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The impact of Emotional intelligence on the Human Factor: a cross-cultural study USA-Italy

DAVID Burr
UNIVERSITA DEGLI STUDI DI FIRENZE
PIAZZA DI SAN MARCO 4
FIRENZE, 50121
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1. SUMMARY

The present study adopted a mixed methods methodology, which entailed for the systematic integration of quantitative and qualitative data in order to provide a more complete evidence on the impact of emotional intelligence (EI) on psychological health and performance in the air traffic control context. A total of 504 Italian civilian ATCs completed the paper and pencil form of the standardized questionnaires (N = 408), focus groups (N = 102), and interviews (N = 20). The results of the study shed light on the significant impact of EI skills on psychological health and performance also in specific context of the air traffic control. Limitations and implications of the study for recruitment and training of professional ATCs are discussed.
This document is a continuation of the two previous reports (period of reference Dec, 1st 2015-Nov, 30th 2016; Dec, 1st 2016-Nov, 30th 2017) sent to EOARD for the grant liable to Professor Burr and Dr. Artusio (FA9550-16-1-0068). Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Air Force Office of Scientific Research, Air Force Materiel Command, USAF. This material is based upon work supported by the Air Force Office of Scientific Research, Air Force Material Command, USAF under Award No. FA9550-16-1-0068.

2. INTRODUCTION

The dominant role of Human Factors (HFs) in aviation crashes has long been acknowledged (Herbolsheimer, 1942). Overall, HFs has been implicated in a variety of occupational accidents; previous research has shown that between 60% and 80% of aviation accidents are attributable, at least in part, to human error (Li, 1994; O'Hare, Wiggins, Batt, & Morrison, 1994; Shappell, Detwiler, Holcomb, Hackworth, Boquet, & Wiegmann, 2017; Wiegmann & Shappell, 2001a and b, 2017). HFs impact the pilots' capabilities in achieving their mission targets, in both civilian and military contexts (Chappelle, McDonald, Thompson, McMillan, & Marley, 2010; Kontogiannis & Malakis, 2009; Wiegmann & Shappell, 1999). As aircraft equipment has become more reliable due to the advancements made in technology over the past forty years, the relative importance of HF in aviation safety has further increased (Nagel, 1988; Shappell & Wiegmann, 1996). The most significant HFs in aviation accidents and incidents are fatigue, situational awareness (SA), communication, safety management systems (the human component), workload, decision-making and decision errors, cooperation, leadership, skill based errors, and perceptual errors (Helmreich, 1996; Kharoufah, Murray, Baxter, & Wild, 2018).
In addition to cognitive factors, the ability to manage emotions and behaviors in stressful contexts (e.g., rotating shift work, deployed in-Garrison status, ergonomic design of ground control station, and sustaining vigilance and long work hours) is of critical importance (Chappelle et al., 2010; Chappelle, McDonald, Thompson, & Swearengen, 2012). Some studies have underlined the association between an individual's capabilities to identify a specific emotional state during a particular experience (Salovey, Mayer, Goldman, Turvey, & Palfai, 1995) and decreased cognitive difficulties (Gohm, Baumann, & Sniezek, 2001). Neuroscience and social psychology research have shown that emotions impact cognitive processes, ultimately affecting flight performance (Causse, Dehais, Péran, Sabatini, & Pastor, 2013; Mayer, Salovey, & Caruso, 2008). In fact, emotions can interfere with rational reasoning by shifting decision-making criteria from coded safety rules to subjective rules, and compromise the rational processes in situations with high uncertainty (Damasio, 1994), for example causing a failure to revise a flight plan, despite emerging evidence (Causse et al., 2013; Orasanu, Ames, Martin, & Davison, 2001).

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2.1 Theoretical Framework on EI

EI is the ability "to monitor one's own, and those of others, to discriminate among them and use this information to guide one's thinking and one's actions" (Salovey & Mayer, 1990). The Mayer and Salovey (1997) model of EI defines four discrete mental abilities: (a) perception of emotions, (b) use of emotions to facilitate thought, (c) understanding of emotions, and (d) management of emotions. The model is arranged hierarchically and systemically. The ability model of EI (Salovey & Mayer, 1997), the so called Four Branch Model of EI, provides a framework to measure and train these critical emotional skills. The last twenty years of research in this field have showed scientific findings on support of the validity and the effectiveness of the ability model of EI (Brackett et al., 2011), but also some limitations to be improved.
In consideration of this, an updated version of ability model of EI authored by Salovey and Mayer (1990; Mayer & Salovey, 1997), is proposed to be used as theoretical framework for the present project: the so called PUERUModel of EI described by Artusio (2016).
The PUERUModel defines EI as a set of 5 discrete, hierarchical and systemic abilities that can be measured and trained: (a) perceiving emotions, (b) understanding emotions, (c) expressing emotions, (d) regulating emotions, and (e) using emotions (Figure 1).
The developments proposed by the PUERUModel of EI aim to update the Four Branch Model, integrating some concepts based on the main results of the last twenty years of research in the EI field with the evidences produced in the aviation sector, in order to decline the model in this specific context.

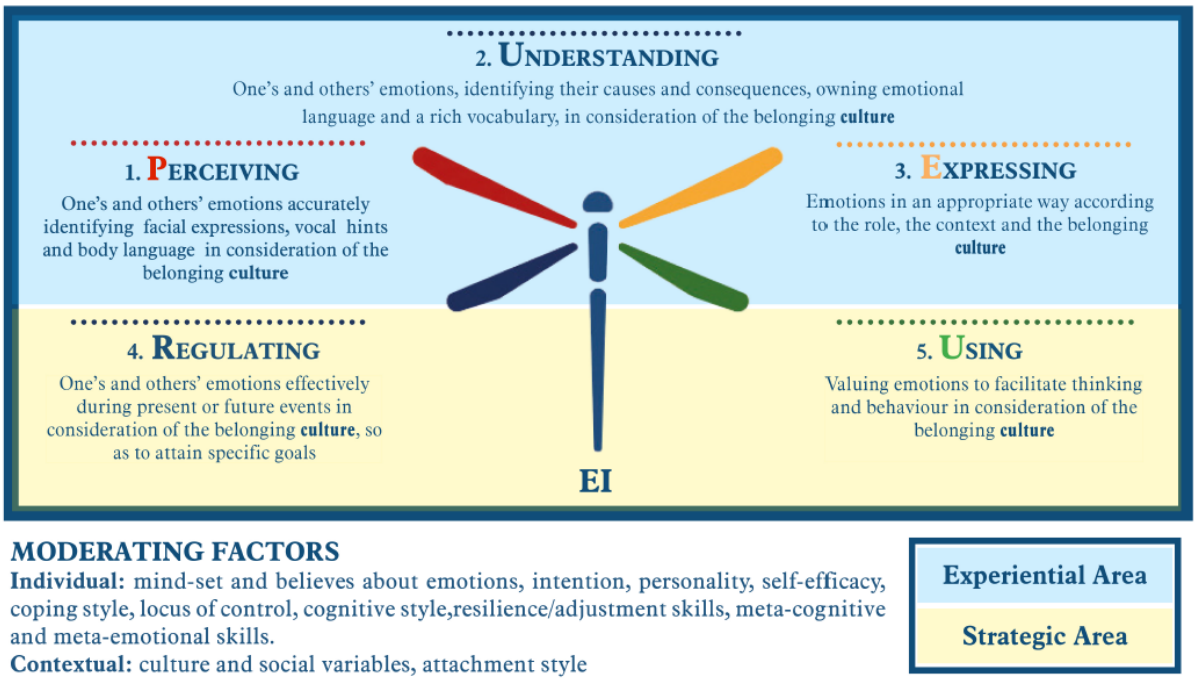

Figure 1. The PUERUModel: A Hierarchical and Systemic Ability Framework of EI (Artusio, 2016)

2.2 EI in the Aviation Context

Emotion management techniques play a critical role in regulating stress, and in turn performance (Rivers, Brackett, Reyes, Elbertson, & Salovey, 2013). International literature has shown that EI is negatively correlated with lower stress levels (Brackett, Rivers, & Salovey, 2011; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006). Individuals that are able to regulate the intensity of their

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emotional responses are also more able to allocate their cognitive resources. In fact, also an emotion with an extreme positive valence can induce high levels of arousal, with a consequent decrement of job performance. The emotional valence and the level of arousal are strongly interconnected (Cai & Lin, 2011).
EI abilities are critical for pilots and ATCs, in particular, for coping with stressors derived from high-risk events, such as unexpected situations or flying critical events. Pilots and ATCs are continually dealing with environmental, acute reactive, and life events stressors (Green, 1985), which influence flight safety or increasing performance demand or reducing pilot performance ability. At the exhaustion stage of adaptation, critical events are the result of a level of performance demand higher than the pilot's performance ability. Enhancing EI skills provides individuals with effective strategies in order to cope with daily stressors, increasing performance ability.
EI skills are also important for team goal processes. In fact, studies on the ability model of EI have shown that higher EI skills are linked to improved psychophysical health, quality of relationships, performance, and stressed management, in addition to many other positive outcomes relevant to the aviation sector (Ashkanasy & Daus, 2002; Brackett & Mayer, 2003; Fulmer & Barry, 2004; Humphrey, 2002; Lopes, Cote, & Salovey, 2006; Mayer, Caruso, & Salovey, 1999; Mayer, et al., 2008).
There are few studies that have explored the importance of the ability model of EI in the aviation context. One of the first European researches on EI in the aviation sector showed the essential role played by emotions in particular stressful events (Artusio, 2013).
The general purpose of the present study was to investigate the impact of EI skills on psychological health and human performance in an Italian expert population of ATCs.
A mixed methods analysis has proven to be an effective method for attaining a more comprehensive understanding of the impact of emotions on Human Factor (HF) and performance in the aviation context among ATCs population. In fact the integration of quantitative (e.i., questionnaires) and qualitative data (e.i., interviews and focus groups) provides a deeper and more meaningful assessment of the analysis and findings of the present study (Creswell, Plano Clark, Guttman, & Hanson, 2003).
Finally, this study aims to generate empirical evidence regarding the impact of EI in the air traffic control context as a first step in the process of developing an EI evidence-based training for aviation professionals to increase performance and safety and to reduce situational distress and human error.

2.3 Ethics Statement

The study was approved by three Ethics Committees (CNR Research Ethics and Bioethics Committee, Ethical Committee of US Air Force, and Ethical Committee of Western Institutional Review Board - WIRB). All the participants of this research project signed the approved informed consent and did not receive any compensation for participating.

3. QUANTITATIVE STUDY

3.1 Purpose of the Study

This research aimed to:
1) At a descriptive level, identify EI skills (i.e., perceiving, understanding, using, managing emotions) profiles, key personality traits (i.e., neuroticism, extraversion, openness, agreeableness, conscientiousness), and perceived level of emotional distress on a highly specialized group of Italian civil ATCs. This study measured baseline test scores from the Mayer-Salovey-Caruso Emotional Intelligence Test - MSCEIT, the NEO Personality Inventory-3 (NEO-PI-3), and the Outcome Questionnaire - OQ 45.2 on professional ATCs in order to (a) evaluate if the EI skills and personality traits of such a specialized group differ from the general population; (b) assess for

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significant differences in EI skills and key personality traits between male ATCs and female ATCs; (c) verify the prevalence of clinical distress among Italian ATCs.
2) Assess the relationship between EI skills and psychological health of ATCs, analyzing (a) the correlation between these variables; (b) the impact of the different EI skills on the ATCs' wellbeing; and (c) differences between groups of ATCs with low, average, and high levels of EI skills on ATCs' distress.

3.2 METHOD

3.2.1 Participants

A total of 408 ATCs from across the selected Italian air navigation service provider ENAV participated in the present project. Approximately 23% of the ENAV ATCs were sampled. Participants have an average of 45.8 (SD = 7.5) years of age. See Table 1 for demographics of participants.

Table 1. Sample Demographics

	Survey 2018	
	ENAV ATCs *(n = 408)*	
Demographics	*n*	*%*
Gender		
Male	359	88
Female	45	11
No. That Declined to Report Gender	4	1
Nationality		
Italian	401	98.3
No. That Declined to Report Nationality	7	1.7
Educational Level		
Middle School	1	.2
High School	327	80.1
College Degree	61	15
Master's or Doctoral Degree	13	3.2
No. That Declined to Report Educational	6	1.5
Professional Role in ENAV		
ATC	402	98.6
ATC/Instructors	1	.2
ATC/Operative supervisor	1	.2
No. That Declined to Report Professional Role in ENAV	4	1

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Seniority		
3-10 years	44	10.8
11-20 years	89	21.8
More than 20 years	270	66.2
No. That Declined to Report Seniority	5	1.2

Demographics

A questionnaire on demographic variables was included in the survey, which was composed of items that evaluated for age, gender, nationality, educational level, professional role in ENAV, and seniority. This questionnaire guaranteed anonymity in order to facilitate participants' self-disclosure.

Emotional Intelligence

The Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2002 - Italian version: D'Amico & Curci, 2010) is an ability-based performance test designed to measure the four branches of the EI model of Salovey and Mayer (1990; Mayer & Salovey, 1997): Perceiving Emotions - the ability to perceive emotions in oneself and others as well as in objects, art, stories, music, and other stimuli; Using Emotions - the ability to generate, use, and feel emotions as necessary to communicate feelings or employ them in other cognitive processes; Understanding Emotions - the ability to understand emotional information, to understand how emotions combine and progress through relationship transitions, and to appreciate such emotional meanings; Managing Emotions - the ability to be open to feelings, and to modulate them in oneself and others so as to promote personal understanding and growth. Developed from an intelligence testing tradition, it consists of 141 items and takes 30-45 minutes to complete. It provides 15 main scores: Total EI score, two Area scores, four Branch scores, and eight Task scores.

Personality

The NEO Personality Inventory - 3 (NEO-PI-3; McCrae, Costa, & Martin, 2005 - Italian version: Fossati & Ciancaleone, 2014) is a 240-item self-report questionnaire, which measures personality on five basic personality dimensions: Neuroticism – is the general tendency to experience negative affects such as anxiety, anger, impulsivity; Extraversion – general level of interest in social groups/events and general tendency to be warm, assertive, optimistic, and gregarious; Openness – the tendency to be open to new experiences and unconventional values, intellectually curious, and aesthetically imaginative and sensitive; Agreeableness – the general interpersonal tendency toward trust, cooperation, altruism, straightforwardness, sympathy/empathy; and, Conscientiousness – the general tendency to be organized, show self-discipline, aim for achievement and carrying out tasks. Items are rated on a 5- point Likert scale from "strongly disagree" to "strongly agree". This measure assesses 30 traits, 6 for each dimension of personality.

Psychological Distress

The Outcome Questionnaire (OQ 45.2; Lambert, Hansen, Lunnen, Okiishi, Burlingame, & Reisinger, 1996 - Italian version: Chiappelli, Lo Coco, Gullo, Bensi, & Prestano, 2008) is a 45-item self-report questionnaire that measures symptoms of psychological distress. The OQ 45.2 assesses these symptoms over a 1-week period and items are rated on a 5-point Likert scale from "never" to "almost always". The OQ 45.2 identifies three domains: Symptom Distress –measures subjective symptom distress, Interpersonal Relations – assesses satisfaction with, as well as problem in, social functioning, Social Roles – evaluates individual performance in several roles and activities, and a total score that refers to the general quality of life.

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3.2.3 Procedure

ENAV Academy top management, in particular the head of the Performance Department, Nicoletta Lombardo MA, facilitated the recruitment of ATCs soliciting participation via flyers, informing potential participants that survey participation was voluntary and anonymous. ATCs were widely instructed on the purpose of the research. Researchers communicated to potential participants that ENAV would not have access to individual responses and that results would be presented in an aggregated format in order to guarantee data anonymity. Additionally, potential participants were informed the results of the survey would help them to enhance their awareness on critical aspects related with their activities in ENAV, such as the main sources of occupational distress. Volunteer ATCs were assigned to small groups and tested in a classroom during their working time. Participants were given a paper and pencil form of the survey. In general, it took participants two sessions of about 1 hour each separated by a 20 minutes break to complete the survey.

3.3 RESULTS

3.3.1 Descriptive Analyses

EI – MSCEIT
MSCEIT scores are positioned on a normal curve with an average score of 100 and a standard deviation of 15. Ranges of MSCEIT scores are defined as follows:
1. Improve (69 or less): The subject may have some difficulty in this area. It would be helpful to enhance his/her skills and knowledge;
2. Consider Developing (70-89): While this is not a strength, the subject can consider enhancing this skill area if it is an important part of his/her daily life;
3. Competent (Low average Score 90-99; high average score 100-109): The subject has sufficient skill to perform in this area with some degree of success;
4. Skilled (110-129): This is an area of strength for the subject;
5. Expert (130 or more): This may be a highly developed area of expertise; the score suggests that the subject has a great potential in this area.
Descriptive statistics for the MSCEIT scores are reported in Table 2.

Table 2. MSCEIT Total and Subscales Scores

MSCEIT	Min	Max	Mean	SD
Total EI Score	49.26	131.30	93.42	11.89
Perceiving Emotions	57.91	142.60	103.15	14.17
Using Emotions	60.13	133.98	94.72	14.63
Understanding Emotions	56.69	128.08	91.81	11.20
Managing Emotions	54.56	140.57	92.76	11.89

On average, the ATCs sample resulted competent in all the MSCEIT dimensions (Figure 2).

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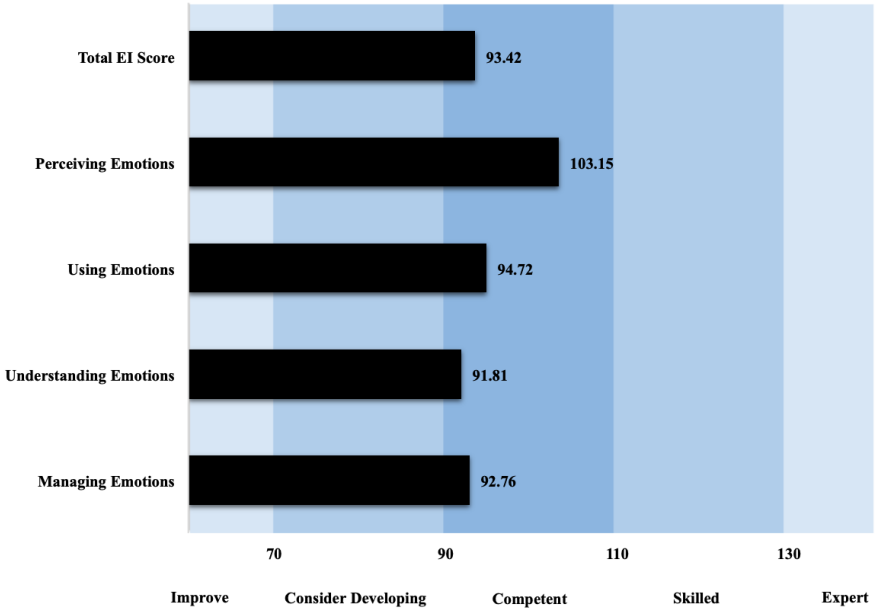

Figure 2. MSCEIT General Profile of the Total Sample

Despite significant differences were found that distinguished males' EI skills from those of females with similar duties (see Table 11), as shown in Figure 3, both groups were on average competence.

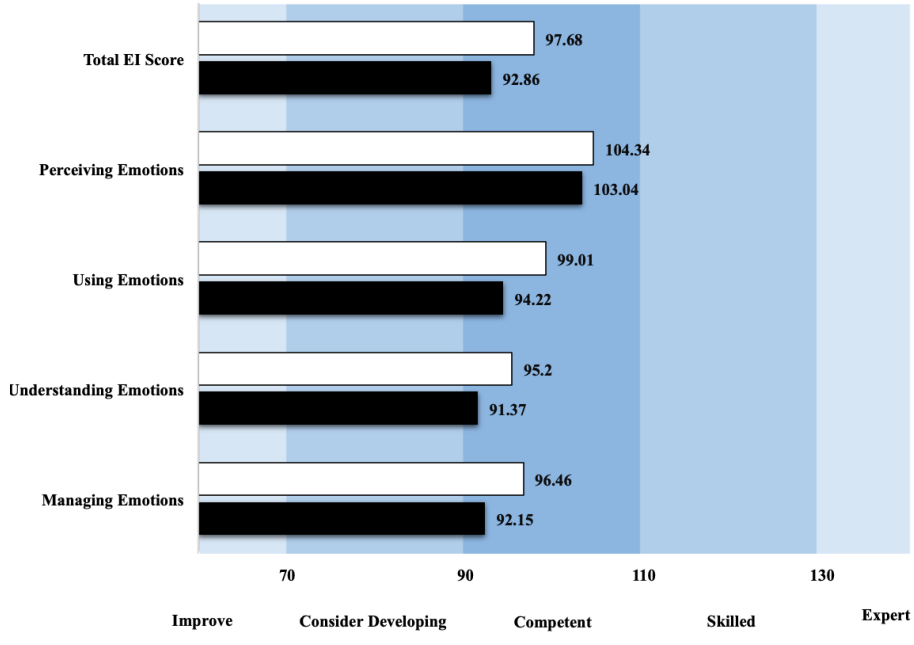

Figure 3. MSCEIT Profiles by Gender

The MSCEIT questionnaire permits to categorize participants based on their scores on the 4 branches variables and on the total EI score. In particular, we employed the proposed cutoff-criteria (≤89, 90 to 109, ≥110) to distinguish participants in three groups, characterized by low, average, and high levels of EI. Percentages of participants in each class are reported in Table 3.

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Table 3. Groups Based on EI Levels (%)

MSCEIT	Low	Average	High
Total EI Score	39.4%	51.9%	8.7%
Perceiving Emotions	17.4%	52.6%	30.0%
Using Emotions	37.6%	47.0%	15.4%
Understanding Emotions	45.7%	49.6%	4.7%
Managing Emotions	40.9%	52.0%	7.1%

Personality – NEO-PI-3

Table 4 reports the percentile equivalent t-scores obtained from the administration of the NEO-PI-3 to the research participants. Percentiles provide an indication of how individuals with different test values are spread over the interval from the smallest to the largest value. Approximately p percent of observations values fall below the score corresponding to pth percentile: as an example, based on results from Table 4, a score of 54 on the Neuroticism scale corresponds to the 75th percentile, indicating that 75% of individuals from the sample fall below a score of 54 on the Neuroticism scale. Tables 5 and 6 report the same information for the male and female subsamples respectively. As can be seen by looking at the distribution, the large majority of the score distribution is similar to the distributions of the general population normative sample. That is, score values corresponding to computed percentiles roughly correspond to those expected based on the distribution of standardized (T) scores (i.e., mean: 50, SD: 10). This seems to indicate the lack of substantial personality differences of the ATCs with respect to the general population.

Table 4. Percentile Equivalent T-Scores for the Total Sample (N = 405)

NEO-PI-3 Domain/Facet	5%	10%	25%	50%	75%	90%	95%
Neuroticism	33	36	41	47	54	60	64
Anxiety	33	35	41	46	54	60	63
Anger	35	37	42	49	56	64	68
Depression	33	35	41	47	53	61	64
Self-Consciousness	36	38	44	48	56	62	64
Impulsivity	33	37	42	49	53	60	67
Vulnerability	34	36	41	48	55	59	64
Extraversion	29	35	41	47	55	59	62
Warmth	27	33	41	48	53	60	62
Gregariousness	27	33	41	47	54	60	61
Assertiveness	33	37	43	48	54	58	63
Activity	32	35	41	49	55	58	64
Excitement-Seeking	37	39	45	51	57	63	65
Positive Emotion	29	33	41	50	56	61	64
Openness	31	34	41	48	54	61	65
Fantasy	36	38	43	50	56	63	67
Aesthetics	29	33	40	47	53	60	62
Feelings	29	36	40	47	54	60	65
Actions	30	36	41	47	54	59	63
Ideas	32	35	41	46	54	60	65
Values	35	37	42	50	57	63	65

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Agreeableness	33	37	43	49	56	61	65
Trusting	36	40	46	53	59	64	67
Straightforwardness	31	38	45	52	59	64	68
Altruism	30	35	40	48	53	61	63
Compliance	33	38	43	51	56	61	63
Modesty	33	38	44	51	55	62	64
Tender-Mindedness	32	35	41	49	55	61	64
Conscientiousness	29	33	40	46	51	56	61
Competence	36	40	43	48	53	61	63
Orderliness	30	34	39	47	53	59	63
Dutifulness	26	33	39	44	53	58	61
Achievement-Striving	27	30	36	43	49	56	60
Self-Discipline	28	32	40	47	52	60	62
Deliberation	33	37	43	50	54	60	63

Table 5. Percentile Equivalent T-Scores for the Male Subsample (N = 356)

NEO-PI-3 Domain/Facet	5%	10%	25%	50%	75%	90%	95%
Neuroticism	33	36	41	47	53	60	64
Anxiety	31	35	41	46	52	58	63
Anger	35	37	42	49	56	64	66
Depression	33	35	39	45	51	60	63
Self-Consciousness	36	38	42	48	54	60	64
Impulsivity	33	36	42	46	53	60	65
Vulnerability	34	36	41	48	52	59	64
Extraversion	30	35	41	47	54	58	62
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Assertiveness	33	37	43	48	54	58	63
Activity	32	35	41	46	55	58	61
Excitement-Seeking	38	39	45	51	57	63	67
Positive Emotion	29	33	41	49	56	60	64
Openness	31	35	40	47	53	60	63
Fantasy	36	38	43	50	56	63	67
Aesthetics	29	32	38	46	53	58	60
Feelings	29	36	40	47	54	58	62
Actions	31	36	41	47	54	59	61
Ideas	32	35	41	46	54	59	65
Values	35	37	42	50	55	63	65
Agreeableness	33	37	43	49	56	61	64
Trusting	36	40	46	53	59	64	66
Straightforwardness	31	36	45	52	59	63	66
Altruism	30	32	40	48	53	61	61
Compliance	33	37	43	51	55	61	63
Modesty	33	38	42	48	55	59	64
Tender-Mindedness	29	35	41	49	55	61	64

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Conscientiousness	30	34	41	47	51	57	61
Competence	36	41	43	48	56	61	63
Orderliness	30	34	39	47	53	59	63
Dutifulness	25	33	39	44	53	58	61
Achievement-Striving	27	30	37	45	51	56	60
Self-Discipline	28	30	40	47	54	60	62
Deliberation	33	37	45	50	56	60	64

Table 6. Percentile Equivalent T-Scores for the Female Subsample (N = 45)

NEO-PI-3 Domain/Facet	5%	10%	25%	50%	75%	90%	95%
Neuroticism	36	43	48	55	59	64	68
Anxiety	36	40	48	54	58	63	63
Anger	35	39	46	52	61	72	73
Depression	38	41	47	53	59	63	65
Self-Consciousness	38	41	46	54	60	64	71
Impulsivity	40	42	48	53	60	66	69
Vulnerability	33	39	48	50	57	64	66
Extraversion	27	34	44	49	58	60	63
Warmth	27	37	45	50	56	63	67
Gregariousness	26	31	40	52	56	61	66
Assertiveness	29	33	39	48	52	58	64
Activity	26	35	44	49	55	64	66
Excitement-Seeking	30	38	45	53	57	61	63
Positive Emotion	28	33	46	52	60	67	68
Openness	33	39	50	53	59	67	70
Fantasy	33	37	46	56	60	67	68
Aesthetics	39	41	49	57	60	65	66
Feelings	31	40	45	54	60	65	67
Actions	33	40	45	50	58	63	69
Ideas	37	41	46	52	58	62	64
Values	37	45	50	53	58	65	72
Agreeableness	41	43	47	49	55	65	71
Trusting	33	38	43	51	57	65	72
Straightforwardness	41	43	47	52	61	73	75
Altruism	36	37	40	48	55	61	63
Compliance	34	38	42	48	56	59	61
Modesty	41	45	48	53	57	64	67
Tender-Mindedness	35	38	46	52	57	65	71
Conscientiousness	29	31	37	43	49	52	54
Competence	33	36	41	48	50	54	57
Orderliness	27	33	38	45	53	58	60
Dutifulness	29	31	36	42	50	58	61
Achievement-Striving	25	26	33	41	49	58	62
Self-Discipline	29	32	39	45	50	56	59
Deliberation	28	32	39	45	52	57	58

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Psychological Distress - OQ 45.2
Total and subscale scores for the OQ 45.2 were obtained by summing item responses. Descriptive statistics are reported in Table 7.

Table 7. OQ 45.2 Total and Subscales Scores (N = 407)

OQ-45.2	Min	Max	Mean	SD
Total Score	1.00	85.00	29.91	16.21
Symptom Distress	.00	50.00	15.32	9.25
Interpersonal Relations	.00	19.00	6.78	3.67
Social Role	54.56	140.57	92.76	11.89

The average OQ-45.2 total score was 29.91 (SD = 16.21) for survey participants. Individuals were separated according to those with OQ-45.2 total scores at and above 66 and those below 66 (66 is the Italian cutoff used to distinguish between individuals with high vs. medium/low distress). A total of 10 (2.5%) participants reported high total distress scores at or above 66. Chi-square tests were then conducted in order to study the possible association of distress with gender and seniority level. No significant associations emerged with respect neither to seniority ($\chi 2(2) = 1.53$, $p = .47$) nor to gender ($\chi 2(1) = 3.67$, $p = .06$).

3.3.2 Associations Between Personality Traits, EI and Psychological Distress

Table 8 shows the Pearson's correlations between the five personality domains (NEO-PI-3), EI (MSCEIT) and psychological distress (OQ 45.2) totals and subscales scores. All the MSCEIT scores show low or no significant correlations with the five traits measured by the NEO-PI-3. The highest correlations were those between OQ 45.2 scales and neuroticism. All the OQ 45.2 scales show quite high positive correlations with neuroticism, and lower correlations with the other personality domains.

Table 8. Correlations Between NEO-PI-3 and MSCEIT Scales and OQ 45.2

	N	E	O	A	C
MSCEIT					
Total Score	-.13**	.14**	.19**	.05	.12*
Perceiving Emotions	-.18**	.14**	.12*	.09	.05
Using Emotions	-.03	.04	.18*	-.03	.10
Understanding Emotions	.01	-.04	.06	-.06	.05
Managing Emotions	-.18**	.23**	.15**	.14**	.19**
OQ 45.2					
Total Score	.70**	-.49**	-.07	-.20**	-.41**
Symptom Distress	.72**	-.j46**	-.05	-.18**	-.43**
Interpersonal relations	.54**	-.49**	-.10*	-.19**	-.30**
Social Role	.57**	-.40**	-.04	-.19**	-.31**

** $p < .01$; * $p < .05$
Legend. N = Neuroticism; E = Extraversion; O = Openness; A = Agreeableness; C=Conscientiousness

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3.3.3 Associations Between EI, Personality, and Psychological Distress with Age

Table 9 shows the Pearson's correlations computed between age and EI (MSCEIT), personality (NEO-PI-3) and psychological distress (OQ 45.2) scales. Concerning EI, the total score, Using emotions, and Managing emotions show a negative correlation with age. As shown in the Table 9, among the five personality traits, Extraversion and some of its facets (e.i., Gregariousness, Activity, Excitement-Seeking, and Positive Emotion) are negatively correlated with age, while Agreeableness and some of its facets (e.i., Straightforwardness and Tender-Mindedness) tend to grow with age. Finally, Impulsivity (Neuroticism), Actions (Openness), and Achievement-Striving (Conscientiousness) tend to decrease with age. Psychological distress scales do not show significant correlations with age.

Table 9. Correlations Among Study Variables and Age

	Pearson's *r*	***p***
MSCEIT		
Total EI Score	-.146	.004
Perceiving Emotions	-.049	.324
Using Emotions	-.128*	.011
Understanding Emotions	-.069	.167
Managing Emotions	-.146**	.004
NEO-PI-3		
Neuroticism	-.034	.505
Anxiety	-.050	.322
Anger	-.016	.760
Depression	-.013	.797
Self-Consciousness	-.020	.692
Impulsivity	-.102*	.045
Vulnerability	.008	.875
Extraversion	-.196**	.000
Warmth	-.043	.399
Gregariousness	-.189**	.000
Assertiveness	-.071	.166
Activity	-.171**	.001
Excitement-Seeking	-.182**	.000
Positive Emotion	-.179**	.000
Openness	-.049	.340
Fantasy	-.022	.670
Aesthetics	.023	.647
Feelings	.002	.963
Actions	-.105*	.038
Ideas	-.074	.144
Values	-.062	.220

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Agreeableness	.111*	.029
Trusting	.079	.119
Straightforwardness	.146**	.004
Altruism	-.005	.921
Compliance	-.003	.947
Modesty	.057	.263
Tender-Mindedness	.125*	.014
Conscientiousness	.011	.834
Competence	-.041	.420
Orderliness	.055	.276
Dutifulness	.078	.127
Achievement-Striving	-.145**	.004
Self-Discipline	.001	.990
Deliberation	.092	.070
OQ-45.2		
Total Score	.057	.265
Symptom Distress	.016	.756
Interpersonal Relations	.090	.075
Social Role	.090	.076

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

3.3.4 Differences Between EI, Personality, and Psychological Distress by Seniority Level and Gender

Results of the one-way ANOVA models performed to investigate differences on EI, personality, and psychological distress by seniority levels are reported in the Table 10. Concerning the MSCEIT measures, significant variability related to participants' seniority level emerged on the ability of Managing emotions. Inspection of η2 revealed the overall effect-size due to seniority level was small. Multiple group comparisons were performed via post-hoc Bonferroni analyses. Significant group differences are reported using compact letter display, i.e. groups with the same letter are not significantly different at alpha= 0.05. When compared with the > 20 years seniority group, the 3-10 years seniority group score significantly higher on Managing emotions. As regards personality, significant variability related to participants' seniority level emerged on Impulsivity, Extraversion, Gregariousness, Excitement seeking, Values, Trusting, Straightforwardness, and Achievement Striving traits. Bonferroni analyses revealed that when compared with the > 20 years seniority group, on average the 3-10 years seniority group scored significantly higher on Impulsivity, Extraversion, Gregariousness, Excitement Seeking, and Achievement Striving traits, and lower on Trusting and Straightforwardness trait. The 3-10 years seniority group also reports significantly higher scores on the Excitement Seeking and Achievement Striving traits when compared with the 11-20 years seniority group. Finally, concerning the OQ 45.2 measures, the 3-10 years seniority group shows significantly higher scores on the symptoms distress subscale than > 20 years seniority group.

Table 10. One-Way ANOVA: MSCEIT, NEO-PI-3, and OQ 45.2 by Seniority Level

	3-10 Years	**11-20 years**	**> 20 years**	***F***	***p***	η^2
MSCEIT						
Total EI Score	94.97 a	95.49 a	92.48 a	2.53	.08	.01
Perceiving	103.71 a	103.45 a	103.05 a	.06	.95	.00

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Using	94.71 a	96.74 a	94.13 a	1.04	.35	.01
Understanding	91.91 a	93.88 a	91.10 a	2.07	.13	.01
Managing	96.18 a	94.23 ab	91.55 b	3.95	.02	.02
NEO-PI-3						
Neuroticism	50.59 a	48.79 a	47.30 a	2.77	.06	.01
Anxiety	48.57 a	48.38 a	48.66 a	1.70	.18	.01
Anger	52.23 a	49.83 a	49.41 a	1.49	.23	. 01
Depression	50.23 a	47.69 a	46.77 a	2.65	.07	.01
Self-Consciousness	51.43 a	50.52 a	48.90 a	2.21	.11	.01
Impulsivity	51.70 a	49.52 ab	47.53 b	4.59	.01	.02
Vulnerability	49.20 a	48.44 a	48.24 a	.22	.80	.00
Extraversion	50.41 a	47.87 ab	46.39 b	3.63	.03	.02
Warmth	45.75 a	47.16 a	46.03 a	.50	.61	.00
Gregariousness	49.75 a	47.00 ab	45.49 b	3.77	.02	.02
Assertiveness	48.66 a	47.94 a	47.85 a	.16	.86	.00
Activity	49.43 a	48.12 a	46.57 a	2.29	.10	.01
Excitement-Seeking	56.25 b	50.56 a	50.44 a	8.58	.00	.04
Positive Emotion	50.66 a	49.36 a	47.45 a	2.45	.09	.01
Openness	47.20 a	48.20 a	47.25 a	.34	.71	.00
Fantasy	49.80 a	50.54 a	49.85 a	.18	.83	.00
Aesthetics	44.93 a	46.93 a	46.60 a	.65	.52	.00
Feelings	47.41 a	46.87 a	47.33 a	.08	.92	.00
Actions	47.50 a	48.36 a	47.38 a	.39	.68	.00
Ideas	48.93 a	48.20 a	47.55 a	.48	.62	.00
Values	49.50 a	52.11 a	49.25 a	2.93	.05	.01
Agreeableness	46.82 a	48.46 a	49.86 a	2.44	.09	.01
Trusting	48.82 a	50.64 ab	52.84 b	4.33	.01	.02
Straightforwardness	46.59 a	50.88 ab	51.87 b	5.02	.01	.02
Altruism	46.16 a	47.11 a	46.88 a	.15	.86	.00
Compliance	48.41 a	48.99 a	48.70 a	.06	.94	.00
Modesty	48.73 a	48.80 a	49.36 a	.19	.83	.00
Tender-Mindedness	48.59 a	46.42 a	49.08 a	2.27	.10	.01
Conscientiousness	45.00 a	45.00 a	45.68 a	0.26	.77	.00
Competence	47.18 a	50.24 a	48.97 a	2.04	.13	.01
Orderliness	46.27 a	45.18 a	46.67 a	.84	.43	.00
Dutifulness	43.48 a	44.16 a	45.57 a	1.36	.26	.01
Achievement-Striving	48.89 b	43.35 a	42.72 a	7.85	.00	.04
Self-Discipline	44.25 a	45.57 a	46.57 a	1.18	.31	.01
Deliberation	46.36 a	48.74 a	49.27 a	2.04	.13	.01
OQ 45.2						
Total Score	33.86 a	30.40 a	29.42 a	1.43	.24	.01
Symptom Distress	18.42 a	16.09 ab	14.71 b	3.33	.04	.02
Interpersonal Relations	7.82 a	7.98 a	7.84 a	.03	.97	.00
Social Role	7.63 a	6.33 a	6.86 a	1.89	.15	.01

Concerning gender, many significant differences emerged on EI, personality and distress measures (Table 11). Inspection of η^2 for significant effects showed that size of effects ranges from negligible

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to small ($0.01 \leq \eta^2 \leq 0.08$). Concerning the MSCEIT scores, female ATCs show higher scores on the Using Emotions, Understanding Emotions, and Managing Emotions subscales and Total EI score. Concerning personality, on average male participants scored significantly higher on the Conscientiousness trait and on two of its facets (Competence and Deliberation). In turn, female participants scored significantly higher than males on the Neuroticism and all its facets (i.e., Anxiety, Anger, Depression, Self-consciousness, Impulsivity, Vulnerability), on Warmth and Positive emotion (Extraversion), on Openness and all its facets (i.e., Fantasy, Feelings, Aesthetics, Actions, Ideas, Values), on Straightforwardness, Tender-Mindedness, and Modesty (Agreeableness) scales. Finally, concerning the psychological distress measures, we also note that on average, female participants showed higher scores than males on all distress measures (Total score, Interpersonal Relations, and Social Role) except for Symptom Distress.

Table 11. T-Test: EI, Personality, and Psychological Distress by Gender

	Male	**Female**	***t***	***p***	η^2
MSCEIT					
Total EI Score	92.86	97.68	-2.57	.01	.02
Perceiving Emotions	103.04	104.34	-.58	.56	.00
Using Emotions	94.22	99.01	-2.07	.04	.01
Understanding Emotions	91.37	95.20	-2.17	.03	.01
Managing Emotions	92.15	96.46	-2.32	.02	.01
NEO-PI-3					
Neuroticism	47.22	53.82	-4.56	.00	.05
Anxiety	46.54	52.56	-4.24	.00	.04
Anger	49.35	53.51	-2.65	.01	.02
Depression	46.58	53.24	-4.59	.00	.05
Self-Consciousness	49.04	53.22	-2.98	.00	.02
Impulsivity	47.76	53.67	-4.06	.00	.04
Vulnerability	47.91	51.93	-2.85	.00	.02
Extraversion	46.93	48.96	-1.33	.18	.00
Warmth	45.90	49.33	-2.21	.03	.01
Gregariousness	46.05	48.20	-1.37	.17	.00
Assertiveness	48.22	46.00	1.59	.11	.01
Activity	47.05	48.58	-1.03	.30	.00
Excitement-Seeking	51.17	50.53	.45	.65	.00
Positive Emotion	47.75	51.84	-2.48	.01	.02
Openness	46.70	53.78	-4.73	.00	.05
Fantasy	49.66	52.87	-2.15	.03	.01
Aesthetics	45.53	54.36	-5.89	.00	.08
Feelings	46.58	52.60	-3.94	.00	.04
Actions	47.28	50.51	-2.25	.02	.01
Ideas	47.50	50.89	-2.26	.02	.01
Values	49.45	53.76	-3.24	.00	.02

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Agreeableness	48.89	51.73	-1.95	.05	.01
Trusting	52.20	50.02	1.42	.16	.01
Straightforwardness	50.54	55.00	-2.74	.01	.02
Altruism	46.70	47.98	-.84	.40	.00
Compliance	48.83	47.84	.68	.49	.00
Modesty	48.60	53.51	-4.28	.00	.03
Tender-Mindedness	48.07	51.36	-2.03	.04	.01
Conscientiousness	45.83	42.44	2.42	.02	.01
Competence	49.45	45.98	2.67	.01	.02
Orderliness	46.47	44.76	1.15	.25	.00
Dutifulness	45.24	43.58	1.09	.28	.00
Achievement-Striving	43.79	41.29	1.62	.11	.01
Self-Discipline	46.28	44.60	1.07	.28	.00
Deliberation	49.28	45.22	2.91	.00	.02
OQ-45.2					
Total Score	29.16	37.36	-3.25	.00	.03
Symptom Distress	7.70	9.07	-1.80	.07	.01
Interpersonal Relations	6.64	8.25	-2.81	.01	.02
Social Role	29.16	37.36	-3.25	.00	.03

3.3.5 Relationships Between EI Skills and Psychological Distress

In order to examine the relationship between EI and psychological distress we computed Pearson's correlations between MSCEIT and OQ 45.2 variables. Results are reported in the Table 12. As show in the Table, the Total EI score is moderately negatively correlated with all of the OQ 45.2 variables, with Pearson's r values ranging from -.14 (for Symptom Distress) to -.19 (for Interpersonal Relations variable). As regards the four MSCEIT branches, the Managing emotions score shows the highest correlations with the OQ 45.2 variables, followed by the perceiving emotions score. The two branches Using emotions and Understanding emotions are not significantly correlated with OQ 45.2 variable scores.

Table 12. Correlations Between MSCEIT and OQ 45.2 Scales

MSCEIT	OQ-TS	OQ-SD	OQ-IR	OQ-SR
Total EI Score	-.168**	-.136**	-.191**	-.149**
Perceiving Emotions	-.156**	-.116*	-.181**	-.156**
Using Emotions	-.003	-.003	.005	-.010
Understanding Emotions	-.033	-.027	-.081	.026
Managing Emotions	-.228**	-.198**	-.215**	-.225**

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

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

As a further step, we performed 4 regression models, using the four EI skills as predictors, and the OQ 45.2 variables as DVs, controlling for age and gender. The aim of these analyses was to identify specific contributions of the four skills of EI on OQ 45.2 variables. In line with the correlations between EI and OQ 45.2 variables, we found that the most relevant predictors were Perceiving and Managing emotions abilities, that exerted a significant negative influence on all of the OQ 45.2

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subscales and on the total score (Table 13). The more the participants are able to perceive and manage their emotions, the less they are likely to experience emotional distress.

Table 13. Standardized Regression Coefficients

Predictors	OQ-TS	OQ-SD	OQ-IR	OQ-SR
Age	-.046	.050	.029	-.005
Gender	.204**	.0120*	.164**	.190**
MSCEIT - Perceiving Emotions	-.122*	-.186**	-.179**	-.166*
MSCEIT - Using Emotions	.077	.129*	.086	.102
MSCEIT - Understanding Emotions	-.029	-.070	.045	-.027
MSCEIT - Managing Emotions	-.228**	-.224**	-.252**	-.255**
R^2	.099	.105	.113	.118
ΔR^2 (EI contribution)	.085	.091	.090	.091

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

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

In order to be able to identify possible non-linear associations between MSCEIT variables and OQ 45.2 scores, we also conducted several one-way ANOVAs aimed at testing the existence of possible significant differences in OQ 45.2 variables among the EI low, average and high groups. Results of these analyses confirm the presence of a substantial linear relationship between EI and psychological distress. Following Tables (Tables 14-18) show the results of ANOVA analyses conducted using EI categorical variables as IV and OQ 45.2 variables as DVs. Post-hoc tests were performed using Bonferroni correction. Significant group differences are reported using compact letter display, i.e. groups with the same letter are not significantly different at alpha= 0.05. As can be seen, participants characterized by a lower level of total EI tend to be more prone to psychological distress, even if the effect sizes are always small.

Table 14. Differences in OQ 45.2 Variables Between ATCs with Low, Average and High Levels of the Overall EI Skill

Tot EI Score	N		OQ-TS		OQ-SD		OQ-IR		OQ-SR	
Low	158	*M*	32.96	a	16.77	a	8.76	a	7.42	a
		SD	14.93		8.67		4.58		3.38	
Average	207	*M*	28.58	b	14.70	ab	7.40	b	6.48	b
		SD	15.98		9.10		4.76		3.66	
High	35	*M*	24.17	b	12.41	b	6.13	b	5.62	b
		SD	18.03		10.26		4.91		4.09	
Total	400	*M*	29.92		15.32		7.83		6.78	
		SD	15.96		9.12		4.77		3.63	
		F	6.016		4.336		6.247		5.101	
		p	0.003		0.014		0.002		0.006	
		η2	0.029		0.021		0.031		0.025	

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

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As regards the four EI branches, significant effects are found for the Perceiving and Managing emotions dimensions (see Table 15 and Table 18 respectively).

Table 15. Differences in OQ 45.2 Variables Between ATCs with Low, Average and High Levels of the EI skill of Perceiving Emotions

Perceiving	**N**		**OQ-TS**		**OQ-SD**		**OQ-IR**		**OQ-SR**	
Low	71	*M*	31.81	a	15.86	a	8.63	a	7.33	a
		SD	15.57		8.92		4.49		3.73	
Average	214	*M*	31.21	a	15.90	a	8.29	a	7.01	a
		SD	16.67		9.48		4.83		3.73	
High	121	*M*	26.06	b	13.70	a	6.39	b	5.97	b
		SD	14.45		8.44		4.55		3.35	
Total	406	*M*	29.78		15.24		7.78		6.76	
		SD	16.00		9.12		4.77		3.65	
		F	4.778		2.466		7.753		4.274	
		p	0.009		0.086		<0.001		0.015	
		η2	0.023		0.012		0.037		0.021	

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

Table 16. Differences in OQ 45.2 Variables Between ATCs with Low, Average and High Levels of the EI skill of Using Emotions

Using	**N**		**OQ-TS**		**OQ-SD**		**OQ-IR**		**OQ-SR**	
Low	150	*M*	30.32	a	15.61	a	7.86	a	6.86	a
		SD	15.28		8.95		4.45		3.40	
Average	189	*M*	29.68	a	15.18	a	7.77	a	6.73	a
		SD	15.74		8.92		4.91		3.53	
High	62	*M*	29.39	a	14.89	a	7.82	a	6.68	a
		SD	18.38		10.18		5.18		4.40	
Total	401	*M*	29.88		15.30		7.81		6.77	
		SD	15.97		9.12		4.77		3.62	
		F	0.100		0.164		0.015		0.072	
		p	0.905		0.849		0.985		0.930	
		η2	0.001		0.001		<0.001		<0.001	

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

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Table 17. Differences in OQ 45.2 Variables Between ATCs with Low, Average and High Levels of the EI skill of Understanding Emotions

Understanding	N		OQ-TS		OQ-SD		OQ-IR		OQ-SR	
Low	186	*M*	30.21	a	15.41	a	8.11	a	6.69	a
		SD	15.72		9.03		4.76		3.57	
Average	201	*M*	29.50	a	15.12	a	7.60	a	6.79	a
		SD	16.49		9.36		4.76		3.75	
High	19	*M*	28.43	a	14.85	a	6.47	a	7.11	a
		SD	13.84		7.68		4.83		3.40	
Total	406	*M*	29.78		15.24		7.78		6.76	
		SD	16.00		9.12		4.77		3.65	
		F	0.166		0.070		1.312		0.128	
		p	0.847		0.932		0.270		0.880	
		η2	0.001		0.000		0.006		0.001	

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

Table 18. Differences in OQ 45.2 Variables Between ATCs with Low, Average and High Levels of the EI Skill of Managing Emotions

Managing	N		OQ-TS		OQ-SD		OQ-IR		OQ-SR	
Low	165	*M*	33.71	a	17.00	a	9.01	a	7.69	a
		SD	14.97		8.71		4.56		3.39	
Average	211	*M*	27.97	b	14.49	b	7.12	b	6.36	b
		SD	15.73		9.01		4.66		3.60	
High	29	*M*	21.20	b	10.96	c	5.86	b	4.38	c
		SD	18.13		10.21		5.08		3.99	
Total	405	*M*	29.82		15.26		7.80		6.76	
		SD	15.99		9.12		4.76		3.65	
		F	11.021		7.206		10.386		13.609	
		p	<0.001		0.001		<0.001		<0.001	
		η2	0.052		0.035		0.049		0.063	

Legend. OQ-TS = OQ 45.2 - Total Score; OQ-SD = OQ 45.2 - Symptom Distress; OQ-IR = OQ 45.2 - Interpersonal relations; OQ-SR = OQ 45.2 - Social Role

3.3.6 Performance Data

ENAV provided performance data only for the 10% of the total sample.
Additionally, the organization provided researchers with different kind of performance data (in fact, evaluation forms included different assessment scales and different studied variables, not

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comparable between participants). For these reasons we could not assess performance in the quantitative study.

3.4 DISCUSSION

At a descriptive level, this study aimed to identify EI skills profiles, key personality traits, and perceived level of emotional distress on a highly specialized group of Italian civilian ATCs.
The normative MSCEIT EI total score of the Italian sample of ATCs is located in the Competent area. A Competent score means that the ATCs possess enough emotional ability to perform several emotional tasks, are aware of emotions in themselves and in others and their perception, using, understanding and managing of emotions is often, but not always, accurate.
More specifically, they are fairly accurate at reading emotional data in faces, pictures, etc. (Perceiving Emotions); most of time they are able to connect with others and to get insight from emotions (Using Emotions); most of the time they can make sense of their emotions or emotions of others, can talk about them, and have a pretty good idea of how people will react. (Understanding Emotions); finally, most of the time they are successful in handling their own and others' feelings and they are able to make decisions that balance thinking and feelings (Managing Emotions).
Dealing with a highly demanding job (Proctor & Van Zandt, 1994), which requires high levels of knowledge and expertise, not only related to cognitive or technical domains but also to emotional and relational aspects, we hypothesized that ATCs scored higher on EI skills than the general population. However, no significant differences were found between the highly specialized group of Italian civilian ATCs and the general population. Currently ATCs professionals have general engineering or other technical backgrounds, but unfortunately, they still have little or no formal education with regards to the development of their emotional abilities. Thus, many safety professionals are still ill equipped in being able to manage the emotional stressors that they constantly have to cope with at work such as peaks of traffic load, time pressure, equipment reliability, shiftwork, conflicts within the team, exposition to critical accidents and high responsibility (e.g. risking lives and the high economic costs of aeronautical activities) (Schultz & Schultz, 2010).
ATCs are supposed to apply, in an effective way, rules and procedures, often under different circumstances and under pressure. They constantly have to cope with a high number of decisions made in a short time, coordination with the team, anticipation and solving problems as they arise (Costa, 1995). Starting from these considerations, participants were expected to have distinctive traits of personality (e.g., higher conscientiousness, lower neuroticism/emotional instability, lower anxiety) in comparison with the general population. However, results showed that the Italian ATCs are not significantly different from the general population in terms of key personality traits as measured by the NEO-PI-3.
The use of the NEO-PI-3 during the recruitment phase of ATCs could provide ENAV with a more focused evaluation of those personality traits considered crucial to better perform in such a complex and demanding context.
A second goal of this study was to assess the relationship between EI skills and the psychological health of ATCs, analyzing (a) the correlation between these variables; (b) the impact of the different EI skills on the ATCs' wellbeing; and (c) differences between groups of ATCs with low, average, and high levels of EI skills on ATCs' distress.
Results showed a significant relationship between EI skills and ATCs' psychological health, but the magnitude of the effect was moderate. This result is in line with previous studies that showed significant association between higher EI skills and improved psychophysical health (Ashkanasy & Daus, 2002; Brackett & Mayer, 2003; Fulmer & Barry, 2004; Humphrey, 2002; Lopes, et al., 2006; Mayer, et al, 1999, 2008) therefore, confirming the importance of EI skills in the context of air traffic control.

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More in detail, among the five EI skills, those that significantly influenced ATCs' emotional distress were the abilities to perceive and manage emotions in self and in others.
This results it is not surprising. In fact, the ability to correctly perceive emotions that arise in self and others is fundamental in order to perform procedures safely and accurately. Speed and accuracy in perceiving nonverbal signals (e.g., facial expressions) are important skills to reduce human error in the air traffic control sector.
Perceiving emotions was expected to be higher in consideration of specific tasks performed by ATCs, which require a high Situational Awareness, that is: ATC's ability to accurately perceive what is "going on" in his or her environment (Endsley, 1995 a and b), quickly processing information and cues of nonverbal communication (e.g., tone of voice).
Additionally, results showed that the EI ability that plays a more critical role on ATCs' emotional distress is Managing emotions. Similarly to other contexts, the ability to regulate emotions is also highly important in the air traffic control sector. This result seems to confirm researches that highlighted how people with higher EI have less emotional distress after critical events (Hunt & Evans, 2004) and were more able to cope with stress (Pau & Croucher, 2003).
In sum, the present study provides a contribution for the corroboration of the significant impact of EI on psychophysical health in the air traffic control context. Therefore, the development of EI skills in Italian ATCs (which at the moment gain a competent area) via an evidence-based training represents a desirable future direction.

4. QUALITATIVE STUDIES

In the present study, we used qualitative methods to expand quantitative results and advance our research aims. Particularly, focus groups (Study 1) and interviews (Study 2) were used to produce a more complete understanding of the impact of EI skills on human performance in the air traffic control context.

4.1 STUDY 1 – FOCUS GROUPS

4.1.1 Purpose of Study

This study aimed to:
(a) Evaluate which emotional states are related to high and low performance in challenging events;
(b) Assess which emotions facilitate the air traffic control task in everyday work life;
(c) Analyze which strategies are more used by ATCs in everyday work life;
(d) Identify effective strategies for the air traffic control.
Focus groups were conducted in order to facilitate idea generation through group interactions.

4.1.2 METHOD

4.1.2.1 Participants

A total of 102 professional ATCs participated in the focus groups. Participants had an average of 43.89 (SD = 8.6) years of age. See Table 19 for demographics of ATCs.

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Table 19. Sample Demographics

	Focus Groups 2017	
	ENAV ATCs *(n = 102)*	
Demographics	*n*	*%*
Gender		
Male	88	86.3
Female	14	13.7
Nationality		
Italian	102	100
Educational Level		
High School	82	80.4
College Degree	17	16.7
Master's or Doctoral Degree	3	2.9
Professional Role in ENAV		
ATC	92	90.2
ATC/Instructor	10	9.8
Seniority		
3-10 years	8	7.8
11-20 years	12	11.8
More than 20 years	82	80.4

4.1.2.2 Procedure

Focus groups were conducted within the ENAV settings in a separate classroom during ATCs working time. The focus-group discussions were facilitated by a moderator (Dr. Artusio, co-investigator of the present project). Not having received the permission nor to videotape or audiotape the focus group, a co-moderator (who received training in focus group implementation from the moderator), took extensive notes during the discussions, subsequently transcribed. Eight focus group sessions (two hours each) were conducted, with small groups (M= 15 ATCs per sessions).

A semi-structured questioning route was developed in order to guarantee coherence in questions asked across different groups. Despite this, focus groups yet maintained some flexibility related to the level of participation within the groups and the different topics arisen. The moderators invited ATCs to previously complete an individual worksheet in order to facilitate their independent thinking before the group discussion. Another goal of the worksheets was to ground their answers with concrete examples taken from their professional experiences. The questioning route used for focus groups was summarized in the Box 1.

Once the worksheet compilation was completed, ATCs were asked to share their individual opinion, focusing mainly on two aspects: emotions that correlated with their high and low performance at work; and strategies they used to manage emotions in their everyday work life. Moderators used flip

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charts to list all the emotional states and strategies identified by ATCs in the different groups. After, moderators invited ATCs to refer back to the list transcribed on the flip chart and to discuss as a group which emotions and strategies can facilitate the task of air traffic control.

BOX 1 - FOCUS GROUP PROTOCOL

1) What is your main task as an air traffic controller? Please describe it.

2) Think about an episode when you were doing your main task and you performed well (no mistakes, goals reached, you were satisfied about results).
- How much energy did you perceive in your body?
- How much pleasantness did you perceive in your body?
- What emotions did you feel?
- What did you do to handle this situation?

3) Think about an episode when you were doing your main task and you did not perform well (you made mistakes, you did not reach the goal, you were not satisfied about results).
- How much energy did you perceive in your body?
- How much pleasantness did you perceive in your body?
- What emotions did you feel?
- What did you do to handle this situation?

4) What strategies do you use to manage emotions in everyday work life?
- Which strategies do you think are the most effective?
- Which do you think are the least effective?

4.1.2.3 Data Analysis

The individual worksheets, the lists on flip charts from the different groups, and the transcriptions of the co-moderator's notes were all used for data analysis.
We used frequencies and percentages to summarize results on the analysis of individual worksheets and flip charts.
First, individual worksheets were reviewed to identify the list of emotional states and strategies associated with low and high performance.
Emotional states can be measured on two core dimensions of emotions: valence and arousal (Russell & Barrett, 1999; Russell, Weiss, & Mendelsohn, 1989). Valence, at a level of subjective experience, summarizes le level of pleasantness of an emotional state; arousal refers to a dimension of physiological activity (the energy perceived about an emotional state). Emotions can be graphically represented in a four-quadrants diagram were the valence dimension (unpleasant to pleasant) is represented by the X axis and the arousal dimension (low to high energy) is represented by the Y axis (Russell, et al., 1989).

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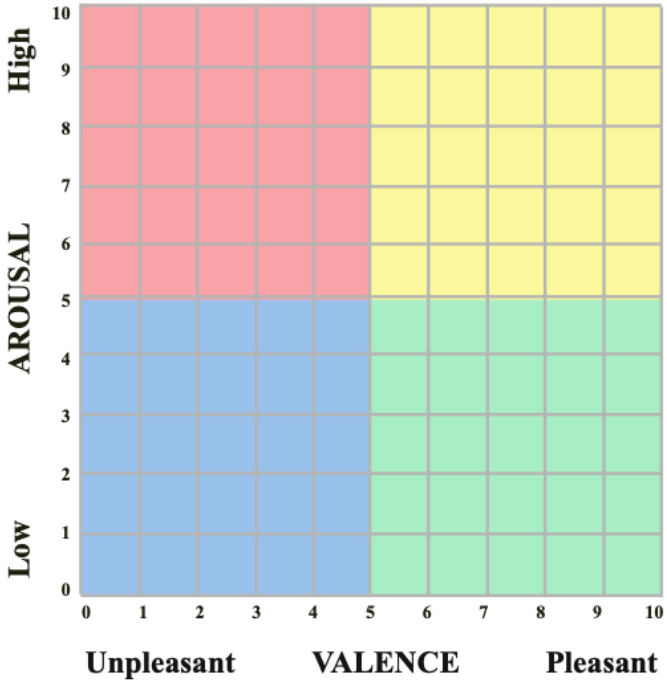

Figure 4. The Emotion Display

ATCs answered to the questions on the amount of energy they perceived in their body and the pleasantness they experienced during a high and a low performance. This information was summarized plotting them into the Emotion Display (Figure 4). This diagram is a tool grounded in the Affect Grid developed by Russell and colleagues (Russell, et al., 1989) and upgraded by the Yale Center for Emotional Intelligence research team (Mood Meter - Brackett, Caruso, & Stern, 2006; Mood Map - Caruso & Rees, 2018; Emotion Display - Artusio, 2018).
The red quadrant is characterized by unpleasant valence and high arousal. This quadrant includes emotions such as anger, fear, stress, frustration, anxiety, panic, etc. (see Figure 5). The blue quadrant includes emotions with unpleasant valence and low arousal such as sadness, disappointment, loneliness, boredom, alienation, fatigue, etc. The green quadrant is characterized by pleasant valence and low arousal and gathers emotions like calm, security, relaxation, tranquility, etc. Finally, the yellow quadrant is characterized by pleasant valence and high arousal and encloses emotions like happiness, motivation, concentration, motivation, trust, etc.

Red Quadrant (Unpleasant/High Arousal)					**Yellow Quadrant (Pleasant/High Arousal)**				
enraged	*terrified*	*stressed*	*scared*	*shocked*	*surprised*	*astonished*	*amazed*	*exhilarated*	*Ecstatic*
overwhelmed	*furious*	*frustrated*	*tense*	*stunned*	*hyper*	*delighted*	*excited*	*optimistic*	*elated*
fuming	*frightened*	*angry*	*nervous*	*restless*	*energized*	*cheerful*	*motivated*	*enthusiastic*	*proud*
anxious	*apprehensive*	*worried*	*Irritated*	*annoyed*	*positive*	*happy*	*joyful*	*inspired*	*thrilled*
disturbed	*troubled*	*concerned*	*uneasy*	*peeved*	*pleased*	*content*	*hopeful*	*playful*	*blissful*
Red Quadrant (Unpleasant/LowArousal)					**Yellow Quadrant (Pleasant/LowArousal)**				
disgusted	*glum*	*disappointed*	*unhappy*	*down*	*at ease*	*easygoing*	*pleasant*	*fulfilled*	*gratified*
pessimistic	*morose*	*discouraged*	*sad*	*bored*	*calm*	*composed*	*satisfied*	*grateful*	*compassionate*
alienated	*miserable*	*lonely*	*jaded*	*tired*	*relaxed*	*chill*	*restful*	*blessed*	*idyllic*
despondent	*hopeless*	*sullen*	*exhausted*	*fatigued*	*mellow*	*contemplative*	*peaceful*	*comfortable*	*harmonious*
despair	*depressed*	*forlorn*	*spent*	*drained*	*sleepy*	*complacent*	*tranquil*	*cozy*	*serene*

Figure 5. Examples of Feeling Words for the Four Quadrants

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Second, the lists generated in each group and transcribed on the flip charts by moderators, were aggregated in an overall list in order to examine factors arisen from group interaction. Finally, researchers' notes were analyzed and some quotes were incorporated in the result section in order to better illustrate factors influencing human performance in the aviation context, or their facets.
In sum, data have been organized around five major findings:
1. Emotional states associated with a challenging event when ATCs had a low performance;
2. Emotional states associated with a challenging event when ATCs had a high performance;
3. Emotions that facilitate the air traffic control in everyday work life;
4. Strategies used by ATCs to manage their emotions in everyday work life;
5. Effective strategies to manage emotions in the air traffic control.

4.1.3 RESULTS

4.1.3.1 Emotional States Associated with Low Performances

As shown in Figure 6, the majority of emotions related with a low performance had unpleasant valence (the frequencies summarized in the Emotion Display resulted from the individual worksheets).

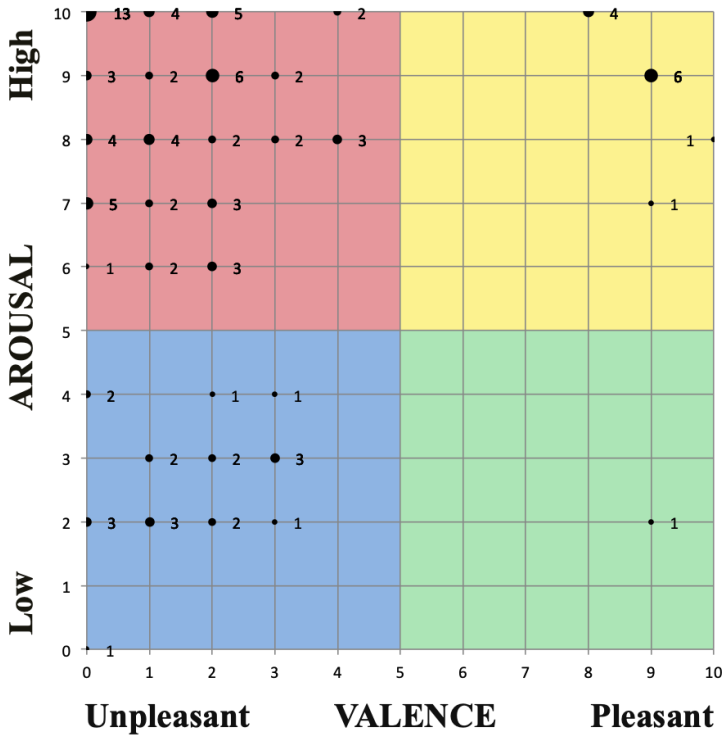

Figure 6. Emotion Display Correlated with Low Performance

Particularly, the 67% (n = 68) of emotional states reported by ATCs as experienced during a challenging situation resulted in a low performance have been graphically represented in the red quadrant; the 20% (n = 21) of the emotional states placed in the blue quadrant of the Emotion Display. A lower percentage of emotions correlated with a low performance had a pleasant valence. The one percent (n = 1) of emotions fell in the green quadrant; finally, the 12% (n = 12) have been plotted in the yellow quadrant of the Emotion Display.

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Feeling Words Used by ATCs to Describe their Emotional States

Emotional words that ATCs associated with a low performance at work are listed in Figure 7 (the percentages resulted from the individual worksheets).

More frequently, ATCs talked about *disappointment* (unpleasant valence and low arousal):

> "*Once I recognized the mistake, I had mixed feelings of anger and disappointment for not having prevented it. Having found a solution made me feel slightly pleased, but the sensation of failing at that time lasted for a while*"
>
> "*Despite the simplicity of the task and the sufficient time available, I was disappointed because I was not able to accomplish what I was supposed to*"

Another emotion experienced during a low performance from several ATCs was *frustration*. For example:

> "*I was worried. I did not feel protected by the environment around me. I felt lonely. I was not feeling well, I was nervous. I felt strongly frustrated*"
>
> "*At the beginning, before the event, I felt confident and aware that I could complete the work. I was an instructor. During the training a student came up with the wrong instruction, and this created a sub-separation event. I felt frustrated*"

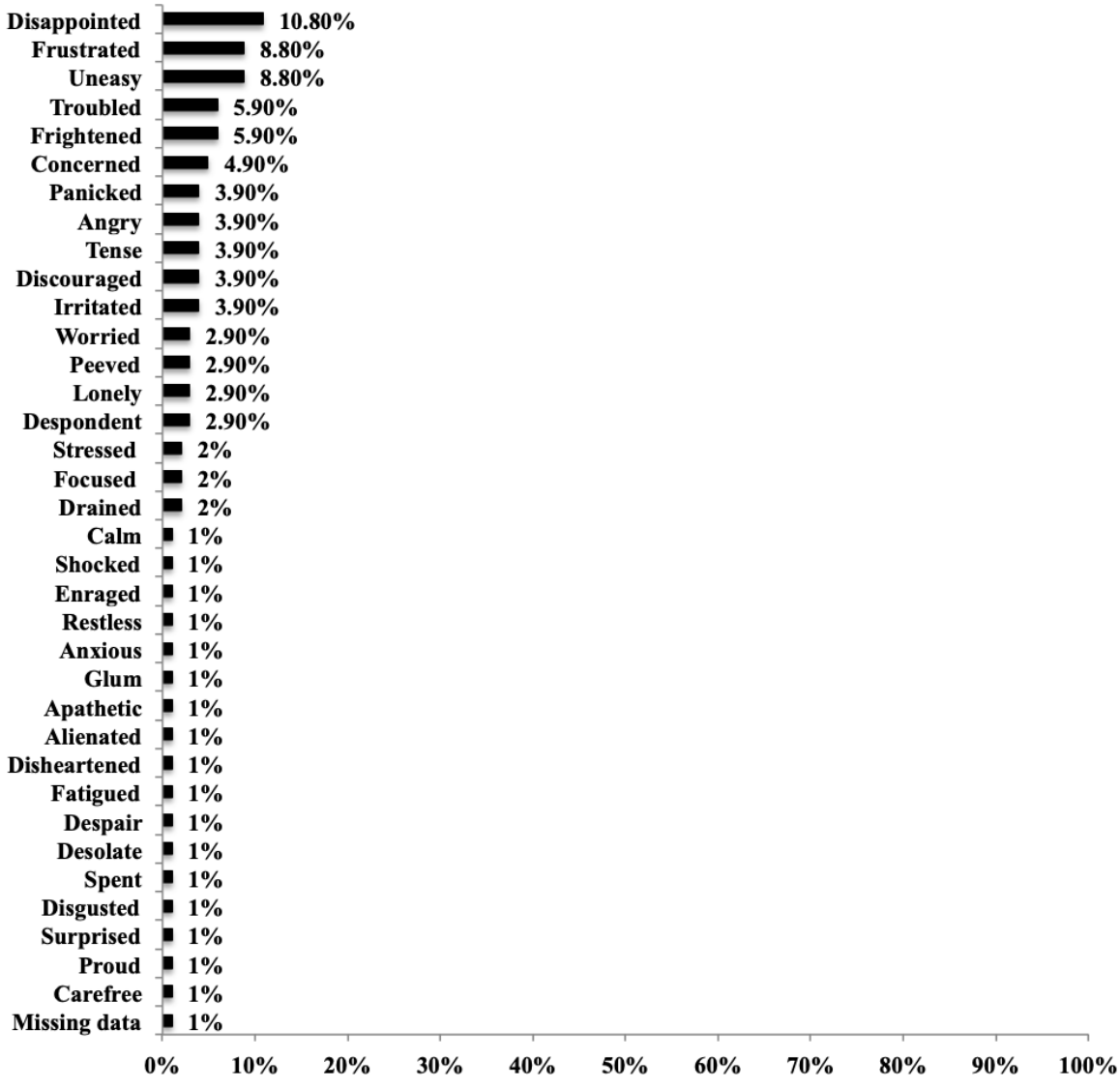

Figure 7. Feeling Words Associated with Low Performance

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Several ATCs reported a sense of *uneasiness*:

> "*I was feeling uneasy because I was not able to work effectively"*
> *"As an instructor, I felt uneasy because of a difficult situation with a trainee. It was a complex task and I was trying to enhance his performance but I lost control of the situation and this generated disapproval. My thoughts were fast and ambivalent: I knew it was not working, but at the same time I was hoping for a positive conclusion*"

They also talked about a sense of being *troubled*. For example:

> *"I felt in breathless, surprised and troubled at that moment"*

ATCs reported to be in some cases *frightened*:

> "*Frightened. I felt I was in a quiet situation with a low energy request, but I was frightened, stiff and uneasy"*
> *"Growing fright as the situation was changing from an initial unawareness of a forthcoming event to the realization that things were not going well at all*".

4.1.3.2 Emotional State Associated with High Performances

As shown in Figure 8, the majority of emotions correlated with a high performance had a pleasant valence (the frequencies resulted from the individual worksheets). Sixty two percent (n = 63) of emotional states reported by ATCs as correlated to a high performance have been plotted in the yellow quadrant of the Emotion Display; the 10% (n = 10) of the emotional states placed in the green quadrant of the Emotion Display; and the 12% (n = 11) on the border between the yellow quadrant and green one. A very low percentage of emotions correlated with a high performance had unpleasant or neutral valence. Ten percent (n = 10) of emotions fell in the red quadrant. The 6% (n = 7) placed on the border between the yellow quadrant and the red one.

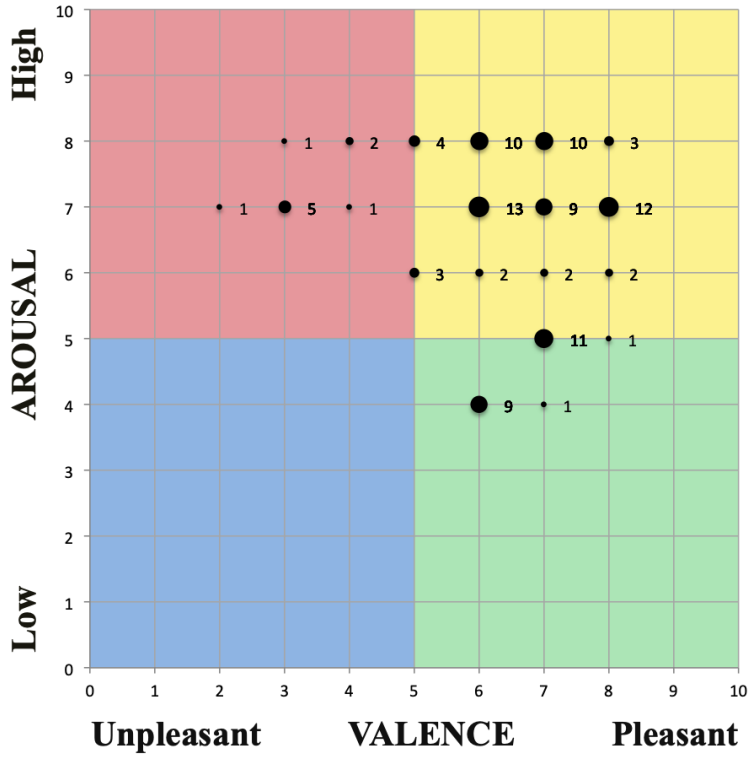

Figure 8. Emotion Display Correlated with High Performance

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Feeling Words Used by ATCs to Describe their Emotional States

Feeling words correlated to a high performance at work are reported in Figure 9 (the percentages resulted from the individual worksheets).

ATCs reported *concentration* as a condition frequently associated with a high performance:

> "*The predominant sensation was concentration, I felt I was focused on the final result and each of my actions naturally followed the previous one"*
>
> *"I was extremely focused and all my cognitive processes were open. I felt that anything could go wrong but that the situation was under control, under my control, although it was complex"*

They also often talked about *satisfaction*. For example:

> "*The situation was stressful for workload and complexity. Despite this, I was able to manage it in compliance with air traffic controller parameters (safety and speed) and this was a source of great satisfaction"*
>
> *"I felt focused on the task of air traffic control. I was satisfied with how I was doing my job and happy to be able to cope with an unusual situation without difficulties"*

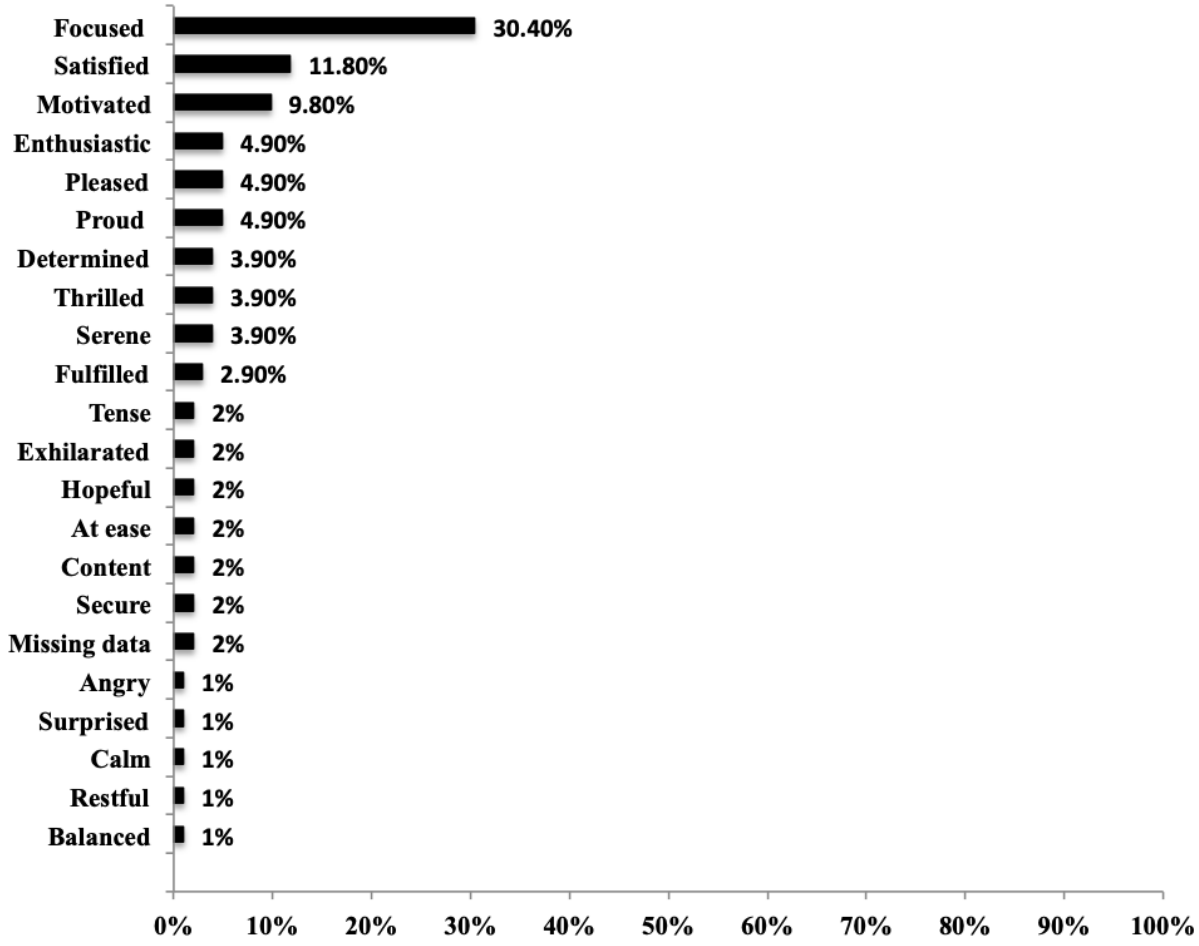

Figure 9. Feeling Words Associated with High Performances

Finally, they reported *motivation* as an emotion that frequently was associated with a high performance:

> "*Motivation was growing and growing, creating a sort of positive energy that generated in me an ever higher level of satisfaction and esteem"*

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"I felt motivated and convinced by the rightness of my choice, but I have always paid attention to all those elements of the situation that were not depending on me"

4.1.3.3 Factors that Facilitate the Task of Air Traffic Control in Everyday Work Life

Table 20 reported the synthesis of the ideas on the emotional states that can facilitate the task of the air traffic control generated by ATCs via group discussion (data from flip chart lists).

Table 20. List of Emotions Facilitating Air Traffic Control

1. Concentration
2. Calm
3. Stress
4. Trust in oneself and in others

These emotions were identified during the group discussions on the basis of the frequency and extensiveness with which the ATCs talked about them. In descending order of importance and frequency mentioned, the emotion that seems to be the most useful to facilitate a high performance at work was concentration (to be focused). In the majority of cases in fact, the answer the interviewed groups gave when they were asked to think about which emotion facilitated their task in the air traffic control was to be focused and concentrated.
The second emotion was calm. The majority of ATCs referred that calm was a good emotion if not too intense, according to their experiences. They specified that if the arousal is too low, the risk is not to be responsive to cope with expected environmental requests. Therefore, an emotional climate at work characterized by a pleasant valence and medium arousal appeared to be crucial in facilitating a high performance in the control tower. Regarding to the third emotion facilitating air traffic control, participants indicated that a level of tension and stress not too intense influenced their performance at work in a positive way. Although stress is not a pleasant emotion, they underlined the importance of it being activated and conscious in order to increase their effectiveness. Finally, they agreed that trust was another emotion, which facilitates their task. They talked about trust in themselves as an emotional state correlated to a sense of self-confidence on their technical and non-technical skills. They used this kind of emotion also to indicate a sense of trust in others, that is the team (colleagues and supervisors). As well as calmness, they specified that trust is a desirable emotion for the task of air traffic control, but only if it is not too intense. When ATCs feel overconfident in fact, they risk underestimating the situation.
The emotional factor plays a central role in facilitating performance, as shown in the Table 21 and 22 (the frequencies resulted from the individual worksheets). In fact, if managed effectively, emotions were described by ATCs as a factor that can facilitate their performance. However, beyond emotions other aspects are also important in order to perform well (Table 21).
During the focus group, ATCs discussed also about factors that can inhibit their performance. Focus groups findings showed that when emotions became too intense, both in terms of unpleasant valence and arousal, and ATCs are not sufficiently able to manage them in a proper way, emotions can become the main factor that hinders performance (Table 22; individual worksheets). The other principal inhibiting factors are listed below in Table 22.

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Table 21. Factors Facilitating Performance

Factors	Exemplification	N
Work team	Support of the team, cooperation between colleagues, competent team, shared participation, great coordination	90
Technical and procedural skills	Effective planning of the activities, problem-solving, effective decision making, high experience, and theoretical knowledge	70
Emotional State	Passionate work, calm, motivation, concentration, adequate level of tension, trust	67
Seniority	Great past experience, experience in complex situations	21
Awareness	Situational awareness, individual competence	16
Weather condition	Favorable conditions, good season	9
Communication	Good communication with pilots, clear communication	7
Working tools	Cutting-edge technological equipment, functioning working tools	7
Work environment	Comfortable environment	7
Traffic load	Intense traffic, adequate microclimate	7

Table 22. Factors Inhibiting Performace

Factors	Exemplification	n
Emotional State	Ineffective stress management, boredom, fatigue, too calm	87
Work team	Sense of loneliness, lack of effective supervision, not supportive team	56
Technical and procedural skills	Failure to comply with rules, poor competence, incorrect tactical planning	41
Over-trust	Too over-confidence in self, over-confidence in devices, over-confidence in the team	25
Seniority	Poor experience; poor experience of the team	22
Traffic load	Underload, overload	20
Comunication	Incorrect coordination, failed delivery	19
Awareness	Poor situational awareness	10
Work environment	Too hot microclimate, bad posture, noises,	6
Work organization	Shift and night work, salary,	6
Weather condition	Unfavorable conditions	3
Working tools	Radio transmission problem, lack of adequate technological tools	3

4.1.3.4 ATCs' Strategies to Manage Emotions

Strategies for managing emotions refer to thoughts and behaviors that promote psychophysical health and performance. Strategies aim to prepare, prevent, reduce, detach, initiate, prolong, or enhance emotional states in self and others. They can be divided into: (a) thought strategies - which are based on shifting people's thinking to manage their own emotions effectively; and (b) behavioral strategies - which are related to actions people can do to regulate their own or others' emotions. Additionally, their effectiveness can be short (e.g., talk with a colleague) or long term

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(e.g., practice physical activity regularly). Box 2 reports the definition of the main strategies used by participants to manage emotions.

Box 2 - Strategies to Manage Emotions	
Thought Strategies	Behavior Strategies
Positive reappraisal – the adaptive process through which challenging events are reframed as adaptive, beneficial, and/or meaningful	**Problem-focused coping** – efforts to change a stressful situation being focused on the problem, seeking information, planning, or taking some actions
Visualization – a type of relaxation training that involves the use of language to create calming, sensory-rich experiences in one's imagination	**Sleep** – adequate quality and quantity of sleep
Positive self-talk – constructive verbalizations or statements, reactive or proactive in nature, addressed to the self for solving problems or making progress on a task	**Social support** – meaningful and supportive social network
Detachment – effort to detach from cognitive dissonance, mental discomfort, and anxiety caused by a person's emotions, belief, and values. It is a process of separating thoughts that will be in conflict with one another to perform a task quickly and accurately without being distracted by them (Short term effectiveness)	**Physical activity** – regular physical exercise (e.g., stretching, walking, exercise)
Rumination – process of repetitively thinking about the same thoughts or problems without completion	**Constructive activities** – leisure time activities that provide a recreative aim (e.g., listening to music, painting, reading)
Suppression – the conscious inhibition of one's own emotions while emotionally aroused	**Relaxation techniques** – variety of techniques have been devised with the intention of helping one to reach a state of relaxation (e.g., breathing, meditating, or other relaxation exercises)
	Modifying the situation – change some items in a strategic way to cope with the situation (e.g., the place, the time, or the people involved)
	Food – eating healthy diet full of nutrient rich food

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	Break/Distraction – efforts to foster the recuperation and replenishment of energy resources (short term)
	Unhealthy habits - e.g., smoking, alcohol, drugs
See for references: Brackett, Caruso, & Stern, 2006; Broman-Fulks & Kelso, 2012; Garland & Gaylord, 2011; Gross & Levenson, 1993; Hardy, 2006; Lehrer, Woolfolk, & Sime, 2008; Shimazu & Scaufeli, 2007; Varvogli & Darviri, 2011	

The strategies used by participants to manage emotions in everyday work life are reported in Figure 10 (percentages resulted from individual worksheets).

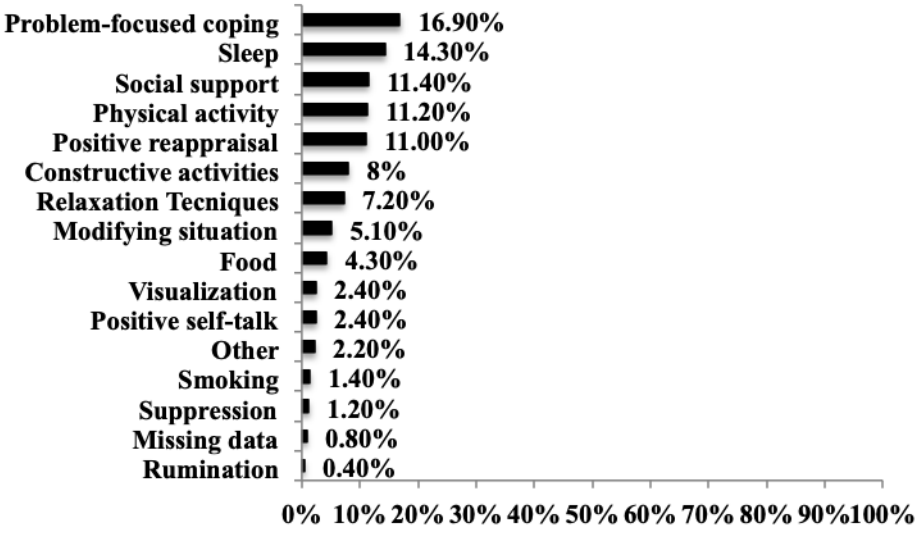

Figure 10. ATCs' Strategies in Everyday Work Life

In general, the majority of the listed strategies are behavioral. Furthermore, all the strategies indicated by ATCs are effective, with the exception of Suppression, Smoking, and Rumination. In more detail, the strategy most frequently indicated by ATCs was the problem-focused coping (16.90%). For example:

> *"I mentally organize the activities before starting. Than I organize the material to prioritize actions, for flights which leave and those, which arrive. I follow a certain procedure in order to have all the material available if I need it"*

Fourteen-point three percent of participants used an adequate quality and quantity of sleep as a preventive strategy to prepare themselves to cope with work stressors. With regard to this strategy, ATCs reported:

> *"I rely on rest. If I am rested I have a calmer and more tranquil attitude. I organize a quiet evening and I try to sleep a sufficient number of hours. As a result, at work I will be rested and calm"*
>
> *"The preparation starts a long before, often I take a nap in the afternoon if a have a night shift"*

Eleven-point four percent of ATCs reported social support as a strategy they especially used when they are coping with stress. About this, ATCs said:

> *"I asked for support to my colleague. I am a humble person, over time I have always requested for support and collaboration"*

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Further, 11.20% of ATCs declares to practice regular physical activities to regulate their emotions. For example:

> *"I usually go running, especially if I had a very stressful day, for me it's a way to let off steam"*

Additionally, 11% of ATCs used positive reappraisal when they are at work to manage emotions. An ATC suggested:

> *"In addition to breathing, I tried to explain to my colleagues what happened in order to understand where I was wrong. They reassured me it was not too serious. Then I tried to take the positive aspect from their advice: This time it went wrong, but next time you'll remember what happened, and you will perform better"*

4.1.3.5 Effective Strategies for the Task of the Air Traffic Control

When moderators asked participants to discuss the most effective strategies for managing emotions and facilitating the task of air traffic control in general, ATCs generated several ideas via group discussions (see Table 23 - data from flip chart lists).

Table 23. Most Effective Strategies

1. Sleep
2. Social support
3. Physical activity
4. Problem-focused coping
5. Positive reappraisal

In particular, *sleep* was the strategy discussed most frequently and in great details. In fact, ATCs talked about adequate quality and quantity of sleep as the best strategy to reduce fatigue and increase concentration and performance at work. They specified that this strategy is to be considered mainly as a preventive strategy to prepare themselves before going to work. Participants also added that this strategy also includes brief naps they can take after the shift change. Several ATCs indicated a strong *social support* network as an effective strategy to cope with stress. In particular, meaningful and supportive relationships with the team rather than countless ones seem to be crucial to facilitate the task of air traffic control. Further, ATCs talked about regular *physical activity* as a strategy associated with numerous physical and psychological health benefits. Another strategy evaluated as effective by participants was the *problem-focused coping*. The tendency to be focused to solve the problem, seeking information, and planning of activities seems to be relevant to cope with work stressors. Finally, ATCs discussed *positive reappraisal* as a strategy they considered effective to manage their emotions when they are at work.

4.1.4 CONCLUSION

The present study sought to explore the impact of EI skills on human performance from a qualitative point of view, assessing which emotions facilitate air traffic control in everyday work life.

Focus group discussions revealed that there are four emotions, which mainly facilitate air traffic control. The emotional state that seems to facilitate the maintenance of the appropriate level of attention and vigilance, as well as to safely and effectively cope with the task of air traffic control, is concentration. Air traffic control entails, on the whole, high demands both in terms of cognitive and psychological requests and a prolonged state of concentration seems to be a fundamental condition to guarantee high performance in everyday work life.

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To improve comfort, wellbeing, and performance of ATCs, an emotional state of calm is crucial as well. In fact, as workload, pressure, and decisions increase, calm helps ATCs to cope with these environmental stressors avoiding excessive mental stress and fatigue and preventing the risk of losing situational awareness. However, according to the opinion of ATCs, a certain level of tension and stress is necessary to ensure the best level of performance. In fact, they reported that human errors often occur as ATCs face periods of light or non-complex traffic. These periods tend to be associated with an emotional condition characterized by a 'too intense' calm. Some tension seems to be necessary to regulate the psychophysical reactions and maintain an appropriate level of arousal and vigilance even in the conditions of a low workload. Finally, findings showed that trust in oneself, in the team, as well as in automation can facilitate ATCs' performance. The emotional state described by ATCs can be defined as calibrated trust, that is the ability of the ATC to accurately calibrate knowledge and trust of one's, other's, and machines' capabilities (Lee & See, 2004). In fact, when trust exceeds the actual capabilities of the ATC, of his or her team, and of the system or, at the contrary, trust falls short of these capabilities, there is the risk to overestimate or underestimate oneself, others, and the overall system. Considerable research has shown the attitude of calibrated trust to be important in promoting accurate self-esteem, reliable interpersonal relationships and safe interaction with automation that has become an integral part of daily ATCs' work in the last decades (Nyhan, 2000; Tan & Tan, 2000).

Via group discussion, ATCs identified these four emotions that, combined with each other, create the appropriate emotional climate to promote safety and performance.

Overall, our results demonstrate that the more external areas of the four quadrants of the Emotion Display, characterized by a level of arousal very low or very high as well as a level of valence extremely pleasant or extremely unpleasant, can hinder ATCs' performance. During focus groups, ATCs discussed intense happiness as a potential risk for ATCs' performance. In fact, this emotional state is often associated with a higher level of distraction and the tendency to underestimate potential risks. In other words, the central part of the Emotion Display tool, characterized by a medium level of arousal and valence, seems to be associated with higher performances. This finding is in line with the results of the study conducted in a virtual driving environment by Cai and Lin (2011), which have used two downward U-shaped curves to describe how task performance changes with arousal and valence. In this previous study, the best performance also occurred when the level of valence was medium, as well as the level of arousal.

Additionally, the study sought to identify the most effective emotion management strategies for air traffic control.

Expert professional ATCs identified, via group discussions, sleep as the most effective strategy to manage emotions in everyday work life. This result is not surprising. In fact, being shift workers and having to have optimum use of all mental faculties at all hours of the day and night, fatigue and lack of sleep can become a difficult challenge to cope with (Eurocontrol, 2018). Preserving sleep both in terms of quantity and quality is a critical factor for recovering from fatigue and promoting psychophysical wellbeing of ATCs. During the group discussions, participants talk about some strategies they used to compensate for the sleep deficit associated with the night shift, such as take a nap before, during, or after the night shift (thanks to the arrangement of proper sleep facilities in the control tower). Previous studies demonstrated that naps release homeostatic pressure resulting in increased alertness and improved levels of cognitive functions (Banks, Van Dongen, Maislin, & Dinges, 2010; Purnell, Feyer, & Herbison, 2002). Further, in line with previous studies (Costa, 2000), findings reveal that the avoidance of potential disturbances (e.g., arranging the bedroom in a silent and dark room; using ear plugs), the adoption of healthy personal lifestyles (e.g., eating light meals before going to sleep; avoiding caffeinated drinks and alcohol and relaxing before going to sleep) represent effective strategies applied by ATCs to improve the quality and the quantity of their sleeping.

The second strategy identified by ATCs as effective was social support. ATCs reported that having access to rich and functional social networks both in terms of emotional (e.g. receiving and

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providing support) and instrumental components (practical help such as assistance in the control room), is very relevant for maintaining their well-being and a high performance at work. According to the literature, the beneficial effects of social support on psychophysical health is well known (Charney, 2004; Ozbay, Johnson, Dimoulas, Morgan, Charney, & Southwick, 2007; Southwick, Vythilingam, & Charney, 2005). Previous studies have already linked positive social support with the improvement of resilience to stress and critical events (Southwick, et al., 2005).
Further, findings showed that physical activities represent a preventive long-term strategy to effectively manage emotions at work. Maintaining good physical fitness is a useful aid in coping with stress. These findings replicate the results of numerous previous studies, which have linked physical exercise, if carried out regularly and with high quality, to a significant improvement of both physical and psychological health (Brackett, et al., 2006; Broman-Fulks & Kelso, 2012; Lehrer, et al., 2008).
Another strategy that seems to improve the effectiveness of ATCs, is problem-focused coping. Air traffic control entails the practical application of a set of cognitive skills, such as information processing, logic reasoning, and decision making. A coping style focused on solving the problem, seeking information and planning activities, seems perfectly coherent with the highly demanding task of air traffic control.
Finally, according to ATCs' opinion, positive reappraisal can be considered an effective strategy. Previous research demonstrated that this specific kind of cognitive restructuring characterized by the ability to change maladaptive thoughts into more adaptive and rational thought patterns is helpful in managing emotion, significantly improving mood and reducing stress (Broman-Fulks & Kelso, 2012).
It is important to highlight that the majority of the strategies used by ATCs in their everyday work life (individual worksheets) resulted effective, with few exceptions such as smoking, which can have an apparent short-term positive effect (sense of relief and calmness) but, in the long-term, can cause further problems in health and well-being (Brackett, et al., 2006). Finally, the strategies identified via group discussions as the most effective for the task of air traffic control were very coherent to those that they were used to apply at work. All these emotions can be classified as helpful and effective according to the literature on this subject (Brackett, et al., 2006; Broman-Fulks & Kelso, 2012; Garland & Gaylord, 2011; Gross & Levenson, 1993; Hardy, 2006; Lehrer, et al., 2008; Shimazu & Scaufeli, 2007; Varvogli & Darviri, 2011).
In sum, the obtained results can be used to predict ATCs' performance based on the shifting of emotional states. Further, they can also be applied for the design of an evidence-based training aimed at improving ATCs' emotion management skill.

4.2 STUDY 2 – INTERVIEWS

4.2.1 Purpose of Study

The aim of the present study was to use the PUERUModel framework to better understand how EI skills (i.e., Perceiving, Understanding, Expressing, Regulating, and Using emotions) can guide and improve ATCs' performance. Qualitative research has proven to be an effective method to analyze ATCs' subjective perspectives on how the five EI skills impact their performance before, during, and after a challenging event at work.

4.2.2 METHOD

4.2.2.1 Participants

A total of 20 ENAV ATCs participated in the present project. The sample has an average of 45.7 (SD = 8.22) years of age. See Table 22 for demographics of participants.

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Table 24. Sample Demographics

	Interview 2017	
	ENAV ATCs *(n = 20)*	
Demographics	*n*	*%*
Gender		
Male	17	85
Female	3	15
Nationality		
Italian	20	100
Educational Level		
High School	19	95
College Degree	1	5
Professional Role in ENAV		
ATC	20	100
Seniority		
3-10 years	2	15
More than 20 years	17	85

4.2.2.2 Procedure

ENAV Academy top management (in particular the head of the Performance Department, Dr. Lombardo) facilitated the recruitment of ATCs soliciting participation via e-mail and flyers. ATCs were informed on the purpose of the research, that their participation in the interviews was voluntary and anonymous, and that nonparticipation would not have a negative effect on their occupational prospects. Researchers communicated to potential participants that ENAV would not have access to individual interviews in order to guarantee data anonymity and that results would be presented in an aggregated format. Further, potential participants have been informed the interviews would have helped them to enhance their awareness on critical aspects related to their activities in ENAV, such as the main sources of occupational distress.

Data were collected using a semi-structured, open-ended interview, conducted by two female researchers with long experience in interviews, following a well-established protocol. Topics to be discussed in the interview were grounded in the PUERUModel of EI (Artusio, 2016). The interviews tried to explore ATCs' thoughts and feelings about challenging situation at work, as well as their performance in relation to this situation. The protocol used for interviews is summarized in Box 3.

Interviews took place within ENAV settings and lasted 20-45 minutes. All interviews were digitally tape-recorded and verbatim transcribed.

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BOX 3 - INTERVIEW PROTOCOL			
1. Think about a challenging situation (a critical event; accidents; a very stressful episode) at work when you did not perform well (you made mistakes, goals were not reached, you were not satisfied with results).			
Questions	Before event	During event	After event
1. How did you feel? Please give us an emotion word to describe what you felt. 2. Why did you feel that way? 3. How did you express your emotions (posture, facial expressions, tone of voice, etc.)? 4. How did you manage your emotions (did you apply specific strategies)? 5. How did your emotions impact your behavior? Did they facilitate or inhibit your task?			
2. Think about a challenging situation (critical event; accidents; very stressful episode) at work when you did perform well (you made no mistakes, you reached the goals, you were satisfied with results).			
Questions	Before event	During event	After event
1. How did you feel? Please give us an emotion word to describe what you felt. 2. Why did you feel that way? 3. How did you express your emotions (posture, facial expressions, tone of voice, etc.)? 4. How did you manage your emotions (did you apply specific strategies)? 5. How did your emotions impact your behavior? Did they facilitate or inhibit your task?			

4.2.2.3 Software Description

The text file transcriptions of the interviews have been processed using the 2015 version of the Linguistic Inquiry and Word Count (LIWC) software. LIWC allows the implementation of the linguistic analysis of text counting the occurrence of words that reflect different categories of emotions and cognitive styles. This software analyzes and compares the words of the document to a built-in dictionary to extract and categorize the dimensions of interest (Tausczik & Pennebaker, 2010). LIWC can extract up to 85 variables using its validated dictionaries, classifying them in 4 macro-categories: Linguistic Processes, Other Grammar, Psychological Process, and Punctuation. The validated Italian dictionary has been set up in the software to analyze the documents (Agosti & Rellini, 2007) to analyze the Italian ATCs' interviews.
One of the main criticalities of qualitative analysis is the arbitrariness with which the texts are processed, for this reason, we decided to use LIWC which use standardized categories (Pennebacker, Boyd, Jordan, & Blackburn, 2015). Another strength of LIWC is the possibility to customize the setup dictionary, including specific themes of interest. Finally, the software can be used to realize a quanti-qualitative analysis, since it generates an output compatible with other software for statistical analysis, such as SPSS (Pennebaker, Francis & Booth, 2001).

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4.2.2.4 Data analysis

Data Pre-Processing
The transcriptions obtained from the interviews were cleaned up to exclude possible confounding factors. In particular, the interviewer's questions were removed from the files, to analyze with LIWC only the answers of the ATCs. The transcription of each subject was divided into six files by two experts in qualitative analysis, and all the narratives were accurately encoded through a blind process, namely with the two experts confronting on the different sections only at the end of the coding procedure. Each document has been split into two sections, differentiating the part of the interview associated with a high performance from the one related to a low performance. Moreover, these two sections have been further divided into three different temporal phases, before, during, and after the challenging event.
In order to capture specific aspects of our sample, a customized category has been added to the Italian dictionary to deepen the procedures and the technics related to the task of air traffic control. This category was called "Technical/Procedural" and has been generated thanks to a focus group of five professional psychologists that identified the words that should be included in the category. Finally, some LIWC categories haven't been considered since they were not relevant for the study, while others have been gathered to optimize the narrative analyses and the results presentation. The following list presents the encoding of the categories:

Table 25. Codification of LIWC Categories

Study Variable	LIWC Category
Total words	Words count
Vocabulary richness	Dictionary
Individual dimension	Pronouns + I + 1st person singular verb
Collective dimension	Pronouns + We + You + She/He + They + 1st person plural verb + 2nd person plural verb + 3rd person singular verb + 3rd person plural verb
Pleasant emotions	Positive emotions
Unpleasant emotions	Negative emotions + Anxiety + Anger + Sadness
Emotional processes	Affectivity
Cognitive processes	Cognitive processes + Causation + Insight + Inhibition + Discrepancy + Tentative + Certainty
Insight	Insight
Inhibition	Inhibition
Sensory perceptions	Perceptual processes + Sight + Hearing
Sight	Sight
Hearing	Hearing

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Social processes	Social + Communication + Friends + Humans + Mentions of the others + Family
Communication	Communication
Mentions of the others	Others + Humans
Friends	Friends
Family	Family
Strategies	Leisure + Religion + Eat + Sleep + Social Support
Leisure	Leisure
Religion	Religion
Eat	Eat
Sleep	Sleep
Social support	Social processes
Emotional vocabulary richness	Affectivity
Technical/Procedural*	---

*Customized variable, created ad hoc for the study

Data Processing

After the data pre-processing, the transcriptions of the interviews were analyzed through the LIWC software in an aggregate way, by maintaining the above mentioned temporal phases division (before, during, and after the event). The excel file generated by LIWC presented the words occurrence percentage for each category in the text. The transcriptions of each ATC were processed through SPSS software, in order to compare the high and the low performance in all the categories. To reach this goal, a Student t for a paired sample has been conducted. For the sake of readability, the figures reported in the results section present the aggregate values of the analyzed interviews, while the statistical analysis reported in the text have been implemented separately on each narrative. The figures' values represent the linear composition of the analyzed ones. In addition to this quanti-qualitative analysis, a simple qualitative analysis has been conducted on the transcriptions of the narratives, in order to enrich the understanding of the main emotions and strategies mentioned by the ATCs in their interviews.

4.2.3 RESULTS

In this section, the analysis of the LIWC selected macro categories listed below are reported.

- Total words (number of words of the narratives)
- Vocabulary richness (percentage of words variety)
- Emotional processes (percentage of times that individuals refer to emotions)
- Cognitive processes (percentage of times that individuals refer to cognitive mechanisms)
- Perceptive processes (percentage of times that individuals refer to sensory perceptions)
- Social processes (percentage of times that individuals refer to social processes)
- Technical/Procedural (percentage of times that individuals refer to technical and procedural aspects)

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- Individual and Collective dimension (percentage of times that individuals refer to themselves or to others)

4.2.3.1 Comparison Between the General Narrative Style Associated with the High and Low Performance

Both high and low performances have been compared on the basis of the macro categories above listed. For what concerns the Total words (Figure 11) used by the ATCs to answer the questions related to the phase before, during and after the event, a significant difference between the number of words used to speak about the phase before a high performance and a low performance was found [$t(38) = -2.28$, $p < .05$]. In particular, ATCs tended to use more words to describe the phase before the event in the low performance ($M = 206.51$, $SD = 216.78$) than in the high one ($M = 156.90$, $SD = 125.83$). No significant differences resulted in the number of words used to describe the phases during and after the high and the low performance.

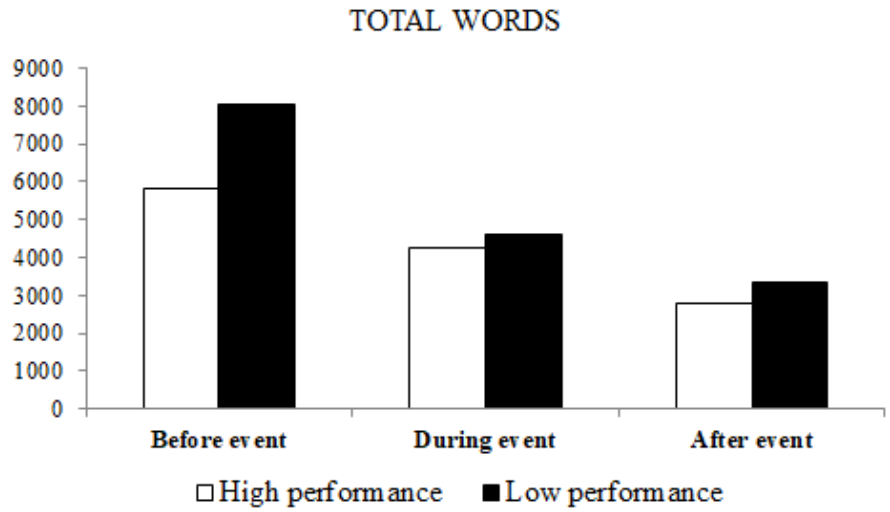

Figure 11. Number of Words Comparison Between High and Low Performance

No significant differences emerged in the Vocabulary richness used to describe the phases before, during, and after the high performance and low performance (Figure 12).

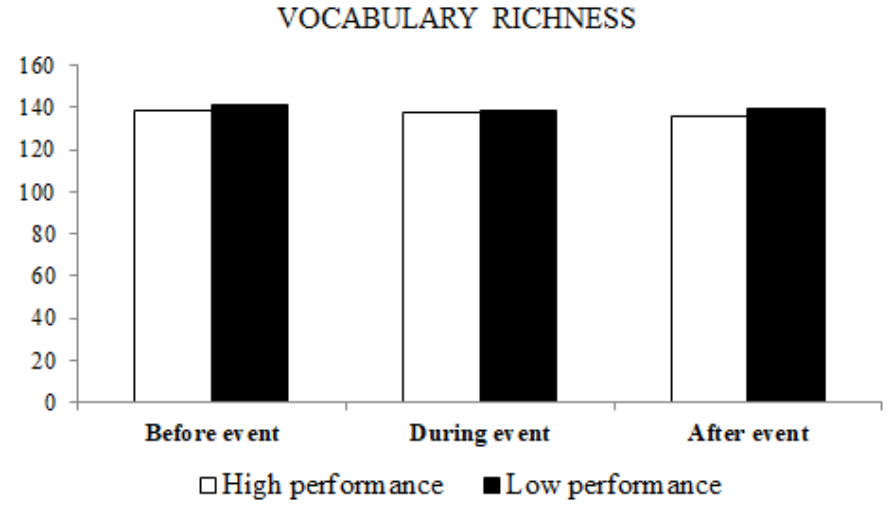

Figure 12. Comparison Between the Percentage of Words Variety in High and Low Performance

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The comparison between the high and the low performance in terms of the Individual and the Collective Dimensions is illustrated in Figures 13, 14, and 15. These dimensions are both present in the ATCs' narratives. There is a significant difference among the mentions of the Individual Dimension in the narratives on the phase before the high and low performance [t (38) = -2.38, p < .05; Figure 13]. In particular, the Individual Dimension is less cited before the high performance (M = 6.50, SD = 4.60) than the low one (M = 8.81, SD = 5.37). Furthermore, there is a significant difference among the mentions of the Individual Dimension in the narrative on the phase during the high and the low performance [t (39) = -2.38, p < .05]. In particular, the Individual Dimension is less cited during the high performance (M = 6.21, SD = 4.13) than the low one (M = 7.95, SD = 4.71). No significant differences resulted for the Collective Dimension.

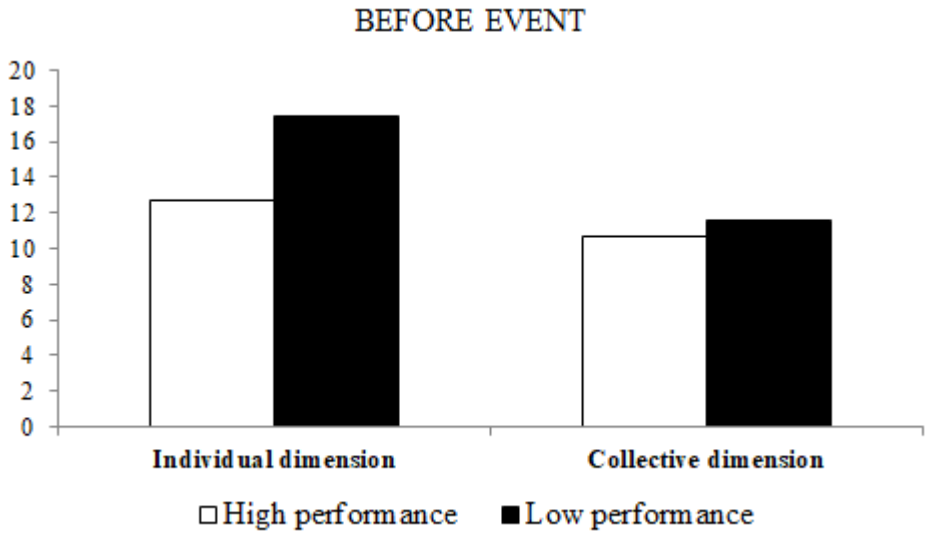

Figure 13. Comparison Between the Percentage of Words Related to the Individual Dimension and the Collective Dimension Before the Event in the High and Low Performance

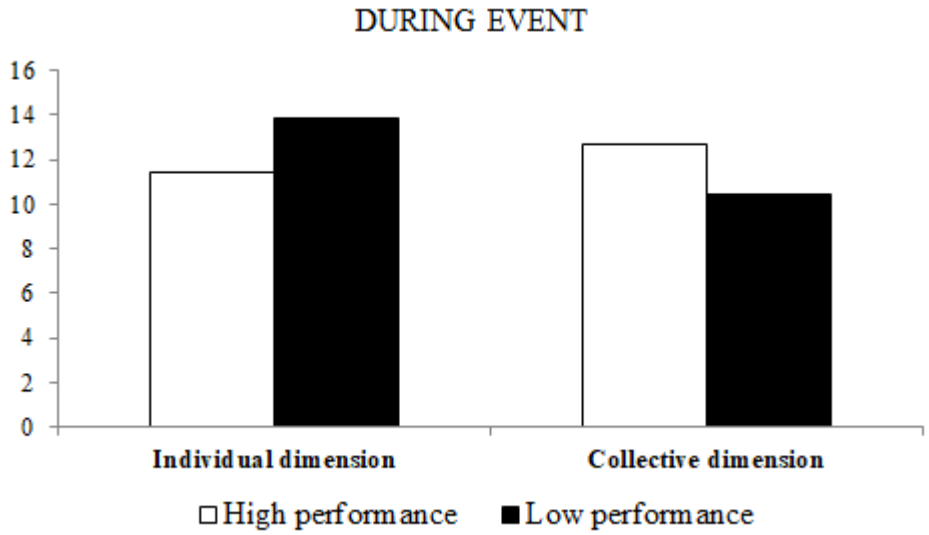

Figure 14. Comparison Between the Percentage of Words Related to the Individual Dimension and the Collective Dimension During the Challenging Event in the High and Low Performance

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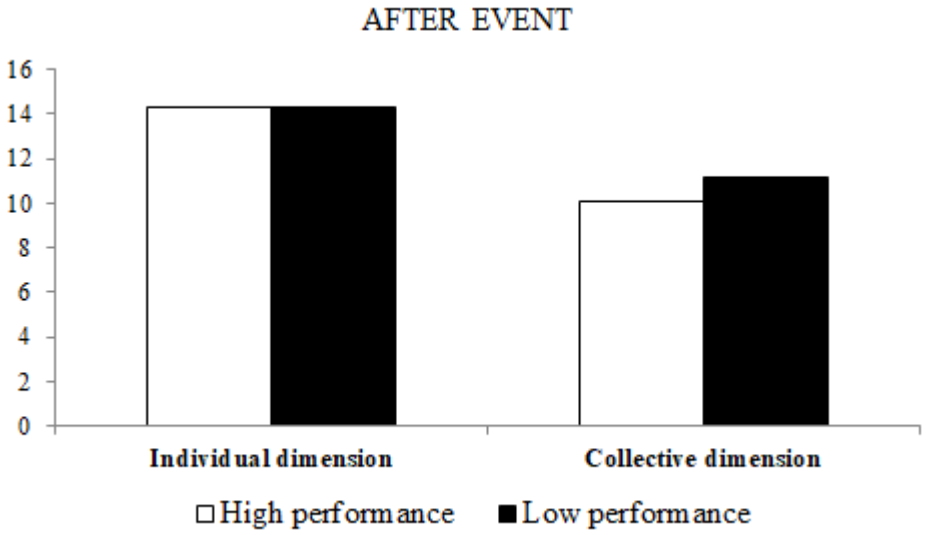

Figure 15. Comparison Between the Percentage of Words Related to the Individual Dimension and the Collective Dimension After the Event in the High and Low Performance

4.2.3.2 The PUERUModel of EI

The interviews were analyzed using the framework of the five skills (i.e., Perceiving, Understanding, Expressing, Regulating, and Using emotions) of the PUERUModel (Artusio, 2016) of EI. Below the analysis conducted on each discrete ability.

Perceiving Emotions

The frequency of the emotional states associated with high performance before, during, and after the event is presented in Figures 16, 17, and 18 respectively.

Tranquil, Relaxed, Calm, and Excited were the most cited feeling words associated with the phase before the high performance (Figure 16).

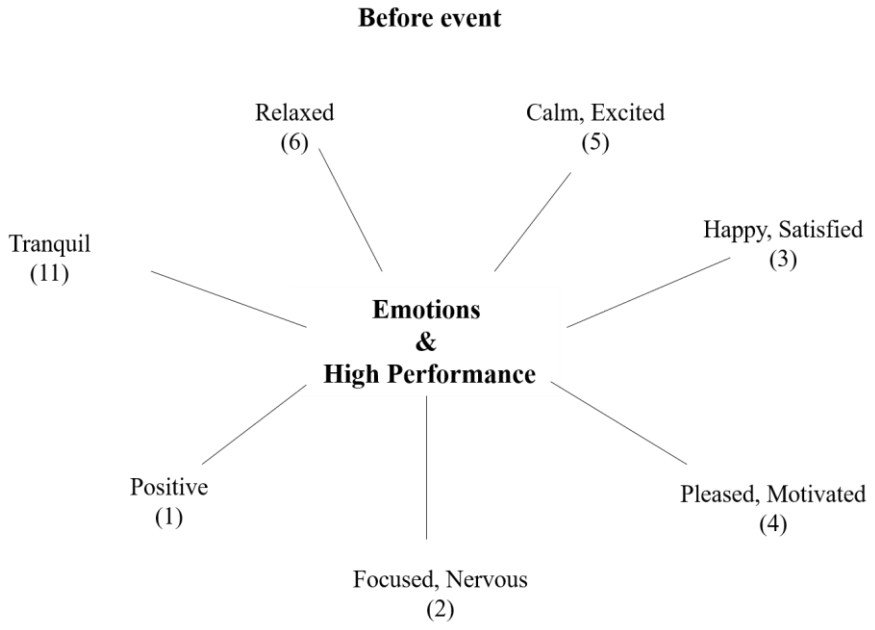

Figure 16. Emotions Related to the High Performance Before the Event

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Focused, Nervous, Excited, and Secure were the most cited feeling words associated with the phase during the high performance (Figure 17).

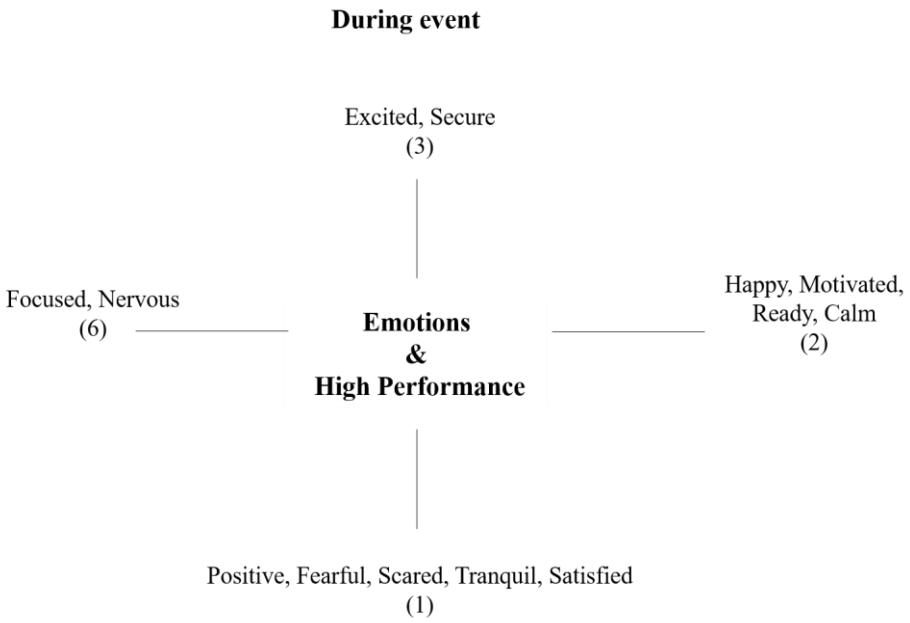

Figure 17. Emotions Related to the High Performance During the Event

Excited, Pleased, Satisfied, Happy, and Relaxed were the most cited feeling words associated with the phase after the high performance (Figure 18).

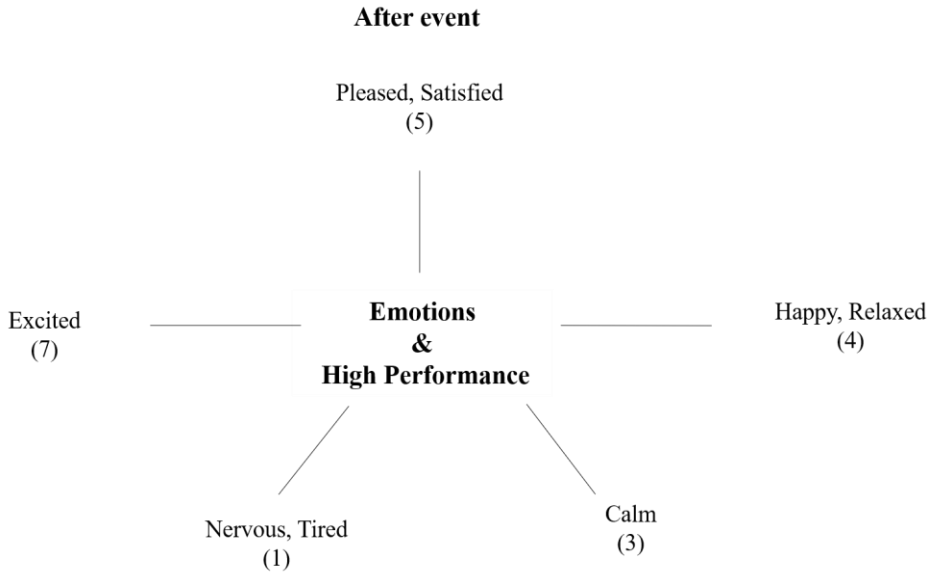

Figure 18. Emotions Related to the High Performance After the Event

The frequency of the emotional states associated with the low performance is illustrated in Figures 19 (before the event), 20 (during the event), and 21 (after the event) respectively.
Tranquil, Motivated, Happy and Nervous were the most cited feeling words associated with the phase before the low performance (Figure 19).

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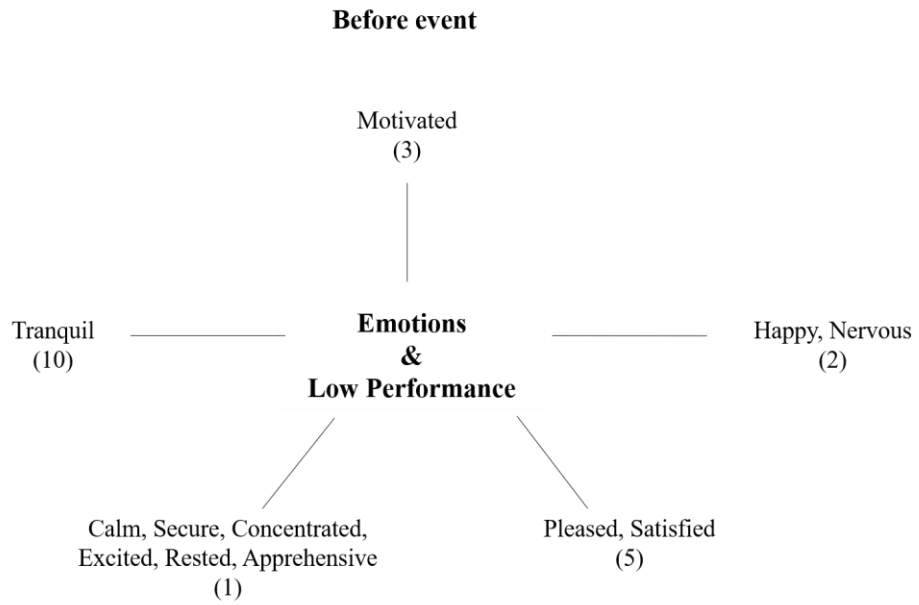

Figure 19. Emotions Related to the Low Performance Before the Event

Focused and Motivated were the most cited feeling words associated with the phase during the low performance (Figure 20).

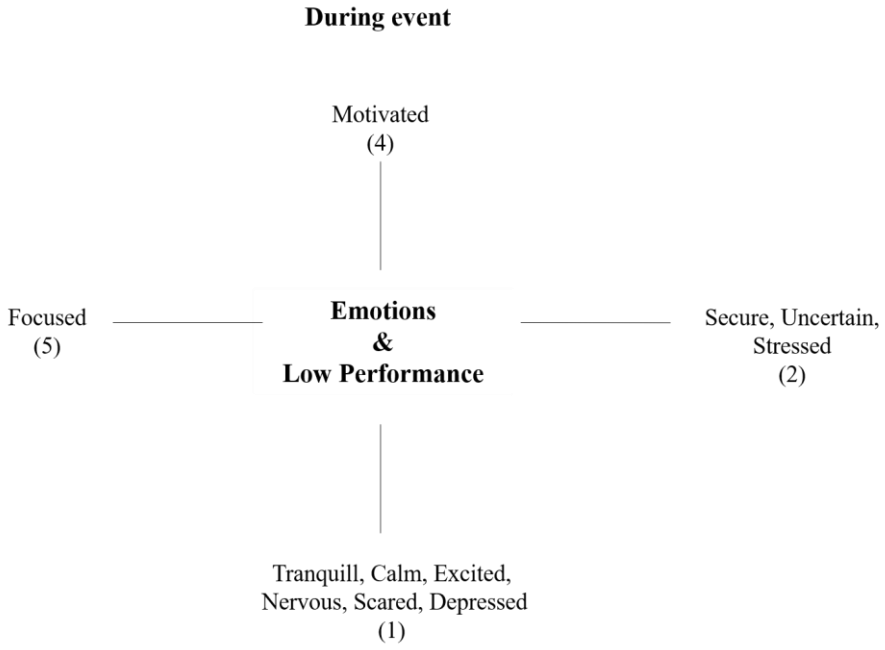

Figure 20. Emotions Related to the Low Performance During the Event

Scared, Frustrated, Depressed, Shamed and Worried were the most cited feeling words associated with the phase after the low performance (Figure 21).

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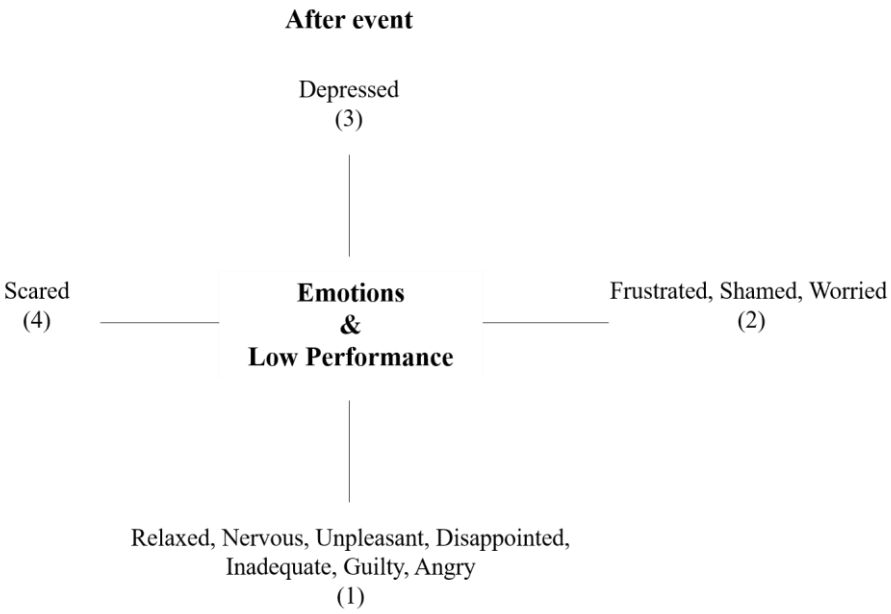

Figure 21. Emotions Related to the Low Performance After the Event

Understanding Emotions

The comparison between the high and the low performance in terms of Emotional Vocabulary is represented in Figure 22. Data analysis showed that there is a significant difference between the richness of the Emotional Vocabulary in the narratives on the phase after the high and low performance [t (37) = 3.20, p < .01]. In particular, the Emotional Vocabulary is richer after the High performance (M = 6,57, SD = 3.19) than the low one (M = 4.77, SD = 3.21). No significant differences resulted in the richness of Emotional Vocabulary before and during the event.

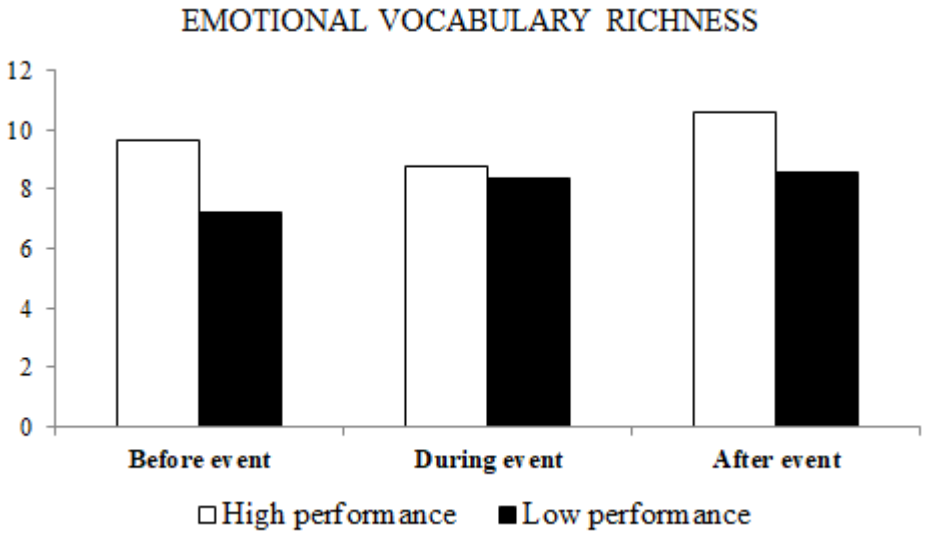

Figure 22. Comparison Between the Percentage of Words Variety in the Emotional Vocabulary in High and Low Performance

Expressing Emotions

The comparison between the high and the low performance in terms of Emotional Processes, Cognitive Processes, Sensory Perceptions, Social Processes, and Technical/Procedural referred to

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the phases before, during, and after the event is represented in Figure 23, 24, and 25. Data analysis showed that the Cognitive Processes play a central role in all the narratives taken into account. There is a significant difference among the mentions of the Social Processes in the narratives on the phase during the high and low performance [t (39) = 2.16, p < .05; Figure 24]). In particular, Social Processes are more cited during the High performance (M = 5.89, SD = 4.52) than the low one (M = 4.00, SD = 3.67). Furthermore, for what concerns the narratives on the phase after the challenging event, Figure 15 illustrates a significant difference between the high and the low performance in terms of Sensory Perceptions [t (37) = -2.36, p < .05], as well as Emotional processes [t (37) = 3.20, p < .01]. Sensory Perceptions are less cited after the high performance (M = 1.74, SD = 2.39) than the low one (M = 3.35, SD = 3.49), while the ATCs refer less to Emotional Processes after the low performance (M = 4.77, SD = 3.21) than the high one (M = 6.57, SD = 3.19).

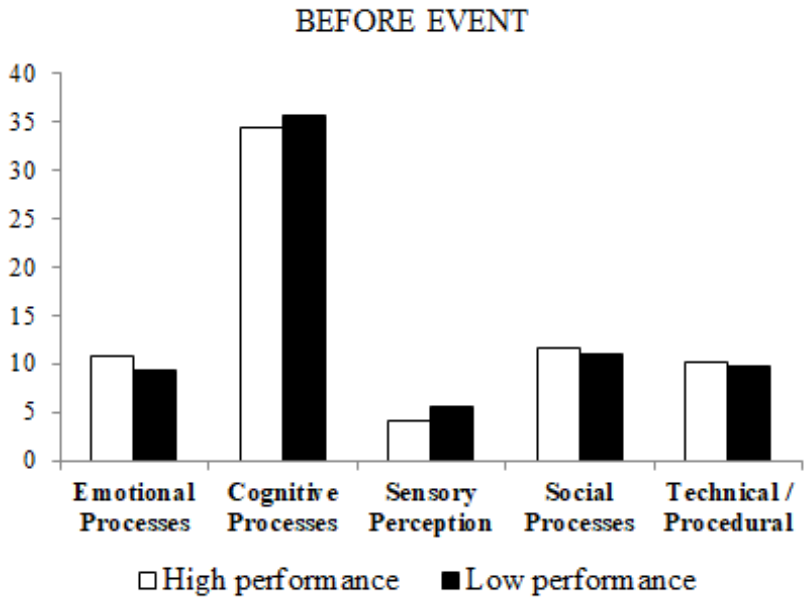

Figure 23. Comparison Between the Percentage of the Macro Categories Before the Event in the High and Low Performance

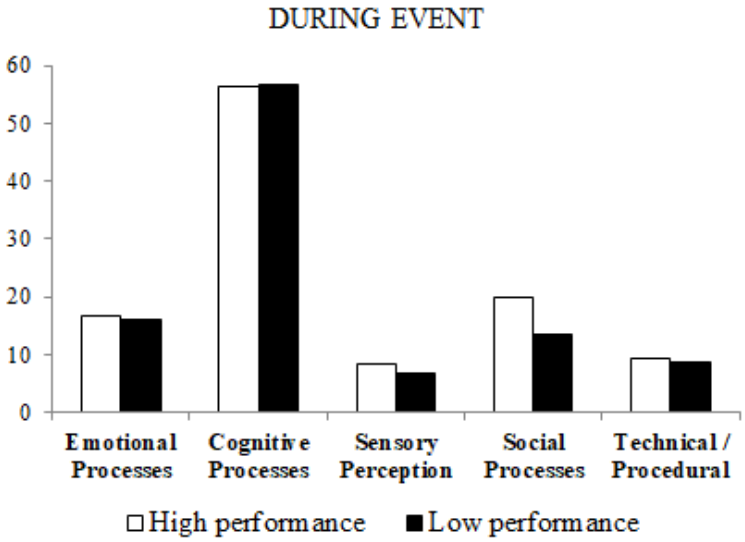

Figure 24. Comparison Between the Percentage of the Macro Categories During the Event in the High and Low Performance

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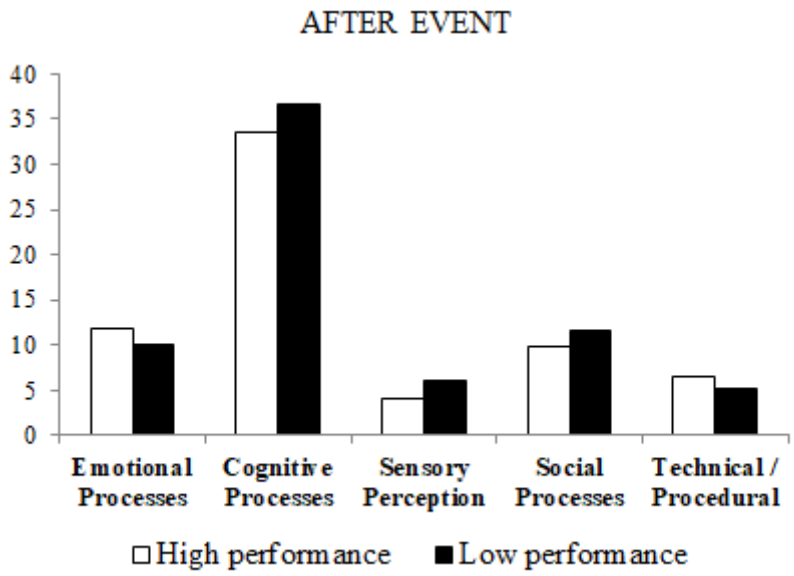

Figure 25. Comparison Between the Percentage of the Macro Categories After the Event in the High and Low Performance

Both high and low performance have been compared on the basis of the LIWC macro category named Emotional Processes (Figure 26, 27, 28), dividing the emotions into two different dimensions: Pleasant and Unpleasant. With regard to the Pleasant emotions, a significant difference between the Pleasant emotions mentioned in the phase after a high performance and a low performance was found [t (37) = 4.21, p < .001; Figure 28]. In particular, ATCs tended to mention more Pleasant emotions in the phase after the event in the high performance (M = 5.89, SD = 3.31) than in the low one (M = 2.81, SD = 2.63). Furthermore, considering the Unpleasant emotions, a significant difference between the Unpleasant emotions mentioned in the phase after a high performance and a low performance was found [t (37) = -2.05, p < .05; Figure 28]. In particular, ATCs tended to mention less Unpleasant emotions in the phase after the event in the high performance (M = 3.59, SD = 3.97) than in the low one (M = 1.87, SD = 3.60).

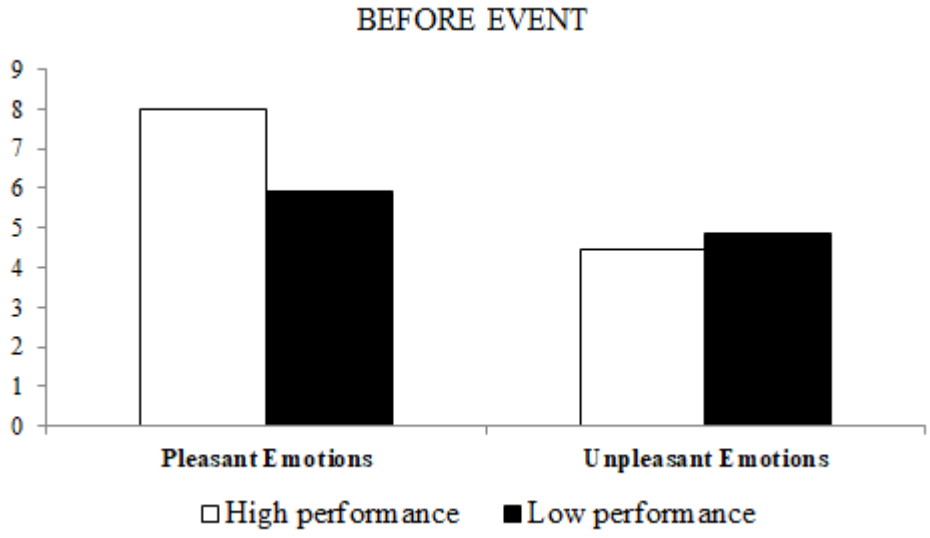

Figure 26. Comparison Between the Percentage of Pleasant and Unpleasant Emotions Before the Event in the High and Low Performance

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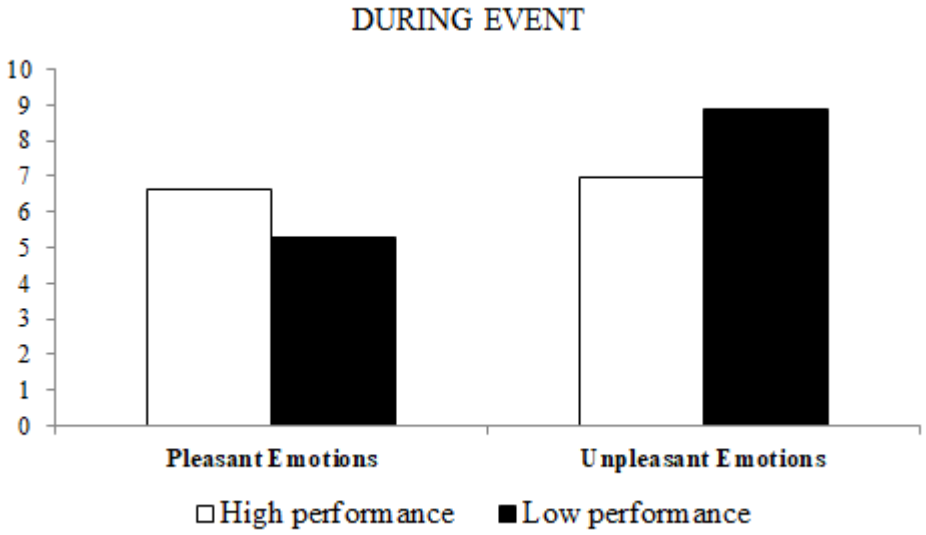

Figure 27. Comparison Between the Percentage of Pleasant and Unpleasant Emotions During the Event in the High and Low Performance

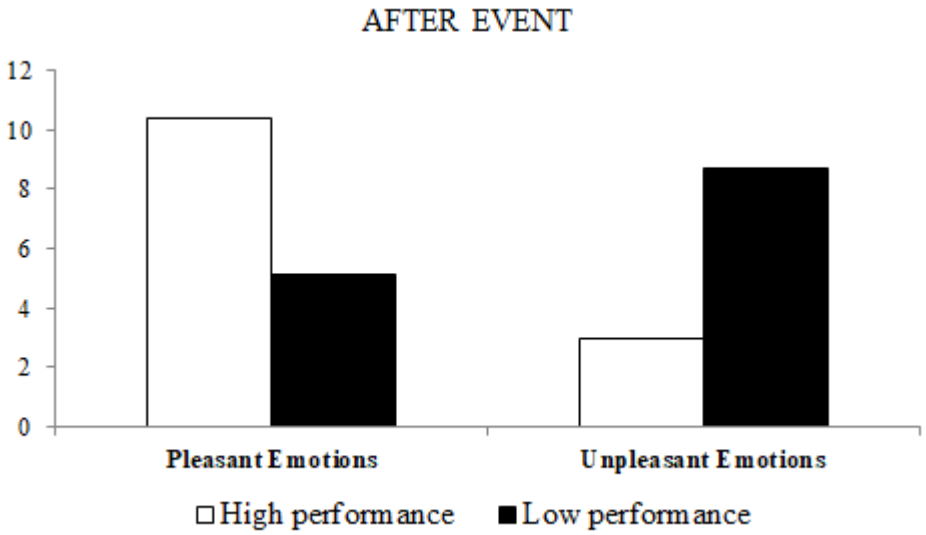

Figure 28. Comparison Between the Percentage of Pleasant and Unpleasant Emotions After the Event in the High and Low Performance

The comparison between the high and the low performance in terms of Insight and Inhibition is represented in Figures 29 (before the event), 30 (during the event), and 31 (after the event). Findings show a trend [t (37) = -1.87, p = .06; Figure 31] linked to the tendency of ATCs to report less mentions of Inhibition after the high performance (M = 0.24, SD = 0.54) than low performance (M = 0.60, SD = 1.05). No significant differences resulted in the category Insight.

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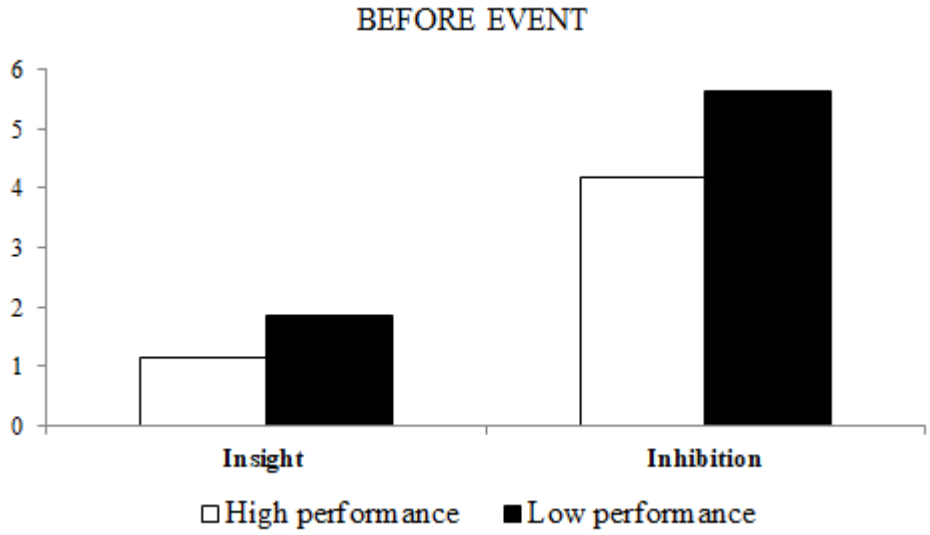

Figure 29. Comparison Between the Percentage of Words Related to the Categories Insight and Inhibition Before the Event in the High and Low Performance

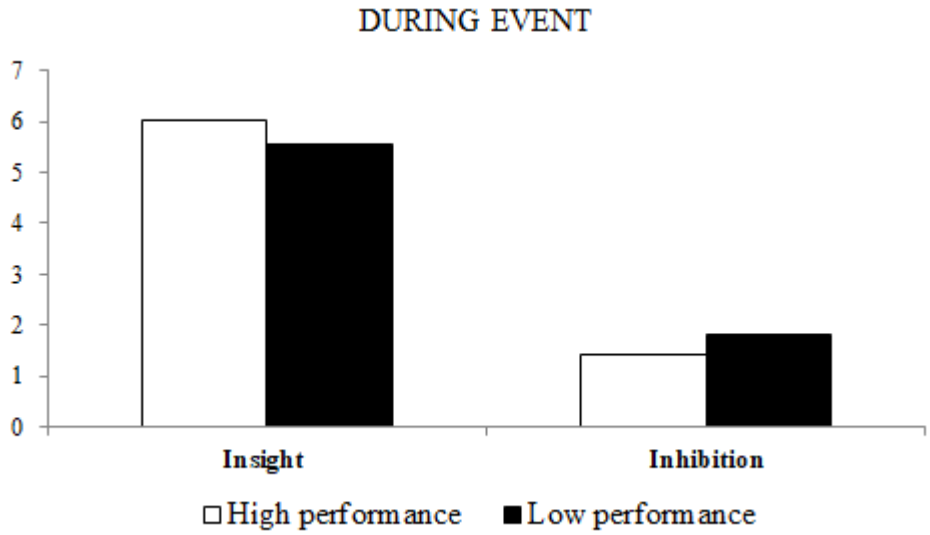

Figure 30. Comparison Between the Percentage of Words Related to the Categories Insight and Inhibition During the Event in the High and Low Performance

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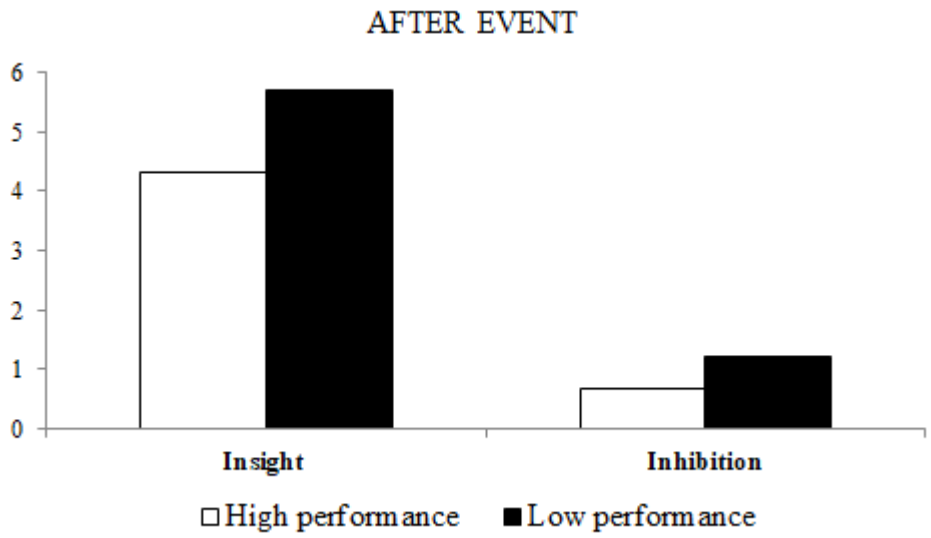

Figure 31. Comparison Between the Percentage of Words Related to the Categories Insight and Inhibition After the Event in the High and Low Performance

The comparison between the high and the low performance in terms of Sight and Hearing is shown in Figures 32 (before the event), 33 (during the event), and 34 (after the event). A significant difference among the mentions of Hearing in the narratives on the phase after the high and the low performance was found [t (37) = -1.82, p < .01; Figure 34]. In particular, Hearing is more cited after the high performance (M = 0.53, SD = 1.17) than the low performance (M = 1.15, SD = 1.69). No significant differences resulted in the category Sight.

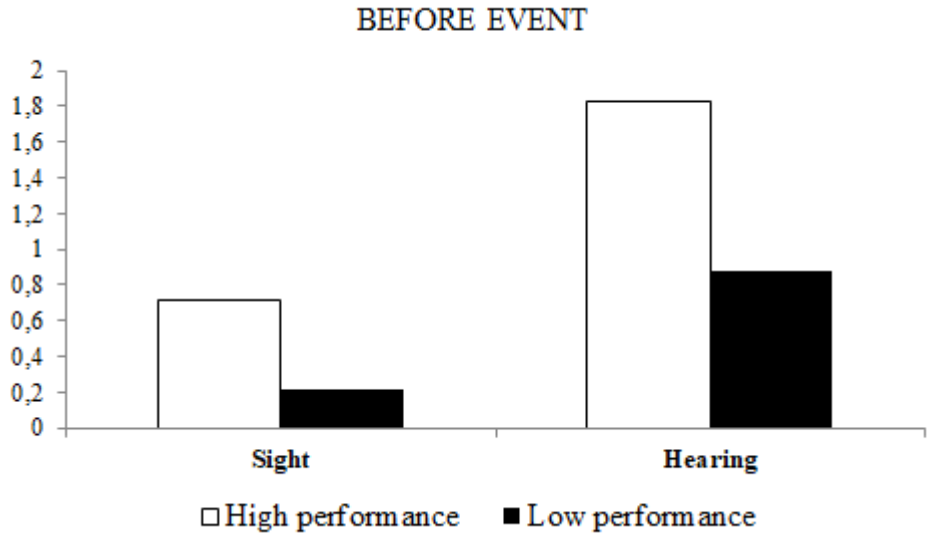

Figure 32. Comparison Between the Percentage of Words Related to the Categories Sight and Hearing Before the Event in the High and Low Performance

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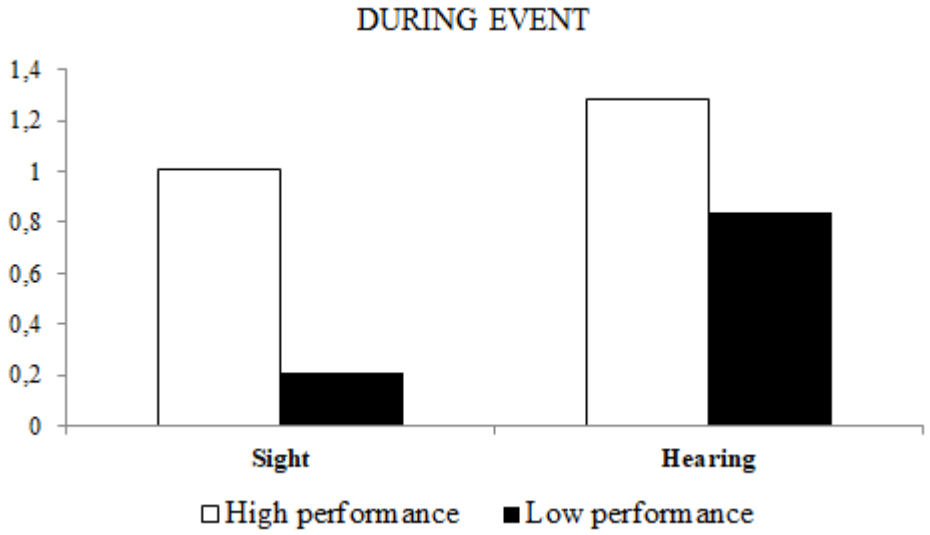

Figure 33. Comparison Between the Percentage of Words Related to the Categories Sight and Hearing During the Event in the High and Low Performance

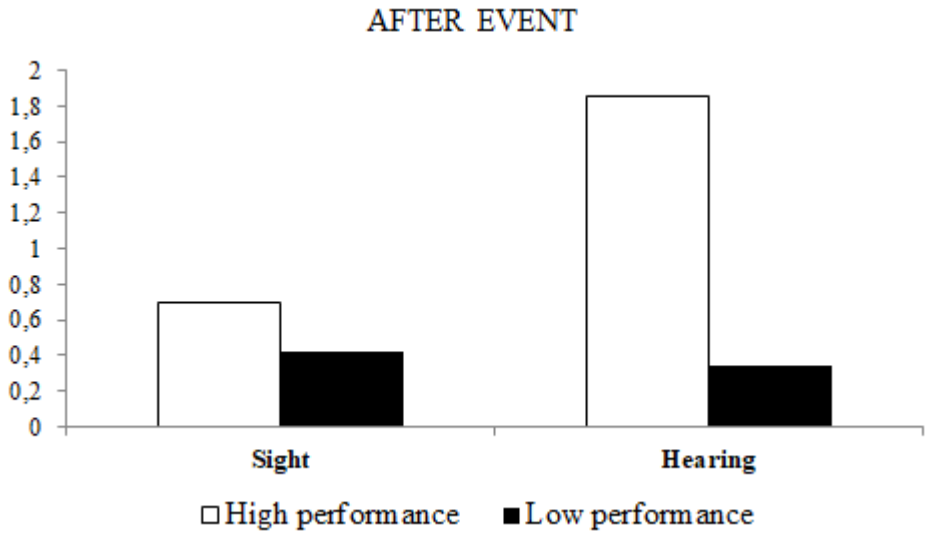

Figure 34. Comparison Between the Percentage of Words related to the Categories Sight and Hearing After the Event in the High and Low Performance

The comparison between the high and the low performance in terms of Social Processes is represented in Figures 35, 36, and 37. Data analysis showed that Communication play a central role in all the narratives taken into account. There is a significant difference among the mentions of Communication in the narratives on the phase after the high and low performance [t (37) = -1.88, p = .06; Figure 37]. In particular, Communication is less cited after the high performance (M = 0.79, SD = 1.35) than the low one (M = 1.61, SD = 1.93). No significant differences resulted for Mentions of others, Friends, and Family.

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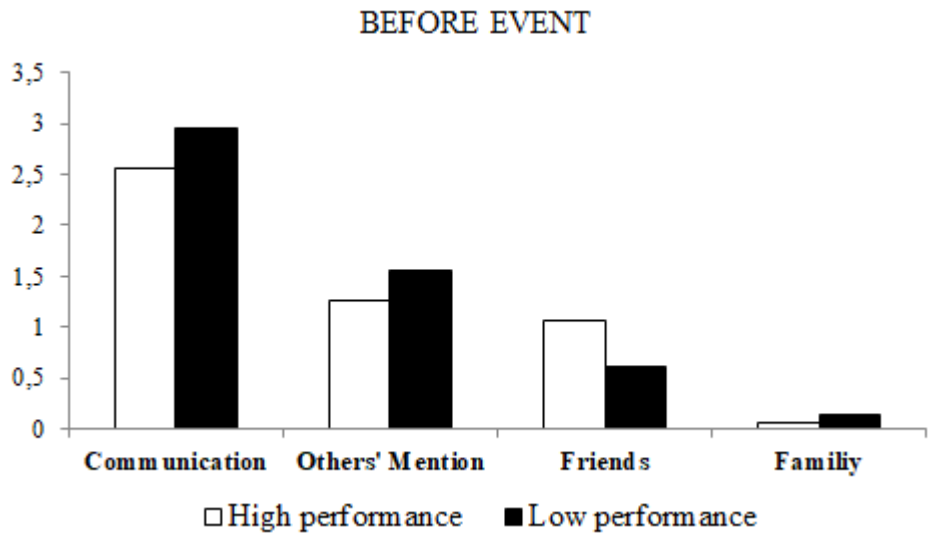

Figure 35. Comparison Between the Percentage of Words Related to the Macro Category of Social Processes Before the Event in the High and Low Performance

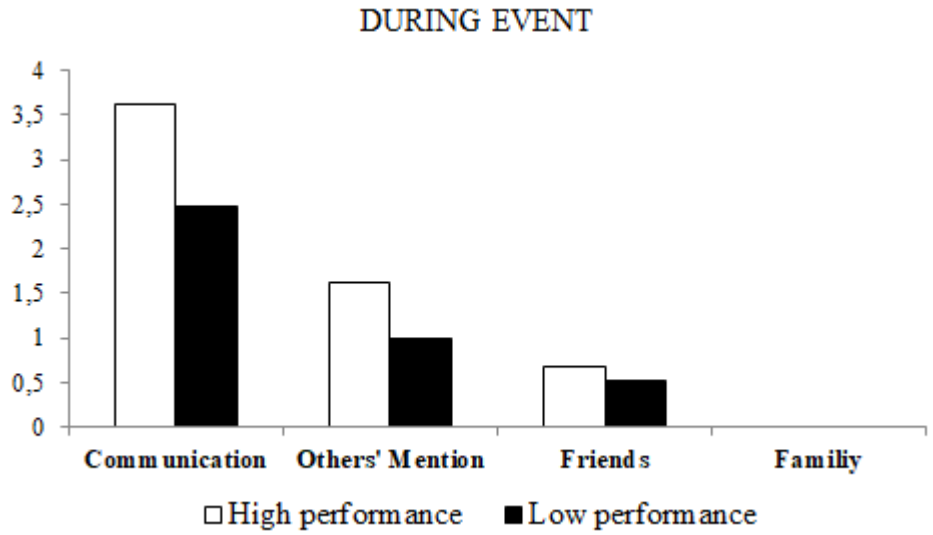

Figure 36. Comparison Between the Percentage of Words Related to the Macro Category of Social Processes During the Event in the High and Low Performance

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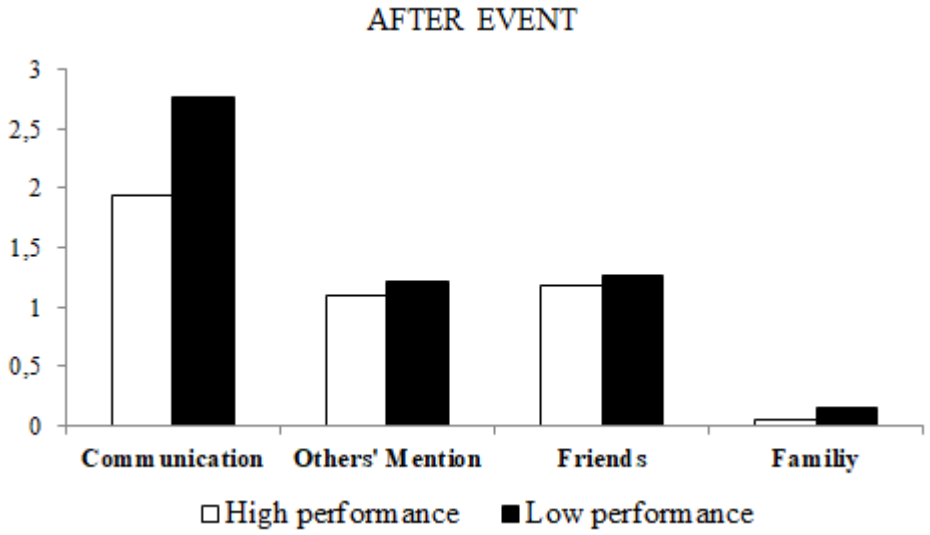

Figure 37. Comparison Between the Percentage of Words related to the Category of Social Processes After the Event in the High and Low Performance

Finally, it is interesting to notice that in their interviews several ATCs reffered that during the critical event, they often changed their posture, from a sitting position they tended to stand up, leaving in some cases their desk and moving to the window to directly see the situation.

Regulating Emotions

Both high and low performances have been compared on the basis of the Strategies mentioned by the ATCs before, during, and after the event. For what concerns the Strategies (Figure 38), a significant difference between the citations reported in the phase during the low and high performance was found [$t(39) = -2.39$, $p < .05$]. In particular, ATCs cited significantly more Strategies during the event in the high performance ($M = 6.38$, $SD = 4.51$) than in the low one ($M = 4.23$, $SD = 3.68$). No significant differences resulted in the number of citations of the Strategies in the phases before and after the event.

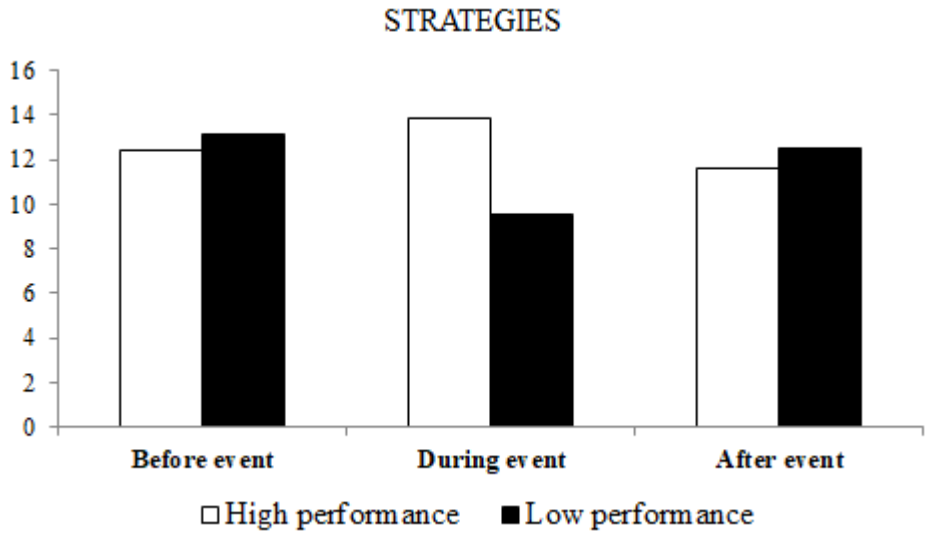

Figure 38. Strategies Citations Comparison Between High and Low Performance

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Figures 39 and 40 illustrate the frequencies of the strategies used by ATCs to manage their emotions in the high performance and in the low one respectively. As shown in Figure 39, the most frequent category is "no strategies," namely often when ATCs performed well they did not adopt particular strategies, or they were not aware of them.
For example, someone highlighted that:

> *"It's a routine task. The preparation is long before, maybe taking a nap in the afternoon. But I do not remember specific strategies"*

Finally, ATCs reported the importance of being focused on the problem when they are in their work position and to adopt relaxation techniques (e.g., breathing, autogenic training) to manage emotions.

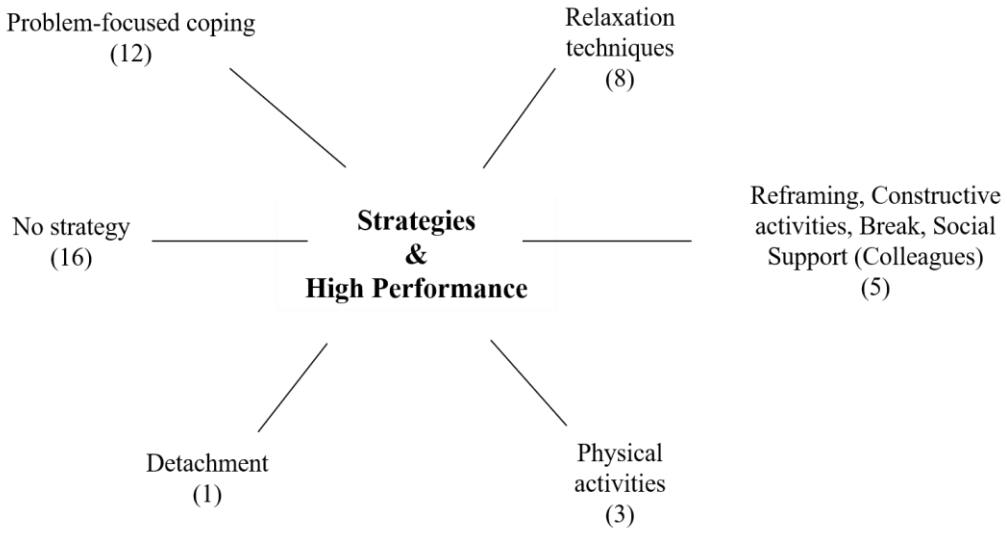

Figure 39. Strategies Used in the High Performance

Figure 40 shows how in a low performance, besides relaxation techniques, the ATCs were used to rely on Social Support, such as talking with colleagues or with family members.

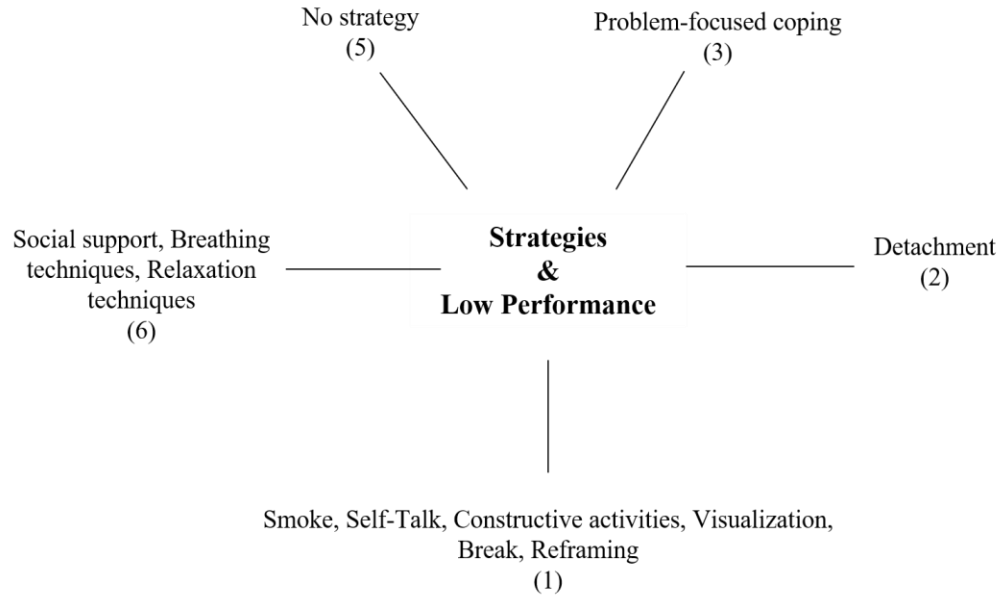

Figure 40. Strategies Used in the Low Performance

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Using Emotions

This section analyzes how ATCs' emotions impacted their thought and behavior in relation to the high and low performance. As regard to high performance, the most cited emotions were Calm, Satisfied, Relaxed, Excited and Focused (Figure 41).

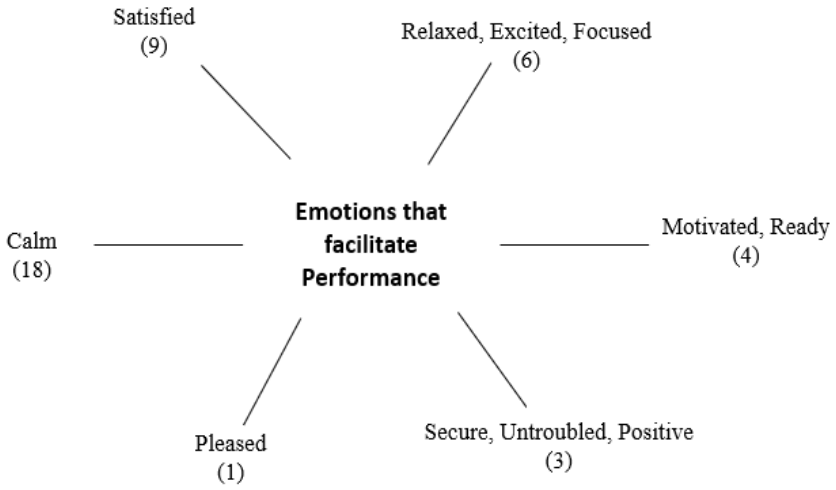

Figure 41. Emotions that Facilitated the Performance

Emotions that seem to inhibit the performance were Disappointed, Nervous, Scared, and Angry (Figure 42).

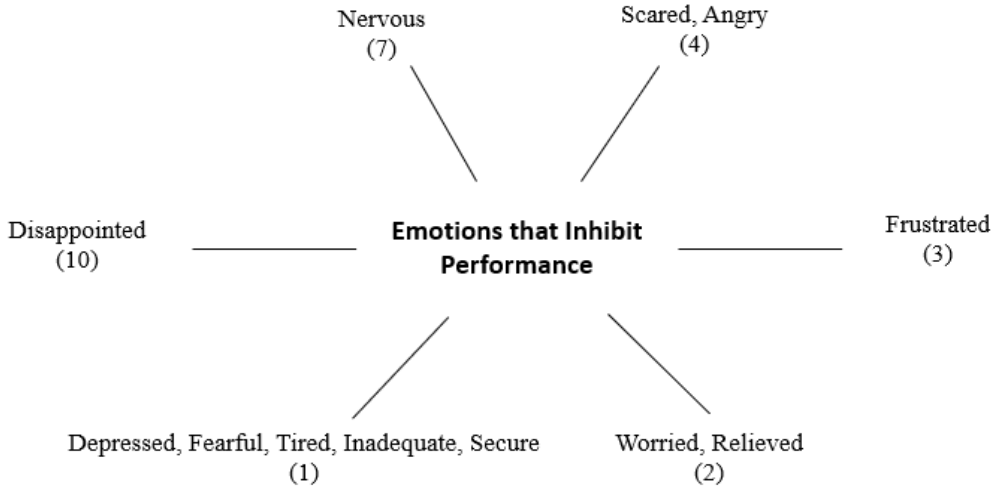

Figure 42. Emotion that Inhibited the Performance

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4.2.4 DISCUSSION

The aim of the present study was to use the PUERUModel framework to better understand how EI skills (i.e., Perceiving, Understanding, Expressing, Regulating, and Using emotions) can guide and improve ATCs' performance.

The PUERUModel of EI provided a useful framework to investigate the associations between emotional states and performances in our sample of ATCs.

Emotions can combine in complex, blended emotional states, which can change quickly and evolve in different feelings (Mayer & Salovey, 1997). Compared with focus groups, interviews provided a more detailed image of how the ATCs's perception of emotions changed before, during and after two challenging events from ATCs careers, one where their performance has been very satisfying (high) and one in which they were not satisfied at all about how they performed, they made mistakes, and they experienced a potential or an actual critical event due, at least in part, to their behavior (low).

Regarding the first ability of the PUERUModel, the *Perceiving emotions,* the analysis of its two core dimensions (i.e., valence and arousal), graphically represented via the Emotion Display (see Figure 4), showed the following trend for high performance: (a) in the phase before the challenging event, valence tended to be medium-high and arousal ranged from medium-low to medium-high; (b) during the event valence became medium while arousal tended to increase, becoming medium-high; (c) in the phase after the event, valence became medium-high and arousal tended to be medium in the majority of the ATCs interviewed.

In several cases, when ATCs described their emotional state during the high performance episode, they referred about something similar to what in positive psychology is known as "a flow state", that is, the mental state of operation in which a person performing an activity is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity (Csikszentmihalyi, 2008; Nakamura & Csikszentmihályi, 2001).

A slightly different trend emerged with regards to the emotions perceived in the low performance: (a) in the phase before the challenging event, emotions' valence and arousal ranged from medium-low to medium-high; (b) during the performance emotions' valence ranged from low to medium-high while arousal tended to increase, becoming medium-high; (c) in the phase after the event, valence tended to be extremely low and arousal tended to range from extremely low to extremely high in the majority of the ATCs interviewed.

Describing the low performance episode, in several cases, ATCs were aware of the fact that sometimes pleasant emotions (e.g., amusement) can inhibit their performance while emotions that are perceived as unpleasant (e.g. stress) can facilitate it. In fact, in some cases, ATCs described an event related to the first part of their career, when their motivation and enthusiasm were very high and, in some cases, they probably overestimated their resources to cope with the job's requests. They considered this attitude as a potential source of risk for their work, which require a lot of accurate appraisal and strategic thinking.

Cai and Lin (2011) suggest that emotions characterized by a positive valence have a high chance of simulating a high arousal, which could degrade task performance because of the potential U-shaped relationship (Cai & Lin, 2011; Csikszentmihalyi, 2008). In line with the literature from different contexts such as car driving (Cai & Lin, 2011) and ATCs' focus group discussions, not too intense emotions in terms of valence and arousal (e.g., calmness, secureness, slight excitement) seem to be associated with an emotional state which facilitate the task of air traffic control, preparing the professional to promptly react to environmental requests and better perform.

Regarding the second ability of our theoretical framework, that is, the ability to *Understand emotions*, which also include possessing a sophisticated and rich emotional vocabulary, the LIWC analysis showed a richer emotional vocabulary in relation to the high performance compared to the low one. This tendency was at its highest when ATCs speak about the phase after the event. In other words, pleasant emotions were explained using a more complex, sophisticated and rich vocabulary

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than unpleasant ones. Therefore, ATCs seemed to be more competent in this ability when they talked about a positive memory (i.e. the high performance) than when they recalled negative events (i.e., the low performance). This result is in line with the tendency to better recall positive events than negative experiences (Byrne, Hyman, & Scott, 2001).
Further, with regards to the third ability (i.e., *Expressing emotions*), the findings are straightforward. ATCs tended to express their own emotional experiences referring, above all, to cognitive aspects. It is well known that relevant cognitive abilities (e.g., spatial perception, information processing, logic reasoning and decision making) are required for ATCs to be able to perform at high levels at radar workstations (Chappelle, et al., 2010; Chappelle, McDonald, & King, 2010). Therefore, not surprisingly, when ATCs were asked to describe a critical event at work, they tended to focus on cognitive aspects. The training of ATCs to express their emotions integrating cognitive data with the emotional ones should be a target for non-technical training.
About the fourth ability of the PUERUModel, that is, the ability to *Regulate emotions* effectively, results showed that ATCs tend to be more aware of the strategies they use during challenging events even that resulted in a high performance than those they use during a low performance. However, overall findings suggested that often ATCs do not use known strategies either to emotionally prepare themselves before manning their workstation or to manage their emotions during and after their work task. Given the results from our quantitative study, as well as those of numerous previous ones (Ashkanasy & Daus, 2002; Brackett & Mayer, 2003; Fulmer & Barry, 2004; Humphrey, 2002; Lopes, Cote, & Salovey, & 2006; Mayer, et al., 1999, 2008) that demonstrated the importance of this particular EI skill to enhance ATCs psychological health, it would be helpful to focus the training of professional controllers on the strengthening of this ability.
Finally, narratives helped to clarify the last ability of our theoretical model, the *Using emotions*. This is the ability to use emotions in order to facilitate thinking and behavior, thus enhancing performance at work. According to the results from the focus groups, emotions that facilitated ATCs' performance were characterized by medium valence and arousal. Results from interviews seem to confirm that emotions that are too intense, both in terms of valence and arousal, inhibit performance. About this, it is interesting to notice that some of them underlined that the high level of satisfaction and joy generated from a high performance, could represent a source of risk and distraction worthy of notice, in case the shift is not yet finished. In fact, some slight tension is needed to maintain concentration on the task of air traffic control (Cai & Lin, 2011).
It should be noted that despite ATCs voluntarily chose to join the study, compared with the focus group discussions, interviews might've been more influenced by social desirability, the fact that they were audio-video recorded and the emotions evoked by describing high and low performances during a challenging event from their past career.
Although this study was conducted on a limited number of ATCs, results offered an interesting contribution for the deepening of the links between EI skills and performance in the air traffic control context.

5. CONCLUSIONS

5.1 Main Limitations of the Study

Although this study adopted both a quantitative (reliable and valid questionnaires) and qualitative (interviews and focus group) approach in order to deepen individual and group perceptions of a rare and large sample of Italian ATCs, this study presents some limitations.
First, the present study did not include objective data on ATCs' performance. This variable was evaluated just analyzing participants' subjective perceptions via focus groups and interviews. Future studies should attempt to integrate in the evaluation system standardized and objective measures of performance.

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Second, our data are compatible with a causal interpretation of the relationship between EI and psychological distress: higher levels of EI skills are associated with higher psychological health as widely documented in different contexts from air traffic control (Ashkanasy & Daus, 2002; Brackett & Mayer, 2003; Fulmer & Barry, 2004; Humphrey, 2002; Lopes, Cote, & Salovey, & 2006; Mayer, et al., 1999, 2008). Therefore, in order to confirm the causal nature of the relationships observed in the specific population of Italian ATCs, more studies with longitudinal design are needed.
Third, despite data being collected on a large sample of ENAV ATCs (about 30%) and the process used in the selection of participants (non-random sampling), some caution is required in the generalization of this study's results.

5.2 Implications and Future Directions

A wide literature demonstrated that EI skills are related to relevant outcomes for the aviation context (e.g., effective decision making, problem-solving, leadership skill, conflict management). Findings from our quantitative and qualitative studies provided a contribution to the corroboration of the existence of a significant impact of EI skills on psychological health and performance also within the air traffic control context.
The identification of key psychological attributes (EI skills and personality traits) of ATCs is crucial to identify professionals who can be able to adapt to such a highly stressful environment. On one hand, the study suggests that a higher emphasis on these factors during the recruitment process of future ATCs may represent a first step in the direction of selecting ATCs with high performing profiles, thus increasing both their performance efficiency and psychological health.
On the other hand, the fact that the EI skills can be measured and developed through evidence-based tools and strategies lays the foundation for the creation of a specific training program for the air traffic control context, where both technical and no-technical skills are crucial.
The PUERUModel provides a useful framework to develop the EI abilities of Perceiving, Understanding, Expressing, Regulating and Using emotions. Although emotions present individual and cultural differences, they also follow universal patterns, which allow generalizing some schemes that tend to be true for the majority of people. In particular, future training on EI should focus on teaching Perceiving and Regulating emotions skills. In fact, these abilities seem to play a stronger impact on the psychophysical health of ATCs, so that they can improve their ability to cope with chronic and acute stressors. ATCs should be trained to constantly practice the most effective strategies in order to interiorize them in their everyday work life routine, strengthening helpful strategies and restricting the ineffective ones.
Further, an important part of the training should also focus on the development of EI tools tailored on ATCs, such as the Emotion Display, aimed at teaching them how: (a) to improve ATCs' awareness on their emotional states; (b) to match emotional states with different task to enhance performance; and (c) to manage emotions applying effective strategies to prepare, prevent, reduce, detach, initiate, prolong, or enhance emotional states in self and others.
As a future direction, it would be noteworthy to extend our study to a military context, such as the Italian Air Force, in order to reach a more comprehensive understanding of the impact of EI on the human performance in the aviation context.
Finally, a comparison between our data and those collected in the US by Dr. Chappelle and his team of research, via a cross-cultural study, should represent a possible future development of this research, in order to better understand cultural differences.

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LIST OF ABBREVIATIONS AND ACRONYMS

ATC	Air traffic controller
CNR	Consiglio Nazionale delle Ricerche
DVs	Dependent variables
e.g.	Exempli gratia
EI	Emotional Intelligence
HFs	Human factors
i.e.	Id est
IV	Independent variable
LIWC	Linguistic Inquiry and Word Count
MSCEIT	Mayer-Salovey-Caruso Emotional Intelligence Test
NEO-PI-3	NEO Personality Inventory - 3
OQ 45.2	Outcome Questionnaire - 45.2
USAF	U.S. Air Force
WIRB	Western Institutional Review Board

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