

Predicting resistance to stress: Incremental validity of trait emotional intelligence over alexithymia and optimism

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As trait emotional intelligence [TEI] is claimed to facilitate adaptation, study 1 (N= 80) investigated whether TEI would be associated with adaptive outcomes such as enhanced self-reported mental and physical health. As these assumptions were supported, study 2 (N= 75) tested the hypothesis of a moderating effect of TEI on the relationship between stress and psychological and somatic health. Incremental validity of TEI over alexithymia and optimism was also examined. We chose academic exams as the stressor and took measures at the beginning of the year and during the examination period. Regression analyses predicting changes in mental/somatic health from baseline to follow-up revealed that TEI significantly moderated the relationship between examination stress and self-reported health. The fact that high EI people appraised the examination situation as less threatening partly explained this effect. Moreover, TEI predicted both mental and somatic symptoms amid stress over and above alexithymia and optimism.

Predecir la resistencia al estrés: validez incremental de la inteligencia emocional rasgo sobre la alexitimia y el optimismo. La Inteligencia Emocional Rasgo (IER) parece facilitar la adaptación, el estudio 1 (N= 80) investigó si la IER estaría asociada a resultados adaptativos como un incremento autoinformado de la salud mental y física. Ya que los resultados apoyaron esta premisa, el estudio 2 (N= 75) analizó la hipótesis de un efecto moderador de la IER en la relación entre el estrés y la salud psicológica y somática. Se examinó también la validez incremental de la IER sobre la alexitimia y el optimismo. Como estresor escogimos los exámenes académicos y realizamos las medidas al comienzo del curso académico y durante el período de exámenes. Los análisis de regresión predijeron cambios en la salud mental y somática entre la línea base y el seguimiento, revelando que la IER moderó significativamente la relación entre el estrés de los exámenes y la salud mental autoinformada. El hecho de que las personas con alta inteligencia emocional valorasen la situación del examen como menos amenazante explicó parcialmente este efecto. Más aún, la IER predijo los síntomas mentales y somáticos ante el estrés por encima de la alexitimia y el optimismo.

The ability to experience emotions is innate to every human being. However people differ in the way they are able to identify, express, utilize and regulate their feelings and those of others. The concept of «Emotional Intelligence» (EI) has been proposed to account for this variability.

Research devoted to emotional intelligence has grown immensely over the last years and has now split off into two distinct perspectives. Both perspectives share the idea that cognitive abilities are not the unique predictor of successful adaptation but that emotional competencies have to be taken into consideration. However, these perspectives markedly differ regarding their conceptualisation of such emotional competencies and their measurement. On the one hand, «ability» models (Mayer & Salovey, 1997; Brackett & Salovey, 2006) conceive EI

as an ability encompassing four dimensions: (a) emotions identification; (b) emotions utilization; (c) emotions understanding and (d) emotions regulation. In this «ability» perspective, EI is assessed via intelligence-like tests. On the other hand, «trait» models (Bar-On, 1997; 2006; Petrides & Furnham, 2003b) consider EI as a multifaceted construct encompassing thirteen to fifteen (depending on the model) emotion-related behavioural dispositions thought to affect the ways an individual would cope with demands and pressures. In this «trait» perspective, EI is evaluated via personality-like questionnaires. While ability tests capture *maximal* performance, personality tests aim to capture *typical* performance (see Petrides & Furnham, 2003a). The present research comes under the second perspective with the aim to assess the predictive and incremental validity of trait EI regarding psychological and somatic resistance to stress.

The study of people's responses to stressful situations and their consequences for adaptation has received a great deal of attention. Firstly, stress-related issues have generated a vast amount of scientific research to such an extent that «*the relationship between stress, coping processes and adaptational outcomes, such as*

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psychological and physical health has become a major concern in many psychological domains» (Matthews & Zeidner, 2002, p. 459). Secondly, stress has also become a major issue in real life-settings. For instance, companies have now to deal with the cost of employees' stress in terms of absenteeism, turnover and performance (Elangovan, 2001).

Given the importance of stress regulation for successful adaptation, it is not surprising to observe that stress management is central to any model of EI (Bar-On, 1997; Petrides & Furnham, 2003b; Salovey, Bedell, Detweiler, & Mayer, 1999). The EI model on which this research is based encompasses 15 subscales organized under 4 factors: well-being (generalized sense of well-being extending from past achievements to future expectations, accompanied by high self-esteem), self-control (ability to regulate one's impulses and emotions, as well as managing external pressures and stress), emotional skills (ability to identify and express feelings, and to use these faculties to maintain close relationships with significant others) and social skills (capacity to assert oneself as well as to influence others emotions and decisions) (Petrides & Furnham, 2003b). In this model, EI is assessed through the TEIQue (Trait Emotional Intelligence Questionnaire, Petrides and Furnham, 2003b).

Among these factors, «self-control» appears particularly relevant for our study as it specifically targets perceived abilities regarding emotion regulation and stress management. Since research has shown that perceived mood regulation abilities (measured on the Negative Mood Regulation Scale [Catanzaro & Mearns, 1990] or on the Repair subscale of the Trait Meta-Mood Scale [TMMS; Salovey et al., 1995]) are actually associated with the implementation of more efficient mood regulation strategies (e.g. more adaptive coping style, less threatening evaluations of the stressful situation [Salovey, Stroud, Woolery, & Epel, 2002], ability to initiate incongruent cognitive processes in negative situations in order to repair one's mood [Smith and Pety, 1995]), people high in perceived self-control are expected to show higher resistance to stress.

As the factor «well-being» is characterized by the propensity to experience positive emotions, it should also have a protective effect against stress. Indeed, according to Fredrickson's Broaden-and-Build theory (2001), the broadened mind-sets that accompany positive emotions result in enhanced durable personal resources (physical, social, intellectual and psychological), which are particularly useful in the context of prolonged stress. In addition, the occurrence of positive emotions amid adversity promotes various coping strategies that have been related to successful outcomes: positive reappraisal, problem focused-coping (Folkman & Moskowitz, 2000), humour, hopeful thinking and relaxation (Werner & Smith, 1992).

The «emotional skills» factor of EI is not expected to facilitate, as a whole, stress management. Indeed, among the four abilities it encompasses (emotion expression, emotion perception, empathy, relationship skills), only emotion perception has been found to be related to emotional regulation capacities (Barrett, Gross, Christensen, & Benvenuto, 2001).

Finally, «social skills» should affect stress resistance. As this factor involves the ability to assert oneself and influence others emotions and decisions, it is likely that it enhances self-confidence as well as control over one's environment, which are both known to influence stress resistance (Wallston, Wallston, Smith, & Dobbins, 1987).

Since most of its components are assumed to promote efficient coping, EI is expected to represent, as a whole, a protective factor against stress. Moreover, if high EI people cope better with stress than their lower counterparts, the former should experience, on average, less psychological distress and less somatic problems than the latter, since unregulated stress has been shown to affect living beings both mentally and physically (Lazarus & Folkman, 1984; Selye, 1974). There is some evidence that perceived EI (especially emotional repair) is associated with less self-reported physical and psychological symptoms (Extremera & Fernández-Berrocá, 2002). However, as these results were obtained through a short survey and in a very specific population (middle-aged women), our first study aimed at replicating these results using another EI questionnaire, a more detailed investigation of mental and somatic functioning, and in a younger population. Then our second study aimed at shedding light on the association between EI and self-reported health, under the hypothesis that it may be at least partly explained by a moderating impact of EI on resistance to stress.

Despite the theoretical and practical interest of this issue, only three studies have investigated the role of EI regarding stress management. Moreover, these studies had some shortcomings. Two were cross-sectional (Ciarrochi, Deane, & Anderson, 2002; Slaski & Cartwright, 2002) which precludes any causal interpretation. The third one relied on the TMMS which represents a no longer used model of emotional intelligence (Salovey et al., 2002). Besides the lack of sound investigations of this question, neither the incremental validity of EI over existing constructs, nor the psychological processes involved have been examined. The present studies aim to overcome these limitations.

Testing the incremental validity of trait EI is an important step for its validation. Indeed, the major claim addressed to trait models of emotional intelligence was their redundancy with established personality trait taxonomies (Matthews, Zeidner, & Roberts, 2002). The TEIQue model has demonstrated correct discriminant validity in relation to personality by being independently located in both Eyeckian and Five Factor¹ space (Petrides, 2001, 2004). Moreover, Furnham and Petrides (2003) and Petrides, Pérez and Furnham (under review) have now demonstrated the incremental validity of trait EI to predict outcomes such as dysfunctional attitudes, adaptive/maladaptive coping, and several mental disorders, beyond the five-factor model (Costa & McCrae, 1992). So, as far as the TEIQue is concerned, empirical findings have failed to support Matthews et al.'s claim. However, it is still conceivable that trait EI does not bring any additional information over existing personality traits relating specifically to emotional competences. Alexithymia and optimism represent such alternatives. Alexithymia refers to (a) a difficulty identifying feelings; (b) a difficulty describing feelings to others; (c) a restricted imagination and (d) an externally oriented cognitive style (Taylor & Bagby, 2000). Those features are thought to reflect deficits in the cognitive processing and regulation of emotions (Taylor & Bagby, 2000, 2004; Taylor, Bagby, & Parker, 1997). Optimism is defined as a generalized tendency to believe that one will generally experience good instead of bad outcomes in life (Scheier & Carver, 1985). Empirical studies have suggested that low alexithymia and high optimism were associated with enhanced resistance to stress, as well as to better mental and physical health indicators (e.g., Chang, 1998; Mikolajczak & Luminet, 2003; Mikolajczak, Luminet, & Leroy, 2004). The issue of the

incremental validity of EI over these well-established constructs appears worthy of examination, specifically as high correlations have been found between EI and these constructs (Parker, Taylor, & Bagby, 2001; see also Appendix B).

Regarding the coping processes involved in the purported enhanced stress resistance associated with EI, they are certainly manifold. The present research focuses on cognitive appraisals (i.e., how an individual perceives a given situation). Lazarus and Folkman (1984) as well as Gross and John (2002) have shown that it is not the stimuli/situation *per se* but rather the cognitive evaluation of this stimuli and of one's available resources to cope with it that is responsible for the emotion generated. Challenge and threat appraisals have received a great deal of attention in the literature as mediators having contrasting psychological and physiological correlates (Tomaka, Blascovitch, Kibler, & Ernst, 1997). While threatened individuals essentially focus on the possibility for loss related to the situation, challenged individuals concentrate also on the potential gains. Threat appraisals decrease psychological and physical resistance to stress whereas challenge appraisals have the opposite effect (Tomaka, Blascovich, Kelsey, & Leitten, 1993). In addition to challenge/threat appraisals, perceived self-efficacy will also be examined. Self-efficacy refers to an individual's belief in his/her ability to organize and execute the required course of action to achieve a desired result (Bandura, 1997). It was found to mediate the impact of potentially stressful situations on physiological and psychological responses (Bandura et al., 1985; Gerin, Litt, Delch, & Pickering, 1995).

Overview

Study 1 investigates through a cross-sectional design whether EI—as assessed through the TEIQue—is associated with positive outcomes such as better mental or physical health. Adopting a prospective perspective, study 2 examines (a) the extent to which EI moderates the effect of stress on psychological and somatic symptoms (b) the mediating role played by appraisals in this process, and (c) the incremental validity of EI over and above alexithymia and optimism.

Study 1

Method

Participants and procedure

Eighty undergraduates participated in the study. Ninety-two percent were females (Mean age: 22.5, SD= 5.02). Participants filled in three questionnaires assessing emotional intelligence, as well as mental and physical health.

Measures

- *Emotional intelligence* was assessed using the short version of the «Trait Emotional Intelligence questionnaire» (TEIQue-SF: Petrides and Furnham, 2001; French adaptation by Mikolajczak and Luminet). This version comprises 30 items rated on a 7-point scale.
- *Mental health* was evaluated via the Brief Symptom Inventory (BSI, Derogatis and Melisaratos, 1983; French adaptation by Dreyfus and Guelfi). The BSI encompasses

nine dimensions: anxiety, depression, somatization, obsessive-compulsive disorder, phobias, hostility, vulnerability, paranoia and psychotic symptoms. Items are rated on a 5-point scale.

- *Physical health* was assessed through the PILL (Physical Inventory of Limbic Languidness; Pennebaker, 1982) which is a list of 53 physical symptoms and bodily sensations. Participants are required to rate items on a 5-point scale (*never or nearly never / 3 or 4 times a year / about every month / about every week / more than once a week*).

Results

Means, standard deviations and Cronbach's alphas for the variables are shown in table 1.

- *Emotional intelligence and mental health.* As expected, EI was found to be highly and negatively correlated with total mental disorders ($r = -0.76, p 0.001$). At the subscale level, correlations were high with vulnerability, paranoid or psychotic symptoms, and anxiety (-0.63 *rs* $-0.73, ps 0.0001$) and moderate with depression, phobias and obsessive compulsive disorders (-0.45 *rs* $-.54, ps 0.0001$). Somewhat lower negative correlations were observed between EI and somatization and hostility ($r = -0.37$ and -0.35 , respectively, *ps* 0.001).
- *Emotional intelligence and physical health.* EI was highly related to the total of self-reported physical symptoms ($r = -0.46, p 0.001$).

Discussion

In line with theoretical considerations according to which emotional intelligence should facilitate adjustment, EI explained a large amount of variance in mental disorders (anxiety, depression, and so forth). The fact that EI explained a larger part of variance in psychological disorders than in somatization suggests that somatic symptoms have other causes beside unregulated affects, or that the link between EI and somatic symptoms is less direct than the link between EI and psychological symptoms. Regarding the magnitude of the correlation between EI and hostility, it suggests that although high EI people appear globally less hostile than their counterparts, being emotionally intelligent does not

| | Means | SD | Alphas |
|---------------------------------|-------|-------|--------|
| Emotional intelligence (TEIQue) | 148.2 | 22.26 | 0.88 |
| Mental health (BSI) | 85.37 | 26.64 | 0.95 |
| Anxiety | 10.87 | 4.69 | 0.84 |
| Depression | 9.37 | 3.87 | 0.82 |
| Somatization | 9.13 | 3.46 | 0.75 |
| Obsessive-Compulsive Disorder | 10.77 | 4.14 | 0.75 |
| Phobias | 6.91 | 2.77 | 0.65 |
| Hostility | 8.37 | 3.09 | 0.74 |
| Vulnerability | 7.24 | 3.50 | 0.83 |
| Paranoiac symptoms | 8.36 | 3.50 | 0.73 |
| Psychotic symptoms | 6.67 | 2.54 | 0.72 |
| Physical health (PILL) | 110.4 | 20.96 | 0.90 |

mean being always nice (which is a common stereotype). In addition to predicting enhanced mental health, EI was also found to predict better self-reported physical health. As trait EI is assumed to facilitate adaptation to demands and pressures, one logical explanation for this finding would be that high EI people handle stress better than their lower peers, thus experiencing less chronic/residual stress. Consequently their corticotrophin axis would be less activated, thus leading to fewer symptoms/diseases (Corcos & Speranza, 2003). The hypothesis according to which emotional intelligence moderates the effects of stress on self-reported psychological and somatic functioning will be examined in study 2.

Though noteworthy, these findings have several limitations. First, results are based on a cross-sectional design, which precludes any interpretation in terms of causality. Secondly, the present design prevents any conclusion about the processes at stake. Finally, the use of the short version of the TEIQue makes it difficult to know which factor(s) or subscale(s) accounts for the findings. Study 2 was designed to overcome these limitations.

Study 2

The first aim of study 2 was to clarify the relationship between EI and mental/physical health. Drawing on a prospective design, this study examines the hypothesis that EI moderates the effects of stress, thus reducing psychological and somatic symptoms. The second aim of study 2 was to shed some light on the processes explaining the assumed protective role of EI regarding stress consequences: Does EI influence cognitive appraisals? Finally, the third aim of the study was to assess the incremental validity of EI over and above alexithymia and optimism.

Method

Participants and procedure

One hundred freshmen psychology students participated in this study. Eighty-five percent were females (Mean age: 18.36, SD= 2.47). Questionnaires completed at baseline (no stress) assessed emotional intelligence, alexithymia, optimism, mental health, physical health, and perceived self-efficacy to pass exams. Questionnaires completed at follow-up (3 months later, during the exams) evaluated mental and somatic resistance to stress, as well as cognitive appraisals. The decision to choose the exam period as the stressor was taken as it is the most relevant stimulus for the category of people under consideration (Kohn & Frazer, 1986).

Measures

Measures at baseline

- *Trait Emotional Intelligence* was measured using the Trait Emotional Intelligence Questionnaire - Long form (TEIQue-LF; Petrides & Furnham, 2001; French adaptation by Mikolajczak, Luminet, Leroy & Roy, in press). The TEIQue-LF consists of 153 items measured along 7-point scales. It encompasses four factors: well-being, self-control, emotional skills and social skills [See Appendix A for a detailed description of subscales].

- *Alexithymia* was assessed using the French version of the Toronto Alexithymia Scale, TAS-20 (Bagby, Taylor, & Parker, 1994; French adaptation: Loas et al., 1996). This questionnaire consists of 20 items (rated on 5-point scales) targeting the core dimensions of the construct: difficulty identifying feelings, difficulty describing feelings and externally oriented thinking.
- *Optimism* was measured through the Life Orientation Test - Revised (LOT-R, Scheier & Carver, 1985). The LOT-R comprises six items and four fillers, measured along a 5-point scale.
- *Subjective health* was assessed via the SMU-HQ which is a 63 symptoms and diseases checklist (Watson and Pennebaker, 1989). The original dichotomous scale (yes/no, according to whether the person has experienced the symptom during the last twelve months) was replaced by a 6-point scale for symptoms assessment (*never or nearly never / 3 or 4 times a year / about 6 times a year / about every month / about every week / more than once a week*) in order to maximize the inter-individual variability. For the diseases checklist, the dichotomous scale was kept. However, the diseases subscale was not considered in the analyses due to its very low variance (probably caused by the young age of the sample).

| Appendix A - Table A Factorial and subscale structure of the TEIQue (Petrides and Furnham, 2003b) | |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Factors & facets | High scorers perceive themselves as... |
| Well being | |
| Self-esteem | ... successful and self-confident |
| Trait happiness | ... cheerful and satisfied with their lives |
| Trait optimism | ... confident and likely to «look on the bright side» of life |
| Self-control | |
| Emotion regulation | ... capable of controlling their emotions |
| Stress management | ... capable of withstanding pressure and regulating stress |
| Impulsiveness (low) | ... reflective and less likely to give in to their urges |
| Emotionally | |
| Emotion perception self and others) | ... clear about their own and other people's feeling |
| Emotion expression | ... capable of communicating their feelings to others |
| Relationship skills | ... capable of having fulfilling personal relationships |
| Empathy | ... capable of taking someone else's perspective |
| Sociability | |
| Social competence | ... accomplished networkers with excellent social skills |
| Emotion management (others) | ... capable of influencing other people's feelings |
| Assertiveness | ... forthright, frank and willing to stand up for their rights |
| The following subscales do not belong to any particular factor and are directly included in the total score | |
| Adaptability | ... flexible and willing to adapt to new conditions |
| Self-motivation | ... driven and unlikely to give up in the face of adversity |

- *Mental health* was evaluated using the BSI (described in study 1).
- *Perceived self-efficacy to pass exams* was measured via the SEPUE (Self-Efficacy to Pass University Exams Questionnaire; created for the purpose of the present study). This 27-item questionnaire targets self-efficacy regarding the aptitudes required to succeed at the university. As it is usually the case with self-efficacy measures, respondents rated their self-efficacy on an 11-point scale comprising every ten percent from 0% («I feel completely unable») to 100% («I feel totally able»).

Measures at follow-up

- *Mental disorders amid stress* were assessed through the BSI (described in study 1).
- *Somatic symptoms amid stress* were evaluated through the PILL (described in study 1). The response format was adapted to the duration of the exams' period: *Over the last month, how often did you experience the following symptoms? Never – 1 or 2 times – about once a week – several times a week – every day.*
- *The appraisal of the situation* was measured using the ECTA (Exams Challenge and Threat Appraisal; created for the purpose of the present study). The ECTA comprises 8 items assessed on a 5-point scale. It encompasses two orthogonal factors: challenge and threat. The full questionnaire is available from the first author on request.

Results and discussion

Descriptive analyses

Means, standard deviations and Cronbach's alphas for all variables are reported in table 2. Except for 'externally oriented thinking' ($\alpha = .46$), internal consistencies were strong, with Cronbach's alphas ranging from 0.76 to 0.96, with a mean of 0.86.

Replication of the results of Study 1

The results of study 1 were fully replicated, with emotional intelligence explaining a significant amount of variance of both mental and physical symptoms (see table 3, first two columns). Factorial scores bring some additional information about the respective contribution of each factor. However, these values should be interpreted with caution since these correlations are cross-sectional.

Predicting mental and somatic resistance to stress

In order to test whether emotional intelligence would moderate the effect of examination stress on psychological and somatic symptoms, it must first be demonstrated that the exam situation had the expected stressful effect. Results suggest that it was clearly the case: both mental symptoms ($t = 5.6, p < 0.001$) and somatic symptoms ($t = 3.6, p < 0.001$) increased from baseline to follow-up. It is noteworthy that since the symptom checklist used at time 2 (PILL) differed from the one used at time 1 (SMU-HQ), comparison was based on the 12 symptoms which were common to both checklists. However, the response format was also slightly

different, spread over one year in the case of the SMU-HQ and over one month in the case of the PILL. For instance, a student who suffers from stomach ache about once a week will answer 5 on the SMU-HQ but will answer 3 on the PILL. As a result, if participants experienced no more symptoms during the exam period than at baseline, then, the mean at the PILL (exams) should be inferior to the mean at the SMU-HQ (baseline). Yet, the sample mean at the PILL was significantly superior to the mean at the

Table 2
Means, standard deviations and Cronbach's alphas of the variables examined in Study 2

| | Means | SD | Alphas |
|---------------------------------------------------|--------|-------|--------|
| Emotional intelligence (TEIQue): | 18.23 | 2.31 | 0.94 |
| Well-being | 4.86 | 0.93 | 0.91 |
| Self-control | 3.99 | 0.76 | 0.85 |
| Emotional skills | 4.85 | 0.59 | 0.81 |
| Social skills | 4.50 | 0.77 | 0.87 |
| Alexithymia (TAS-20) | 48.20 | 11.00 | 0.81 |
| F1: Difficulty identifying feelings | 17.50 | 6.09 | 0.82 |
| F2: Difficulty describing feelings | 14.13 | 4.56 | 0.76 |
| F3: Externally oriented thinking | 16.84 | 3.96 | 0.46 |
| Optimism (LOT-R) | 19.84 | 4.81 | 0.82 |
| Mental health (BSI) | 90.21 | 29.30 | 0.96 |
| Physical health (SMU-HQ) | 67.50 | 9.14 | 0.78 |
| Perceived self-efficacy to pass the exams (SEPUE) | 188.45 | 36.19 | 0.94 |
| Mental resistance to stress (BSI) | 105.89 | 33.90 | 0.96 |
| Somatic resistance to stress (PILL) | 110.72 | 29.93 | 0.93 |
| Appraisals (ECTA) Challenge | 18.46 | 4.57 | 0.88 |
| Threat | 12.52 | 4.33 | 0.83 |

Table 3
Pearson correlations between emotional intelligence, alexithymia and optimism measured at baseline and (1) Mental and somatic health at baseline and (2) Mental and somatic disorders at follow-up (i.e., Amid Stress)

| | Mental health ^a at baseline | Physical health ^a at baseline | Mental disorders amid stress | Somatic symptoms amid stress |
|-------------|----------------------------------------|------------------------------------------|------------------------------|------------------------------|
| EI: total | 0.67*** | 0.58*** | -0.51*** | -0.40*** |
| WB | 0.71*** | 0.50*** | -0.44*** | -0.19 [†] |
| SC | 0.52*** | 0.40*** | -0.59*** | -0.38*** |
| ES | 0.27* | 0.23* | -0.18 | -0.18 |
| SS | 0.49*** | 0.42*** | -0.38*** | -0.35** |
| Alex: total | -0.38*** | -0.29** | 0.23 [†] | 0.20 [†] |
| DIF | -0.65*** | -0.52*** | 0.36** | 0.27* |
| DDF | -0.17 | -0.21 [†] | 0.17 | 0.13 |
| EOT | 0.01 | 0.02 | -0.03 | -0.03 |
| OPT | 0.55*** | 0.36*** | -0.32** | -0.19 |

Note: DIF= difficulty identifying feelings; DDF= difficulty describing feelings; EOT= externally oriented thinking; OPT= optimism; WB= well-being; SC= Self-control; ES= emotional skills; SS= Social skills.

^a Mental and physical health were measured respectively via the BSI and the SMU-HQ. Since both measure symptoms/disorders, signs of correlations have been reversed in those columns.

*** $p < .001$; ** $p < .01$; * $p < .05$; [†] $p < .10$ (marginally significant)

SMU-HQ, thus clearly indicating that the students experienced more somatic symptoms or that they experience symptoms more frequently during the exam period.

The influence of emotional intelligence, alexithymia and optimism measured at baseline on psychological and physical symptoms measured under stress was examined through Pearson correlations (see table 3).

As expected, *psychological* symptoms amid stress were significantly predicted by emotional intelligence, optimism and difficulty identifying feelings. Among emotional intelligence factors, three were significant: well-being, self-control and social skills. As far as *somatic* symptoms amid stress are concerned, they were significantly predicted by the total score of emotional intelligence and by the difficulty in identifying one's feelings. Among emotional intelligence factors, only self-control and social skills were significant.

Predicting changes in mental and physical status

As all significant predictors of mental or physical symptoms *amid stress* are also significantly associated with mental and physical health status *at baseline*, it is important to examine whether they can predict *changes* in mental and physical status. Considering the problems inherent in the use of change scores (see Bereiter, 1963), the association between predictors and change in mental and physical status was examined using hierarchical regressions, holding constant the prior level of the variable being assessed. In the present case, analyses checked whether predictors would remain significant after that mental and physical status at baseline had been controlled for.

In order to avoid collinearity (i.e. between factorial and total scores) or model overload, 20 hierarchical regressions were performed (10 predictors \times 2 dependent variables: psychological and somatic symptoms amid stress), entering baseline psychological or physical status first, followed by the potential predictor.

Regarding *psychological* symptoms amid stress, only self-control was found to be significant over and above mental health status at baseline ($\beta = -0.27$, *F Change* [1,65]= 5.95, $p = 0.018$). Regarding *somatic* symptoms amid stress, both self-control and social skills predicted substantial variance over and above physical health status at baseline (for self-control: $\beta = -0.27$, *F Change* [1,65]= 5.5, $p = 0.022$; for social skills: $\beta = -0.24$, *F Change* [1,63]= 4.3, respectively, $p = 0.043$).

Incremental validity of the TEIQue over proximate constructs

Pearson correlations between EI, alexithymia and optimism are given in Appendix B. The issue of the incremental validity of EI over and above optimism and alexithymia was tested using hierarchical regressions, entering optimism and the three factors constituting alexithymia as the first block of predictors and the four factors constituting emotional intelligence as the second block.

As shown in table 4, both well-being and self-control predicted *psychological* symptoms amid stress, over optimism and alexithymia. On the other hand, only self-control predicted *somatic* symptoms amid stress over and above optimism and alexithymia.

Two conclusions may be drawn from all afore-mentioned analyses: firstly EI seems to moderate psychological and somatic

Appendix B - Table B
Pearson correlations between emotional intelligence, optimism and alexithymia

| | Optimism | Total score of alexithymia | F1: Difficulty identifying feelings | F2: Difficulty describing feelings | F3: Externally oriented thinking |
|---------------------------|----------|----------------------------|-------------------------------------|------------------------------------|----------------------------------|
| Total score of the TEIQue | 0.68*** | -0.55*** | -0.58*** | -0.43*** | -0.20 [†] |
| F1: Well-being | 0.81*** | -0.42*** | -0.47*** | -0.32** | -0.12 |
| F2: Self-control | 0.48*** | -0.24* | -0.41*** | -0.02 | -0.05 |
| F3: Emotional Skills | 0.36*** | -0.64*** | -0.51*** | -0.65*** | -0.31** |
| F4: Social skills | 0.36*** | -0.39*** | -0.35*** | -0.39*** | -0.18 [†] |

*** $p < .001$; ** $p < .01$; * $p < .05$; [†] $p < .10$ (marginally significant)

Table 4
Hierarchical regression analyses for variables predicting psychological and somatic symptoms amid stress

| Predicted variable | Predictor | B | SE B | β |
|------------------------------------|-----------|--------|------|-------------------|
| Psychological symptoms amid stress | Step1 | | | |
| | DIF | 1.39 | 0.75 | 0.26 [†] |
| | DDF | 0.03 | 0.93 | 0.05 |
| | EOT | -0.63 | 0.96 | -0.08 |
| | OPT | -2.24 | 0.88 | -32* |
| | Step 2 | | | |
| | DIF | -0.04 | 0.83 | -0.01 |
| | DDF | 1.20 | 1.06 | 0.18 |
| | EOT | -0.56 | 0.93 | -0.07 |
| | OPT | 1.12 | 1.33 | 0.16 |
| | WB | -16.46 | 8.05 | -0.42* |
| | SC | -19.89 | 7.11 | -0.44** |
| | ES | 8.15 | 8.08 | 0.16 |
| | SS | 0.69 | 6.13 | 0.02 |
| Somatic symptoms amid stress | Step1 | | | |
| | DIF | 1.32 | 0.77 | 0.25 [†] |
| | DDF | -0.11 | 0.95 | -0.02 |
| | EOT | -0.80 | 0.98 | -0.11 |
| | OPT | -0.94 | 0.89 | -0.14 |
| | Step 2 | | | |
| | DIF | 0.46 | 0.88 | 0.09 |
| | DDF | 0.19 | 1.17 | 0.03 |
| | EOT | -0.77 | 0.96 | -0.10 |
| | OPT | 0.34 | 1.41 | 0.05 |
| | WB | 1.81 | 8.03 | 0.05 |
| | SC | -14.93 | 7.21 | -0.35* |
| | ES | 2.39 | 8.74 | 0.05 |
| | SS | -9.82 | 6.09 | -0.24 |

Note: DIF= difficulty identifying feelings; DDF= difficulty describing feelings; EOT= externally oriented thinking; OPT= optimism; WB= well-being; SC= Self-control; ES= emotional skills; SS= Social skills.

Predicting psychological symptoms amid stress, $R^2 = .21$ ($p < .01$) for step 1; $R^2 = .16$ for step 2 ($p < .05$). Predicting somatic symptoms amid stress, $R^2 = .10$ for step 1 (NS); $R^2 = 0.12$ for step 2 ($p < .10$).

** $p < 0.01$. * $p < .05$. [†] $p < 0.10$ (marginally significant).

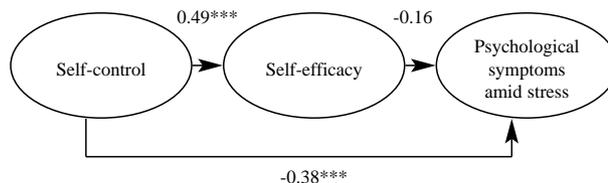
responses to stress. This may be one of the pathways by which EI promotes better mental and physical health. Secondly, the factor «self-control» appears to be the most stable predictor of stress resistance. In order to understand the processes through which self-control moderates the effects of stress on psychological and somatic symptoms, cognitive appraisals will be examined next.

Accounting for the influence of self-control on mental/somatic symptoms amid stress

Results revealed that self-control significantly affected appraisals. At baseline, higher scorers showed higher anticipative self-efficacy to pass their exams than lower scorers ($r = 0.49, p < 0.001$). This is particularly interesting since this finding cannot be explained by the fact that high emotionally intelligent students would have higher IQ, thus making them more confident. Indeed, Leroy (2004) has shown that emotional intelligence shared no variance with general intelligence. At follow-up, results were in the same direction: People higher in self-control appraised the situation as less threatening ($r = 0.43, p < 0.001$; it is worth mentioning that this correlation remained significant when mental health at time 1 was partialled out, indicating that self-control explained a substantial part of the variance in the evaluation of the situation three months later, over and above mental health). However, contrary to our hypothesis, participants high in self-control did not appraise the situation as more challenging ($r = 0.19, ns$).

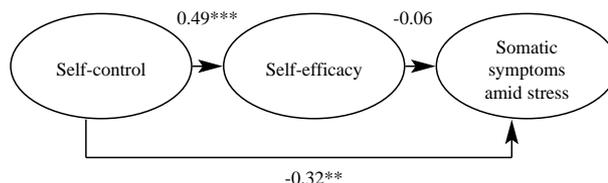
The association between self-control and (1) self-efficacy and (2) threat appraisals is remarkable since appraisals affect subsequent resistance to stress. Self-efficacy measured at baseline is negatively associated with psychological and somatic symptoms three months later (r s are respectively $-0.42, p < 0.001$ and $-0.22, p < 0.10$). Threat appraisal during the exams period is positively associated with both psychological and somatic symptoms at that time (r s are respectively 0.70 and $0.50, ps < 0.001$). Mediation analyses have thus been performed in order to check whether the influence of self-control on psychological and somatic resistance to stress was mediated by self-efficacy and/or threat appraisals. According to Baron and Kenny (1986), mediation is said to occur when (1) the independent variable (IV) significantly influences the mediator, (2) the IV significantly influences the dependent variable (DV) in the absence of the mediator, (3) the mediator has a unique effect on the DV and (4) the effect of the IV on the DV shrinks upon the addition of the mediator to the model. Full mediation is said to occur when this latter effect drops to zero, partial mediation is said to occur when this effect diminishes but remains significant. In case of partial mediation, a Sobel test (1982) has to be performed to ensure that the indirect effect of the IV on the DV via the mediator is significantly different from zero (Preacher & Leonardelli, 2003).

Mediation analyses suggested that anticipative self-efficacy did not significantly mediate the relationship between self-control and mental or somatic symptoms amid stress (see fig. 1 and 2). On the other hand, as shown on Figures 3 and 4, threat appraisal was found to mediate partially the effect of self-control on both psychological symptoms (Sobel test = $-2.76, p = 0.005$) and somatic symptoms amid stress (Sobel test = $-2.17, p = 0.03$). The divergent findings observed for self-efficacy and threat appraisals are likely to be due to the fact that self-efficacy, measured at baseline, might have altered as students became more familiar



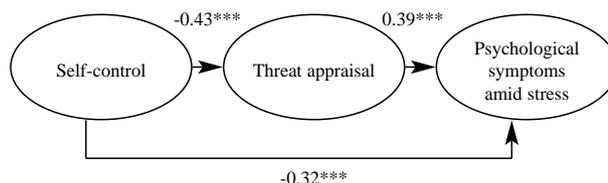
*** $p < .001$; ** $p < .01$; * $p < .05$

Figure 1. Mediating role of self-efficacy in predicting psychological symptoms amid stress



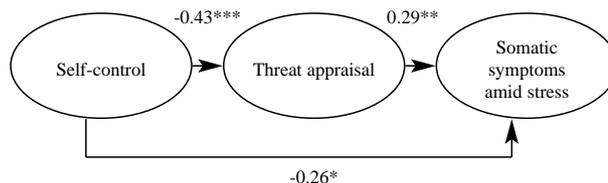
*** $p < .001$; ** $p < .01$; * $p < .05$

Figure 2. Mediating role of self-efficacy in predicting somatic symptoms amid stress



*** $p < .001$; ** $p < .01$; * $p < .05$

Figure 3. Mediating role of threat appraisal in predicting psychological symptoms amid stress



*** $p < .001$; ** $p < .01$; * $p < .05$

Figure 4. Mediating role of threat appraisal in predicting somatic symptoms amid stress

with the university system. Changes in self-efficacy with time might explain why it was less linked than threat appraisals with symptoms under stress. As Hoyle and Kenny (1999) showed that the power of mediation tests is greater when the link between the mediator and the DV is larger than the link between the IV and the mediator, this probably explains our results.

General discussion

The present studies provide some insight into possible connections between emotional intelligence and successful adaptation. In Study 1, we examined the extent to which trait emotional intelligence, defined as a set of competencies influencing the ways in which individuals cope with demands and

pressures (Bar-On, 1997), would be associated with adaptative outcomes such as better mental or self-reported physical health. As emotional intelligence was found to explain a large amount of variance in both mental and physical health, study 2 was designed to assess whether emotional intelligence would moderate the effect of stress on psychological and somatic symptoms. Up to now, little attention has been devoted to examining the relationship between emotional intelligence and stress management. As mentioned earlier, only three studies addressed this question (Ciarrochi et al., Salovey et al., 2002; Slaski & Cartwright, 2002), with the limits that we have already pointed out. The present study extends prior work in several ways. First, it is based on a *prospective* design; secondly, it examines a *real life stressor*, thirdly it throws some light on the *processes* at stake in the association between emotional intelligence and resistance to stress; lastly, it tests the *incremental validity* of emotional intelligence over proximate constructs that represent known predictors of stress resistance.

Emotional intelligence was found to be a significant predictor of both psychological and somatic symptoms amid stress, over and above optimism and alexithymia. These findings suggest that EI represents an additional factor that is worthy of consideration in the study of the relationships between personality and health.

It should be noted that the predictive power of emotional intelligence regarding stress appeared to be mostly due to the contribution of its factor «self-control». First, self-control explained the largest part of variance of both psychological and somatic symptoms amid stress. Then, it was the only predictor to account for a significant part of the variance of these symptoms under stress beyond mental and physical health status at baseline. Lastly, it was the only predictor that remained significant when the influence of all others was partialled out. These findings are consistent with the theoretical structure of the TEIQue as the factor «self-control» aims exactly to capture stress management and emotional regulation aptitudes. These results also support the content validity of such self-reported measures of self-control: People who perceive themselves as being able to manage stress do report less psychological and somatic symptoms amid stressful situations.

Concerning the three other factors, results are more contrasted. (1) The factor «well being» was found to be negatively associated with psychological and somatic symptoms at both baseline and follow-up, which is consistent with Fredrickson's Broaden-and-Build theory predicting that positive emotions result in long-lasting enhanced psychological and physical resources (2002). Yet, contrary to our hypotheses, well-being did not predict *changes* in mental and physical health status under stress. People high in well-being gained as many symptoms as their lower counterparts during exams. These results suggest that people high in well-being might be *proportionally* as much affected by stress than their lower counterparts, meaning that they are perhaps not able to enlist positive emotions *amid* adversity in order to benefit from their positive effects on successful coping. (2) Next, the factor «emotional skills» was not related to stress responses. This absence of effect was expected, except for the subscale emotion perception. However, factor analyses suggested that this subscale encompasses two factors: emotion perception in the self and emotion perception in others. As only the former was found to influence stress responses, it sounds logical that its influence on the global relationship between emotional skills and stress

responses was weak. (3) Finally, results concerning the factor «social skills» were mitigated. On the one hand, social skills were found to be negatively linked to psychological and somatic symptoms, at both baseline and follow-up. On the other hand, whereas this factor predicted change in *somatic* symptoms from baseline to follow-up, it did not predict changes in *psychological* symptoms. This result was mostly due to the contribution of the «assertiveness» subscale. Indeed, the «social competence» subscale did not predict change, either in mental or physical status. The «managing others' emotions» subscale predicted change in both mental and physical status which is not surprising as the ability to manage others' emotions increases perceived control over one's environment, which has demonstrated a functional effect on both mental and physical health (Bruchon-Schweitzer, 2002). Finally, the subscale «assertiveness» predicted change in physical status but not in mental status. The fact that only 1 out of 3 subscales predicted change in mental health status but that 2 out of 3 subscales predicted change in physical status explained why the factor «Social skills» predicted change only in physical status. It should be noted that the finding according to which more assertive participants gained less somatic symptoms under stress is fully consistent with the literature about type-C personality, showing that the lack of assertiveness in adverse situations is damaging with regard to health (Greer, Morris, Pettingale, & Haybittle, 1990; Watson et al., 1999).

Research has shown that examining cognitive appraisals enlarges the understanding of how a particular personality trait influences the coping process. Such appraisals were thus considered in relationship to self-control. Consistent with Lazarus and Folkman's theory (1984), appraisals were found to mediate the influence of self-control on stress responses. However, whereas self-control reduced *threat* appraisal, it did not promote *challenge* appraisals. This latter finding was somewhat unexpected given that prior studies found self-control to be associated with a general tendency to experience positive emotions (Leroy, 2004; Verstrynge, 2004), which should, according to Fredrickson's Broaden-and-Built theory (2001), promote positive appraisals. Albeit unexpected, these results seem, however, consistent with the literature. For instance, Tugade and Fredrickson (2004) found higher resilient individuals less threatened by a speech task but not more challenged. In the same vein, Salovey et al. (2002) found higher scores on a « mood repair » scale less threatened by various laboratory stressors but not more challenged.

Limitations and future directions

Albeit suggestive, results of the present studies should be considered in light of several limitations. Their first limitation is clearly their reliance on self-report measures. On the one hand it raises the problem of shared method covariance. This is particularly relevant for study 1, in which all measures were cross-sectional. We overcame that limitation in study 2 by analysing *changes* in self-report. On the other hand, self-reports may not seem the most appropriate way to measure *somatic* resistance to stress and it goes without saying that our results should be replicated using physiological or neuroendocrine indexes. Nevertheless, although self-reports are subject to biases, research has suggested that they are not less valid than some so-called «objective» data like hospital records. Indeed, as reported by

Matthews, Yousfi, Schmidt-Rathjens and Amelang (2003), health self-ratings have been shown to be good predictors of mortality over a 23-year interval (Heistaro et al., 2001) and predicted functional disability better than medical records over a 15-year period (Ferraro & Su, 2000).

The second limitation of these studies is that causality links cannot be definitely established, in spite of the prospective design of study 2. Indeed, for ethical reasons, emotional intelligence was not measured during exams (administration time was too long). So, although emotional intelligence predicted changes in mental and physical health from baseline to follow-up, we still cannot reject the hypothesis according to which mental health at baseline would have predicted changes in emotional intelligence from baseline to follow-up. This explanation is, however, quite unlikely since the TEIQue has been found to be fairly stable over a one year period (test-retest coefficient over one-year period is 0.78 for the whole scale, 0.74 for the factor «self-control»; Petrides & Furnham, 2003b), whereas the BSI is sensitive to mood variations (test-retest coefficient is 0.64 over a three-month period). Finally, the third limitation of this study resides in the small sample size and in its composition: all participants were students and most of them were females, which raises the possibility that results would not extend to other populations.

Further research should examine to what extent results hold when other kinds of stressors are examined (acute vs chronic, performance vs socio-relational, etc.). Indeed, the possibility exists that predictors would be different according to the category of stressors under consideration. Future investigations would also benefit from using experimental designs to manipulate situation's appraisals or psychological resources that can be allocated to regulation processes. Finally, incremental validity of trait emotional intelligence over other personality traits (ex. locus of control) or proximate constructs (ex. resilience, ability emotional intelligence) should be examined more extensively.

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Note

¹ Costa and McCrae, 1992.

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