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## **Emotional Plasticity: Conditions and Effects of Improving Emotional Competence in Adulthood**

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# Emotional Plasticity: Conditions and Effects of Improving Emotional Competence in Adulthood

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This study aimed to investigate (a) whether it is possible to increase emotional competence (EC) in adulthood; (b) whether this improvement results in better mental, physical, and social adjustment; (c) whether this improvement can be maintained 1 year later; and (d) whether these benefits are accompanied by a reduction in stress-hormone secretion (i.e., cortisol). One hundred and thirty-two participants were randomly assigned to an EC-enhancing intervention (in group format) or to a control group. Participants in the intervention group underwent a specifically designed 15-hr intervention targeting the 5 core emotional competencies, complemented with a 4-week e-mail follow-up. Results reveal that the level of emotional competencies increased significantly in the intervention group in contrast with the control group. This increase resulted in lower cortisol secretion, enhanced subjective and physical well-being, as well as improved quality of social and marital relationships in the intervention group. No significant change occurred in the control group. Peer reports on EC and quality of relationships confirmed these results. These data suggest that emotional competencies can be improved, with effective benefits on personal and interpersonal functioning lasting for at least 1 year. The theoretical implications of these results as well as their practical implications for the construction and the development of effective emotional competencies interventions are discussed.

*Keywords:* emotional competence, emotional intelligence, training, health, social relationships

Emotional competence (EC) refers to the capacity to identify, understand, express, manage, and use one's own feelings and those of others (Mayer & Salovey, 1997; Petrides & Furnham, 2003; Saarni, 1990). The field of EC is gaining interest, as a growing number of studies suggest that EC is an important factor explaining unique variance in individuals' adaptation and well-being (Gannon & Ranzijn, 2005; Van der Zee, Thijs, & Schakel, 2002). Is it really possible to improve EC in adults? What would be the effects of such improvement on one's life? What are the conceptual and methodological challenges of an effective intervention? These are the core questions that this article aims to answer.

Emotion-related individual differences have alternately been conceptualized as abilities (Salovey & Grewal, 2005; Salovey & Mayer, 1990), traits (Petrides & Furnham, 2000), or a mix of both

(Bar-On, Tranel, Denburg, & Bechara, 2003; Dawda & Hart, 2000). These models have led to different lines of research, which have all produced significant and important results (Mayer, Roberts, & Barsade, 2008; Petrides, Pérez-González, & Furnham, 2007; Schutte, Malouff, Thorsteinsson, Bhullar, & Rooke, 2007). It is only recently that an integration of these different research findings began to emerge (Joseph & Newman, 2010) from the ongoing debate on the status of emotion-related individual differences (R. D. Roberts, Matthews, & Zeidner, 2010). In that context, Mikolajczak and colleagues proposed an integrative model of EC encompassing three levels: knowledge, abilities, and traits (Mikolajczak, 2009; Mikolajczak, Quoidbach, Kotsou, & Nelis, 2009). The first level—the knowledge level—refers to what people know about emotions. The ability level focuses on what people can do and their ability to apply knowledge in a real situation. For instance, even though many people know that acceptance is an efficient strategy to reduce anxiety, many are simply not able to observe and accept their emotions when they are anxious. The trait level refers to the propensity to behave in a certain way in emotional situations. We assessed this level in the current study. The focus here is not on what people know or can do but on what they consistently do: their dispositions. For instance, some individuals may be able to practice acceptance in an exercise if explicitly asked to do so, while not applying this strategy in their life.

A decade of research has highlighted the importance of EC in all aspects of people's lives. It has been shown, for instance, that EC plays a crucial role in mental and physical health (for a meta-

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analysis, see Schutte et al., 2007), work and academic performance (see Van Rooy & Viswesvaran, 2004), and quality of social relationships. The importance of EC for mental health is considerable: Over half of the non-substance-related Axis I disorders and all of the Axis II disorders in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) involve some form of emotion dysregulation (Gross & Levenson, 1997). Moreover, EC correlates negatively to trait anxiety, stress, depression, burnout, and negative affect in general (Ciarrochi, Deane, & Anderson, 2002; Mikolajczak, Menil, & Luminet, 2007), whereas it correlates positively to subjective well-being (Schutte, Malouff, Simunek, McKenley, & Hollander, 2002) and life satisfaction (Gallagher & Vella-Brodrick, 2008; Gannon & Ranzijn, 2005). One of the explanations for these findings is that EC moderates reactions to negative and stressful events. Individuals with high EC appraise those events less negatively (Mikolajczak & Luminet, 2008) and use more efficient coping and regulation strategies (Mikolajczak, Nelis, Hansenne, & Quoidbach, 2008).

EC is not only crucial for mental health but is crucial for physical health as well. A deficit in EC is involved in the genesis or the prognosis of numerous somatic diseases, such as diabetes (Bastin, Luminet, Buysschaert, & Luts, 2004), gastro-intestinal disorders (Porcelli et al., 2003), or coronary-heart disease (Suls, Wan, & Costa, 1995). Both direct and indirect pathways account for these relationships. First, EC significantly influences health-related behaviors, reducing damaging behaviors (e.g., alcohol and drug abuse; Limonero, Tomas-Sabado, & Fernandez-Castro, 2006; Riley & Schutte, 2003) and increasing preventive behaviors (e.g., exercise; Saklofske, Austin, Rohr, & Andrews, 2007). Second, EC significantly moderates neuro-endocrine reactivity in emotional situations (Mikolajczak, Roy, Luminet, Fillee, & de Timary, 2007; Salovey, Stroud, Woolery, & Epel, 2002), thereby preventing the consequences of chronic or exaggerate reactivity on health.

EC also plays a key role in social relationships. It predicts the quality of social interactions (Lopes et al., 2004; Lopes, Salovey, Côté, & Beers, 2005), the amount of received social support, as well as the extent of satisfaction with social support (Ciarrochi, Chan, & Bajgar, 2001). Moreover, EC seems to play a protective role in terms of well-being during family and professional conflicts (Lenaghan, Buda, & Eisner, 2007). EC does not only influence relationships with friends (Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006) but it also has an influence within the couple (Schutte et al., 2001). EC plays a role in partner selection and in longer term relationship satisfaction (Casey, Garrett, Brackett, & Rivers, 2008). As an example, a deficit in EC has been associated with more conflicts and bad quality of relationship in couples (Brackett, Warner, & Bosco, 2005). More broadly, EC may predict better reasoning capacities in social exchange situations (Reis et al., 2007). The effect of EC on social relationships is also particularly relevant regarding health. Indeed, numerous studies have shown that the quality of social support buffered the effect of adverse life events on both mental and physical health. It is noteworthy that EC not only affects individuals but also organizations and, to a larger extent, societies. One of the most striking examples is that EC is related to lower levels of occupational stress and bullying, two problems that lead to substantial social and organizational costs (Hoel, Cooper, & Zapf, 2002; Hoel, Sparks, & Cooper, 2001). Numerous studies also show that EC plays a

significant role in professional adjustment and work performance in particular (Daus & Ashkanasy, 2005; Joseph & Newman, 2010; Newman, Joseph, & MacCann, 2010; Sy, Tram, & O'Hara, 2006; Van Rooy & Viswesvaran, 2004). Emotions and EC have an impact on group processes (Sy, Côté, & Saavedra, 2005) and leadership (Cherniss, Grimm, & Liautaud, 2010; Côté, Lopes, Salovey, & Miners, 2010; Rosete & Ciarrochi, 2005; Sy et al., 2005). EC is also related to lower levels of absenteeism, greater job involvement and commitment (Mignonac, Herrebach, & Gond, 2003), and increased organizational citizenship (Day & Carroll, 2004).

These results raise questions about the acquisition and the development of EC: Are individuals with low EC condemned to display poor indicators of adjustment, or is there room for improvement? There is some discussion about the plasticity of socioemotional abilities in young people, as several promising studies have demonstrated the possibility of improving these abilities in children (Zins, Weissberg, Wang, & Walberg, 2004), adolescents (Ruini et al., 2009), and college students (Nelis, Quoidbach, Mikolajczak, & Hansenne, 2009). Yet, it is still unclear whether EC can be learned among adults, and to what extent EC can be changed in this population (Mayer, Salovey, Caruso, & Sitarenios, 2001). Indeed, several basic cognitive mechanisms, such as attention and memory, progressively decline with age, resulting in a lower capacity to concentrate and to process and organize information (e.g., Cross, 1981; Horn, Donaldson, & Engstrom, 1981; Merriam, Caffarella, & Baumgartner, 2007), making it difficult to learn new behaviors and to adopt new habits. This may explain why age is related to increased rigidity (Schaie, 1958) and why personality change may largely be confined to young adulthood and may only be anecdotic after 30 years of age (McCrae et al., 1999, 2000). Yet, research also shows that adults are not set like plaster: The impact of environmental changes on personality, at any age, has been widely demonstrated (B. W. Roberts, Helson, & Klohnen, 2002; B. W. Roberts, Walton, & Viechtbauer, 2006; Srivastava, John, Gosling, & Potter, 2003). Nevertheless, whereas the later set of research shows that environment has an impact on personality development, even in later adulthood, it does not indicate whether and how *deliberate* change would be possible. One could therefore legitimately wonder whether an intervention aimed at improving trait EC would be effective with adults.

Over the last decade, the question of the development of EC in adults has received increased attention in the workplace, and from corporate trainers in particular. Given the impact of EC on stress, mental and physical health (Hoel et al., 2001), and the costs of stress-related mental and physical disorders for companies (\$42 billion a year for the U.S. economy; Kalia, 2002), numerous training programs designed to improve emotional skills have been marketed. The problem is that these training programs were developed and conducted without proper scientific evaluation or validation. A large number of them have been developed by practitioners without a direct link to the academic research field. The theoretical and empirical bases of most training programs are therefore vague, and their effects have seldom been appraised. In cases where evaluations are conducted, they often present several methodological flaws, such as insufficient sample sizes, the absence of a control group, and no longitudinal follow-up (Matthews et al., 2006; Matthews, Zeidner, & Roberts, 2007). Consequently, the behavioral mod-

ifications that follow these training programs are unknown, and the purported improvements on real-life criteria have still to be empirically demonstrated. Moreover, the conditions of such EC improvements—if they exist—are unclear: Can any individual benefit from an intervention? Are there factors moderating a possible improvement? These limitations and unanswered questions highlight the need for empirically based standardized interventions, which are conducted on a sample from the general adult population.

The present study aims at addressing the limitations of previous research, using a scientifically derived and rigorously tested EC intervention. First, we ensured the content validity of the current intervention by basing it on empirical evidence only (i.e., hundreds of publications on emotions, emotional competencies, and pedagogical aspects). Our review of the empirical literature was published so as to make it available to anyone willing to acquaint themselves with the scientific background behind the intervention and/or use it to develop their own intervention (Mikolajczak et al., 2009). Details on our intervention methods are explained in the Method section. Second, we also tried to objectify as much as possible the efficacy of the treatment. We therefore used peer report and biological measures to extend the reliability of the results. As a biological marker, we used cortisol measures. Cortisol is widely regarded as an objective marker of changes in psychological stress (Kirschbaum, Prüssner, Stone, & Federenko, 1995). Salivary cortisol has been shown to be highly correlated to plasma cortisol (Shimada, Takahashi, Ohkawa, Segawa, & Higurashi, 1995); it remains stable in saliva for several days and is thus ideally suited to being used as a measure of stress in intervention paradigms (Kahn, Rubinow, Davis, Kling, & Post, 1988). In addition, the assessment of cortisol in saliva avoids the confounding effects of venepuncture-induced stress associated with measuring plasma cortisol. Cortisol has been shown to increase during periods of both acute (Steptoe, Cropley, Griffith, & Kirschbaum, 2000) and chronic (McEwen, 1998, 2008; Schulz, Kirschbaum, Prüssner, & Hellhammer, 1998) stress. High cortisol levels are positively associated with stress and are negatively associated with speed of wound healing, perceived health, and optimism (Ebrecht et al., 2004). On the basis of the theory and empirical research as outlined above, we expected that the intervention would lead to an increase in EC (Hypothesis 1), which would be evidenced not only by an increase in self-reported EC but also by a decrease in cortisol levels and an increase in spouse-reported EC. Because EC is strongly associated with mental health, physical health, and the quality of relationships (as highlighted previously in this article), we propose, as a second hypothesis, that an improvement in EC would result in better mental, physical, and social adjustment (Hypothesis 2). In addition to testing these two main hypotheses, we posed two research questions: The first related to the stability of intervention effects; the second related to individual differences that may influence the efficacy of the intervention. First, we were interested to know whether the changes would last in the long term, that is, after 1 year (Research Question 1). Second, we examined whether age, sex, IQ, and baseline EC levels moderate the improvement of EC (Research Question 2).

## Method

### Sample

The study design was experimental with a between-subjects variable (EC training group vs. no-intervention control) and a within-subject variable (pretest vs. posttest). The study was advertised in a newspaper and on the Internet and was presented as an investigation of the effect of EC training on stress. Participants were informed of the procedure, inclusion and exclusion criteria, and ethical considerations. Exclusion criteria were as follows: (a) any planned psychological interventions during the course of the study, (b) present drug dependency or abuse, (c) use of psychopharmacotherapy, and (d) absence of motivation for the process of an intervention. Participants from both the intervention and control groups were included in the study on the same basis: their motivation to take part in the study. Specifically, people had to write a motivation letter to be included in the study. On the basis of this letter, we excluded a few individuals who were only interested by the content of our intervention (e.g., coaches, trainers, consultants) but not by the process of improvement. Motivation was therefore a prerequisite for both groups but there was no difference in motivation levels between control and intervention groups. Selected participants were asked for their availabilities and were then allocated to the intervention group or to the waiting list by an undergraduate research assistant who was not involved in the design of the study or in the intervention or analysis of the results. All participants were assigned a confidential identification number. Participants were also asked to report whether any significant emotional event (e.g., car accident, death of a relative) occurred in the week before pretesting or posttesting. Seventy-two participants constituted the training group (49 women and 23 men; mean age = 38.24 years,  $SD = 9.38$ ), and 60 participants were allocated to the waiting list as a control group (40 women and 20 men; mean age = 38.85 years,  $SD = 11.77$ ).

The 72 participants of the training group were randomly allocated to one of the six EC training sessions. Analysis on self-report measures were conducted on the whole sample, however, there was a loss of data due to peer reports data collection constraints or biological data collection constraints (insufficient or missing samples, code errors). To ensure that results were not influenced by differential dropout, we performed multiple data imputation (see, e.g., Adler, Bliese, McGurk, Hoge, & Castro, 2009). Analysis showed that results from the “completer only sample” were consistent with results of the imputed data set. Multiple imputation of missing data results can be obtained on request from the first author. The total sample size ( $N$ ) for each measure can be found in Table 1.

### Procedure

The participants were asked to complete the measures just before the intervention (Time 1), 1 month after the intervention (Time 2), and 1 year after the intervention (Time 3). The participants in the control group completed the measures at the same time interval. Participants of the intervention group attended a two-and-a-half-day program (15 hr) on emotional competencies. The training was made available for participants of the control group once the follow-up measures on Time 3 (1 year after the intervention)

Table 1  
*N for Each Variable and Each Group*

Measures	Intervention group		Control group		Reason	N at Time 3 intervention group <sup>a</sup>	N at Time 3 control group <sup>a</sup>
	Valid	Loss	Valid	Loss			
Self-reported measures (TEIQue, SWLS, PSS, PILL, EQRI)	72	3	60	5	Not showing up at the follow-up, sickness, work constraints	41	28
Peer-reported measures (EC)	52	23	52	13	The partners did not send the questionnaires back	25	28
Peer-reported measures (EQRI)	49	26	49	16	Peer's missing data	26	28
Biological measures (AUC–cortisol)	57	18	45	20	Insufficient or missing sample, code errors, sickness, or emotional event	No data	No data

*Note.* To ensure that results were not influenced by differential dropout, we performed multiple data imputation (see, e.g., Adler et al., 2009). Analysis showed that results from the “completer only” sample were consistent with results of the imputed data set. TEIQue = Trait Emotional Intelligence Questionnaire; SWLS = Satisfaction With Life Scale; PSS = Perceived Stress Scale; PILL = Pennebaker Inventory of Limbic Languidness; EQRI = Quality of Interpersonal Relationships Scale; EC = emotional competence; AUC = overall diurnal profile of cortisol.

<sup>a</sup> For Time 3 data collection, the questionnaires were sent 1 year after, and analysis was performed on all the data collected in the following 45 days.

were taken. The first two days (12 hr) consisted in intensive training structured around the acquisition and/or the improvement of five core emotional competencies: (1) the capacity to identify one's own and others' emotions; (2) the capacity to understand emotions, their antecedents, and consequences; (3) the capacity to express emotions in a socially adequate manner and to listen to others' emotions; (4) the capacity to manage one's own and others' emotions; and (5) the capacity to use emotions to enhance thinking and actions. Reminders and readings were given to the participants at the end of each day. This intensive training was followed by a 1-month Internet follow-up (i.e., participants received an e-mail twice a week, encouraging them to apply a different part of the intervention each time). As an example, the first mail asked participants to pay attention to the next emotion-related situation they would encounter. They were instructed to observe and differentiate the different components of that situation (physiological activation, cognitions, action tendencies, and subjective feeling). Two weeks after the beginning of the program, participants attended a half-day session (3 hr), where they received a reminder of the materials covered during the first two training days. Following this, team discussions, reflections, and feedback within the group were encouraged to gauge the extent to which individuals attempted to use the competencies.

### Content of the Intervention

The intervention was built on the basis of important theoretical work and several intervention trials. Theoretically speaking, the intervention was a process-based conceptual frame construct (see the Appendix) based on hundreds of publications on emotion research to ensure its scientific relevance and content validity. All theoretical references can be found in Mikolajczak et al. (2009). Only empirically supported theories and methods were used to inform teaching modules. The EC intervention strives to improve the participant's flexibility in addressing emotionally difficult and stressful situations in a more adaptive manner. Participants learn to change the relations they have with difficult emotions by learning how to tame them instead of avoiding or struggling with them. The intervention aims at helping individuals (a) to observe the relations

among environmental triggers, beliefs, thoughts, emotions, and behaviors; (b) to recognize and understand the conditioned links among emotions, thoughts, action tendencies, and habitual behaviors (see the Appendix); (c) to use various emotion regulation strategies (e.g., cultivating positive affect) as appropriate to the context; (d) to express and listen to emotions in an adaptive manner related to one's context and objectives; and (e) to use emotions and emotional situations to clarify their priorities and needs. The intervention was structured into five blocks, covered in the 2.5 days of training.<sup>1</sup>

### Methodology of the Intervention

The intervention focused on creating a context of learning where participants could understand the importance of emotional competencies, improve their self-awareness, as well as experience and practice several tools to develop these competencies. Our pedagogy was based on behavioral and experiential teaching methods (e.g., group discussions, role play, self-observation; Bandura, 1997; Kolb & Boyatzis, 1970). The intervention was designed to maximize training transfer (Burke & Hutchins, 2008) and followed Kirkpatrick's (1996) guidelines for intervention evaluations.

### Measures

#### Pre- and posttest measures of EC.

**Self-reported global EC.** Self-reported global EC was assessed using the Trait Emotional Intelligence Questionnaire–Short Form (TEIQue-SF; Petrides & Furnham, 2006). This measure comprises 30 seven-point items (from *strongly agree* to *strongly disagree*) providing a global EC score. The TEIQue-SF shows excellent psychometric properties (see Petrides, 2009). In this study, the internal consistency (alpha) of the scale was .87. Examples of items are “I often find it difficult to show my affection to those close to me” and “I often pause and think about my feelings.”

<sup>1</sup> All materials are available from the authors on request.

**Informant-report of global EC.** Informant-report of global EC was assessed using the Trait Emotional Intelligence Questionnaire–360–Short Form (TEIQue 360°-SF; see Petrides, Niven, & Mouskounti, 2006). This measure is a short form designed for peers or 360° assessment of EC. It consists of 15 items, each representing one of the 15 facets of the TEIQue-SF. Examples of items are “[the participant] is able to express his/her feelings to others]” and “[the participant] is good at managing other people’s emotions.” An informant (husband, spouse, or close friend) was selected for each participant and was instructed to indicate in the form of a percentage score (from 0% to 100%) how well the participant conforms to each item. The internal consistency of the TEIQue 360°-SF was .86 in the present study.

**Pre- and posttest measures of psychological, somatic, and social adjustment.**

**Life satisfaction.** Life satisfaction was appraised by the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). This well-validated, five-item instrument assesses satisfaction with the respondent’s life as a whole (e.g., “I am satisfied with my life”). Participants indicate agreement or disagreement with the item on a 7-point scale (1 = *strongly agree*, 7 = *strongly disagree*). The internal consistency was excellent ( $\alpha = .87$ ).

**Perceived stress.** Perceived stress was evaluated via the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The PSS is a 10-item scale designed to measure the degree to which individuals appraise their life as stressful. All items begin with the same phrase: “In the past month, how often have you felt . . .” (e.g., “In the past month, how often have you found that you could not cope with all the things that you had to do?”). It is scored on a 5-point scale (0 = *never*, 1 = *almost never*, 2 = *sometimes*, 3 = *fairly often*, 4 = *very often*). The PSS reliability was .88 in this study.

**Cortisol levels.** Overall diurnal profile of cortisol (AUC) was assessed to obtain an objective measure of stress. All participants were asked to provide five different saliva samples. The samples were collected in the following time ranges of the day: in the 30 min following waking up, between 9:00 a.m. and 9:30 a.m., between 11:00 a.m. and 11:30 a.m., between 3:00 p.m. and 4:00 p.m., and between 10:00 p.m. and 11:00 p.m. (procedure used by Vedhara, Hyde, Gilchrist, Tytherleigh, & Plummer, 2000). Saliva samples were collected using the Sarstedt Salivette collection devices (Nümbrecht, Germany) and were stored at room temperature until completion of the session and at  $-20^{\circ}\text{C}$  until they were assayed. The cortisol assays were carried out at the Department of Clinical Biochemistry, Cliniques Universitaires Saint-Luc (Brussels, Belgium). Saliva was extracted from the cotton swab by centrifugation (1,000 g, 2 min), and the cortisol was measured using a competitive polyclonal immunoassay, composed of an electromagnetic separation step followed by electrochemiluminescence quantitation with the Elecsys 1010/2010 analyzer (Roche Diagnostics, Mannheim, Germany). The intra- and inter-assay coefficients were, respectively, 4.0% and 7.2%. Results are expressed in nanomoles per liter. As with the other measures, cortisol measures were taken on the first day of the intervention and 1 month later.

**Somatic complaints.** Somatic complaints were assessed through an adaptation of the Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1982), which originally consisted

of a list of 54 physical symptoms and bodily sensations. To keep the measures as short as possible, we kept only the 29 most frequent somatic complaints. Participants were required to rate the frequency they experienced each symptoms/sensation during the past month on a 5-point scale (1 = *never or nearly never*, 2 = *1 to 3 times*, 3 = *every week*, 4 = *several times a week*, 5 = *every day*). Examples of symptoms are “congested nose” or “feeling pressure in the head.” This adapted PILL was highly reliable in our sample ( $\alpha = .85$ ).

**Quality of relationships.** Quality of relationships was assessed with an adaptation of the Quality of Interpersonal Relationships Scale (EQRI; Senécal, Vallerand, & Vallières, 1992), which measures the quality of the participant’s relationships with their family, partner, and friends. The current measure consists of 16 items scored on a 5-point scale. Examples of items include “My relationships are satisfying,” and “In case of conflict, I know how to solve it.” The internal consistency (alpha) of the measure was .86.

**Informant-report of quality of relationships.** Informant-report of quality of relationships was assessed using the Quality of Interpersonal Relationships Scale–360° Form (EQRI-360°). This measure is an informant report version of the previous adaptation of the EQRI (Senécal et al., 1992). It consists of 16 items. The informant (spouse or close friend) was instructed to indicate on a 5-point scale the quality of the relationship the participant had with the informant, with his/her family, and with his/her friends. Examples of items are “[The participant’s] relationships are satisfying,” and “In case of conflict, [the participant] knows how to solve it.” The alpha was .85 in the current sample.

**Measures of potential moderators of the training effects.** Age and gender were measured via single items (i.e., “Are you a male/female?” “How old are you?”).

Cognitive ability (CA) was measured using the Bonnardel Test of Verbal Comprehension, Version 16 (BV16; Bonnardel, 1977). The BV16 is a test of abstract verbal comprehension that assesses the efficiency of conceptual thought. It comprises 11 items. Each item is a quote of a classical author, followed by six sentences among which the participant has to select the sentence that has the closest meaning to the quote/thought. This item is designed to measure verbal intelligence.

## Results

### Preliminary Analyses

Independent *t* tests (see Table 2) showed that besides perceived stress, which was higher in the training group at baseline ( $t = -0.220$ ,  $p = .044$ ), there was no significant difference between the training group and the control group on any of the pretest measures. Means, standard deviations, and significance of differences between intervention and control groups prior to EC intervention are shown in Table 2.

### Change in EC

The Means and standard deviations for each variable at each time in each group are shown in Table 3. Repeated measures analyses of variance were performed on each measure, with group (control, training) as a between-subjects factor, and time (Time 1,

Table 2  
Means (and Standard Deviations) and Significance of Differences Between Intervention and Control Groups Prior to EC Intervention

Variable	Training group ( <i>N</i> = 72)	Control group ( <i>N</i> = 60)	<i>t</i>
TEIQue	4.80 (0.66)	4.97 (0.61)	<i>t</i> (132) = -0.154, <i>p</i> = .167
TEIQue 360°-SF	5.13 (0.76)	5.35 (0.66)	<i>t</i> (99) = -0.201, <i>p</i> = .162
SWLS	4.97 (1.07)	5.06 (0.96)	<i>t</i> (132) = -0.103, <i>p</i> = .562
PSS	2.92 (0.62)	2.70 (0.63)	<i>t</i> (132) = 0.220, <i>p</i> = .044
AUC	24.96 (5.50)	23.20 (5.70)	<i>t</i> (100) = 1.760, <i>p</i> = .117
PILL	1.75 (0.40)	1.71 (0.44)	<i>t</i> (132) = 0.032, <i>p</i> = .658
EQRI	3.30 (0.63)	3.51 (0.71)	<i>t</i> (132) = -0.195, <i>p</i> = .092
EQRI-360°	3.28 (0.84)	3.44 (0.83)	<i>t</i> (100) = -0.157, <i>p</i> = .344

Note. EC = emotional competence; TEIQue = Trait Emotional Intelligence Questionnaire; TEIQue 360°-SF = Trait Emotional Intelligence Questionnaire-360-Short Form (peer-reported); SWLS = Satisfaction With Life Scale; PSS = Perceived Stress Scale; AUC = overall diurnal profile of cortisol; PILL = Pennebaker Inventory of Limbic Languidness; EQRI = Quality of Interpersonal Relationships Scale; EQRI-360° = Quality of Interpersonal Relationships Scale-360° Form (peer-reported).

Time 2) as a within-subject factor (cf. Table 3). In each case, we were looking for a Time × Group interaction, which would indicate a differential change between the two groups. As depicted in Table 3, analyses confirmed a highly significant group interaction for all scales: TEIQue-SF,  $F(1, 130) = 40.136, p < .001, \eta_p^2 = .24$ ; TEIQue 360°-SF,  $F(1, 98) = 32.126, p < .001, \eta_p^2 = .25$ . The breakdown of these interactions indicated that the intervention group presented a significant increase on self-report of trait EC (TEIQue-SF),  $t(71) = -8.087, p < .001$ , and informant report of EC (TEIQue 360°-SF),  $t(48) = -5.38, p < .001$ . The control group showed no significant difference between Time 1 and Time 2 on the TEIQue-SF but showed a significant decrease for the TEIQue 360°-SF,  $t(50) = 2.462, p = .017$ .

### Change in Psychological, Somatic, and Social Adjustment

The means and standard deviations for each variable at each time in each group are shown in Table 3. Repeated measures analyses of variance were performed on each measure, with group

(control, training) as a between-subjects factor, and time (Time 1, Time 2) as a within-subject factor (cf. Table 3). In each case, we were looking for a Time × Group interaction, which would indicate a differential change between the two groups. As depicted in Table 3, analyses confirmed a significant Group × Time interaction for all scales: SWLS,  $F(1, 130) = 15.829, p < .001, \eta_p^2 = .11$ ; PSS,  $F(1, 130) = 40.010, p < .001, \eta_p^2 = .24$ ; cortisol (AUC),  $F(1, 100) = 14.065, p < .001, \eta_p^2 = .12$ ; PILL,  $F(1, 129) = 12.00, p = .001, \eta_p^2 = .09$ ; EQRI,  $F(1, 130) = 24.669, p < .001, \eta_p^2 = .16$ ; EQRI-360°,  $F(1, 98) = 15.532, p < .001, \eta_p^2 = .14$ .

As shown in Table 3, the breakdown of these interactions indicated that the intervention group presented a significant decrease in stress,  $t(71) = 11.314, p < .001$ ; cortisol levels,  $t(56) = 5.731, p \leq .001$ ; and somatic complaints,  $t(71) = 7.460, p < .001$ ; as well as a significant increase in life satisfaction,  $t(71) = -6.902, p < .001$ ; self-reported quality of social relationships,  $t(71) = -5.799, p < .001$ ; and informant-reported quality of social relationships,  $t(48) = -3.850, p < .001$ . The control group showed no significant difference between Time 1 and Time 2 for most indi-

Table 3  
Means (and Standard Deviations) and Significance of Differences Between Before and After EC Intervention for Each Variable and Each Group

Variable	Intervention group				Control group			
	Time 1	Time 2	<i>t</i>	<i>d</i>	Time 1	Time 2	<i>t</i>	<i>d</i>
TEIQue	4.80 (0.66)	5.33 (0.49)	$t(71) = -0.529, p \leq .001$	0.9	4.97 (0.61)	4.97 (0.66)	$t(59) = -0.002, p = .968$	0.00
TEIQue 360°-SF	5.13 (0.76)	5.58 (0.67)	$t(47) = -0.452, p \leq .001$	0.63	5.35 (0.66)	5.17 (0.77)	$t(50) = 0.184, p = .017$	-0.26
SWLS	4.97 (1.07)	5.58 (0.89)	$t(71) = -0.608, p \leq .001$	0.62	5.06 (0.96)	5.11 (1.04)	$t(59) = -0.057, p = .605$	0.05
PSS	2.92 (0.62)	2.21 (0.43)	$t(71) = 0.713, p \leq .001$	1.34	2.70 (0.63)	2.61 (0.57)	$t(59) = 0.094, p = .219$	0.15
AUC	24.96 (5.50)	21.21 (4.59)	$t(57) = 3.745, p \leq .001$	0.75	23.20 (5.70)	23.84 (6.23)	$t(44) = -0.635, p = .537$	-0.11
PILL	1.75 (0.40)	1.48 (0.25)	$t(71) = 0.277, p \leq .001$	0.82	1.72 (0.44)	1.63 (0.42)	$t(58) = 0.093, p = .016$	0.21
EQRI	3.30 (0.63)	3.63 (0.60)	$t(71) = -0.332, p \leq .001$	0.54	3.51 (0.71)	3.45 (0.72)	$t(59) = 0.063, p = .246$	-0.08
EQRI-360°	3.26 (0.83)	3.73 (0.66)	$t(49) = -0.477, p \leq .001$	0.63	3.46 (0.82)	3.24 (1.07)	$t(49) = 0.222, p = .083$	-0.24

Note. EC = emotional competence; TEIQue = Trait Emotional Intelligence Questionnaire; TEIQue 360°-SF = Trait Emotional Intelligence Questionnaire-360-Short Form (peer-reported); SWLS = Satisfaction With Life Scale; PSS = Perceived Stress Scale; AUC = overall diurnal profile of cortisol; PILL = Pennebaker Inventory of Limbic Languidness; EQRI = Quality of Interpersonal Relationships Scale; EQRI-360° = Quality of Interpersonal Relationships Scale-360° Form (peer-reported).

caters, except for a decrease in somatic complaints,  $t(58) = 0.093$ ,  $p = .016$ .

### Mediated Changes

Mediation analyses were carried out to test whether the effect of the intervention on the various outcomes were mediated by changes in EC. Analyses revealed that changes in EC significantly mediated the effect of the intervention on stress (Sobel test = 3.085,  $p < .002$ ), somatic complaints (Sobel test = 3.31,  $p < .001$ ), relationships quality (Sobel test =  $-3.18$ ,  $p < .001$ ), and life satisfaction (Sobel test =  $-2.78$ ,  $p < .005$ ). Mediation failed to reach significance for cortisol levels.

### Moderator Variables

Moderated multiple regression analysis (following Baron & Kenny, 1986) revealed that the magnitude of EC<sup>2</sup> change did not depend on CA ( $p = .30$ ), age ( $p = .80$ ), or gender ( $p = .44$ ). Thus, CA, age, or gender did not moderate the effects of the intervention. However, the baseline level of EC significantly influenced the magnitude of EC changes: Although both high and low EC people<sup>3</sup> significantly benefited from the intervention, people starting with a lower level of EC improved significantly more ( $p = .001$ ; mean EC change for low EC people =  $.83$ ,  $p < .001$ ; mean EC change for high EC people =  $.19$ ,  $p < .01$ ).

### Long-Term Effects

The means, standard deviations, and  $t$  tests between Time 2 and Time 3 (1 year after the intervention) and between Time 1 and Time 3 for each variable and group are shown in Tables 4 and 5. Regarding the long-term effects (1 year) of the intervention, all significant Time 1–Time 2 changes were also significant at Time 3 (see Table 5; all  $ps \leq .001$  except  $.032$  for EQRI). The only variable that could not be measured again (because of financial restrictions) was cortisol. As expected, the control group showed no significant difference between Time 1 and Time 3 for any of the measures ( $ps$  ranging from  $.149$  to  $.857$ ; see Table 5).

## Discussion

The present study supports the notion that EC can be trained and improved among adults, with significant benefits for psychological, somatic, and social adjustment. Indeed, compared with the control group, the intervention group showed a significant improvement in EC, which was associated with a decrease in perceived and objective stress (e.g., cortisol), a decrease in somatic complaints, and an improvement in the quality of social relationships. Moreover, improvements in EC emerged with a remarkable coherence among self-reported and informant measures. Taken together, these findings have important theoretical and practical implications. On a theoretical level, the results confirm that trait ECs that are supposed to be relatively stable in adults can be modified through a well-designed, and even relatively short, intervention. From a practical point of view, they show that it is possible to influence crucial aspects of people's lives: psychological well-being, subjective physical health, and relationship quality, among others. It is important to note that these changes lasted over a 1-year period. The fact that we methodically constructed

and tested an empirically based intervention opens possibilities for replication.

In the next section, we first discuss the conditions involved in the improvement of EC, starting with the conditions inherent to the participants, and continuing with the conditions inherent to the intervention. We then comment on the effects of the intervention, and we conclude by suggesting new research directions.

### Conditions of EC Improvement Inherent to the Participants

CA, age, and gender did not influence the magnitude of the intervention-related changes. Moreover, having a minimum level of baseline EC did not appear to be a necessary condition for EC improvement (however, in this study, lower baseline EC corresponded with larger changes). Given that our CA and EC ranges were somewhat limited (as the sample did not comprise people suffering from severe mental or cognitive impairments), futures studies will therefore have to determine whether an improvement is possible with individuals with a CA or an EC level far below the norm. Yet, these preliminary results suggest that a large part of the population may benefit of such an intervention. The only condition for improvement in this research may be the motivation for change. Indeed, all participants had to write a motivation letter, where they had to say why this intervention was important for them, to be allowed to take part in the study. We thereby ensured that all participants were motivated to change (Eccles & Wigfield, 2002; Miller & Rollnick, 2004). Future studies will have to determine whether similar findings can be generalized to people having no particular motivation for change (e.g., in conditions in which the intervention is imposed on people, such as in organizational or hospital settings). Because motivation may also depend on the instructor, two different instructors delivered the intervention. To control whether our results were trainer-dependent, we included a trainer factor in our analysis. Results show no trainer effect on the results.

### Conditions of Improvement Inherent to the Intervention

There are a number of factors that deserve to be pointed out as potential determinants of our intervention's success. Some of these factors are theoretical and conceptual, some are pedagogical, and some are methodological. First, starting from existing work on the improvement of EC (Cherniss & Adler, 2000; Slaski & Cartwright, 2002, 2003), we constructed a rigorous, scientifically derived, and valid EC intervention program. At a conceptual level, a coherent content- and process-based rationale may be an important determinant of success. Our process-based model can be seen as a tool that allows participants to be more specific about their emotional experiences, which could foster their self-efficacy over time (Vanlede, Philippot, & Galand, 2006). From a pedagogical perspective,

<sup>2</sup> For the moderating effects, EC was measured with the TEIQue-SF.

<sup>3</sup> Discriminating 50% lower percentiles and the 50% higher percentiles defined low and high EC participants. We conducted the moderated regression on the continuous EC variable, but we are describing the results using the median split.

Table 4

Means (and Standard Deviations) and Significance of Differences Between Before and After EC Intervention for Each Variable and Each Group

Variable	Intervention group				Control group			
	Time 2	Time 3	<i>t</i>	<i>d</i>	Time 2	Time 3	<i>t</i>	<i>d</i>
TEIQue	5.30 (0.51)	5.37 (0.58)	$t(40) = -0.068, p = .272$	0.13	4.91 (0.75)	4.92 (0.73)	$t(29) = -0.005, p = .938$	0.01
TEIQue 360°-SF	5.50 (0.70)	5.58 (0.69)	$t(24) = -0.080, p = .382$	0.12	5.22 (0.84)	5.27 (0.81)	$t(28) = -0.048, p = .721$	0.06
SWLS	5.58 (0.81)	5.43 (0.99)	$t(39) = 0.160, p = .166$	-0.18	5.15 (0.90)	5.07 (1.21)	$t(29) = 0.080, p = .650$	-0.08
PSS	2.18 (0.45)	2.04 (0.84)	$t(39) = 0.137, p = .251$	0.23	2.56 (0.57)	2.66 (0.59)	$t(29) = -0.106, p = .231$	-0.18
PILL	1.47 (0.25)	1.52 (0.32)	$t(39) = -0.053, p = .181$	-0.18	1.58 (0.35)	1.64 (0.37)	$t(29) = -0.061, p = .186$	-0.17
EQRI	3.68 (0.55)	3.71 (0.65)	$t(39) = -0.036, p = .679$	0.05	3.33 (0.76)	3.43 (0.60)	$t(29) = -0.102, p = .156$	0.14
EQRI-360°	3.61 (0.55)	3.68 (1.21)	$t(25) = -0.702, p = .764$	0.08	3.23 (1.20)	3.24 (0.96)	$t(28) = -0.009, p = .965$	0.01

Note. EC = emotional competence; TEIQue = Trait Emotional Intelligence Questionnaire; TEIQue 360°-SF = Trait Emotional Intelligence Questionnaire-360-Short Form (peer-reported); SWLS = Satisfaction With Life Scale; PSS = Perceived Stress Scale; PILL = Pennebaker Inventory of Limbic Languidness; EQRI = Quality of Interpersonal Relationships Scale; EQRI-360° = Quality of Interpersonal Relationships Scale-360° Form (peer-reported).

our experiential, behavioral, and pragmatic training methods may be the second determinant. If participants are put in a context where they can already experience the tools they will have to apply later, they may already develop models and references for the competencies needed in the future (Bandura, 1999). A learning context that fosters emotional self-awareness may be the third determinant: As one becomes aware of one's own emotional tendencies and habits, it will make it easier to regulate emotions (Herwig, Kaffenberger, Jäncke, & Brühl, 2010) and to develop behavioral flexibility. Finally, another key to the intervention's success may have been the follow-up procedure. Change does not occur immediately—time and effort are needed. The Internet follow-up is a low-cost, follow-up tool that can be very efficient (if the intervention created a motivational dynamic) because it is generally easy for participants to access. It serves to remind participants to continue to apply the different skills that were taught in the intervention and to maintain participants' motivation for change.

### Effects of the Intervention

As far as psychological adjustment is concerned, the improvement of EC was associated with a significant improvement in life

satisfaction (12.3%) and a significant decrease in perceived stress (24.3%). Life satisfaction is an important mental health indicator that has been shown to be negatively associated with suicidal attitudes (Koivumaa-Honkanen et al., 2001; Swami et al., 2007) and depression (Beutel, Glaesmer, Decker, Fischbeck, & Brahler, 2009). For instance, longitudinal studies have shown that level of life satisfaction can be used to identify people from the general population who have a high risk of developing depressive symptoms (Koivumaa-Honkanen, Kaprio, Honkanen, Viinamäki, & Koskenvuo, 2004). Similarly, life dissatisfaction has been reported to be strongly associated with healthy individuals who have an increased risk of subsequent work disability due to psychiatric and nonpsychiatric causes (Koivumaa-Honkanen, Koskenvuo, et al., 2004). The strong decrease in perceived stress that followed our intervention is also an important result. Prospective studies have provided substantial evidence for the role of severe stress in depression, cardiovascular disease, and cancer (Cohen, Janicki-Deverts, & Miller, 2007). Perceived stress (as measured via the PSS; i.e., the measured used in the current study) has been associated with numerous health-related parameters or outcomes, such as antibody status (Burns, Carroll, Ring, Harrison, & Drayson, 2002), severity of upper respiratory infection (Cohen, Doyle, &

Table 5

Means (and Standard Deviations) and Significance of Differences Between Before and After EC Intervention for Each Variable and Each Group

Variable	Intervention group				Control group			
	Time 1	Time 3	<i>t</i>	<i>d</i>	Time 1	Time 3	<i>t</i>	<i>d</i>
TEIQue	4.80 (0.71)	5.38 (0.57)	$t(42) = -0.583, p \leq .001$	0.88	4.90 (0.65)	4.92 (0.75)	$t(28) = -0.022, p = .784$	0.03
TEIQue 360°-SF	5.07 (0.74)	5.60 (0.68)	$t(25) = -0.528, p \leq .001$	0.74	5.42 (0.65)	5.27 (0.81)	$t(28) = 0.149, p = .223$	-0.22
SWLS	4.93 (0.99)	5.41 (0.97)	$t(41) = -0.486, p \leq .001$	0.50	4.99 (1.07)	5.07 (1.23)	$t(28) = -0.090, p = .534$	0.07
PSS	2.88 (0.54)	2.04 (0.83)	$t(41) = 0.843, p \leq .001$	1.29	2.66 (0.62)	2.64 (0.59)	$t(28) = 0.017, p = .857$	0.03
PILL	1.68 (0.29)	1.51 (0.32)	$t(41) = 0.175, p \leq .001$	0.57	1.68 (0.44)	1.65 (0.38)	$t(28) = 0.027, p = .453$	0.07
EQRI	3.33 (0.64)	3.72 (0.63)	$t(41) = -0.396, p \leq .001$	0.62	3.34 (0.79)	3.44 (0.60)	$t(28) = -0.108, p = .241$	0.14
EQRI-360°	3.31 (0.69)	3.78 (1.20)	$t(25) = -0.470, p = .032$	0.56	3.53 (0.79)	3.24 (0.96)	$t(28) = 0.293, p = .149$	-0.35

Note. EC = emotional competence; TEIQue = Trait Emotional Intelligence Questionnaire; TEIQue 360°-SF = Trait Emotional Intelligence Questionnaire-360-Short Form (peer-reported); SWLS = Satisfaction With Life Scale; PSS = Perceived Stress Scale; PILL = Pennebaker Inventory of Limbic Languidness; EQRI = Quality of Interpersonal Relationships Scale; EQRI-360° = Quality of Interpersonal Relationships Scale-360° Form (peer-reported).

Skoner, 1999), and susceptibility to the common cold (Cohen, Tyrrell, & Smith, 1993). The decrease in stress and cortisol may therefore explain why we observed a decrease in somatic complaints (15.4%) in the intervention group.

The improvement in subjective health is also an important result: Although self-reports are subject to biases, research has suggested that they are no less valid than objective data such as hospital records. Indeed, health self-ratings have been shown to be good predictors of mortality over a 23-year interval (Heistaro, Jousilahti, Lahelma, Vartiainen, & Puska, 2001) and have predicted functional disability better than medical records over a 15-year period (Ferraro & Su, 2000). Note that the improvement in subjective health following the intervention may be more than purely subjective, as it was accompanied by a significant decrease in salivary cortisol (15%). Given that cortisol response is a useful index of hypothalamus-pituitary-adrenal axis activity (Wüst, Federenko, Hellhammer, & Kirschbaum, 2000) and is therefore an important physiological marker of the stress response, the current results suggest that people can favorably alter their neuroendocrine parameters with a short, well-designed program, without the need for pharmacological intervention.

In addition to leading to meaningful improvement in psychological and somatic adjustment, the intervention enhanced the quality of social relationships (as indicated by both self- and informant-reports). This is important not only because relationships are a central part of our lives but also because social relationships influence our health. The strong impact of relationships on health through social support is well-established. For example, social isolation is known to be a major risk factor for mortality (House, Landis, & Umberson, 1988), and social and emotional support have been shown to be protective for health (see Reblin & Uchino, 2008, for a review). Focusing on more specific health processes, quality of relationships has an impact on cardiovascular reactivity (Holt-Lunstad, Uchino, Smith, & Hicks, 2007) and on ambulatory blood pressure (Holt-Lunstad, Uchino, Smith, Olson-Cerny, & Nealey-Moore, 2003). Analysis of the change dynamics further revealed that all these initial changes remained stable over a 1-year period. Our intervention was meant to have an effect on emotion-related dispositions. It was therefore designed to give the participants—during the 2.5 days of the intervention—not only the EC tools but also the motivation to apply these tools during the month preceding Time 2 measures. Therefore, we do not argue that 2.5 days can produce a lasting change but, more realistically, that 1 month of training could do so.

### Limitations and Future Directions

This study breaks new ground in several ways that leave ample room for future research to probe or refine its findings. Although this research shows that change is possible, future studies will need to refine these results. For instance, future research could investigate which individuals/groups may not benefit from this kind of intervention. It would also be useful to examine the possible alternatives to promote change in these individuals. If using a biological marker can be seen as an added value to our research, it is important to acknowledge that even biological measures are not free of limitations (Chida & Steptoe, 2009). Subsequent studies will have to investigate more deeply and precisely the biological changes associated with an EC intervention. As a first step, we

started an investigation on the effects of the EC intervention on neural activity (Nelis, Majerus, Feyers, Salmon, & Hansenne, 2011). The fact that we used a nonactive control group and restricted our study to motivated participants may also be pointed out as a limitation. No-intervention control design and targeted design may produce larger effects sizes (Brunwasser, Gillham, & Kim, 2009) and that has to be taken into account in further studies. With this in mind, we conducted another study where we compared the same intervention to an active control group with comparable results (Nelis et al., 2011).

Another research direction concerns the many applications of this intervention in health, educational, and organizational settings. There is a plethora of training packages currently being claimed to improve emotional skills, without being conceptually and methodologically validated. For instance, could this intervention be used to complement addiction treatments? Our laboratory is currently testing the efficiency of this intervention in the prevention of relapse after a protracted drinking withdrawal. Many other clinical and health applications could be imagined and tested. Would it be helpful to prevent depression relapse? Our intervention may be applied and tested in the mental health sector (as a complement for the treatment of chronic stress) and in the physical health sector (as a complement in the treatment of psychosomatic pathologies such as migraine). Exciting directions for future research also emerge in work settings (e.g., would such EC training help prevent burn-out in stressful occupations? Could EC training benefit workers in high emotional labor jobs?). The results of these studies promise to provide significant resources for both research and practice.

Emotions are important in our lives and so is the way we manage them. This study attempts to clarify whether it is possible to improve EC in adulthood, and the conditions required for this. It also attempts to better understand the impact and the mechanisms of such improvements. A benefit of this research is to enable other academic researchers to explore the benefits derived from such interventions and to review and retest the results. It would also provide practitioners with a clearer conceptual framework, which is supported by empirical evidence, on the effects of effective intervention tools for personal and emotional change.

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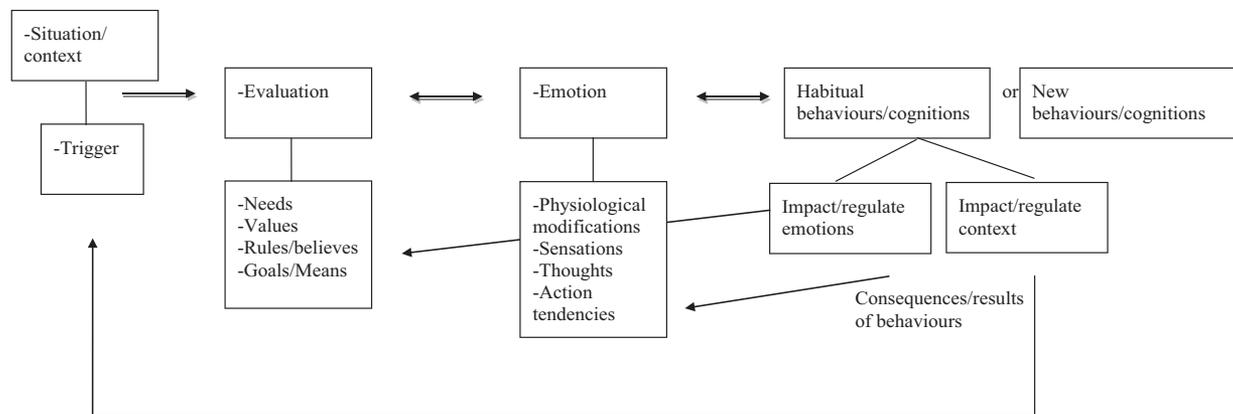
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## Appendix

### Pragmatic Process Model of an Emotional Episode



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