Original Papers

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The relationship between Trait Emotional Intelligence and emotion recognition in the context of COVID-19 pandemic

Abstract: Covid-19 pandemic is severely impacting worldwide. A line of research warned that facial occlusion may impair facial emotion recognition, whilst prior research highlighted the role of Trait Emotional Intelligence in the recognition of non-verbal social stimuli. The sample consisted of 102 emerging adults, aged 18-24 (M = 20.76; SD = 2.10; 84% females, 16% males) and were asked to recognize four different emotions (happiness, fear, anger, and sadness) in fully visible faces and in faces wearing a mask and to complete a questionnaire assessing Trait Emotional Intelligence. Results highlighted that individuals displayed lower accuracy in detecting happiness and fear in covered faces, while also being more inaccurate in reporting correct answers. The results show that subjects provide more correct answers when the photos show people without a mask than when they are wearing it. In addition, participants give more wrong answers when there are subjects wearing masks in the photos than when they are not wearing it. In addition, participants provide more correct answers regarding happiness and sadness when in the photos the subjects are not wearing the mask, compared to when they are wearing it. Implications are discussed.

Keywords: COVID-19, Trait EI, Emotion Recognition

INTRODUCTION

The COVID-19 pandemic is severely impacting globally, and at the end of 2020 more than 12 million people had been infected and over 551,000 had died (World Health Organization, 2020a). To hinder the spread of COVID-19 several countries have established the use of containment measures. In this regard, World Health Organization has recommended wearing face masks in public areas (World Health Organization, 2020b). Although face masks are regarded as an effective means to mitigate the spread of the pandemic (Wu & McGoogan, 2020) a recent line of research addressed the potential intervening role of mask-wearing on emotion recognition (Ruba & Pollak, 2020). Understandably, masks cover most part of individuals' faces, which may deeply influence social interaction. In this regard, previous findings warned that disguised faces are predictive of impaired emotion recognition (Dhamecha, Singh, Vatsa, & Kumar, 2014). Such concerns stem from past findings suggesting that one's ability to recognize facial emotions decreases in presence of occlusions covering certain facial regions. For instance, Dhamecha, Singh, Vatsa, and Kumar (2014) found in a small sample of human participants that emotion recognition was impaired in presence of masked faces. Further insights confirmed that recognition accuracy was similarly reduced when different parts of the face were not visually available (Stephan & Caine, 2007).

This may be because faces provide several pieces of information regarding a person's identity, such as age and gender, as well as allowing us to infer emotional states from facial mimicry (Bruce & Young, 1986). In the context of the COVID-19 pandemic, Carbon (2020) emphasized how emotional reading was hampered by the presence of a mask in a sample of healthy individuals in a fairly broad age span (18-87). In addition, Freud,

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Stajduhar, Rosenbaum, Avidan, and Ganel (2020) high-lighted lower accuracy in recognizing masked faces and therefore a decrease in face perception abilities in a community sample.

Lower facial emotion recognition also has important consequences, such as lowering empathic concerns (Besel & Yuille, 2011) and impairing interpersonal relationships (Assed et al., 2019). It is therefore important to understand the factors that draw individuals toward lower accuracy and to shed light on potential factors that may help to promote effective social interactions, even when relevant visual information is less available, like in the current COVID-19 outbreak.

It is thought that facial expressions guide interpersonal interactions because they foster the ability to accurately perceive nonverbal social cues (Holland, O'Connell, & Dziobek, 2020). In a similar vein, it is known that the emotional aspects may play a pivotal role in acknowledging social cues (Hall, Andrzejewski, & Yopchick, 2009). Past findings found an association between alexithymia and facial emotion recognition, thereby high-lighting how greater difficulty in distinguishing one's own emotional states was related to poorer ability in recognizing emotional stimuli (Cuzzocrea, Barberis, Costa, & Larcan, 2015; Pedrosa et al. 2009). Recent findings suggested that the appropriate knowledge and management of one's emotional dimension may be relevant for facial emotion recognition (Davis, Morningstar, & Qualter, 2021). For this reason, Trait Emotional Intelligence (trait EI; Petrides, Pita, & Kokkinaki, 2007) may be a worthwhile domain of assessment as it represents an umbrella-term encompassing that set of dimensions that capture the typical way in which individuals perceive emotional information and behave in a given emotional environment (Sarrionandia & Mikolajczak, 2020). Trait EI in fact refers to a set of emotional self-perception located at the lower levels of personality hierarchies (Petrides et al., 2007; Petrides, 2011), and thus encompasses the typical way of processing emotion related informations (Petrides, et al., 2016). A wide body of research emphasized that trait EI is related to several domains such as organic diseases (Barberis, et al., 2019; Sarrionandia, & Mikolajczak, 2020), mental health (Barberis, Costa, Cuzzocrea, & Quattropani, 2018; Formica, et al., 2018), self care practices (Baudry, Grynberg, Dassonneville, Leloran, & Christophe, 2018; Costa, Barberis, Larcan, & Cuzzocrea, 2018), parenting (Barberis, Verrastro, Papa, Quattropani, 2020; Costa, Barberis, Gugliandolo, Larcan, & Cuzzocrea, 2018), and task performance (Barberis, Calaresi, & Gugliandolo, 2019; Sanchez-Ruiz, Mavroveli, & Poullis, 2013). It is assumed that trait EI results from developmental processes such as maturational processes, cognitive development, and experiences in social environments (Petrides, et al., 2007; Petrides, Furnham, & Mavroveli, 2007).

A robust line of research highlighted how Trait EI may be a key component for the recognition of the affective states of facial expressions. Specifically, Petrides and Furnham (2003) suggested that higher levels of Trait EI predicted higher accuracy in identifying dynamic morphed expressions, and Edgar, McRorie, and Sneddon (2012) highlighted higher levels of Trait EI were positively related to higher consistency in decoding non-verbal expressions of emotion. In addition, the results of the existing studies showed that high trait EI individuals yield good performance in assessing a happy emotional state (Lea et al., 2018), since its components (e.g. optimism) have been shown to influence attentional processing of emotion (Kress & Aue, 2017).These results provided clear evidence for the role of trait EI in a well-developed ability to recognize facial emotions.

While the aforementioned findings showed how individuals from the general population infer emotional expression and how the accuracy lowers when the face is occluded by a mask, no study to the authors' knowledge addressed the impact of such containment measures on a more specific population, namely emerging adults.

Emerging adulthood usually refers to the age from approximately 18 to 24 years and is regarded as a relevant developmental stage in which individuals rebuild their interpersonal dimensions as a result of a detachment from parents and increased autonomous functioning (Arnett, 2004; Reis, Collins, & Berscheid, 2000). Assessing emerging adults may be relevant as it may provide important insights regarding the different levels of adaptation during the COVID-19 pandemic (Chew, Wei, Vasoo, Chua, & Sim, 2020) and therefore provide more information to help prevent risky behaviours, which indeed commonly occur in this life period (Atchison et al., 2020; Barari et al., 2020).

In summary, the current study sought to assess how emerging adults draw inferences regarding emotional states from faces partially covered by surgical face masks and, as a comparison, without any form of occlusion.

Specifically, it was hypothesized that:

Hypothesis 1 (H1)- participants provide more correct answers when the photos show people without a mask than when they are wearing it, whereas they provide an higher degree of wrong answers when they have to recognize masked faces.

Hypothesis 2 (H2)- participants provide different numbers of correct/wrong on the basis of the sex of persons displayed in emotion stimuli.

Hypothesis 3 (H3)- participants provide different numbers of correct/wrong on the basis of the age of persons displayed in emotion stimuli.

Hypothesis 4 (H4)- a higher degree of trait EI was positively related to higher levels of facial emotion recognition.

METHOD

Participants

A convenience sample took part in this study on a voluntary basis, without any form of compensation. The research was approved by the ethical committee of the an Italian university. The sample consisted of 102 emerging adults, aged 18-24 (M = 20.76; SD = 2.10) of whom 84%

were females. All participants had Italian nationality and were Italian speaking. Regarding the occupational level, the overwhelming majority of the participants were students (87%), whilst 13% were unemployed.

Measures

Trait EI

The Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF) in its Italian validation (Petrides, 2009; Chirumbolo, Picconi, Morelli, & Petrides, 2019) is a 30-item self-report form that taps into 15 facets of Trait EI sampling domain (adaptability, assertiveness, emotion perception (self and others), emotion expression, emotion management, emotion regulation, impulsiveness (low), relationships, self-esteem, self-motivation, social awareness, stress management, trait empathy, trait happiness and trait optimism). Unlike the full form, it is not possible to get single facet scores, but it is possible to obtain the scores of four trait EI factors, namely: sociability (eg, "I would describe myself as a good negotiator"), self-control (eg, "I usually find it difficult to regulate my emotions"), well-being (eg, "On the whole, I'm pleased with my life") and emotionality (eg, "I'm normally able to 'get into someone's shoes' and 'experience their emotions'") and a total trait score EI. The TEIQue is a tool widely used on the international scene, both in the full version and in the short version, to evaluate trait EI and has been translated into many languages. Participants are required to rate, on a 7-point scale, their level of agreement with each item. Higher scores indicate higher trait EI. The internal consistency of the trait EI in this study is .90.

Emotion recognition

All face stimuli were obtained from frontal photos of 6 Caucasians individuals (3 females and 3 males) belonging to three different age span (childhood, young adulthood, and middle-age). Each individual was asked to reproduce each of the following emotions: "sadness", "fear", "anger", and "happiness" without any form of facial occlusion. In addition, each individual was asked to reproduce the same emotion wearing a facial mask.

In sum, the following number of face stimuli was obtained: 2 (face sex) × 3 (age groups) × 4 (types of emotion) × 2 (no face mask vs. face mask) = 48 face stimuli. Participants were asked to choose which emotion was portrayed by the each stimulus by choosing the most correct option among the four types of emotions observed for the purposes of this study. Parallel to well-established insights positing that facial emotion recognition is a general skill based on a global score rather than on single emotions acknowledgment (Kirouac & Dore, 1985; Scherer & Scherer, 2011), two different global scores for wrong and correct answers were computed.

Procedure

Before photo shooting, individuals that provided stimuli used for the study were informed that each photo would be used for research purposes and provided their consent. In case of underage individuals, such consent was provided by parents or legal representatives. Participants were recruited using social media posts by soliciting psychology students to post a link to an anonymous online survey on their social network profiles (Facebook and Twitter). Students shared this link on a voluntary basis, without any form of compensation. To comply with physical distancing recommendations aimed at hindering the spread of COVID-19, a web-based survey was chosen and therefore all data were collected remotely. Each advertisement contained a link in which the general purpose of the study was described and an informed consent schedule was presented. Responses in the electronic survey had been set as mandatory and therefore all questions were answered. The protocol required about 25 minutes to be completed.

RESULTS

Table 1 illustrates Means, Standard Deviations of scores on each of the variables. To verify potential differences in the scores of the variables taken into account, t-tests were carried out (table 1). Frequencies of the responses were collected, and thus data were coded in wrong and correct answers. Subsequently, mean scores for both correct and wrong answers were obtained and T-test was carried out.

(H1). T- test was performed and significant differences were found with stimuli without the mask being recognized more correctly than those with the mask in happiness [$t(101) = 14.05$; p <.001] and sadness [$t(101) = 6.69$; p = <.001]. Not statically significant differences were found with regard to facial stimuli depicting anger in faces wearing mask and without occlusion [$t(101) = 1.28$; p =. 20]. Not statically significant

Table 1. Descriptive analyses and t-test analysis

	Without mask		With mask				
	M	SD	M	SD	t	df	p
Happiness	5.16	1.10	3.05	1.28	14.05	101	<.001
Sadness	4.74	1.03	3.66	2.14	6.69	101	<.001
Anger	3.80	2.20	3.62	1.25	1.28	101	.20
Fear	2.85	1.89	3.05	1.28	-1.35	101	.18
Correct Answers	16.55	4.63	15.03	5.33	5.26	101	<.001
Wrong Answers	2.90	4.56	4.77	5.66	-9.49	101	<.001

differences were found with regard to facial stimuli depicting fear in faces wearing mask and without occlusion [$t(101)$ = -1.35; p =.18]. Significant differences were found for correct answers with stimuli without the mask being recognized more correctly than those with the mask [$t(101)$ = 5.26; p <.001]. Moreover, significant difference were found for wrong answers for stimuli with the mask comparing with stimulus without the mask [$t(101)$ = -9.49; p <.001].

(H2) To test potential differences that may arise due to sex of persons displayed in emotion stimuli a t-test was performed. Results showed that individuals are prone to provide more correct answers when they have to recognize masked females compared to masked males [$t(101)$ = 7.08; p <.001]. Not statically significant differences in correct answers provided were found when they have to recognize facial stimuli depicting individuals without occlusion [$t(101)$ = 1.88; p =.06]. In addition, results showed that individuals are prone to provide more wrong answers when they have to recognize masked males compared to masked females [$t(101)$ = -3.54; p <.05] and they are prone to provide more wrong when they have to male facial stimuli without occlusion compared to female ones [$t(101)$ = -2.78; p <.05] (Table 2).

(H3) To test potential differences that may arise due to age of persons displayed in emotion stimuli, a repeated measures ANOVA was conducted. There is a significant difference in the number of correct responses regarding stimuli depicting female figures wearing masks (F(2,202) = 6.03; p<.01), with child being more accurately recognized compared to young woman (p<.01) and middle-aged woman.

In addition, there is a significant difference in the number of correct responses regarding stimuli depicting female figures without occlusion F(2,202=4.86; p<.01) with participants tending to provide more correct responses to stimuli children (p<.01). Moreover, a statistically significant difference emerged in the number of correct responses given in front of pictures depicting male figures wearing masks (F(2,202)=9.11; p<.01). A greater number of correct responses was given in front of stimuli depicting children wearing masks compared to those depicting middle-aged men (p<.01) and to those depicting young individual compared to middle-aged man (p<.01).

Moreover, a statistically significant difference emerged in the number of correct responses given in front of pictures depicting male figures without (F(2,202) =25.33; p<.01) with stimuli depicting young individual being more recognized compared to those of child (p<.01) and middle-aged man.

In addition, there is a significant difference in the number of wrong responses regarding stimuli depicting female figures wearing masks (F(2,202=4.70; p<.01) with participants tending to provide more wrong responses to stimuli depicting a young individual compared to the one depicting a child (p<.01).

Non-significant results were found for wrong responses regarding stimuli depicting female figures without occlusion (F(2,202)=1.73 p=.18), for wrong responses regarding stimuli depicting male figures with mask (F(2,202=.80; p=.45) and for wrong responses regarding stimuli depicting male figures without mask (F(2,202) =1.24; p=.29) (Table 3).

Table 2. Descriptive analyses and t-test analysis

	Female		Male				
	M	**SD**	**M**	**SD**	**t**	**df**	**p**
Correct answers (stimuli without mask)	8.49	2.04	8.06	3.04	1.88	101	.06
Correct answers (stimuli with mask)	8.20	3.30	6.91	2.81	7.08	101	<.001
Wrong answers (stimuli without mask)	1.15	1.51	1.75	3.25	-2.78	101	<.01
Wrong answers (stimuli with mask)	2.12	3.23	2.66	2.61	-3.54	101	<.001

Table 3. Descriptive data and results of repeated measures ANOVA

	With mask					**Without mask**				
	Childhood	**Young adulthood**	**Middle age**			**Childhood**	**Young adulthood**	**Middle age**		
	M(SD)	M(SD)	M(SD)	F(2,202)	p	M(SD)	M(SD)	M(SD)	F(2,202)	p
Correct answers (female stimuli)	2.92(1.11)	2.61(1.48)	2.67(1.08)	6.03	<.01	2.97(.85)	2.68(.99)	2.84(.78)	4.86	<.01
Correct answers (male stimuli)	2.36(.07)	2.46(.14)	2.01(.08)	9.11	<.01	2.44(1.05)	3.03(1.14)	2.59(1.20)	25.33	<.01
Wrong answers (female stimuli)	.61(1.09)	.82(1.38)	.69(.95)	4.70	<.01	.38(.65)	.32(53)	.44(.68)	1.73	.18
Wrong answers (male stimuli)	.88(.74)	.95(1.37)	.82(.95)	.80	.45	.55(1.11)	.62(1.14)	.59(1.09)	1.24	.29

(H4) As can be seen in table 4, trait emotional intelligence seem to favor the identification exclusively of the emotion of Happiness Without Mask; in fact, there is a positive correlation between the recognition of Happiness Without Mask (r=.22; p<.05). There are not significant correlation between trait Emotional Intelligence and Happiness with Mask (r= .11; p>.05); Wrong Answers without Mask (r= .08; p>.05); Wrong Answers with Mask (r= .11; p>.05); Correct Answers without Mask (r= -.01; p>.05); Correct Answers with Mask (r= -.01; p>.05); Sadness Answers without Mask (r= -.02; p>.05); Sadness Answers with Mask (r= -.01; p>.05); Anger Answers without Mask (r= -.08; p>.05); Anger Answers with Mask (r= -.04; p>.05); Fear Answers without Mask (r= -.04; p>.05); Fear Answers with Mask (r= .11; p>.05).

Table 4. Correlation analysis between the observed variables

	Trait EI (M=4.80; SD=.82)
Wrong Answers Without mask	.08
Wrong Answers With mask	.11
Correct Answers Without mask	-.01
Correct Answers With mask	-.01
Happiness Without Mask	.22*
Happiness With Mask	.11
Sadness Without Mask	-.02
Sadness With Mask	-.01
Anger Without Mask	-.08
Anger With Mask	.04
Fear Without Mask	-.04
Fear With Mask	.11

Note: *p < .05.

DISCUSSION

Several studies (Carbon, 2020; Freud et al., 2020) have expressed concerns regarding the potential impact of facemasks on individual social functioning. Because masks are challenging for daily social interactions, it is reasonable to suggest that they would affect the quality of the perception and understanding of emotions and might thus be an important source of impaired emotion recognition. Many findings have highlighted how appropriate knowledge and management of one's emotion may foster the acknowledgment of non-verbal social stimuli (Edgar et al., 2012; Holland et al., 2020; Petrides & Furham, 2003), and therefore the current study investigated relationships between facial emotion recognition and the set of cognitive and affective dimensions that denote typical responses in a given emotional scenario, that is, Trait EI (Sarrionandia & Mikolajczak, 2020).

Results suggest that participants were better able to recognize happiness and sadness in faces without a mask. These results reflect previous insights arguing that extreme emotions are better recognized than mild ones, as they involve greater muscle contracture and consequently greater facial activation (Ekman, 2003). These results are consistent with previous findings suggesting that wearing a mask limits recognition of the other person's facial expressions, which nonetheless are key components of interpersonal interactions (Nestor, Fischer, & Arnold, 2020). Current results suggest that emotion recognition may be impaired by wearing face masks in the context of COVID-19 pandemic, except for fearful and angry faces, which is consistent with past findings that employed different types of occlusion to cover the mouth area, such as the Bubbles technique (Blais, Roy, Fiset, et al., 2012) or garments (Fischer, Gillebaart, Rotteveel, et al., 2012; Kret, de Gelder, 2012). These results may be viewed in light of the fact that such emotions highly involve the upper part of the face and eyes, which are not covered by facemask, thereby allowing this facial region to be still indicative for these emotional states (Bombari et al., 2013; Kret, de Gelder, 2012; Wegrzyn, et al., 2017). Moreover, participants recognized correct emotions more in faces not covered with a mask. This finding further corroborates the assumption that that the occlusion of specific facial areas may impair emotion recognition abilities (Stephan, & Caine, 2007; Dhamecha et al., 2014; Kret, de Gelder, 2012) and extended such insights by assessing how a common face mask may impact in social interactions during a relevant social and clinical concern, namely COVID-19 pandemic. Indeed, individuals perceive each other's facial expression, and this helps to successfully navigate in social environments, but the facemasks commonly worn during the COVID-19 pandemic to shield the mouth could be viewed as a physical occlusion that covers that part of the face relevant for emotional expression, and thus, emotion reading (Carbon, 2020). These findings corroborate the reasoning that blocking one-half of the face increases the chance of recognizing emotions or confusing them with each other (Nestor et al., 2020) (H1).

In addition, results suggest that participants were better able to recognize stimuli depicting female individuals. Individuals were able to more accurately recognize the emotions of both mask-wearing and non-mask-wearing females displayed in emotion stimuli, and this may be due to the fact that Women are generally more emotionally expressive than men (Korb et al., 2015; Stevens & Hamann,2012) and this may result into a more accurate processing facial expressions of emotion that may allow other to better understand one's emotional states (H2). Some noteworthy findings were that ages of individuals displayed in emotion stimuli have an effect on participants' accuracy in recognizing emotions. This result is consistent with some insights stemming from emotion recognition research (Abbruzzese, Magnani, Robertson, & Mancuso, 2019; Richter, Dietzel, & Kunzmann, 2010). However, given the mixed results about age differences of observed individuals during experimental tasks regarding emotion recognition (Abbruzzese et al., 2019; Borod et al., 2004; Ebner & Johnson, 2009) more research addressing

the influence of structure of different time of experimental tasks and types of stimuli is needed (H3).

Moreover, individuals high in Trait EI are very accurate in recognizing the states of others and are more able to recognize their emotions (Jaksic & Schlegel, 2020). Therefore, high Trait EI individuals may better use their attentional resources to decode emotional stimuli, thereby enhancing the recognition of subtle happy states. As such, trait EI is associated with the acknowledgment of happiness in faces not wearing facemasks, and this may be due to the fact that trait EI is closely linked to a biased preference for scenes depicting positive visual pieces of information (Fiori, 2009; Lea et al., 2018). This may explain why the results of the current study did not report significant associations for anger, fear, and sadness, given the negative nature of such emotions and consistent with past insights suggesting positive relationships between Trait EI and positive emotional stimuli (Lea et al., 2018). Given that Trait EI encompasses both affective self-perceptions and personal evaluation of social effectiveness (Van der Linden et al., 2017) that may be useful for managing interpersonal contexts (Hall et al., 2009), the association between trait EI and emotion recognition may also depend on as-yet-undiscovered that future studies may deepen (H4).

The current study has the merit of assessing a relevant affective dimension of personality in the context of emotion recognition during the COVID-19 pandemic. Past research has consistently shown that Trait EI is a key component for promoting one's adjustment (Martins, Ramalho, Morin 2010), and given that Trait EI denotes people's perceptions of their social effectiveness (Van der Linden et al., 2017), it may be useful to consider implementing interventions aimed at fostering the use of such set of emotion-related personality dispositions to promote well-being for mask wearers. This may be of particular relevance for emerging adults, given that social stressors were more consistently associated with emerging adults' emotional distress during the COVID-19 pandemic (Shanahan et al., 2020). Hence, such results underline from a practical point the fact that emerging adults with high trait EI may be able to effectively recognize positive emotions in the pandemic context. Training and intervention programs should therefore emphasize the promotion of trait EI for emerging adults during the COVID-19 pandemic.

Although current findings suggested how facemasks may complicate social encounters as a result of the impaired reading of facial expression, it is worth noting that wearing a facemask is an important part of the COVID-19 containment strategy. Therefore the implementation of a variety of compensatory behaviors, such as body language during communication, facing the communication partner directly while respecting physical distancing, articulating speech, and increasing its volume in a quiet setting may have a favorable effect in adjusting interpersonal communication and thus emotion recognition (Mheidly, Fares, Zalzale, & Fares, 2020).

Despite the practical and theoretical contributions, the current study has some drawbacks that future studies may address. First of all, it is cross-sectional in nature, and therefore it is not possible to disentangle the directionality of the observed variables. Future studies may be longitudinal and potentially observe variations in parallel with the evolution of the pandemic context. In addition, only four emotions were assessed. Future studies should observe a wider repertoire of emotions, to provide a more nuanced representation of the dynamics and effects of mask-wearing on non-verbal emotional stimuli. In addition, the convenience sample was fairly small and quite unbalanced in terms of the presence of male and female participants, and therefore caution is needed to interpret the results.

Finally, a better understanding of the attitudes associated with emotion recognition while wearing face masks is vital to foster healthy communication with face masks is crucial, and the identification of personal dimensions, like trait EI, may help the identification of the corresponding psychological underpinnings.

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