narcissistic, histrionic, and borderline personality disorders, thus including various traits of different personality disorders (13, 14). Similar to depression, PPT is also characterized by emotional and cognitive functioning deficits. For example, studies indicated that individuals with higher PPT scores tend to lack the ability to regulate or process their own emotions (15–18), focus on emotional stimuli (19), or differentiate correctly between emotional aspects of facial expressions (20, 21). Similarly, evidence from meta-analytic work reveals deficits in recognizing emotions in faces or vocals of others in individuals scoring high in PPT measures (22, 23). However, there are also findings indicating no difference in emotion perception and responsiveness between individuals with higher or lower PPT scores (24). Regarding cognitive functions, there is profound evidence on the negative relationship between PPT and

certain aspects of attention (25–28), executive function (29, 30), and other cognitive processes such as language processing, which is, among others, attracted to underlying impaired neurobiological processes (31).

The connection between depression and PPT was examined in previous studies, with results indicating mainly positive associations between PPT and depression or cognitive and interpersonal aspects of depression (e.g., 32, 33). However, other studies revealed inverse relationships between PPT and depression, pointing toward a protective function of PPT in depression (e.g., 34–36). The role of PPT in depression has thus yet not been clearly determined; however, both constructs share the feature of deteriorating influences on emotion and cognitive functioning. This conclusion is also supported by evidence from neurobiological research, which indicates altered activity and connectivity in the regions commonly found to be impaired in depression and anxiety (e.g., the frontal lobe circuitry, 37–40). For example, functional changes in brain circuits targeting the cognitive control network and the affective-salience network were found in individuals high in PPT. In individuals with higher PPT, disturbances in the neurobiological stress-response systems, including the hypothalamic–pituitary–adrenal axis, and the immune system were identified (1). Studies on structural brain alterations in depression found altered regional brain volumes such as a hippocampal atrophy (41, 42), enlarged amygdala volume (43, 44), alterations in the prefrontal cortex (45) and anterior cingulate cortex (46), all of which play a major role in emotion and cognitive functioning (e.g., 47). In line with the alterations found in individuals with depression, research on neurobiological correlates of PPT showed impairments in functions tapping into emotional and cognitive domains (48, 49). For example, studies found a reduction of gray matter volume in prefrontal and temporal areas, including the orbital frontal cortex, anterior cingulate cortex, as well as amygdala and hippocampus alterations (31, 50, 51). Functionally, a systematic review indicated that PPT are related to a dysfunction of the default mode network, which is involved with moral judgment, metacognitive and introspective abilities (52). Moreover, PPT are assumed to be associated with imbalances in the neurotransmitter system (53), among others they are connected to serotonin pathways (54, 55), which also have been shown to be altered in depression (e.g., 56). In PPT, it is supposed that low serotonin levels interact with testosterone, resulting in increased violent and impulsive behavior. The ratio between testosterone and cortisol is also assumed to be imbalanced in pronounced PPT, thus resulting in emotional deficits (57, 58). Interestingly, alterations in cortisol levels were also found in depression and connected to cognitive deficits and emotional processing within the disease (59, 60). Finally, altered autonomic responses to emotional stimuli have been found in both PPT (61) and depression (62).

Current research depicts the connection between depression and PPT, as well as their deteriorating influence on emotion and cognitive functioning. Both depression and PPT seem to share underlying neurobiological processes, which are connected to emotion and cognition processes. The connection between emotional, cognitive, and personality domains is also supported by transdiagnostic models like the Research Domain Criteria (RDoC) constructs, which describe a neurobiological foundation of human experience. In the RDoC framework, psychological constructs are categorized in five main domains: Negative Valence Systems, Positive Valence Systems,

Cognitive Systems, Social Processes, and Arousal and Regulatory Systems. Each domain is further divided into constructs and subconstructs, which may be further examined using seven units of analysis. It was found that personality aberrations are tied to RDoC constructs in the Social Processes domain, indicating that there are brain circuits involved in facial emotion perception and interpersonal rejection. Further, the RDoC domains of Negative and Positive Valence were found to be associated with clinical personality disorders, thus reflecting the disruption of computational processes involved in estimating risks and benefits of a future outcome. Next to the social and emotional RDoC domains, the Cognitive Systems domain, especially the subconstruct “Cognitive Control” has been shown to be related to personality disorders associated with impulse control, thereby suggesting a connection of clinical personality disorders to neural circuits influencing goal selection and behavioral control. Finally, personality disorders were also connected to the RDoC domain of Arousal and Regulatory Systems, indicating a biological sensitivity to internal and external stimuli (63). In psychopathological illnesses like depression, these transdiagnostic approaches between emotion, cognition, and personality are specifically important. Bifactor models, in which a general factor of psychopathology is specified overarching externalizing and internalizing factors, were previously associated with the Big Five personality traits (64), and maladaptive personality traits on multiple levels of the hierarchical taxonomy of psychopathology (HiTOP) structure, which also represents a hierarchical transdiagnostic model (65). Derived from the HiTOP dimensional model of psychopathology, it has been suggested that personality traits have substantial implications for later psychopathology (66), and thus associated functions like emotion and cognition.

This leads to the question of what role PPT play in the development and maintenance of depressive symptomatology, specifically in the emotional and cognitive domains. The current study thus aimed to examine the influence of PPT on the relationship between emotional competence and cognitive function in individuals with depression. Based on current literature, we hypothesized that (a) there is a significant positive relationship between emotional competence and cognitive functions in individuals with depression, (b) PPT are significantly related to emotional competence and cognitive functions, and (c) PPT significantly moderate the relationship between emotional competence and cognitive functions in individuals with depression.

## 2. Materials and methods

### 2.1. Sample

Data from 1,447 individuals with psychiatric disorders were collected between April 2015 and February 2017 at an Austrian psychiatric rehabilitation center focusing on affective and stress-related diseases. For this study, we only included individuals fulfilling the diagnostic criteria for depression (independently of depression severity or presence of current episode) above the age of 18 years. Six hundred and twenty-three participants who were already diagnosed according to the ICD-10 criteria before their rehabilitation stay by experts working in the psychiatric and psychological field were included in the current analysis. However, due to missing data in the

questionnaires examining PPT, emotional competence, and cognitive functions, data of 250 participants were excluded. Further exclusion criteria were a comorbid disorder of schizophrenia, neurodegenerative diseases, acute psychotic symptoms, or substance abuse, since the latter is followed by altered cognitive functions in the domains of attention, inhibition, working memory, and decision-making (67). However, none of the remaining subjects fulfilled these criteria. Participants were also screened for neurological diseases, but were not excluded in case they had neurological illnesses. In total, 373 individuals (158 male, 215 female) with a mean age of 52.64 ( $SD=7.50$ ) were included in all analyses. A *post hoc* power analysis (using GPower, version 3.4; 68) indicated a sufficiently large sample size ( $n \geq 325$ ) to conduct moderated regression analyses and detect a small effect ( $f^2=0.03$ ), considering an  $\alpha$ -level of 0.05 and a power of 80%. Participants provided written informed consent prior to taking part in the study. This study was conducted in accordance with the Declaration of Helsinki and was provided with a positive ethics vote of the ethics committee of the Federal State Upper Austria (EK-number: E-24-14).

### 2.2. Material

This study was part of a large-scaled study focusing on the investigation of several psychological, biological, and cognitive parameters in psychiatric rehabilitation treatment (for detailed description see also 34, 69–71). Only measures which were assessed in the beginning of the treatment (including PPT, emotional, and cognitive parameters) were relevant for the present investigation as described in the following. In total, the study completion took at least two hours.

#### 2.2.1. Emotional competence

Emotional competence was assessed with the German version of the Emotional Competence Questionnaire (72). This self-report questionnaire includes 62 items allocated to four scales (Recognizing and Understanding Emotions, Recognizing Emotions of Others, Regulation and Control of own Emotions, and Emotional Expressivity). Items are presented as statements (e.g., “When I’m on the phone with a friend, I can understand what he’s feeling”). Subjects were asked to answer the items on a five-point Likert scale, ranging from (1) “strongly disagree” to (5) “strongly agree.” Scale scores were built by calculating the mean of the corresponding items. Moreover, a total score was created by calculating the mean of all scales (ECQ Score).

#### 2.2.2. Psychopathic personality traits

Psychopathic personality traits were measured with the German version of the Psychopathic Personality Inventory-Revised (PPI-R; 73; Original version: 74). This self-report questionnaire contains 154 items offering scores for eight subscales: (1) “Machiavellian Egocentricity” (measures ruthlessness and an intention to manipulate others), (2) “Social Potency” (measures superficial charm and striving for interpersonal dominance), (3) “Coldheartedness” (records callousness and lack of guilt), (4) “Carefree Nonplanfulness” (measures deficiencies in planning behavior and controlling maladaptive impulses), (5) “Fearlessness” (measures a tendency for high-risk behavior), (6) “Blame Externalization” (records externalizing own

blame), (7) “Impulsive Nonconformity” (measures indifference toward social customs), and (8) “Stress Immunity” (records the lack of emotional reactions toward possibly fear-inducing situations; 75). Items are presented as statements (e.g., “I use many white lies”). Subjects were asked to answer on a four-point Likert scale [(1) = “False,” (2) = “Mostly False,” (3) = “Mostly True,” and (4) = “True”]. Subscores and a total PPT score were built by creating the mean of the corresponding items.

## 2.2.3. Cognitive domains

### 2.2.3.1. Attention and processing speed

To calculate the cognitive domain score of attention and processing speed, we used the scores of the Trail Making Test part A (TMT A; 76), in which participants were asked to connect digits in an ascending order. Further, we used the word- and color-naming trials from the Stroop Color and Word Interference Test (77), in which participants were asked to read aloud a list of color words printed in black, a list of color words printed in the color of the word itself, and a list of color words printed in a color diverging from the color word (interference trial). Moreover, the revised d2-Test (d2-R; 78) was administered to measure attention, focus efficiency, and accuracy during the distinction of visually similar objects. Participants were asked to mark the letter “d” with two dashes but no other distractors in several rows of letters.

### 2.2.3.2. Verbal learning and memory

To construct the domain of verbal learning and memory verbal learning and memory, we administered the German version of the California Verbal Learning Test (CVLT; 79). In this test, participants were instructed to memorize a list of 16 nouns drawn from four semantic categories, which was repeated in fixed order five times (list A). They were asked to recall as many words as possible in any order after each repetition (recall trials 1–5). Hereafter, a list of distractor words was presented to them and they were asked to freely recall the distractor words (list B). Free and cued recall of list A were then tested immediately (short-delay free recall, short-cued recall), and again after 20 min (long-delay free recall, long-delay cued recall). In the cued recall, the subjects were prompted with the semantic word category. Finally, subjects were presented with a recognition task, which encompassed 44 words either from list A or other distractor lists. For each word, participants had to indicate whether it stems from list A or is a distractor word. We included all free and cued recall trials from list A into the verbal memory domain score. Moreover, the Digit Span Test (forward recall), which is part of the Wechsler Adult Intelligence Scale 4th Edition (WAIS-IV; 80), was administered. In this test, participants were asked to recall number sequences that were read to them in the same order.

### 2.2.3.3. Executive function

To assess the executive function domain, we recorded scores of the TMT B, in which participants had to connect digits and letters in ascending order (76), and calculated the difference between TMT B and TMT A. This difference indicates task switching ability (78). Further, we considered the interference trial of Stroop Color and Word Interference Test (77), and the Digit Span Test (backward recall), in which participants were asked to recall number sequences that were read to them backward (79).

## 2.2.4. Beck depression inventory

To descriptively determine depression severity, we administered the Beck Depression Inventory II (BDI-II; 81). Severity of depression is measured with 21 items on a four-point ascending Likert type scoring system. The total sum score ranges from 0 to 63, with higher values indicating higher severity. Clinically significant depression is indicated by scores over 18.

## 2.2.5. Clinical Global Impression Scale

The Clinical Global Impression Scale was administered to descriptively evaluate clinical severity and course of the current depressive episode. It subsumes three components, i.e., measurement of illness severity, global improvement, and an efficacy index, which records medication efficacy. We used the illness severity component, which is assigned a score between 1 and 7 (1 = “not at all ill,” 7 = “most extremely ill”; 82).

## 2.3. Statistical analyses

Data were analyzed using the softwares SPSS (Version 27, for calculating the cognitive domain scores) and R ([www.r-project.org](http://www.r-project.org); Version 4.1.2, for all further analyses). To construct scores in the cognitive domains’ attention, executive functioning, and verbal learning/memory, we used the procedure proposed by previous literature (83): First, variables with smaller values indicating better results were multiplied by  $-1$ , with the aim of all variables having larger values indicating better performance. Secondly, all variables were transformed to standardized  $z$ -scores. Third, the newly built  $z$ -scores were summed up for each of the neuropsychological measures according to their allocation toward the three domains as presented in Table 1. Since these scores were not normally distributed, they were

TABLE 1 Allocation of neuropsychological tests to cognitive domains (83).

Domain	Ability	Neuropsychological test
Attention	Psychomotor speed	TMT A (time in seconds)
		Stroop test word naming (time in seconds)
		Stroop test color naming (time in seconds)
Executive function	Working memory	Digit-symbol-test (number of correct symbols)
		Digit-span backward (correct numbers)
		Stroop test word color interference (time in seconds)
Verbal learning and memory	Task switching	TMT B and TMT B-TMT A (time in seconds)
	Verbal learning	CVLT correct (short-delay free recall)
	Consolidation	CVLT loss of recalled words (short-delay cued recall)
	Long-term memory	CVLT loss of recalled words (long-delay free recall)
	Recognition	CVLT recognition (long-delay cued recall)
	Short-term memory	Digit-Span forward (correct numbers)

TMT A/B, Trail-making-test; CVLT, California verbal learning task.



once again  $z$ -transformed using Rankit's formula. The mean of all scores was then calculated to build a total cognitive composite score (in the following referred to as composite score).

To test the first and second hypothesis, we conducted bivariate Pearson correlation analyses between the ECQ score, composite score, and PPT subscales using the Benjamini–Yekutieli adjustment for multiple comparisons to control the false discovery rate (84). Moreover, we conducted moderation analyses with 95% BCa-bootstrapping confidence intervals based on 10,000 samples to examine the third hypothesis using the PROCESS macro in R by Hayes (Version v4.0, 85). Assumptions necessary to conduct this analysis were analyzed (linearity, homoscedasticity, multicollinearity, normality, and independence of residuals; see [Supplementary material](#)). For all moderation calculations, we centered means of the predictor and moderator variable prior to analyses. To determine whether the gradient of one or both regression slopes per moderation significantly differs from zero, we conducted simple slope analyses. Data and data codes can be accessed via <https://doi.org/10.17605/OSF.IO/5GUD9>.

### 3. Results

#### 3.1. Sample description

[Table 2](#) provides information on the sample characteristics.

#### 3.2. Correlation analyses

Results on the descriptively conducted bivariate Pearson/Spearman correlations between the demographic characteristics and the study variables can be found in [Table 3](#).

Statistical details on bivariate Pearson correlations between the study variables and their subscales, as well as means and standard deviations, are provided in [Table 4](#). Since sex was significantly correlated with the ECQ score and the composite score, we additionally stratified the analysis for sex.

The ECQ score and the composite score were positively correlated, as well as the ECQ score and the PPT “Stress Immunity” and “Social Potency,” respectively. There was a significant negative relationship between the ECQ score and the PPT “Blame Externalisation” and “Careless Nonplanfulness,” respectively. Moreover, there were no significant relationships between the composite score and the PPT. When stratifying for sex, the relationship between the ECQ score and the composite score was not significant, neither in the female ( $r=0.11$ ,  $p=.106$ ) nor in the male sample ( $r=0.09$ ,  $p=.280$ ). Among female participants, there was a significant negative relationship between the ECQ score and the PPT “Blame Externalisation,” and “Careless Nonplanfulness.” Further, there was a significant positive association between the ECQ score and the PPT “Stress Immunity” and “Social Potency.” Among male participants, there was a significant negative relationship between the ECQ score and the PPT “Blame Externalisation,” and “Machiavellian Egocentricity.” Further, there was a significant positive association between the ECQ score and the PPT “Stress Immunity” and “Social Potency.” For both females and males, there were no significant relationships between the investigated cognitive functions and the PPT (see [Supplementary Tables 4A,B](#) in the [Supplementary material](#) for exact results).

TABLE 2 Socio-demographic, medical, and psychological sample.

Characteristics	
Sex	
Female	215 (57.64%)
Male	158 (42.36%)
Education	
No formal education	3 (0.80%)
Formal education	44 (11.81%)
Polytechnic education	41 (10.99%)
Middle school diploma	34 (9.12%)
High school diploma	102 (27.35%)
Subject-specific high school diploma	29 (7.77%)
University degree	66 (17.69%)
Other	46 (12.33%)
Not specified	8 (2.14%)
Occupation	
Unemployed	7 (1.88%)
Student	3 (0.80%)
Employed	289 (77.48%)
Self-employed	3 (0.80%)
Retired	10 (2.68%)
Not specified	61 (16.35%)
Psychiatric medication (yes)	314 (84.18%)
Somatic medication (yes)	215 (57.64%)
Neurological disease (yes)	59 (15.82%)
Not specified	52 (13.94%)
Age	$M = 52.64$ $SD = 7.50$
BDI-II score	$M = 21.08$ $SD = 10.35$
CGI-score	$M = 3.61$ $SD = 1.00$
PPI-R	
BE	$M = 32.27$ $SD = 8.65$
RN	$M = 48.60$ $SD = 10.89$
SI	$M = 33.67$ $SD = 7.15$
SP	$M = 38.11$ $SD = 8.50$
CN	$M = 30.00$ $SD = 5.78$
ME	$M = 34.92$ $SD = 5.55$
CH	$M = 27.93$

(Continued)

TABLE 2 (Continued)

Characteristics	
	SD = 5.77
F	M = 14.13
	SD = 5.08

M, mean; SD, standard deviation; BDI-II score, Beck Depression Inventory II-score. CGI-score, Clinical Global Impression Scale. PPI-R, Psychopathic Personality Inventory-Revised; BE, blame externalization; RN, rebellious nonconformity; SI, stress immunity; SP, social potency; CN, careless nonplanfulness; ME, machiavellian egocentricity; CH, coldheartedness; F, fearlessness.

### 3.3. Moderation analyses

To examine whether the relationship between emotional competence (ECQ score) and cognitive function (composite score) is moderated by the single PPT, we conducted eight moderation analyses. We found three outliers deviating more than three standard deviations, however, all Cook's Distance values were below the critical threshold of 1, hence we included these cases in all further analyses. Results indicated that "Stress Immunity" ( $R^2=0.014$ ) and "Social Potency" ( $R^2=0.011$ ) significantly moderated the relationship between the ECQ score and the composite score. Similar  $R^2$  values were previously found in studies of cognition or emotion, and depression using moderation analyses (86, 87). Detailed moderation statistics depicting the unstandardized beta-weights, their standard errors, and the lower and upper bounds of the confidence intervals of main and interaction effects can be found in Table 5.

In an additional analysis, we conducted all moderation analyses without the three outliers. These analyses indicate the same results as the analyses including the outliers [i.e., significantly moderating effects of "Stress Immunity" ( $R^2=0.034$ ) and "Social Potency" ( $R^2=0.031$ )]. Detailed results can be found in the Supplementary Table 5A.

To further examine the significant interaction effects, we conducted simple slope analyses. Figure 1 reveals a plot indicating that the ECQ score significantly predicted the composite score at high and low values of the moderator "Stress Immunity." Further examination indicated that in individuals with depression low in the PPT "Stress Immunity" there was no statistically significant relationship between emotional competence and cognitive functions ( $b=0.27, t=0.69, p=.492$ ), but in individuals high in "Stress Immunity" there was a significantly positive relationship ( $b=1.46, t=3.72, p<.001$ ).

Figure 2 shows that the ECQ score significantly predicted the composite score at high and low values of the moderator "Social Potency." The analysis indicated that, in depression, there was no statistically significant relationship between emotional competence and cognitive functions in individuals with lower scores in the PPT "Social Potency" ( $b=0.25, t=0.62, p=.535$ ), but there was a statistically significant relationship between emotional competence and cognitive functions in individuals high in "Social Potency" ( $b=1.28, t=3.28, p<.01$ ).

### 4. Discussion

This study aimed to investigate the relationship between PPT, emotional competence, and cognitive functions in individuals with

TABLE 3 Bivariate Pearson- and Spearman correlations between demographic characteristics and study variables.

Variable	ECQ	BE	RN	SI	SP	CN	ME	CH	F	CogScore
1. Age	0.04	-0.12	-0.05	0.04	0.03	0.04	-0.04	-0.04	-0.28*	-0.25*
2. Sex	-0.20**	0.08	0.12	0.13	0.05	-0.04	0.11	0.28*	0.35*	-0.27*
3. Education <sup>a</sup>	0.21**	-0.13	-0.06	0.08	0.12	-0.07	0.00	-0.09	-0.02	0.14
4. Occupation <sup>a</sup>	0.02	0.01	0.10	0.07	0.14	0.01	0.10	-0.06	-0.01	0.02
5. Psychiatric medication <sup>b</sup>	-0.17**	0.07	-0.01	-0.13	-0.14	0.04	0.04	-0.00	-0.04	-0.12
6. Somatic medication <sup>b</sup>	-0.05	0.08	0.00	-0.07	-0.03	0.07	0.07	-0.01	-0.15*	-0.07
7. BDI-II score	-0.36**	0.40*	0.12	-0.37*	-0.27*	0.12	0.12	-0.21*	-0.10	-0.13
8. CGI-score	-0.14*	0.16*	0.08	-0.17*	-0.18*	0.03	0.03	-0.09	0.01	-0.11
9. Neurological disease <sup>b</sup>	0.07	0.07	-0.06	-0.01	-0.03	-0.02	-0.02	-0.12	0.04	0.07

ECQ, emotional competence questionnaire; BE, blame externalization; RN, rebellious nonconformity; SI, stress immunity; SP, social potency; CN, careless nonplanfulness; ME, machiavellian egocentricity; CH, coldheartedness; F, fearlessness; CogScore, cognitive composite score. Sex = Female (=1) and male (=2) participants. BDI-II score, Beck Depression Inventory II score; CGI score, Clinical Global Impression Scale. \*  $p<.05$ . \*\* $p<.01$ . Benjamini-Yekutieli adjustments for all  $p$  values. Significant results are printed in bold.

<sup>a</sup>Spearman correlation analysis.

<sup>b</sup>0 = none, 1 = present.

TABLE 4 Correlations, means, and standard deviations between study variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	M	SD	
PPI-R	1. BE	1	<b>0.27***</b>	<b>-0.21***</b>	<b>-0.18***</b>	-0.11	<b>0.24***</b>	<b>0.14*</b>	0.10	<b>-0.33***</b>	-0.12	<b>-0.26***</b>	<b>-0.18***</b>	<b>-0.30***</b>	-0.13	-0.09	-0.04	-0.10	32.27	8.65
	2. RN		1	<b>0.16*</b>	<b>0.27***</b>	0.08	<b>0.44***</b>	<b>0.29***</b>	<b>0.42***</b>	-0.08	0.04	-0.03	0.07	0.01	-0.04	0.01	-0.05	-0.03	48.60	10.89
	3. SI			1	<b>0.37***</b>	<b>-0.17**</b>	<b>-0.17**</b>	<b>0.26***</b>	<b>0.33***</b>	<b>0.36***</b>	0.07	<b>0.68***</b>	<b>0.14**</b>	<b>0.40***</b>	0.06	-0.00	-0.00	0.02	33.67	7.15
	4. SP				1	-0.09	<b>0.13*</b>	<b>0.15**</b>	<b>0.16**</b>	<b>0.31***</b>	<b>0.29***</b>	<b>0.21***</b>	<b>0.41***</b>	<b>0.43***</b>	0.10	0.05	0.02	0.07	38.11	8.50
	5. CN					1	<b>0.20**</b>	<b>0.15*</b>	-0.01	<b>-0.22***</b>	-0.13	<b>-0.26***</b>	0.08	<b>-0.16*</b>	-0.08	-0.09	-0.09	-0.11	30.00	5.78
	6. ME						1	<b>0.20***</b>	0.03	-0.07	-0.09	<b>-0.19***</b>	0.04	-0.10	-0.01	0.01	-0.01	-0.00	34.92	5.55
	7. CH							1	<b>0.19***</b>	0.07	<b>-0.31***</b>	0.14	0.02	-0.04	-0.04	-0.13	-0.06	-0.09	27.93	5.77
	8. F								1	0.04	-0.09	0.12	-0.02	0.01	0.01	-0.06	-0.03	-0.03	14.13	5.08
ECQ	9. RUE								1	<b>0.44***</b>	<b>0.47***</b>	<b>0.49***</b>	<b>0.82***</b>	<b>0.17**</b>	0.12	0.11	<b>0.16**</b>	3.11	0.57	
	10. REO									1	0.14	<b>0.41***</b>	<b>0.71***</b>	0.10	<b>0.15*</b>	0.04	0.12	3.58	0.68	
	11. RCE										1	<b>0.15*</b>	<b>0.56***</b>	0.00	0.02	0.02	0.02	2.79	0.55	
	12. EE											1	<b>0.77***</b>	<b>0.19***</b>	0.05	0.06	0.12	2.70	0.77	
	13. ECQ Score												1	<b>0.17**</b>	0.12	0.08	<b>0.15*</b>	3.05	0.46	
Cognitive domains	14. A/PS													1	<b>0.39***</b>	<b>0.74***</b>	<b>0.88***</b>	0.02	1.03	
	15. EF														1	<b>0.37***</b>	<b>0.71***</b>	0.10	0.99	
	16. VL/M															1	<b>0.87***</b>	3.05	0.96	
	17. CogScore																1	0.15	2.43	

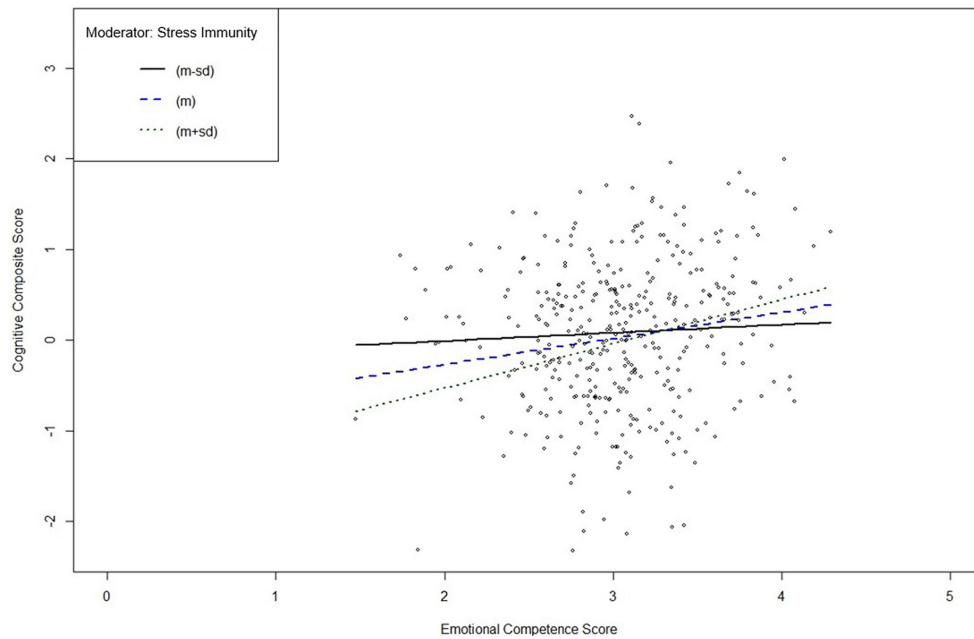
PPI-R, Psychopathic Personality Inventory-Revised; ECQ, emotional competence questionnaire; BE, blame externalization; RN, rebellious nonconformity; SI, stress immunity; SP, social potency; CN, careless nonplanfulness; ME, machiavellian egocentricity; CH, coldheartedness; F, fearlessness; RUE, recognizing and understanding emotions; REO, recognizing emotions of others; RCE, regulation and control of own emotions; EE, emotional expressivity; A/PS, attention/psychomotor speed; EF, executive function; VL/M, verbal learning/memory; M, mean; SD, standard deviation. \* $p < .05$ ; \*\* $p < .01$ ; and \*\*\* $p < .001$ . Benjamini-Yekutieli adjustments for all  $p$  values. Significant results are printed in bold. Pearson correlation analyses results between study variables indicating significant relationships between the Emotional Competence Score (ECQ Score) and the Cognitive Composite Score (CogScore).

TABLE 5 Moderation analyses results for psychopathic personality traits scores moderating the relationship between emotional competence (ECQ Score) and cognitive composite score.

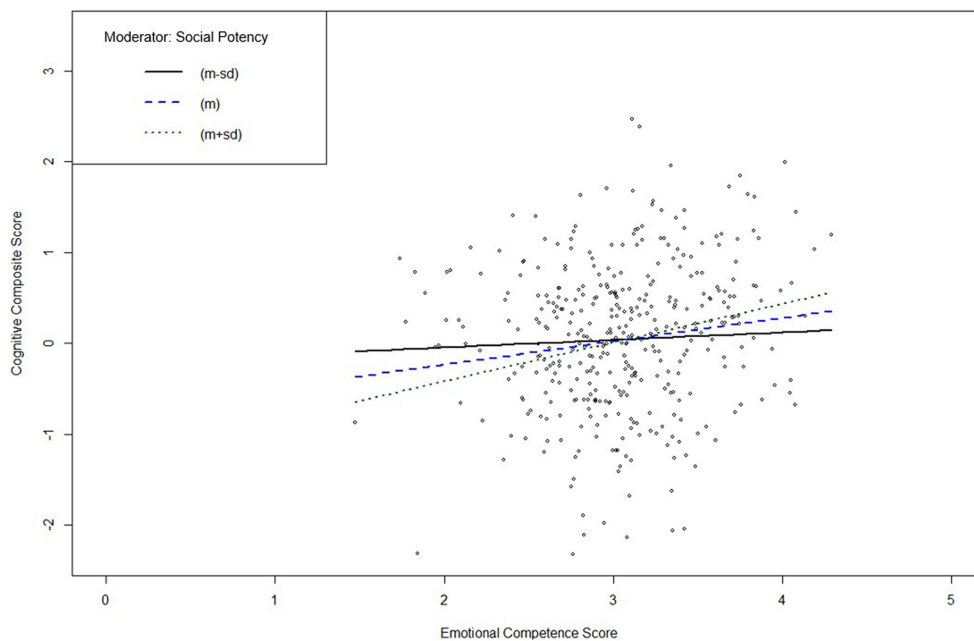
Effect	Estimate	SE	t	95% CI		p
				LL	UL	
Blame externalization (BE)						
Constant	0.16	0.13	1.20	-0.10	0.40	.230
ECQ score	<b>0.67*</b>	0.28	2.37	0.13	1.23	.018
BE	-0.02	0.02	-1.22	-0.05	0.01	.222
ECQ score × BE	-0.04	0.03	-1.46	-0.10	0.01	.145
Rebellious nonconformity (RN)						
Constant	0.21	0.13	1.65	-0.04	0.45	.100
ECQ score	<b>0.78**</b>	0.27	2.88	0.26	1.32	.004
RN	-0.01	0.01	-0.54	-0.03	0.02	.588
ECQ score × RN	0.01	0.03	0.41	-0.03	0.06	.679
Stress immunity (SI)						
Constant	0.10	0.14	0.74	-0.17	0.36	.462
ECQ score	<b>0.87**</b>	0.28	2.95	0.31	1.42	.003
SI	-0.02	0.02	-1.10	-0.06	0.02	.273
ECQ score × SI	<b>0.08*</b>	0.04	2.29	0.01	0.15	.023
Social potency (SP)						
Constant	0.11	0.14	0.78	-0.17	0.37	.434
ECQ score	<b>0.77*</b>	0.30	2.55	0.19	1.36	.011
SP	-0.00	0.02	-0.13	-0.03	0.03	.898
ECQ score × SP	<b>0.06*</b>	0.03	2.01	-0.00	0.12	.045
Careless nonplanfulness (CN)						
Constant	0.21	0.13	1.64	-0.04	0.46	.103
ECQ score	<b>0.71*</b>	0.28	2.57	0.18	1.27	.011
CN	-0.04	0.02	-1.58	-0.08	0.01	.116
ECQ score × CN	-0.02	0.05	-0.04	-0.10	0.10	.967
Machiavellian egocentricity (ME)						
Constant	0.22	0.13	1.76	-0.03	0.47	.080
ECQ score	<b>0.77**</b>	0.27	2.85	0.27	1.30	.005
ME	0.01	0.02	0.23	-0.04	0.05	.822
ECQ score × ME	0.06	0.05	1.18	-0.05	0.15	.240
Coldheartedness (CH)						
Constant	0.21	0.13	1.64	-0.04	0.45	.102
ECQ score	<b>0.78**</b>	0.27	2.87	0.26	1.31	.004
CH	-0.03	0.02	-1.67	-0.08	0.01	.095
ECQ score × CH	-0.02	0.05	-0.54	-0.12	0.08	.590
Fearlessness (F)						
Constant	0.21	0.13	1.65	-0.04	0.45	.099
ECQ score	<b>0.79**</b>	0.27	2.89	0.27	1.32	.004
F	-0.02	0.02	-0.67	-0.06	0.03	.503
ECQ score × F	-0.06	0.06	-0.12	-0.12	0.11	.904

Estimate, unstandardized regression weight; SE, standard error of the unstandardized regression weight; 95% CI, 95%—confidence intervals based on 10,000 samples (BCa bootstrapping); LL, lower level of the 95% confidence interval; UL, upper level of the 95% confidence interval; \* $p < .05$ , \*\* $p < .01$ . Significant results are printed in bold. Results indicate a significant interaction effect between the ECQ score and the cognitive composite score, which is positively moderated by SI and SP.





**FIGURE 1** Interaction plot of the simple slope analysis of psychopathic personality trait “Stress Immunity” in individuals with depression. *m*, mean; *sd*, standard deviation. Simple slope analysis of the moderating effect of “Stress Immunity” on the relationship between the Emotional Competence Score and the Cognitive Composite Score indicates a significant moderation effect at high (+1 *sd* above *m*; solid black line) and low (−1 *sd* below *m*; dotted black line) values of “Stress Immunity” (*m* is represented by the blue dashed line). Subsequent significance tests indicate a significant positive moderating effect for individuals with depression and high values in “Stress Immunity,” but not for individuals with depression and low values in “Stress Immunity.”



**FIGURE 2** Interaction plot of the simple slope analysis of psychopathic personality trait “Social Potency” in individuals with depression. *m*, mean; *sd*, standard deviation. Simple slope analysis of the moderating effect of “Social Potency” on the relationship between the Emotional Competence Score and the Cognitive Composite Score indicates a significant moderation effect at high (+1 *sd* above *m*; solid black line) and low (−1 *sd* below *m*; dotted black line) values of “Social Potency” (*m* is represented by the blue dashed line). Subsequent significance tests indicate a significant positive moderating effect for individuals with depression and high values in “Social Potency,” but not for individuals with depression and low values in “Social Potency.”

depression. We sought to find out whether there is a significant association between emotional competence and cognitive functions, and whether PPT are significantly related to emotional competence

and cognitive functions in individuals with depression. Further, the current study investigated whether PPT have a moderating role in the relationship between emotional competence and cognitive functions.

Our results indicate that there is a significant positive relationship between emotional competence and cognitive functions in individuals with depression, indicating that higher emotional competence is related to better cognitive abilities in the domains attention, executive function, and verbal learning/memory. When stratifying the results for sex, the relationship between emotional competence and cognitive functions did not remain significant, neither in the female nor in the male sub-sample. Moreover, we found that some of the PPT are positively, and some are negatively related to emotional competence, but not related to any of the investigated cognitive functions. This was found for both the general and the stratified sample. Last, we found that the PPT “Stress Immunity” and “Social Potency” significantly positively moderated the relationship between emotional competence and cognitive functions in individuals with depression. This finding indicates that being immune toward stress and anxiety (i.e., “Stress Immunity”) and being superficially charming and dominant toward others (i.e., “Social Potency”; 75) might serve as strengthening and protective traits in the relationship between emotional competence and cognitive functions in individuals with depression. Interestingly, none of the other PPT had a significant influence on the relationship between emotional competence and cognitive functions.

Our result of a positive relationship between emotional competence and cognitive functions in individuals with depression is in line with our hypothesis and is supported by existing literature (e.g., 88, 89). We strengthen the already existing work by highlighting the importance of examining emotional and cognitive abilities together when investigating mood disorders, which was also previously proposed (90). Looking closely at our results, it can be observed that the subcomponents of emotional competence were related to the cognitive function of attention/processing speed, but not the other domains. This poses an interesting finding, since previous research mainly found evidence on a negative link between emotional competence and executive dysfunction in depression (e.g., 91). In addition to these previous findings, our results support studies which show that emotional aspects and attention are positively related (e.g., 92). When stratifying the results according to sex, the relationship between emotional competence and cognitive functions did not remain significant, neither in among female nor male participants. For the moderation analyses, we refrained from including sex as a covariate due to the possibility of reduced availability of degrees of freedom, statistical power, and amount of explainable variance in the outcomes (93). Moreover, in line with current recommendations on the inclusion of control variables (94), it was aimed not to force the relationship between emotional competence and cognitive functions to be the same across sex, thus resulting in not including sex as a control variable.

Moreover, we found that the PPT “Blame Externalisation” and “Careless Nonplanfulness” were significantly negatively associated with emotional competence. This finding aligns previous studies stating that PPT are associated with both emotional dysregulation and externalization behavior, because individuals high in PPT are more likely to blame external factors for their behavior rather than confronting their emotions (95, 96). Other studies revealed that the superior factor of both PPT subscales, namely “Self-Centered Impulsivity,” which assesses a narcissistic and reckless tendency to exploit and blame others, is associated with a deficit in self-conscious emotions and adopting other’s perspective (97) and is thus seen as maladaptive behavior (98). Indeed, our findings show that both PPT are negatively related to the ECQ subscale “Recognizing and Understanding Emotions of Others.” Contrary, the PPT “Stress

Immunity” and “Social Potency” were significantly positively related to emotional competence, which is in line with other studies revealing a negative association between stress immunity and emotional dysregulation (89) or a positive association between emotional intelligence and both traits’ superior factor “Fearless Dominance,” which comprises physical and social boldness as well as immunity to anxiety. This relationship is referred to as “successful psychopathy” and is thus largely associated with adaptive behavior (98, 99). This finding can be explained by the fact that psychopathic stress immunity helps to maintain a healthy emotional distance (97) and can thus be seen as a key element in emotional competence. “Social Potency,” on the other hand, is a PPT that circumcises the influential and manipulative behavior, as well as the deceptive use of emotions in social situations. This requires at least some understanding of one’s own and other’s emotions, thus possibly leading to the positive association with emotional competence, although it is discussed that this trait just reflects the impression but not a real presence of emotional competence (100). Interestingly, we did not find any significant associations between PPT and cognitive domains or overall cognition score, thus only partly confirming our second hypothesis. This finding is contrary to studies revealing major cognitive deficits in PPT (31, 101), specifically when it comes to attention and cognitive control (27, 102, 103). Moreover, our result of no significant association between PPT and cognitive functions is surprising since we investigated individuals with depression whose cognitive functions have also previously been shown to be impaired in general (e.g., 104). Possibly, the interaction between cognitive functions and PPT is different in those individuals than in other populations; however, further research is needed to disentangle the underlying mechanisms.

Finally, we found that only the PPT “Stress Immunity” and “Social Potency” are able to significantly positively moderate the relationship between emotional competence and cognitive functions, thus partly supporting our hypothesis. Another study examining the moderating role of PPT in the relationship between cognitive functions and emotion processing, as measured by response to threatening stimuli, in mentally healthy individuals revealed that the superior factor of “Social Potency” and “Stress Immunity,” namely “Fearless Dominance” interacts significantly positively with cognitive and affective processing (105). Taken together with our finding of positive moderating effects of “Stress Immunity” and “Social Potency,” our study results also support the findings of Dalkner and colleagues (34), who concluded that there may be a protective function of PPT in depression. Thus, being more resilient to potentially anxiety-inducing events and showing more charming and interpersonally bold behavior seems to have a positive effect on the interaction between emotional competence and cognitive functions in depression. This finding is also in line with the fact that stressful environments (106, 107) can result in the manifestation of depressive symptoms and that individuals with depression tend to be shyer and more insecure in social contexts (108), often showing symptomatic social withdrawal. Our result regarding the positive influence of “Social Potency” and “Stress Immunity” thus implies that stress coping strategies and training of social skills should be targeted in the treatment of depressive symptomatology. All other PPT did not significantly moderate the relationship between emotional competence and cognitive functions. This poses an interesting finding, since psychopathy is connected to both emotional and cognitive aspects (e.g., 48). Possibly, the interaction between emotional competence and cognitive functions in depression works independent of most PPT or is influenced by other aspects (e.g., symptom severity).

Future studies should look more closely at these relationships to determine the influence of PPT on these constructs, consider possibly other influencing variables, and transfer this knowledge into everyday treatment of depressive symptoms. For example, since depression and PPT share underlying neurobiological processes, further research could examine both constructs with regard to their physiological correlates. Ultimately, novel findings on personality traits in depression could be integrated in the therapeutic process, thus supporting the multifactorial treatment of psychiatric disorders in general.

## 4.1. Limitations

The study results should be interpreted with following limitations in mind. First, we only used self-report measures, which has to be observed critically when examining PPT due to a possible social desirability bias (109). It should also be noted that the PPT scores of this specific sample were located in the lower area of the total possible scale scores. Secondly, no data of a healthy control group were collected, thus no comparisons can be made and we do not know whether our results are limited to depressive subjects. Future studies should include a control group to fully understand the investigated relationships. Third, we did not control for socio-demographic (e.g., sex, education) or illness-related variables such as number of depressive episodes (first-time or recurrent) or illness duration, which could possibly influence our findings. Fourth, the current study did not include imaging or molecular data, thus only depicting subjectively measured findings. Nevertheless, our results serve as a stepping stone for further examinations including imaging or molecular methods to determine the relationships between cognition, emotion, and PPT. Finally, due to the correlative and cross-sectional study design, no statements about the causal relationships between the examined constructs can be made. In light of our results, however, the importance of looking more closely at the mechanisms driving these relationships is given and should be considered in future studies.

## 4.2. Conclusion

This study reveals a positive relationship between emotional competence and cognitive functions (including attention/psychomotor speed, executive functions, and verbal learning/memory) in individuals with depression. Further, it was observed that single PPT, but not all, are related to emotional competence. In particular, the PPT “Stress Immunity” and “Social Potency” positively moderated the relationship between emotional competence and cognitive functions, thus indicating the importance of developing stress coping mechanisms and better social skills in individuals with depression to maintain a good interaction between emotional competence and cognitive functions. Future studies should aim to examine the relationships between PPT, emotion, and cognitive functions in individuals with psychiatric disorders more closely, as considering personality traits in research can possibly improve the overall treatment outcome and help understand the mechanisms of such diseases. Moreover, the integration of PPT in the treatment process could enrich the therapeutic possibilities by identifying individual traits as resilience-strengthening or potentially harmful factors for depressive symptomatology. Subsequently, measures preventing depressive deterioration in cognitive and emotional

domains could be established. In the interest of translational research, these results should encourage the consideration of PPT in the clinical treatment of several psychiatric disorders.

## Data availability statement

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 at: <https://doi.org/10.17605/OSF.IO/5GUD9>, OSF repository.

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics committee of the Federal State Upper Austria (EK-number: E-24-14). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

ES and ND: conceptualization, formal analysis, and methodology. ND, KS, ER, and BR: data curation. ES: funding acquisition, software, visualization, and writing—original draft. ND: investigation and supervision. ND, ER, and BR: project administration and resources. ES, ND, KS, ER, and BR: validation and writing—review and editing. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2023.1061642/full#supplementary-material>

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