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Emotion recognition changes in a confinement situation due to COVID-19

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ABSTRACT

The confinement situation experienced as a result of COVID-19 will have consequences at a psychological level. These consequences can affect emotion recognition because, due to isolation, interactions and social contacts have been drastically reduced. The aim of this study was to find out if there were differences in facial emotion recognition in two groups of young adults, one confined during COVID-19 and the other unconfined.

One hundred and sixty-four young adults were tested twice, the first time unconfined, to obtain the baseline, then the sample was divided into two subgroups so that 84 were evaluated in a confined situation and 80 in an unconfined situation. . Ekman 60 Faces test, which includes the recognition of the six basic emotions (anger, disgust, fear, happiness, sadness, and surprise) was applied. The main results obtained showed that during the confinement situation there was a significant decrease in the recognition of happiness, and a significant increase in the recognition of sadness and depressed mood. Confinement significantly alters and reduces our social interactions, which can affect our mood as well as our emotional facial recognition. For this reason, health services need to engage in early detection of the psychological effects this situation will have on the population.

1. Introduction

The confinement state produced by the COVID-19 pandemic has created a new situation that may have psychological repercussions due to the context where people from different countries are living, as in the case of Spain. Extreme, real, or simulated situations, such as lengthy space flights, winter in polar stations or polar expeditions, submarine missions, solitary navigation, etc., have been studied to analyze the possible changes in subjects exposed to them. Regarding the psychological consequences of previous pandemics, the information that exists is scarce, and its impact has been less, thus making it difficult to compare it with the current pandemic. The most relevant pandemics of the 21st century were the Severe Acute Respiratory Syndrome (SARS) in 2003, Ebola in 2014, or the Influenza A/H1N1 in 2009 and 2010. These pandemics have produced quarantines that have affected specific populations and the results indicate that when people in quarantine are compared with those who were not, quarantine was the most predictive factor of the symptoms of acute stress disorder (Bai et al., 2004), psychological distress (Taylor, Agho, Stevens, & Raphael, 2008) or higher depression symptoms (Liu et al., 2012). In addition, the study of people placed in quarantine with a high probability of contagion reported negative responses during the quarantine period such as fear, nervousness, or sadness (Reynolds et al., 2008). Hawryluck et al. (2004) studied 129 quarantined persons during SARS and revealed symptoms of Post-Traumatic Stress Disorder (PTSD) and depression in 28.9% and 31.2% respectively. The review by Brooks et al. (2020), points out that the duration of the quarantine is a stressor and that those quarantines for more than 10 days showed significantly higher post-traumatic stress symptoms than those quarantined for less than 10 days; it was also observed that confinement, loss of usual routine, and reduced social and physical contact with others were frequently shown to cause boredom, frustration, and a sense of isolation from the rest of the world.

A situation is considered extreme when an individual is subjected to exceptional physical or psychosocial circumstances that require adaptive responses that could overwhelm his/her physiological and psychological resources (Rivolier, 1992). This definition corresponds to the current situation of confinement, where we find ourselves in unfamiliar conditions that test our limits and, therefore, require developing adaptive capacities to overcome it. Furthermore, the stressors to which people are exposed in the current confinement situation have similar

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characteristics to those indicated by Nicolas, Martinent, Suedfeld, and Gaudino (2019) as being typical of some external situations such as polar expeditions. These situations are characterized by monotony and boredom, and people have little control over their own schedules. Forced social interaction within the same small and unchanging environment makes interpersonal conflict and tension a great source of stress. In addition, Sandal, van deVijver, and Smith (2018) point out that key stressors for participants in Antarctic expeditions include lack of social variation, monotony of the physical environment, limited confinement and privacy, and emotional and physical deprivation.

A psychosocial environment characterized by isolation and confinement produces several psychological symptoms that are repeatedly reported by people on polar expeditions (Palinkas & Suedfeld, 2008). Indeed, reductions in mood, adaptation problems, and sleep difficulties accounted for 60% of all diagnoses in Antarctica, as Lugg (2005) noted. Depressed affect is one of the most common symptoms people have on polar expeditions, closely followed by anxiety and irritability (Palinkas & Suedfeld, 2008). An excessive level of stress, in terms of its intensity, frequency, accumulation, and duration, could generate impaired stress outcomes affecting well-being (Nicolas & Gushin, 2014). Well-being is associated with modes of coping and their consequences, and problem-focused strategies positively predict well-being, as shown in the results by Mayordomo et al. (2015), who found that coping had a strong effect on psychological well-being and was a mechanism to protect against and modify stress. A comparison of the coping strategies used before and at the end of the Antarctic expedition showed a decrease in seeking social support and problem-focused coping, indicating less frequent use of these coping strategies (Peri, Scarlata, & Barbarito, 2000). The authors suggested that the participants probably tended to protect themselves from frustration and emotional deprivation. Nicolas, Sandal, Weiss, and Yusupova (2013) noted that, during the 105 days of isolation and confinement, emotions showed significant variations. A significant decrease in positive emotions was found in all the participants, indicating that isolated and confined environments might induce some changes in psychological states.

Regarding the psychological effects of COVID-19, it has been observed that in general the most relevant disorders have been depression, anxiety and stress. Odriozola, Planchuelo, Irurtia, and de Luis (2020) found that in a sample of university students, two weeks after the confinement of the Spanish population by the COVID-19 pandemic, 34.19% of the participants reported moderate to extremely severe symptoms of depression, 21.34% moderate to extremely severe anxiety; and 28.14% of moderate to extremely severe stress. In the case of Kaparounaki et al. (2020) with a sample of Greek students, the data was even more alarming, showing percentages of 74.3% for depression, 42.5% for anxiety, and 63.3% increase in total suicidal thoughts, as a consequence of the confinement situation.

However, there is no information about the consequences of a confinement situation like the one produced by the COVID-19 pandemic, in terms of possible changes in the recognition of emotions. Therefore, the question we ask ourselves is, if there is a significant variation in emotions due to confinement, will there also be a variation in the recognition of emotions? Difficulties in emotion recognition are associated with interpersonal problems (Surcinelli, Codispoti, Montebarocci, Rossi, & Baldaro, 2006) and specific types of social functioning impairments, including poor interpersonal functioning and communication and reduced social behavior (Ruffman, Henry, Livingstone, & Phillips, 2008). Williams et al. (2008) reported that the development of facial expression recognition followed an inverted U-shaped trajectory, where the young and middle-aged adults were the most accurate, compared to children and older adults. Similarly, Horning, Cornwell, and Davis (2012) examined facial expression recognition using a lifespan approach, revealing emotion perception changes from childhood to older age, with peak performance occurring in young adulthood and middle age. They showed that the ability to accurately recognize emotional states from expressions continues to develop throughout young adulthood and middle age, and they concluded that cognitive functions do not appear to greatly influence the development of facial emotion recognition in younger participants. Moreover, many of the studies on emotion recognition have been based on the comparison of older and younger adults in order to find out how emotions change. Mather and Carstensen (2003) showed that when photographs are shown individually, older and younger adults look at negative (sad and angry) photographs longer than positive (happy) photographs. In addition, a related idea stems from older adults' tendency to focus on the mouth region of facial expressions, unlike younger adults, who spend more time looking at the more informative eye regions of negative expressions (Sullivan, Ruffman, & Hutton, 2007, pp. P53–P60; Wong, Cronin-Golomb, & Neargarder, 2005). In any case, young adults are more likely to identify emotional aspects of a facial expression, even when a limited amount of information is available (Orgeta & Phillips, 2007).

The objective of this study was to find out if there were differences between two groups of young people in their ability to recognize emotions due to the confinement situation produced by COVID-19; one group of young people was evaluated before and during the confinement situation caused by COVID-19, and the other group was evaluated once phase 3 of the de-escalation had ended (non-confinement situation) and the "new normality" situation began. Significant differences in emotion recognition were expected to be observed when subjects were confined, showing a significant decrease in the recognition of happiness and a significant increase in the recognition of sad emotion.

2. Materials and methods

2.1. Participants

As in some previous research with community samples, participants were Spanish young adults recruited in undergraduate education courses (e.g, Chen, Garcia, Fuentes, Garcia-Ros, & Garcia, 2020). The sample consisted of 164 young adults who were evaluated twice and assigned to groups labeled confined and not-confined. The confined group was evaluated first in a normal situation and the second time in a confined situation; the sample on confinement group was composed of 84 young adults (71 women, 13 men), ranging from 18 to 25 years old ($M = 20.88$, $SD = 2.8$), who were first-year psychology students; 4 participants dropped out because they could not be evaluated in the confinement situation. The non-confined group was evaluated once the confinement and the de-escalation phases were completed and the situation of new normality began; the sample on non-confined group situation was composed of 80 young adults (64 women, 16 men), ranging from 18 to 26 years old ($M = 21.25$, $SD = 2.1$), who were first-year psychology students; 8 participants dropped out because they could not be evaluated on the second time. The samples were matched on age ($t\ (163) = 0.95$, $p = .343$) and gender ($U = 3208$, $p = .449$). All the participants voluntarily gave their consent to participate, and they reported being in good physical health.

Via G*Power to compute a priori statistical power analysis indicated a minimum total sample size of 166 for a power of 0.95 ($\alpha = 0.05$; $1 - \beta = 0.95$; two groups; 6 measurements, and correlation among repeated measures of 0.5) to detect a low effect size ($f = 0.10$), in a F test of repeated measures for within-between interaction (García, Pascual, Frías, Van Krunckelsven, & Murgui, 2008). Finally, with $n = 164$, a sensitivity statistical power analysis indicated that this design is able to detect a low effect size of 0.10 ($f = 0.1005$; $\alpha = 0.05$; $1 - \beta = 0.95$). Effect size 0.10 is a very desirable small effect-size for sensitivity power analysis (Faul et al., 2009).

2.2. Instruments

Initially, the Mini-Mental State Examination (MMSE; Folstein, Folstein, & Mc Hugh, 1975) and the Center for Epidemiologic

Studies-Depression Scale (CES-D; Radloff, 1977) were administered. MMSE was used as an index of overall cognitive functioning; the maximum score is 30 points. The CES-D is a short self-report scale designed to measure depressive symptomatology in the general population. It consists of 20 items that assess symptoms of depression during the week before the test.

Finally, participants completed the Ekman 60 Faces test (Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002), on which they had to identify one of six emotions in each photograph from a series of 60 faces of 10 subjects (6 women, 4 men) depicting anger, disgust, fear, happiness, sadness, or surprise. All the images are derived from pictures of facial expressions in the Ekman and Friesen (1976) series of Pictures of Facial Affect, which is the most widely used and validated series of photographs in facial expression research. The faces appeared on a computer screen for 5 s each in a randomized order, following the procedure of Ekman and Friesen (1976). Later, the labels of the six emotions appeared in Spanish, and the subjects had to respond verbally, choosing the label that best described the facial expression shown. The next face was not shown until a selection had been made. Before starting the test, the subjects performed six trials consisting of an example of each emotion on the face of someone who did not appear in the subsequent test phase. These responses were not included in the analysis. The test offers an overall score where 60 indicates the best possible performance, and each basic emotion has a sub-score of a maximum of 10 points.

2.3. Procedure

Prior to confinement, a study was started whose objective was to analyze the recognition of emotions in young adults. This study began approximately ten days before the confinement due to the COVID-19 pandemic began. The Ethical Committee on Human Research of the University of Valencia approved this study, which was conducted in accordance with the Declaration of Helsinki The evaluation was carried out in a group with a maximum of twelve subjects in a session lasting approximately 1 h. At the beginning of the session, the objective was explained, and the participants signed an informed consent form prior to completing the questionnaire. They then completed the MMSE and CES-D and, finally, performed the Ekman 60 Faces test.

When the confinement situation occurred, the proposal was made to modify the objective of the study. Research across different confined and isolated contexts has suggested that psychological resilience is linked to the relative passage of time, and that a decrease tends to occur around the third quarter of the stay, regardless of the duration (Sandal et al., 2018). Taking this information into account and given that the forecast for confinement was approximately 45 days, with a subsequent de-escalation process, it was established that the new evaluation should be carried out from the 35th day of confinement (confined group). In addition, it was proposed to include a control group (non-confined group), which was first evaluated once phase 3 of the de-escalation had ended and the "new normality" situation had begun (where there was total flexibility in mobilization and social contacts); the second evaluation of this group was made from day 35 of the new normal period.

The initial participants were contacted by email and asked if they would be willing to participate in this modification of the initial study. Subjects who agreed were individually called for an appointment to apply the protocol online. In this call, all subjects were fully informed about the nature of the investigation and gave their declaration of consent verbally. In addition, new participants who made up the non-confined group were contacted and the same procedure was applied. The instruments were administered in the same order.

2.4. Analysis

Two mixed factorial analysis of variance (ANOVA) were applied. First with six emotions and two times as the within-subject variable and groups (confined and non-confined) as the between-subject variable; and second mixed ANOVA was carried out for CES-D to study the interaction (group x time), as well as the simple effects of time and group. The significance level for all statistical tests was alpha ($\alpha \leq 0.05$).

3. Results

A mixed ANOVA with 6 emotions (anger, disgust, fear, happiness, sadness, and surprise; within subjects) X 2 times (within subjects) X 2 groups (Confined vs Non-confined; between subjects) showed that the main effect of the emotion (F (5, 159) = 153.99, $p < .0001$, $\eta^2p = .829$) was significant but not for time (F (1, 163) = 0.45, $p < .832$, $\eta^2p = .001$) and group (F (1, 163) = 2.53, $p = .114$, $\eta^2p = .015$); interactions for emotion X group (F (5, 159) = 5.79, $p < .0001$, $\eta^2p = .154$) and emotion X time (F (5, 159) = 9.33, $p < .0001$, $\eta^2p = .227$) were significant but not time X group (F (1, 163) = 0.22, $p < .641$, $\eta^2p = .001$. Finally, emotion X time X group interaction was significant (F (5, 159) = 9.28, $p < .0001$, $\eta^2p = .226$).

Post-hoc Bonferroni t-tests conducted to analyze the significant emotion X time X group interaction (see Table 1) showed that: on the six emotions there were no differences between groups on non-confinement situation (first evaluation on the two groups); when comparing confinement and non-confinement situation (second evaluation on the two groups) there were no significant variations in the number of hits on recognized emotions in the case of anger ($p = .246$, 95% confidence interval: −0.117 to 0.453), disgust ($p = .978$, 95% confidence interval: −0.464 to −0.477), fear ($p = .556$, 95% confidence interval: −0.348 to 0.633), and surprise ($p = .416$, 95% confidence interval: −0.252 to 0.605). However, significant differences were obtained for the emotion recognition of happiness ($p < .0001$, 95% confidence interval: −0.832 to −0.241) and sadness ($p < .0001$, 95% confidence interval: 0.517 to 1.308); compared to the non-confined group the number of correct answers in the confined group was less for happiness ($M_{\text{Confined}} = 9.15$; $M_{\text{Non-confined}} = 9.69$) and greater for sad ($M_{\text{Confined}} = 9.03$; $M_{\text{Non-confined}} = 8.12$). Finally, the non-confined group did not obtain any significant change between the two evaluations; a significant change was observed on confined group from the situation of non-confinement to the situation of confinement, with a significant reduction in the hits of happiness ($p = .001$; $M_1 = 9.63$; $M_2 = 9.15$; 95% confidence interval: 0.221 to 0.742) and an increase in the hits of sadness ($p < .0001$; $M_1 = 8.22$; $M_2 = 9.03$; 95% confidence interval: −1.071 to −0.548).

Regarding the dependent variable CES-D, a mixed analysis of variance (2 times X 2 groups) was performed that showed a significant main effect of the time variable (F (1, 163) = 18.71, $p < .0001$, $\eta^2p = .103$); the main effect of the group variable was also significant (F (1, 163) = 27.21, $p < .0001$, $\eta^2p = .143$). Finally, the time X group interaction was significant (F (1, 163) = 24.45, $p < .0001$, $\eta^2p = .130$). Bonferroni post-hoc tests to analyze this significant interaction showed that the difference between the groups at time 1 was not significant ($M_{\text{Confined}} = 15.66$; $M_{\text{Non-confined}} = 14.38$), but at time 2, the comparison of the groups showed a significant difference ($p < .0001$; 95% confidence interval: 5.413 to 9.422) with a higher score in the confined group ($M_{\text{Confined}} = 21.39$; $M_{\text{Non-confined}} = 13.97$). Moreover, the difference between the means at T1 and T2 was not significant in the non-confined group, but

Table 1
Means and standard deviations of the emotions in the groups in the two times.

	Confined		Non-confined	
	T1	T2	T1	T2
Anger	8.56 (1.01)	8.46 (.87)	8.34 (.77)	8.29 (.98)
Disgust	7.45 (1.16)	7.49 (1.44)	7.25 (1.57)	7.48 (1.61)
Fear	7.54 (1.63)	7.47 (2.06)	7.38 (.85)	7.33 (.88)
Happiness	9.63 (.48)	9.15 (.89)	9.54 (1.11)	9.69 (1.02)
Sadness	8.22 (1.63)	9.03 (1.02)	8.04 (1.09)	8.12 (1.51)
Surprise	9.26 (1.03)	8.98 (1.64)	9.24 (1.14)	9.12 (1.45)

the mean at T2 was significantly higher than the mean at T1 in the confined group ($p < .0001$; 95% confidence interval: −7.435 to −4.017), indicating that in the confinement situation the mean CES-D increased.

4. Discussion

The results of this study were obtained in the circumstances caused by the COVID-19 pandemic. The different primary emotions were compared in two groups (confined and non-confined), and the results showed that, there was a significant decrease in the happiness emotion from before confinement to during confinement, and the recognition of sadness obtained a significant increase. The emotions of anger, fear, disgust and surprise showed no significant changes in their scores. Finally, a significant increase in depressive mood was observed in the group of young adults who were exposed to confinement, compared to those who were evaluated during the new normality.

Regarding the emotions that showed no significant differences between groups, our results would be consistent with other studies that have compared samples of healthy adults and people with some type of psychological disturbance as fear, disgust, anger and surprise. Kan, Mimura, Kamijima, and Kawamura (2004) found that in general there were no significant differences in the recognition of facial emotions between depressed patients and controls, and in particular the results showed that the recognition of fear was even more inaccurate than the recognition of other emotions, both in depressed patients and in controls. Specifically, Gotlib, Krasnoperova, Yue, and Joormann (2004) found that when comparing healthy adults and depressed participants, the latter did not show attention bias towards angry faces. For their part, Surcinelli et al. (2006) compared facial emotional recognition in the population with and without anxiety, observing similar mean accuracy scores on the recognition of anger, surprise and disgust.

Regarding the emotions that showed discrepancies we want to highlight the decrease in the recognition of happiness in confined group. The facial expression of happiness is usually the most highly recognized, probably because it is one of the first to be recognized during development and is highly relevant for adaptation to the social environment (Durand, Gallay, Seigneuric, Robichon, & Baudouin, 2007; Widen & Russell, 2003). In addition, it is a positive emotion that occurs in interpersonal relationships more often than sadness, fear, or anger (Tomkins, 1962). However, in the current situation, where social relationships have been drastically interrupted and contacts with family and friends at home have been seriously disrupted, we have to consider that emotion recognition could be altered due to mood disturbances and a significant decrease in social contacts. This decrease in the recognition of the emotion of happiness could be explained by the phenomenon of emotional congruence, which implies that people with depressive symptoms tend to judge positive emotions as neutral (Noguchi, Gohm, & Dalsky, 2006; Latorre et al., 2013); that is, there is an alteration in the recognition of this positive emotion. Also, according to Venn, Watson, Gallagher, and Young (2006), this result confirms that the deterioration in the recognition of this emotion is a mood-dependent effect.

Furthermore, the recognition of sadness increased considerably in the confined group. It has been found that when processing information, there is asymmetry depending on whether it is positive or negative. Specifically, negative information attracts more attention, leads to stronger neurological reactions, and is recognized with greater precision (Fazio, Pietri, Rocklage, & Shook, 2015). Furthermore, negative information has a stronger psychological impact than positive information because it is more relevant to well-being, causing stronger affective and motivational reactions that then trigger deeper and more elaborate processing (Taylor, 1991), thus increasing the likelihood of being recognized. In addition, regarding the phenomenon of emotional congruence, discussed above, in the recognition of happiness, some studies have also found that people with mood disturbances are more likely to interpret an ambiguous face as sad (Gollan, McCloskey, Hoxha, & Coccaro, 2010; Lee, Mathews, Shergill, & Yiend, 2016) or more accurately identify sadness (Dalili, Penton-Voak, Harmer, & Munafò, 2015).

Finally, although the relationship between facial expression recognition and depression is not fully established, in congruence with our results, some studies support the hypothesis that a decrease in facial expression recognition occurs in adults suffering from major depression (Brasilino, Barbosa, Lacerda, Santos, & Torro-Alves, 2014; Demenescu, Kortekaas, den Boer, & Aleman, 2010). Therefore, the idea of the presence of an overall deficit when depressed people are judging facial expressions is corroborated (Csukly et al., 2009; Leppänen et al., 2004). The present study indicates that during the confinement situation, depressed mood, in terms of the score obtained on the CES-D test, was affected in confined group, which indicates an increase in depressive symptoms after spending 35 days in partial isolation. In a threatening situation like the one caused by COVID-19, people have two alternatives: surrender and wait for things to happen or face the situation as a challenge and strengthen relationships with people close to them. Furthermore, research in isolated, confined, and extreme settings (ICE settings) found that active coping and positive re-evaluation of the situation were related to adaptation, whereas avoidance was associated with depression and poor adaptation (Nicolas et al., 2013). In fact, there is extensive literature that supports the relationship between the increase in depressive symptoms and living in confined situations. Given that the situation we are living in does not have a precedent, at least not in recent decades, the studies we have used as a reference are contextualized in environments such as simulated flights into space (Nicolas & Gushin, 2015; Tafforin, 2013), hibernation in Antarctica (Sandal et al., 2018), polar expeditions (Palinkas & Suedfeld, 2008), or Lunar missions (Gardini, 2011), among others. These situations can be recognized as natural laboratories for studying the effects of isolation and confinement on human behavior (Suedfeld & Weiss, 2000). An extensive review of the literature revealed that the consequences of isolation produce alterations at the physical level (sleep disturbances, fatigue, lack of energy, or headaches, among others) and the psychological or emotional level, an aspect on which our research has focused. Specifically, the most frequent emotional disturbances would be negative affect, anger, anxiety, irritability, and depressed mood.

4.1. Conclusions

It is important to highlight that emotions fulfill an adaptive function and constitute a fundamental element to guarantee our survival, although they are not always functional and their misinterpretation or a failure to recognize them could be an obstacle to achieving our objectives.

In our sample of young adults, the decrease in facial recognition of the emotion of happiness and the increase in the recognition of sadness were consistently associated with those subjects who suffered a confinement situation produced by the COVID-19 crisis compared to those who were not in a situation of confinement; in addition, a significant increase in depressed mood was observed in the group of confined participants. Therefore, the confinement situation makes the subjects pay more attention to those stimuli that have a negative component and increases the negative mood. Additionally, findings of this study supports the results from some studies with clinical sample about the negative impact of COVID-19 on mental health (Wang et al., 2020), but extending the evidence to a community sample of young adults.

From a psychological perspective, pandemics constitute life events associated with uncertainty, ambiguity, and loss of control, and we must not forget that one of the main adverse consequences of the COVID-19 pandemic is the increase in social isolation and loneliness, aspects that are strongly related to depressive symptoms and anxiety, but also to other more dangerous disorders, such as self-harm or suicide attempts (Holmes et al., 2020).

Therefore, an immediate priority of the health services is to identify as soon as possible the appearance of psychological consequences

derived from the confinement situation, in order to put mechanisms in place to prevent and intervene on them.

CRediT authorship contribution statement

Juan C. Meléndez: Conceptualization, Methodology, Supervision. **Encarnacion Satorres:** Methodology, Writing - original draft. **Maria Reyes-Olmedo:** Visualization, Formal analysis. **Iraida Delhom:** Writing - review & editing, Visualization. **Elena Real:** Resources, Data curation, Visualization. **Yaiza Lora:** Resources, Data curation, Visualization.

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