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The moderating effect of trait emotional intelligence on mood deterioration following laboratory-induced stress[1]

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ABSTRACT. A vast amount of research has documented an association between trait emotional intelligence (EI) and mental health. Several pathways could account for this relationship. First, it is possible that the association between trait EI and mental health is merely an artefact of the methods and measures used (response bias pathway). Second, trait EI may reduce the susceptibility to mental disorders via a succession of biological mechanisms (neuroendocrine pathway). Third, trait EI may reduce one's susceptibility to psychological disorders by minimizing mood alterations in difficult circumstances (affective pathway). This experimental study aims at documenting the third pathway. It presents three experimental studies investigating the moderating role of trait emotional intelligence (trait EI) on mood deterioration following laboratory-induced stress. The incremental validity of trait EI to predict mood changes over and above social desirability, alexithymia, resilience and the five-factor model of personality was also examined. Multiple regressions, performed on the three samples as well as on the combined sample (N = 196), showed that a) trait EI significantly moderated the

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impact of the experimental stressor on subsequent mood deterioration, b) the effect held after controlling for social desirability and c) trait EI had incremental validity to predict mood deterioration over and above the other predictors.

KEYWORDS. Trait emotional self-efficacy. Stress. Incremental validity. TEIQue. Experimental study.

RESUMEN. Una grand cantidad de investigación ha demostrado una asociación entre el rasgo de inteligencia emocional (IE) y salud mental. Varias vías pueden contribuir a esta relación. Primero, es posible que la asociación entre el rasgo de IE y la salud mental sea un mero artefacto de los métodos y medidas utilizadas (vía sesgos de respuesta). Segundo, el rasgo de IE puede reducir la susceptibilidad a trastornos mentales mediante la sucesión de mecanismos biológicos (vía neuroendocrina). Tercero, el rasgo de IE puede reducir la susceptibilidad a trastornos minimizando las alteraciones del estado de ánimo en diferentes circunstancias (vía de afecto). Este estudio experimental tiene como objetivo documentar la tercera vía. Presenta tres estudios experimentales sobre el rol moderador del rasgo de inteligencia emocional (IE rasgo) en el deterioro del estado de ánimo después del estrés inducido en el laboratorio. La validez incremental del rasgo de IE para predecir los cambios del estado de ánimo más la deseabilidad social, alexitimia, resiliencia y el modelo de personalidad de los cinco factores también fue estudiada. Regresiones múltiples sobre las tres muestras y también sobre la muestra combinada (N = 196), demostraron que a) la IE rasgo moderó significativamente el impacto del estresor experimental en el subsecuente deterioro del estado de ánimo, b) el efecto se mantuvo después de haber controlado la deseabilidad social y c) la IE rasgo tuvo una validez incremental para predecir el deterioro del estado de ánimo sobre otros predictores.

PALABRAS CLAVE. Autoeficacia emocional rasgo. Estrés. Validez incremental. TEIQue. Estudio experimental.

Though emotions are common to all human beings, individuals markedly differ in the extent to which they experience, attend to, process, and utilize affect-laden information of an intra-personal (*e.g.,* managing one's own emotions) or interpersonal (*e.g.,* managing others' emotions) nature (Petrides and Furnham, 2003). The construct of emotional intelligence provides a scientific framework to this idea. Research on emotion-related individual differences has immensely grown over the past decade and the need has emerged to distinguish between three levels of emotional intelligence, ranging from the most conceptual to the most applied. The first level refers to the complexity and width of conceptual-declarative emotion knowledge (*i.e*., number of differentiated concepts and number of links in the connected web of multimodal emotion-related concepts). The second level refers to emotion-related abilities (*i.e.,* ability to apply knowledge to a problem solving situation and actually implement a given strategy). The third level refers to emotion-related dispositions (or traits) (*i.e.,* propensity to behave in a certain way in emotional situations, frequency with which one uses one's abilities).

These three levels of emotional intelligence are loosely connected. Namely, knowledge does not always translate into abilities, which, in turn, do not always translate into practice (dispositions). One might well know that the best strategy before an exam is to reappraise the situation in a positive manner but, at the same time, being totally unable to reappraise one's own exam session positively. In the same vein, one might be capable of reappraising when asked to do so, while not using this strategy on a daily basis. The positive but rather modest correlations existing between conceptual emotion knowledge, ability Emotional Intelligence (EI), and trait EI measures (Lumley, Gustavson, Partridge, and Labouvie-Vief, 2005) support the idea that a distinction must be made between the three levels of EI. As its title indicates, the present paper focuses on the third level (*i.e.,* emotion-related dispositions), in relationship with stress and mental health.

Trait EI and mental health: Empirical evidence and mediational pathways

A vast amount of research has documented an association between trait EI and mental health. For instance, trait EI has been negatively associated with depression (*e.g.,* Ciarrochi, Deane, and Anderson, 2002; Saklofske, Austin, and Minski, 2003), anxiety (*e.g.,* Ciarrochi, Chan, and Bajgar, 2001; Mikolajczak, Luminet, Leroy, and Roy, 2007), phobic and obsessive symptoms (Mikolajczak, Luminet, and Menil, 2006), psychopathy (Malterer, Glass, and Newman, 2008), personality disorders (Petrides, Pérez-González, and Furnham, 2007) and burnout. As a matter of fact, statistics from a longitudinal study in the workplace suggest that people scoring high on trait EI measures are thrice as less likely to burn-out as people scoring low (Mikolajczak, Menil, and Luminet, 2007). A recent meta-analysis by Schutte, Malouff, Thorsteinsson, Bhullar, and Rooke (2007) indicated that this association between trait EI and mental health is both significant (the aggregated effect size *r* in 27 studies was .32) and robust. That is, it concerns men and women alike, adolescents and adults, as well as students and the general community.

Although it is tempting to conclude that trait EI prevents mental disorders, these studies demonstrate only a reliable association. There are several different pathways that could potentially account for this relationship. Firstly, it is possible that the association between trait EI and mental health is merely an artifact of the methods and measures used (response bias pathway). In particular, reliance on self-reports for the assessment of both trait EI and mental health raises the possibility that a pervasive response disposition leads to the observed association (*e.g.*, social desirability could lead people to present themselves as more emotionally intelligent than they are, as well as to minimize their psychological symptoms or instability). Secondly, trait EI may reduce the susceptibility to mental disorders via a succession of biological mechanisms (neuroendocrine pathway). Specifically, it has recently been shown that trait EI was negatively associated with cortisol secretion amidst stress (Mikolajczak, Roy, Luminet, Fillée, and De Timary, 2007). Given that hypercortisolemia plays a significant pathophysiologic role in the aetiology of depression and anxiety (via an inhibitory feedback on serotonin and noradrenalin release), it is conceivable that high trait EI protects people from mental disorders simply by preventing exaggerated and prolonged cortisol secretion in times of stress. Thirdly, trait EI may reduce one's susceptibility to psychological disorders by minimizing mood alterations in difficult circumstances (affective

pathway). Specifically, high trait EI individuals would experience a smaller increase in negative mood (anxiety, sadness, *etc*.) than their peers when faced with daily challenges. This would preserve their psychological well-being, while the accumulation of negative moods among low trait EI individuals would eventually result in mood disorders (anxiety disorders, depression, *etc*.).

The present set of studies examines this third pathway. Although the second and third pathways are related, they are worth separate investigations because a) not all types of stressors are conductive of an activation of the hypothalamic-pituitary-adrenal (HPA) axis (Dickerson and Kemeny, 2004) and b) previous research has shown that the various components of the emotional response are only weakly correlated (Cacioppo, Tassinary, and Berntson, 2007; Mauss, Cook, and Gross, 2007). There even exist individuals in which the subjective and physiological components of the emotional response are fully dissociated (*e.g.,* repressors; *e.g.,* Schwartz, 1990).

The present study

The first goal of this experimental (see Montero and León, 2007 as well as Ramos-Alvarez, Moreno-Fernández, Valdés-Conroy and Catena, 2008 for a research typology) study was to examine whether trait EI moderates mood deterioration following an acute stressor. To this end, we allocated participants to either stress or neutral conditions and assessed the effects of these exposures on mood change. Because the present paper targets the subjective component of the emotional response, we controlled for social desirability in order to exclude any potential response bias.

A subsidiary goal of this study was to determine the added value of t trait EI *vis-à-vis* various concurrent predictors. That is, we examined the incremental validity of trait EI to predict mood deterioration over and above the five-factor model of personality, alexithymia and resilience. This was deemed important because a) resilience and the big five (especially neuroticism) are powerful predictors of resistance to stress and b) trait EI shares a high percentage of its variance with all three constructs (*e.g.,* Mikolajczak, Luminet *et al.,* 2007; Parker, Taylor, and Bagby, 2001; Petrides and Furnham, 2001; Saklofske, Austin, and Minsh 2003). Alexithymia is a multidimensional construct encompassing four dimensions thought to reflect deficits in the cognitive processing of emotions (Taylor, Bagby, and Parker, 1997). These dimensions are a) a difficulty in identifying and distinguishing between feelings and the bodily sensations of emotional arousal; b) a difficulty in describing feelings to others; c) a restricted imagination, as evidenced by a paucity of fantasies; and d) a cognitive style that is literal, utilitarian, and externally oriented. Resilience is defined as the ability to thrive in the face of adversity and to adapt flexibly to the changing demands of stressful experiences (Block and Kremen, 1996; Tugade and Fredrickson, 2004). Because this definition targets the final outcome –and not what contributes to this outcome– it leaves little room for prediction (Hjemdal, Friborg, Tore, Rosenvinge, and Martinussen, 2006). Therefore, measures of resilience encompass the factors known to promote resilience, which fall under three categories: a) positive dispositional attributes, b) a cohesive and loyal family and c) a supportive social network (*e.g.,* Werner and Smith, 2001). The more features a person possesses, the more resilient s/he is said to be. The Five-Factor Model of Personality (FFM) is currently the most prominent model for describing personality.

This model posits that personality (*viz.,* individual differences in the configurations of thoughts, emotions and behaviours; McCrae and Costa, 1990, p.23) can be summarized in five major dimensions (often referred to as the «Big 5»): *Neuroticism* (N), *Extraversion* (E), *Openness to experience* (O), *Agreeability* (A) and *Conscientiousness* (C). Along with thoughts and behaviours, emotions are important parts of the definitions of these traits. *N* and *E* predispose to negative and positive emotions respectively, *O* captures the interest for emotions, *A* reflects the hostile triad of emotions (anger, contempt and disgust) and *C* refers to impulse control (Luminet, Bagby, Wagner, Taylor, and Parker, 1999). Given the partial overlap between alexithymia, resilience, the FFM and trait EI, it was important to determine whether trait EI predicts mood change over and above these variables.

STUDY 1

Method

Participants

Sixty-seven students participated in the study in exchange for a ticket from the Belgian national lottery (the winner gets 1000 € per month for life). Participants were 41 males and 26 females. The mean age of the sample was 21.23 years (*SD* = 2.01 years). They were randomly assigned either to the neutral (n = 32) or to the stress (n = 35) condition.

Measures

- Trait emotional intelligence was measured through the French version of the Trait Emotional Intelligence Questionnaire (TEIQue; Petrides, Pita, and Konkinak 2007; for the psychometric properties of the French adaptation used in this study, see Mikolajczak, Luminet *et al.,* 2007). The TEIQue consists of 153 items responded to on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). It provides scores for 15 subscales, four factors (*Well-being, Self-control, Emotionality, and Sociability*) and global trait EI. We chose the TEIQue as a measure of trait EI for three specific reasons. First, it provides comprehensive coverage of the trait EI sampling domain (Freudenthaler, Neubauer, Gabler, Scherl, and Rindermann, 2008); second, it has demonstrated discriminant validity in relation to personality (Petrides, Pita, and Kokkinaki, 2007); third, its factor structure is stable across studies and languages (Mikolajczak, Luminet *et al.,* 2007).
- Positive and negative affectivity were assessed through an abbreviated version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen, 1988). The PANAS is currently the most widely used measure of affectivity. In its original version, it consists of 20 adjectives rated along 5-point scales ranging from 1(*not at all*) to 5 (*extremely*), of which 10 measure positive affectivity (PA; *e.g.,* inspired) and 10 measure negative affectivity (NA; *e.g.,* guilty). Because the present study was part of a larger experiment, a short version of the PANAS was created in which only the mood states that were most

relevant to our manipulation were included. The following adjectives were included: 'cheerful', 'in good shape', 'enthusiastic' and 'proud' for PA ('alive', 'inspired', 'interested', 'determined' and 'active' were excluded) and 'distressed', 'irritated', 'ashamed', 'irritable', 'nervous' and 'aggressive' for NA ('guilty', 'frightened', 'scared' and 'restless' were excluded).

Procedure

All participants were tested individually. Upon arrival at the laboratory, they were invited to complete the TEIQue and subsequently underwent a short relaxation procedure (1 min; based on Schultz, 1965). Baseline positive and negative affectivity were then assessed through the abbreviated version of the PANAS. Subsequently, participants were randomly allocated either to a stress condition or to a neutral condition. There were no trait EI differences between participants in the two conditions.

The stress condition involved a failure experience (Krohne, Pieper, Knoll, and Breimer, 2002). Participants were told they would be tested on a recently developed test designed to predict occupational success. They were informed that, as university students, they were expected to have a 75% success rate (fictitious percentage). In fact, the administered test consisted of the 12 most difficult items from the Raven Advanced Progressive Matrices (Raven, 1976). Furthermore, an unrealistic time constraint was imposed on participants to ensure unsatisfactory performance. In contrast, the neutral condition simply involved reading a magazine article on the measurement of intelligence and rating it on its readability (a pretest revealed that this task induced no particular emotion). Following the mood induction (i.e., stress versus neutral), participants were retested on the PANAS.

Results

Analyses were performed on post-manipulation mood (NA2 or PA2), partialling out the effect of baseline mood (NA1 or PA1). The data were analysed through four-step hierarchical regressions in which we examined the unique and interactive effects of condition and trait EI. Baseline mood was entered as a covariate in Step 1 of the regression. In Step 2, we introduced condition (a nominal variable -1/1 contrasting the *stress versus* the neutral induction). In Step 3, we entered the trait EI scores (as a continuous variable). The two-way interaction between condition and trait EI was entered in Step 4. Following Aiken and West's (1991) suggestion, all predictors were centred around their mean. Finally, in line with Judd and McClelland (1989) multivariate outliers deviating more than 3 standard deviations from the mean were removed in order to get the most honest estimate of population parameters (see Barnett and Lewis, 1994).

Means, SDs, and Cronbach alphas for the variables under examination are reported in Table 1 (first column). Regression results are reported in detail in Tables 2 and 4. The analyses yielded a main effect of condition, indicating greater mood deterioration in the stress group than in the neutral group (that is, the manipulation had the expected effect). The deterioration was manifested both in NA ($F_{(1, 62)} = 43.53$, $p \leq .001$) and in PA scores ($F_{(1, 64)} = 19.20$, $p \leq .001$). There was also a main effect of global trait EI on NA ($F_{(1, 61)} = 13.94$, $p \leq .001$), whereby participants with high trait EI scores experienced

a smaller increase in NA than those with low trait EI scores. More important, there was a condition *x* trait EI interaction on NA ($F_{(1, 60)} = 4.96$, $p \leq .05$), indicating that the negative relationship between trait EI and mood deterioration was stronger in the stress than in the neutral condition (see Figure 1a, where only the stress condition' slope is significant).

TABLE 1. Means, standard deviations and Cronbach alphas for the variables under investigation.

	Study 1		*Study 2*		*Study 3*	
	Means (SD)	*α*	*Means (SD)*	*α*	*Means (SD)*	*α*
Trait EI global	4.64 (.48)	.93	4.56 (.50)	.93	4.64 (.59)	.96
Well-being	5.02 (.72)	.88	5.03 (.80)	.90	4.98 (.88)	.93
Self-control	4.23 (.63)	.82	4.06 (.75)	.84	4.47 (.72)	.86
Emotionality	4.75 (.75)	.91	4.66 (.63)	.84	4.55 (.69)	.91
Sociability	4.63 (.77)	.89	4.59 (.62)	.80	4.76 (.82)	.91
Alexithymia (TAS-20)	—	—	45.09 (9.56)	.81[a]	47.57 (10.18)	.80
Social desirability		—	15.49 (4.25)	.71	48.48 (3.97)	.64
Personality						
Emotional stability	—	—	38.62 (8.24)	.84	43.33 (9.20)	.86
Introversion	—	—	39.65 (8.89)	.79	43.30 (8.57)	.82
Openness	—	—	45.61 (6.27)	.74	46.18 (6.37)	.72
Agreeableness	—	—	48.24 (5.58)	.71	48.29 (6.67)	.83
Conscientiousness	—	—	44.92 (9.73)	.77	45.04 (8.54)	.80
Resilience	—	—	—	—	4.97 (.75)	.92
Personal competence	—	—	—	—	4.91 (.92)	.86
Social competence	—	—	—	—	5.17 (1)	.82
Family coherence	—	—	—	—	4.73 (1.27)	.86
Social resources	—	—	—	—	5.48 (.98)	.84
Personal structure	—	—	—	—	4.34 (1.06)	.63
Positive Affectivity (PA)						
Before manipulation	3.15 (.72)[b]	.75	2.94 (.67)[f]	.87	2.76 (.62)[j]	.85
After manipulation	2.72 (.89)[c]	.82	2.66 (.67)[g]	.85	2.59 (.80)[k]	.90
Negative Affectivity (NA)						
Before manipulation	1.34 (.36)[d]	.55	1.47 (.57)[h]	.91	1.34 (.46)[l]	.88
After manipulation	1.59 (.68)[e]	.85	1.83 (.91)[i]	.94	1.44 (.52)[m]	.89

Notes. [a] Internal consistencies were unavailable for the TAS-20 variables in this study because of the use of a computerized version of the TAS-20 that computed the scores but did not save the answers item by item. The values reported in the table are from Mikolajczak *et al.* (2006). [b] Mean PA before manipulation was 3.05 (.70) in the stressful condition and 3.25 (.74) in the neutral condition. [c] Mean PA after manipulation was 2.37 (.87) in the stressful condition and 3.09 (.75) in the neutral condition. [d] Mean NA before manipulation was 1.33 (.38) in the stressful condition and 1.34 (.35) in the neutral condition. [e] Mean NA after manipulation was 1.92 (.75) in the stressful condition and 1.22 (.31) in the neutral condition. [f] Mean PA before manipulation was 3.17 (.56) in the stressful condition and 2.68 (.70) in the neutral condition. [g] Mean PA after manipulation was 2.54 (.70) in the stressful condition and 2.79 (.61) in the neutral condition. [h] Mean NA before manipulation was 1.47 (.60) in the stressful condition and 1.47 (.55) in the neutral condition. [i] Mean NA after manipulation was 2.28 (.95) in the stressful condition and 1.31 (.50) in the neutral condition. [j] Mean PA before manipulation was 2.98 (.65) in the stressful condition and 2.55 (.51) in the neutral condition. [k] Mean PA after manipulation was 2.93 (.84) in the stressful condition and 2.25 (.59) in the neutral condition. [l] Mean NA before manipulation was 1.23 (.028) in the stressful condition and 1.45 (.58) in the neutral condition. [l] Mean NA after manipulation was 1.60 (.59) in the stressful condition and 1.28 (.38) in the neutral condition.

Discussion

As hypothesized, trait EI moderated the impact of laboratory-induced stress on mood deterioration, such that high trait EI scores were associated with a smaller increase in NA in the stress condition. However, the findings of this study are subject to certain limitations. First, the TEIQue data were collected in the same session as the mood induction, thus raising the issue of shared covariance. Second, the use of a shortened version of the PANAS resulted in a relatively low internal consistency for the baseline measurement of NA (alpha = .55), which may have affected the analysis.

TABLE 2. Regression analyses predicting change in affectivity by condition, trait EI and their interaction.

	Outliers[№]		*Positive affectivity*			*Negative affectivity*		
Study 1	*PA: –* *NA: 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.59	96.31***	.722	.34	34.29***	.51
		Condition	.68	19.20***	.305	.61	43.53***	-.51
		Trait EI	—	—	—	.68	13.94***	-.25
		Condition *x* Trait EI	—	—	—	.70	4.96*	.15^{a}
Study 2	*PA: 2* *NA: 2*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.42	47.80***	.682	.13	10.63***	.28
		Condition	.60	28.73***	.414	.42	32.27***	-.54
		Trait EI	.60	0.36	.033	.47	7.39**	-.23
		Condition *x* Trait EI	.64	8.49**	-219$^{**, e}$	.52	6.27*	.22$^{*, b}$
Study 3	*PA: /* *NA: 45*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.57	73.71***	.54***	.23	17.47***	.43***
		Condition	.59	4.13*	-.17*	.39	14.95***	-.49***
		Trait EI	.61	3.19†	.14^{1}	.59	25.03***	-.42***
		Condition *x* Trait EI	.62	2.02	-.12	.62	4.97*	.19$^{*, c}$
Pooled-sample	*PA: 2, 37* *NA: 2, 4, 13, 19, 20, 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.54	222.31***	.69***	.32	83.61***	.48***
		Condition	.58	16.44***	.20***	.55	97.34***	-.51***
		Trait EI	.59	3.93*	.08†	.61	26.34***	-.23***
		Condition *x* Trait EI	.60	8.15**	-.13$^{**, f}$	.64	14.50***	.17$^{***, d}$

Note. $^{n^{o}}$ = case number of outlier participants. Letter superscripts in the interaction rows link to the corresponding simple slopes data in Table 4.

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{\dagger}p \leq .10$

STUDY 2

Study 2 was conducted to extend the findings of Study 1, with an added emphasis on the issue of incremental validity. As discussed in the general introduction, we controlled for social desirability, alexithymia, and the big five personality dimensions.

Method

Participants

Sixty-six undergraduate psychology students participated in the study in exchange for course credit. Participants were 51 females and 15 males. The mean age of the sample was 18.70 years (*SD* = 1.04 years). They were randomly assigned to either the neutral (*N* = 31) or the stress (*N* = 35) condition.

Measures

- Trait EI was measured with the TEIQue as described in Study 1.
- Positive and negative affectivity were measured through the full version of the PANAS with an enhancement of the NA component. That is, in order to increase the sensitivity of the instrument to the manipulation, the following adjectives were added on account of their particular relevance to our investigation: 'disheartened,' 'incapable,' 'grumpy,' 'disgusted,' and 'tense'.
- Social desirability was measured with the Marlowe-Crowne Social Desirability Scale (Crowne and Marlowe, 1960), which consists of 30 items rated on a dichotomous (*true / false*) scale. Sample items are «I am always courteous, even to people who are disagreeable,» «When I don't know something, I don't mind at all admitting it».
- Alexithymia was measured with the Toronto Alexithymia Scale (Bagby, Parker, and Taylor, 1994). This questionnaire consists of 20 items responded to on a 5-point scale from 1 (*fully disagree*) to 5 (*fully agree*), targeting three specific dimensions: difficulty in identifying feelings («When I am upset, I do not know if I am sad, frightened or angry»), difficulty in describing feelings («I find it hard to describe how I feel about people»), and externally-oriented thinking («I prefer talking to people about daily activities rather than their feelings»).
- Five-factor personality was measured with the D5D (Rolland and Mogenet, 2001), a widely used French personality inventory based on the Five-Factor Model (Costa and McCrae, 1992). It assesses the big five dimensions of emotional stability, introversion, openness, conscientiousness, and agreeableness through 55 adjectives (*e.g.,* 'nervous,' 'reserved,' 'cultivated,' 'compassionate,' 'tidy,' *etc*.) that are rated on a 6-point scale ranging from -3 (does not describe me at all) to +3 (describes me perfectly).

Procedure

The procedure was the same as in Study 1, with the exception of a time lag between the administration of the TEIQue and the stress induction in order to remove any shared

variance. The experimental session (stress induction and affectivity measures) and the questionnaire session (trait EI, alexithymia, social desirability and the five-factor model of personality) were spaced up to three weeks apart.

Results

Means, *SD*s, and Cronbach alphas for the variables under examination are reported in Table 1 (second column). Regression results are reported in detail in Tables 2 and 4. Firstly, as in Study 1, analyses yielded a significant main effect of condition, indicating greater mood change in the stress group than in the neutral group for both NA ($F_{(1, 62)} = 32.27$, $p \leq .001$) and PA ($F_{(1, 62)} = 28.73$, $p \leq .001$) scores. Thus, the manipulation had the expected effect. Secondly, there was also a main effect of global trait EI, whereby participants with high trait EI scores experienced a smaller increase in NA than participants with low trait EI scores ($F_{(1, 61)} = 7.39$, $p \leq .005$). Lastly, there was a significant condition *x* trait EI interaction on both positive ($F_{(1, 60)} = 8.49$, $p \leq .005$) and negative mood change ($F_{(1, 60)} = 6.27$, $p \leq .05$) (see Figures 2a and 2b). In the stress condition, high trait EI scores were, as expected, associated with less mood deterioration (*i.e.,* lesser increase in NA and lesser decrease in PA). It is noteworthy that, in the neutral condition, high trait EI scores were associated with less mood improvement (*i.e.,* less decrease in NA and less increase in PA). Complementary analyses revealed that high trait EI participants reported both more PA ($r = .449$, $p \leq .001$) and less NA ($r = -.382$, $p \leq .005$) than their low trait EI counterparts upon arrival at the laboratory. The fact that low trait EI individuals gained PA and lost NA in the neutral condition suggests they may have been tense upon arrival, but gradually relaxed.

As far as incremental validity is concerned, we analysed the data of this study together with the incremental data of Study 3, in order to get a more accurate estimate of the increment of variance explained. Results are reported in Table 5 and presented in the Results section of Study 3.

Discussion

This study revealed even more pronounced effects than Study 1 in that trait EI moderated the impact of stress on both positive and negative mood. While these findings confirm the role of trait EI as a moderator of subjective mood deterioration in stressful situations, their generalizability might be limited. That is, the task might not be fully representative of real life stressors, which are often more intense. Study 3 aims to investigate whether the moderating effect of trait EI holds in the context of a stronger stressor.

TABLE 3. Regression analyses predicting change in affectivity by condition, trait ei factors and their interaction (pooled-samples analyses).

	Outliers[№]		*Positive affectivity*			*Negative affectivity*		
Well-being	*PA: 2, 37 NA: 2, 13, 19, 20, 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.54	222.31^{***}	$.62^{***}$	.31	83.61^{***}	$.50^{***}$
		Condition	.58	16.44^{***}	$.20^{***}$	.55	97.34^{***}	$-.51^{***}$
		Trait EI	.59	5.95^{*}	$.11^{*}$	.59	12.25^{***}	$-.17^{***}$
		Condition *x* Trait EI	.60	7.73^{**}	$-.13^{**, k}$	.61	12.44^{***}	$.17^{***, g}$
Self-control	*PA: 2, 37 NA: 2, 13, 19, 20, 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.54	222.31^{***}	.75	.32	83.61^{***}	$.50^{***}$
		Condition	.58	16.44^{***}	.20	.55	97.34^{***}	$-.50^{***}$
		Trait EI	.58	.301	.01	.58	12.85^{***}	$-.16^{***}$
		Condition *x* Trait EI	.58	$3.368^{\dagger}$	$-.09^{\dagger, l}$	.59	3.85^{*}	$-.09^{*, h}$
Emotionality	*PA: 2, 37 NA: 2, 13, 19, 20, 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.54	222.31^{***}	$.75^{***}$	.31	83.61^{***}	$.57^{***}$
		Condition	.58	16.44^{***}	$.19^{***}$	.55	97.34^{***}	$-.50^{***}$
		Trait EI	.58	0.035	.01	.56	4.53^{*}	$-.11^{*}$
		Condition *x* Trait EI	.58	3.898^{*}	$-.09^{*, m}$	.57	3.89^{*}	$.10^{*, i}$
Sociability	*PA: 2, 37 NA: 2, 13, 19, 20, 37, 44*		*Adj. R²*	*F change*	*Semi-partial r*	*Adj. R²*	*F change*	*Semi-partial r*
		Affect T1	.54	222.31^{***}	$.72^{***}$	.31	83.61^{***}	$.67^{***}$
		Condition	.58	16.44^{***}	$.19^{***}$	.55	97.34^{***}	$-.63^{***}$
		Trait EI	.59	6.46^{*}	$.10^{*}$	.60	20.90^{***}	$-.30^{***}$
		Condition *x* Trait EI	.60	5.06^{*}	$-.10^{*, n}$	.62	13.29^{***}	$.26^{***, j}$

Note. № = case number of outlier participants. Letter superscripts in the interaction rows link to the corresponding simple slopes data in Table 7.

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{\dagger}p \leq .10$

TABLE 4. Decomposition of significant interactions: Simple regression slopes by condition.

Reference	*Condition*	*Intercept*	*B*	*Beta*	*t*
a	S	2.565**	-.456**	-.366**	-3.176**
	N	.985*	-.131	-.192	-1.608
b	S	5.970***	-.865**	-.524**	-3.379**
	N	-1.054*	.226*	.225*	2.454*
c	S	3.169***	-.502***	-.558***	-3.806***
	N	1.613***	-.221*	-.318*	-2.755*
d	S	3.200***	-,473***	-,408***	-5.076***
	N	.713**	-.074	-.092	-1.428
e	S	-1.339†	.320*	.247*	2.106*
	N	1.835**	-.270†	-.221†	-1.704†
f	S	-1.431**	.320**	.215**	3.052**
	N	.704	-.071	-.049	-.698
g	S	2.309***	-.263***	-.334***	-3.888***
	N	.393*	-.010	-.020	-.075
h	S	1.878***	-.224**	-.264**	-2.99**
	N	.657	-.067†	-.106†	-1.664†
i	S	1.586***	-.173*	-.186*	-2.208*
	N	.451*	-.022	-.039	-.614
j	S	2.195***	-.289***	-.363***	-4.657***
	N	.474*	-.027	-.046	-.072
k	S	-1.072**	.262***	.255***	3.372***
	N	.455	-.007	-.008	-.110
l	S	-.612	.104	.097	1.396
	N	.764*	-.083	-.072	-1.113
m	S	-.705	.112	.094	1.361
	N	.762*	-.084	-.081	-1.231
n	S	-1.043**	.214**	.209**	3.084**
	N	.405	.006	.006	.083

Notes. Reference letters link to the significant interactions in Tables 2 and 3. S = Stress condition, N = Neutral condition.

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{\dagger}p \leq .10$

STUDY 3

Study 3 was conducted to replicate the findings of Study 1 and 2, but in the context of a stronger stressor. The findings presented below are part of a larger study aimed to investigate the moderating effect of trait EI on both subjective and endocrine responses to an acute stressor. Part of this study has been presented elsewhere (Mikolajczak, Roy

et al., 2007) but PA-related data were not reported and NA-related data were analyzed differently. Moreover, these results have not been discussed as this paper focused exclusively on the endocrine response.

In addition to examining the moderating effect of trait EI and its incremental effect over and above social desirability, alexithymia and the five-factors of personality, we introduced in this study a new concurrent predictor, namely the construct of resilience. As this construct has been especially designed to capture the factors known to promote resistance to stress (Friborg, Hjemdal, Rosenvinge, and Martinussen, 2003), we thought that it could represent a suitable construct to include in the incremental validity analysis.

Method

Participants

Fifty-six students recruited through advertisements participated in the study in exchange for course credit or remuneration. Because this study comprised endocrine measures, students who suffered from somatic or psychiatric illnesses, or who were under any form of medication were excluded. Females and those who reported smoking behaviour were also excluded, due to the documented effect of gender and smoking on cortisol responses. Subjects were randomly assigned to the control (n = 28) or the stress (n = 28) condition.

Measures

- Trait EI, positive and negative affectivity, social desirability, alexithymia, and the five-factor personality were measured as described in Study 2.
- Resilience was measured by the Resilience Scale for Adults (RSA; Friborg *et al*., 2003). The RSA consists of 41 items - responded to on a 7-point scale: from 1 (*strongly disagree*) to 7 (*strongly agree*) targeting 5 factors known to promote resilience: personal competence («No matter what happens I always find a solution»), personal structure («I keep up my daily routine even in difficult times»), social competence («I easily adjust to new social milieus»), family coherence («In our family, we are loyal towards each other») and social resources («I have some close friends/family members who really care about me»). Note that there is no consensus in the literature about the factors for resilience. However, this scale encompasses factors which have been empirically shown to promote resilience.

Procedure

- Experimental session. Because the procedure has been described in detail in Mikolajczak, Roy et al. (2007), we summarize it here after, focusing exclusively on measures of mood. Upon arrival at the laboratory, participants underwent a short relaxation procedure and then were left alone for ten minutes in a comfortable room with several magazines at their disposal. Baseline positive and negative affectivity were subsequently assessed through the PANAS. Subsequently, participants in the control condition watched a neutral documentary about Mayan

people (Azzarella and Boyajian, 1997, French version) whereas participants in the stress condition underwent the Trier Social Stress Test (TSST; see Kirschbaum, Pirke, and Hellhammer, 1993 for details on the procedure). The TSST consists of both a public speech (5 minutes, after 10 min preparation period) and a cognitive task (5 min) in front of an audience of two people and a video camera. After the manipulation (neutral vs. stress), participants returned to the first room and were re-tested on the PANAS.

– Questionnaire session. The questionnaire session took place about three weeks after the experimental one. This collective session lasted for about 1 hour, during which participants completed measures of the five factors of personality, trait EI, alexithymia, and social desirability.

Results

Moderating effect of trait EI on mood changes

Means, *SD*s, and Cronbach alphas for the variables under examination are reported in Table 1 (third column). Regression results for global trait EI are reported in detail in Tables 2 and 4. Analyses yielded a significant main effect of condition, indicating greater mood change in the stress group than in the neutral group for NA scores ($F_{(1, 52)} = 14.95$, $p \leq .001$) but not for PA scores ($F_{(1, 53)} = 4.13$, p = ns). These results suggest that the manipulation had the expected effect because it was primarily designed to induce a negative emotional state (*i.e.,* stress). There was also a strong main effect of global trait EI, whereby participants with high trait EI scores experienced a smaller increase in NA than participants with low trait EI scores ($F_{(1, 51)} = 25.03$, $p \leq .001$). Lastly, there was a significant condition *x* trait EI interaction on negative mood change ($F_{(1, 50)} = 4.97$, $p \leq .05$), indicating that the latter effect was even stronger in the stressful condition (see Figure 3a).

Incremental validity of trait EI over and above concurrent constructs

Incremental analyses were completed in two steps. First, we performed separate multiple regressions (condition, predictor, and condition *x* predictor) in order to identify independently the significant predictors of mood change. We then tested the incremental validity of trait EI over and above significant predictors by entering all significant predictors, along with the main and interaction effects of trait EI. The betas (*i.e.,* coefficients controlling for all other predictors entered in the model) are given in Table 5.

– Incremental validity over and above social desirability, alexithymia and the five-factor model of personality. As social desirability, alexithymia and the five-factor model of personality were measured in both Study 2 and Study 3, this section bears on the data of these two studies pooled together (n = 118). The first step (independent analyses) revealed that several variables were significant predictors of NA change: trait EI, emotional stability, openness, agreeableness and social desirability had a main effect (*i.e.,* higher scores were associated with less increase in NA), while trait EI, emotional stability and social desirability also

interacted with the condition (such that their effects were more pronounced in the stress condition). As can be seen in Table 5, in the second step of the regression with all significant predictors entered together in the equation, only the effects of trait EI remained significant when the other predictors were partialed out. Regarding PA change, the following variables were found to be significant predictors: trait EI and openness both had a main effect (*i.e.,* higher scores were associated with lesser PA changes) while trait EI, difficulty identifying feelings, emotional stability, agreeableness, and social desirability interacted with condition (such that their effects were more pronounced in the stress condition). As can be seen in Table 5, none of the predictors remained significant in the presence of the others, except social desirability.

– Incremental validity over and above resilience. The first step (independent analyses) indicated that among the five resilience factors (see Measures section), three had a significant effect on NA change. Perceived competence, social competence and social support had a main effect (higher scores were associated with less increase in NA), while perceived competence also interacted with condition (such that its effect was stronger in the stress condition). The second step (all significant predictors entered together) showed that, apart from baseline NA and condition, only trait EI remained a significant predictor in the presence of the resilience factors. Analyses were not performed regarding PA as trait EI was not a significant predictor of PA change in Study 3.

TABLE 5. Hierarchical regression analyses testing the incremental validity of trait EI over and above concurrent predictors.

Incremental validity over and above alexithymia and its factors, the big five factors of personality and social desirability.

Study 2 and 3 pooled together (n = 118)

Criterion variable	*Predictor Variable*	*Beta*
NA_2	NA_1	.31***
	Condition	-.50***
	Emotional stability	-.12
	Agreeability	.03
	Openness	-.10
	Social desirability	-.11
	Trait EI	-.22*
	Condition *x* emotional stability	.06
	Condition *x* social desirability	.08
	Condition *x* trait EI	-.17*
PA_2	PA_1	.66***
	Condition	.12†
	Openness	.10

TABLE 5. Hierarchical regression analyses testing the incremental validity of trait EI over and above concurrent predictors (cont.).

	Trait EI	.10
	Condition *x* difficulty identifying feelings	.11
	Condition *x* emotional stability	.06
	Condition *x* agreeability	-.08
	Condition *x* social desirability	-.32***
	Condition *x* trait EI	-.09
Incremental validity over and above resilience		
Study 3 (N = 56)		
Criterion variable	*Predictor Variable*	*Beta*
NA_2	NA_1	.35**
	Condition	-.51***
	Resilience – Perceived competence	.13
	Resilience – Social competence	.05
	Resilience – Social support	-.02
	Trait EI	-.65**
	Condition *x* perceived competence	.25
	Condition *x* trait EI	-.04

Notes. NA = Negative affectivity, PA = Positive affectivity

$p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$; $^{\dagger}p \leq 0.1$.

Discussion

As expected, trait EI moderated the impact of laboratory-induced stress on mood deterioration, such that higher trait EI scores were associated with a smaller increase in NA in the stress condition. The effect size was comparable to Study 2, suggesting that the impact of trait EI does not depend on the strength of the stressor. Moreover, the results held up under the successive partialing of social desirability and of variables that, some have claimed, are jingle equivalents of trait EI, like alexithymia, resilience and the big five. These findings of incremental validity are all the more impressive because they have been obtained in an experimental context, where it is often difficult to detect even simple (*i.e.,* non-incremental) personality effects.

POOLED-SAMPLE ANALYSIS

Considered together, the results of the three separate studies clarify the role of trait EI as a moderator of the effects of stress on mood. To further enhance our understanding, and take advantage of the systematic nature of this research, we conducted a final analysis based on the pooled samples of the three separate studies. The most important

benefit of this strategy is that the resultant sample size far exceeds those of each individual study. This helps provide more accurate estimates of the trait EI effects and also goes some way towards addressing the problem of power that is central to moderated multiple regression analysis (Cohen, Cohen, West, and Aiken, 2003). We also examined in this pooled-sample analysis the contribution of each trait EI factor to the global effect. Finally, as gender was unequally distributed across studies (the percentage of males was 61% in Study 1, 23% in Study 2 and 100% in Study 3), the pooled-sample enabled us to test for potential gender differences in the effects of trait EI.

Method

Participants

The three previously described samples were combined for the purposes of this analysis. In total, there were 189 participants (110 females, 77 males, and 2 unreported) with a mean age of 20 years (SD = 2 years), of whom 91 were in the neutral condition and 98 in the stress condition.

Results

Main and interaction effects of condition and trait EI

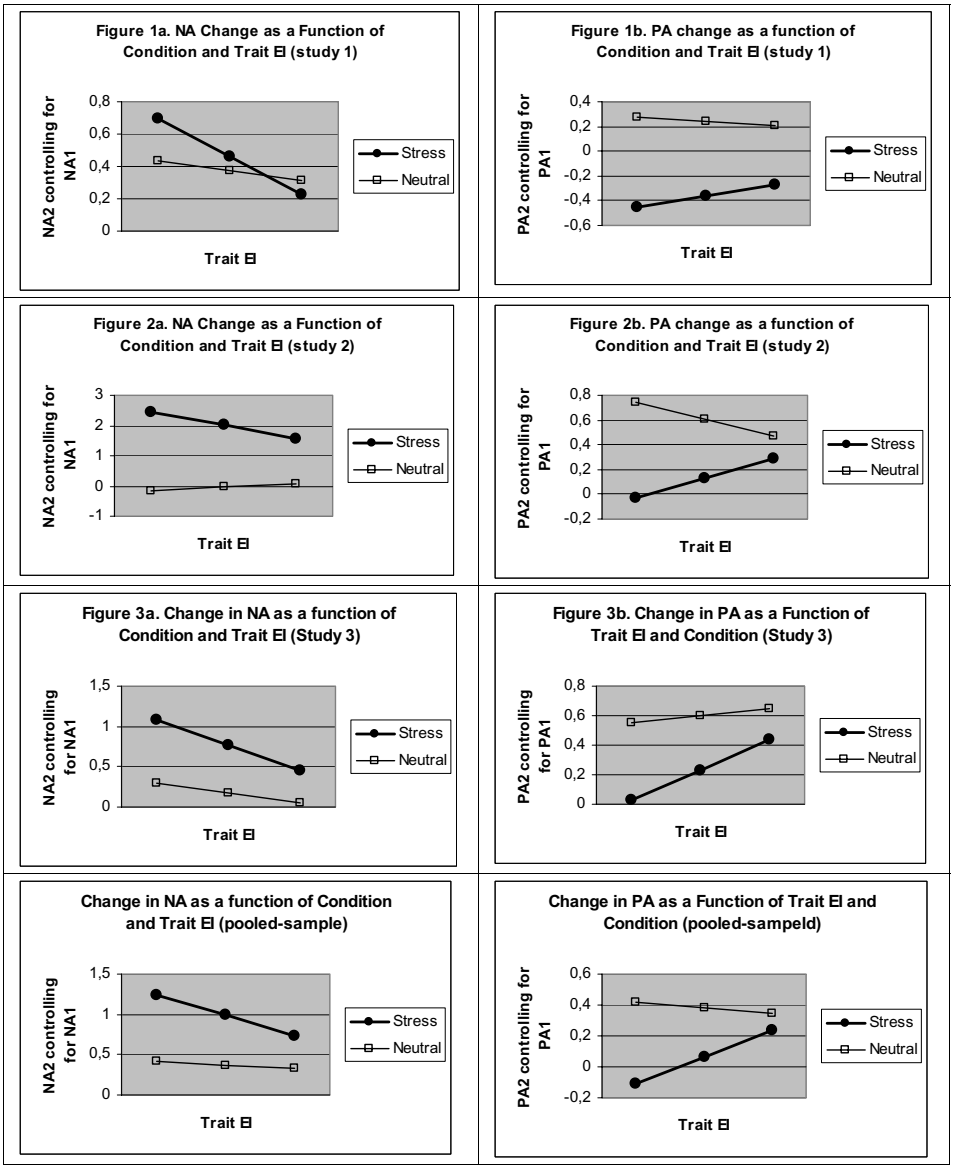
Regression results for global trait EI are reported in detail in Tables 2 and 4. Analyses revealed a significant main effect of condition, indicating greater mood change in the stress group than in the neutral group for both NA ($F_{(1, 181)} = 97.34$, $p \leq .001$) and PA ($F_{(1, 185)} = 16.44$, $p \leq .001$) scores. There was also a main effect of trait EI, indicating that participants with high scores experienced a smaller increase in NA following the stress induction than their peers with low scores ($F_{(1, 180)} = 26.34$, $p \leq .001$). Most important, results revealed a significant condition *x* trait EI interaction on both PA ($F_{(1, 183)} = 8.15$, $p \leq .01$) and NA change ($F_{(1, 179)} = 14.50$, $p \leq .001$) (see Figures 4a and 4b) indicating that high trait EI scores were associated with less mood deterioration (*i.e.,* less increase in NA and less decrease in PA) in the stress condition.

Detailed results at the factor level are reported in Tables 3 and 4. In brief, all four factors contributed in the global effect, although not in the same proportion. As far as the main effects are concerned, *sociability* had the largest effect, followed by well-being, self-control, and emotionality. These factors were also involved in interactions, indicating that their effects were stronger in the stress condition compared to the neutral one.

Gender differences

Gender-specific regression analyses revealed that while the main effect of condition remained significant across gender, the main and interaction effects of trait EI were significant only in the male group. Thus, for males, the semi-partial r was -.28 ($p < .001$) for the main effect of trait EI and .18 ($p < .005$) for the condition *x* trait EI interaction, whereas for females, the semi-partial r was -.11 ($p < .10$) for the main effect and .10 ($p < .15$) for the interaction effect.

FIGURE 1. Mood change as a function of condition and trait emotional intelligence.



Note. The three points on the X axis correspond respectively to the mean trait emotional intelligence (EI) score minus 1 standard deviation, the mean trait EI score, and the mean trait EI score plus 1 standard deviation. The significance levels of the main/interaction effects can be found in Table 2, while the significance levels of the intercepts and slopes can be found in Table 4. NA = Negative affectivity, PA = Positive affectivity.

General discussion

This series of studies supports the hypothesis that trait EI moderates the impact of laboratory-induced stress on mood change: higher trait EI scores were linked to significantly less mood deterioration. The discrepancies in predictive power between the four trait EI factors emphasise the multidimensional nature of the construct and the fact that the different dimensions may be differentially relevant in different contexts. It is, for instance, not surprising that sociability had the largest effect, given that stressors involved a strong social evaluation component (*e.g.,* the Trier Social Stress Test). It was thus expected that people who were more assertive and more confident in their ability to influence others emotions would feel less threatened by a task in which they had to make the best possible impression in front of a jury. Likewise, it is no surprise that the factor emotionality, which encompasses emotion expression and the propensity to initiate and maintain friendships, had the weakest effect here because the nature of the stressor prevented the sharing of emotions or reliance on social support. Notwithstanding the dissimilar weight of the four factors, it is noteworthy that the whole (*i.e.,* global trait EI score) was greater than the sum of its parts (*i.e.,* the factors) in that the slope of the global score in the stressful condition was steeper than the slope of the four factors taken separately.

With respect to gender differences, it was unexpected that the results remained fully significant only in the male group, since field studies on predominantly female samples have revealed strong moderating effects of trait EI on stress responses (*e.g.,* Mikolajczak *et al.,* 2006; Mikolajczak, Menil, and Luminet, 2007). We are, therefore, inclined to attribute this finding to the reduced sample size resulting from the splitting of the sample.

The relationship between trait EI and mood deterioration in response to stress provides some insights about the mediating mechanisms linking trait EI to mental health. As we summarized in the introduction, three pathways can potentially account for the relationship that has been consistently found between trait EI measures and mental health (see Schutte *et al.,* 2007 for a meta-analysis): a) response biases, b) neuroendocrine alterations and c) mood alterations. Note that these pathways are not mutually exclusive. Whereas preliminary support has already been found for the first two pathways, the present paper provides support for the third pathway. By showing that trait EI moderates mood deterioration in response to acute stressors such as those used in this paper, this series of studies complements three other studies showing that trait EI moderates the subjective stress experienced in response to a) intermediary stressors, such as an exam session (Mikolajczak *et al.,* 2006) and b) chronic stressors, such as those encountered in demanding occupations (Mikolajczak, Menil and Luminet 2007; Van Kan, 2004). Taken together, these studies show, one the one hand, that the effects of trait EI emerge not only in laboratory settings, but also in natural conditions and, on the other hand, that they are evident not only in the case of acute stressors, but also in the case of intermediary and chronic ones. It is thus likely that the recurring resilience evidenced by high EI people in response to life stressors protects them *vis-à-vis* burnout and mental disorders, whereas the recurring affective hyper-reactivity evidenced by low trait EI individuals makes them vulnerable to mood disorders.

The contribution of this study is twofold. First, it helps explain the relationship between trait EI and mental health. Second, it shows that trait EI is a particularly useful construct to capture individual differences in stress reactivity. The efficiency with which the TEIQue predicts stress resistance means that the inventory can be successfully integrated into selection and development programmes seeking to reduce the risk of burnout. Our results suggest that screening people on trait EI would more efficient than screening them on other personality constructs (*i.e.,* alexithymia, resilience and the big five factors of personality), because it provides a more comprehensive coverage of emotion-related variables than these other constructs. Note that this finding is congruent with a growing body of literature showing that trait EI does indeed predict a number of criteria better than the Giant Three, the Big Five, and other cognate constructs (*e.g.,* Chamorro-Premuzic, Bennett, and Furnham, 2007; Kluemper, 2008; Petrides, Frederickson, and Furnham, 2004; Saklofske *et al.,* 2003).

There are many ways in which this research can be extended. First, research is needed to understand the processes by which individuals with higher trait EI resist better to stress than their counterparts with lower trait EI. Research has already investigated self-efficacy and challenge/threat appraisals (*e.g.,* Mikolajczak and Luminet, 2008), coping (*e.g.,* Mikolajczak, Nelis, Hansenne, and Quoidbach, 2008; Petrides, Perez-Gonzalez, and Furnham*,* 2007), attention and memory amidst stress (*e.g.,* Mikolajczak, Roy, Verstrynge, and Luminet, in press), help seeking (Ciarrochi and Deane, 2001) but many other processes remain to be examined (*e.g.,* specificity of emotional information processing *etc.*). Second, it would be appropriate to consider the role of qualitatively different stressors (not only performance- but also loss-related stressors, such as bereavement or sentimental break up). Third, it would be useful to conduct long-term follow-ups. Indeed, participants in the present study were young and healthy, which permitted to avoid confounding the effects of trait EI and depression. However, future studies would greatly benefit from investigating how trait EI levels in early adulthood affect mental health over the life course. Is there a critical trait EI level under which the person is at especially high risk for breakdown? How does trait EI interact with the context? Are there any stressors that affect everyone equally, irrespective of their trait EI levels? A third research avenue concerns the part of criterion variance that was left unexplained by trait EI. In this case, baseline affect, condition, and trait EI explained, on average, 64% of the variance in negative affect. Thirty-six percent of the variance, therefore, remains uneaccounted for. What is the source of this variance? Measurement error? Situational factors? Other dispositional factors? Research that can address these questions is much needed.

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