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Catching the audience in a job interview: Effects of emotion regulation strategies on subjective, physiological, and behavioural responses

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Abstract

In the emotion regulation process more than one strategy is often used, though studies continue to rely on the manipulation of one strategy alone. This study compares the effects of Combined Cognitive Reappraisal (CCR: acceptance and reappraise via perspective-taking) and suppression using the Trier Social Stress Test (TSST). One hundred participants were randomly assigned to one of the two groups and subjective, physiological, and behavioural data were recorded. Continuous electrocardiography was recorded to measure heart rate variability (HRV) and stress levels. Affective ratings were provided before and after the TSST. Behavioural expressions were videotaped and analysed independently. Trait social anxiety/fear, age and gender entered as covariates. Although no group differences were found on affective ratings, the CCR group presented less physiological stress, higher HRV, their speech was better perceived, displayed more affiliative smile and hand gestures. Results suggested that CCR is more appropriate than suppression for managing social stress situations.

Keywords: acceptance, reappraisal, social anxiety, suppression, trier social stress test

Catching the audience in a job interview: Effects of emotion regulation strategies on subjective, physiological, and behavioural responses

Acute social stress is an almost universal experience. Being intrinsically emotional, social stress requires using emotion regulation (ER) strategies (Gross, 2015). Difficulties in deploying such strategies may predict several negative outcomes; and in the long-term may contribute to the development of clinical symptoms (Sheppes, Suri, & Gross, 2015). ER is a dynamic and multifaceted regulatory process through which one tries to manage one's emotions, their intensity, and the way the emotions are experienced or expressed (Gross, 2015). In everyday life, ER strategies are deployed spontaneously and in combination (Aldao & Nolen-Hoeksema, 2013; Ford et al., 2019). In contrast, research has mainly focused on using one strategy compared to another (Gross, 2015).

The Extended Process Model of ER by Gross (2015) outlines three primary stages: the need to regulate a certain emotion, strategy selection, and implementation. The author underlines the continuous and dynamic valuation process over time while considering the role of individual differences and the context, defending the use of more than one strategy during an ER process over time as an adjustment response. Ford et al. (2019) defined polyregulation as the concurrent or sequential use of multiple strategies to regulate emotions in a single emotional episode. The authors also postulate that evidence is lacking in regard to the impact of polyregulation.

Several ER strategies have been studied, with research indicating that cognitive change strategies (e.g. cognitive reappraise via perspective-taking) tend to be the more effective compared to strategies of attentional deployment (e.g. distraction, concentration) and response modulation (e.g. suppression) (see Webb, Miles, & Sheeran, 2012). In addition, the timing effect hypothesis proposes that ER is more effective when emotion is still at a low-intensity level than at a high level (Sheppes & Gross, 2011). According to the Model Process

of ER (Gross, 1998), timing is essential for suppression because it operates at a later stage in the ER process. Thus, it requires more effort to modify existing and new emotional information (Sheppes & Gross, 2011). Research in negative contexts also suggests that acceptance and cognitive reappraise via perspective-taking are the most used, whereas suppression tend to be the least reported (Szasz, et al., 2018).

Considering the literature on ER strategies characteristics and related outcomes during negative, anxiety-inducing contexts The present research analysed the responses to a social stress situation using a combination of two cognitive reappraisal strategies (CCR: acceptance/reappraisal of the emotional response and cognitive reappraise via perspective-taking) compared to the suppression of emotional expression (SEE).

Emotion regulation strategies and outcomes

Cognitive reappraise of the stimulus via perspective-taking involves rethinking a stimulus to change its emotional meaning and impact (Webb et al., 2012) by targeting either the meaning or the self-relevance of a potentially emotion-eliciting situation (Gross, 2015). It has shown to be the most effective strategy in stressful situations in decreasing negative affect and increasing positive affect (Jentsch & Wolf, 2020; Quinones et al., 2017), decreasing behavioural expression of anxiety (Gong et al., 2016) and physiological activity (Hofmann et al., 2009; Jentsch & Wolf, 2020; Zaehringer et al., 2020). Studies have also indicated that reappraise via perspective-taking is negatively associated with psychopathological symptoms (Hu et al., 2014) and positively associated with positive perceptions and outcomes in work-related interactions (Quinones et al., 2017).

Despite its effectiveness, some authors have highlighted the difficulties in using reappraise via perspective-taking in high-stress situations because it is a highly demanding cognitive task (Goldin et al., 2019; Gross, 2015). Gross (2015) suggested starting with distraction to adapt to high-stress situations, as being less demanding, and then after a

decrease in the affect intensity, to use the reappraise technique. However, Bebko, Franconeri, Ochsner, and Chiao (2014) have found no impact of distraction when dealing with subjective negative emotions during the use of reappraisal or suppression, stating that attentional deployment influences neither reappraisal nor suppression.

The acceptance of thoughts, feelings, and sensations without judgment is the most widely used strategy in daily life (Heiy & Cheavens, 2014) deployed in a number of situations and by a growing number of people (Aldao & Nolen-Hoeksema, 2013). In part, this may be because it seems to be less challenging to deploy compared to reappraise via perspective-taking (Goldin et al., 2019; Troy et al., 2018). According to the Webb et al. (2012) ER taxonomy, acceptance is considered a reappraisal strategy of the emotional response for being non-judgmental about negative emotions. Research has shown acceptance to be a particular facilitator of social interactions (Dan-Glauser & Gross, 2015) and beneficial in situations of negative affect and acute stress, including job interviews (Beltzer et al., 2014), leading to a decrease in subjective anxiety and physiological arousal (Dan-Glauser & Gross, 2015; Gong et al., 2016; Hofmann et al., 2009; Troy et al., 2018), and also contributes to decreasing behavioural expression of anxiety and shame (e.g. Beltzer et al., 2014; Hofmann & Asmundson, 2008)

Another ER strategy frequently studied is suppression. Suppression has been framed as a response modulation strategy, requiring energy to actively alter physiological, experiential, and behavioural responses (Gross, 2015). Contrary to the strategies presented before, suppression has been related to an increase in depression and anxiety symptoms (Hu et al., 2014), with physiological and subjective costs (Hofmann et al., 2009; Hu et al., 2014). However, suppression seems beneficial in regulating intense negative emotions such as anger (Geisler & Schröder-Abé, 2015), or intense anxiety evoked by acute stress situations like a job interview (Gross, 2015).

Our study focuses specifically on the suppression of emotional expression (SEE), which corresponds to the downregulation of experiencing emotions. We investigate SEE because the use of this strategy in acute stress situations may also lead others to perceive the individual as in control of his/her own emotions (Heiy & Cheavens, 2014) and is indicative of good performance (Heiy & Cheavens, 2014; Sieverding, 2009).

Few studies have compared reappraise via perspective-taking, acceptance, and suppression. Gong et al. (2016) study is one exception, in which the three ER strategies were compared with a control group (no instructions) in a social stress context. Their results showed that those who used either reappraise via perspective-taking or acceptance, reported lower anxiety during a simulated job interview compared to the suppression or the control groups, although they found no differences during the recovery stage. They also reported no differences between the three ER strategies on behaviour. However, there were differences between each of the strategies and the control group, with acceptance and reappraise via perspective-taking groups expressing less unease, stiffness of expression and inability to answer the questions smoothly than the control group. The suppression group expressed less stiffness compared with the control group. Hofmann et al. (2009) found that suppression leads to a greater increase in heart rate than either reappraise via perspective-taking or acceptance, and that suppression contributed to higher anxiety than reappraise via perspective-taking. However, they found no differences in anxiety between acceptance and reappraise via perspective-taking. Overall, in acute stress situations, reappraise via perspective-taking and acceptance tend to be more adaptive for subjective and physiological data and SEE for behavioural expressions (Beltzer et al., 2014; Dan-Glauser & Gross, 2015; Gong et al., 2016). Thus, we investigated if the combination of reappraisal strategies would also supplant suppression effects on behavioural expressions.

Present study

Our study expands previous research in two ways: first, the usage of the CCR strategies in a social evaluative situation; second, the analysis of the three-systems of emotion by measuring subjective, physiological (cardiovascular measures) and behavioural responses.

Few studies have addressed the ER responses across the three-systems of emotions and the associations between the systems. Therefore, the correspondence between the three-systems remains unclear, though some authors highlight the importance of a multimodal approach (Quigley et al., 2013). To the best of our knowledge, this is the first study to analyse the correlation between the three-systems of emotion in response to anxiety/stress induction. In this study, we will consider the relationship between the three-systems of emotion, independent of the group, since they result from the same emotion (anxiety/stress). Though, we do not expect a high correlation, since literature has shown inconsistency between systems (Campbell & Ehlert, 2012; Evers et al., 2014; Quigley et al., 2013). In Campbell and Ehlert's (2012) review, of the 49 papers selected, only 12 reported relations between subjective and cardiovascular responses, and among these, only three studies found significant correlations.

Regarding the main objectives of the study, we induced acute social stress via the Trier Social Stress Test (TSST) to assess the effectiveness of the CCR strategies. The TSST is one of the most effective laboratory stress inductors; it triggers moderate stress responses in most people (Allen et al., 2017). It comprises two tasks, a speech task (5 min) preceded by an initial interview preparation period (3 minutes in silence), followed by a surprise arithmetic task (5 min) in front of a panel of judges asking questions. During both tasks, the judges do not provide feedback and remain emotionally neutral (Allen et al., 2017). TSST combines elements of uncontrollability and social-evaluative threat (Kudielka et al., 2007).

In such situations, people tend to feel negative affect, including shame and anxiety as a response to the social threat and possible negative evaluations from others (Allen et al.,

2017; Gruenewald et al., 2004; Kudielka et al., 2007). We hypothesised that the CCR group, compared to the SEE group, would report less anxiety (H1a), and less shame (H1b), after TSST.

In our study, we also assessed heart rate variability (HRV) as an index of the autonomic nervous system, and vagal tone (Laborde et al., 2017). HRV has been shown to decrease in response to TSST in both adult and youth samples (Seddon et al., 2020). It is considered an important physiological response, related to resilience and behavioural flexibility (McCraty & Shaffer, 2015). Higher HRV has been related to the individual's ability to self-regulate and to adapt effectively to ever-changing contextual and social challenges (Beauchaine & Thayer, 2015; Holzman & Bridgett, 2017). Thus, HRV can be perceived as a bio-marker of top-down self-regulation, indicating the ability to regulate behaviours and cognitive and emotional processes (Holzman & Bridgett, 2017).

Among the various HRV indices, Laborde et al. (2017) recommend the variables that reflect properly identified physiological systems, with theoretical support validated in the scope of psychophysiology, among which are the vagal tone indexes (e.g. Root Mean Square of Successive Differences, RMSSD and High Frequency, HF). RMSSD and HF are highly correlated, the former being relatively free from respiratory influence, in contrast to the latter (Hill & Siebenbrock, 2009; Penttila et al., 2001). The RMSSD reflects the variance between heartbeats, being the most common measure used to estimate changes in HRV mediated by vagal tone in the time domain (Shaffer & Ginsberg, 2017). We also analysed a stress index, the Square Root of the Baevsky Stress Index (SRBSI), as it is strongly linked to sympathetic nervous activity (Tarvainen et al., 2018) and reflects heart rhythm management (Baevsky & Berseneva, 2008). Several researchers have used the SRBSI as a stress indicator for ER analyses (e.g. Brugnera et al., 2018). Studies have shown an increase in HRV for participants using reappraising via perspective-taking and/or acceptance compared to suppression during

stressful situations (Hofmann et al., 2009) and also in the recovery period (Jentsch & Wolf, 2020). Thus, we hypothesised that the CCR group, compared to the SEE group, would present higher HRV as measured by RMSSD (H2a), and lower stress levels as measured by SRBSI (H2b) during and after the TSST.

In addition to the physiological responses, we evaluated behavioural responses. In a job interview, candidates' competency can be assessed through the extent to which they can be convincing with their speech and successful in their ability to regulate anxiety (Sieverding, 2009). Situations of social valuation such as the TSST tend to challenge social worth (e.g., shame, humiliation) and social self-esteem (Gruenewald et al., 2004). Social anxiety leads to somatic symptoms such as shaking, blushing, muscle tension increase and overall unease, and safety behaviours (e.g., avoid eye contact, avoid speaking) (Clark & Wells, 1995; De France et al., 2017; Segrin & Kinney, 1995; Wells et al., 2016). Hence, we assessed the behavioural indexes of social anxiety and social performance, including two types of behavioural assessment: 1) a global perception of behaviour related to affective displays and speech performance; and 2) the exact duration of anxiety discrete behaviours. The latter procedure of behavioural analysis is rarely studied, although relevant for higher robust analysis. Following the literature, we expected that the CCR group would be perceived as less anxious (H3a), less ashamed (H3b), and would demonstrate a higher speech performance (H3c) than the SEE group during TSST. Furthermore, we hypothesised that the CCR group would display more social approach/involvement behaviours (H4a) and less social anxiety/avoidant behaviours (H4b), in comparison with the SEE group during TSST.

Additionally, we explored potential differences between groups regarding their satisfaction with their performance on both tasks and their satisfaction with the ER process. These exploratory objectives were included because the maintenance and repetition of certain behaviours seem to be related to individuals' satisfaction with performance (Kwasnicka et al.,

2016). Moreover, when self-regulation control is attained, feelings of satisfaction and gratification increase (Kwasnicka et al., 2016). On the contrary, the sensation of failure in self-regulation and subsequent ER attempts is associated with feelings of anxiety and frustration (McCraty, 2015). Finally, because cognitive change techniques may allow the individual to change the meaning of the stimulus-situation (Gross, 2015; Hofmann et al., 2009), we explored differences between groups regarding their perception of the TSST, such as the induction of stress, uncontrollability, threat, novelty, unpredictability, and challenge (c.f. Klumbies et al., 2014).

Method

Participants

We used GPower 3.1 to estimate the sample size. Based on prior effect size on reappraisal data from physiological (autonomic) and performance outcomes (d = 0.76, f = 0.38, Beltzer et al., 2014), two independent groups, power = .90, $p < .05$, and three covariates, we would require 65 participants for conducting Multivariate Analyses of Covariance. Nevertheless, we recruited a larger sample because we collected different outcomes.

We recruited participants via snowball sampling. As recommended (Laborde et al., 2017), we used the following exclusion criteria: (i) physical health problems; (ii) medication consumption; (iii) mental disorders (i.e. anxiety, mood, schizophrenia); (iv) drug use; (v) body mass index > 34. Participants were instructed not to engage in intense physical activity, consume alcoholic beverages in the previous 24 hours, or a heavy meal or any caffeinated beverage two hours before the lab session.

A total of 451 participants responded to the initial survey and 112 participated in the lab (see Participant flow chart in the supplementary material). However, 10 participants discontinued their collaboration (Six were in the SEE group, three were in the CCR group

and one participant who resigned before instructions) and two were excluded for failing to comply with instructions (both from the SEE group). The final sample comprised 100 participants, 50 in each group (98 Portuguese and two Brazilian), aged 18-53 years (M = 24.71, SD = 7.40), the majority being female (71%), single (83%), and undergraduate (54%). Most participants had prior experience with job interviews (61%) and planned to apply for a job in the next year (67.0%). Due to equipment problems, we could not record the behavioural data of one participant who was included in the CCR group.

Participants received course credits or a voucher (5€) for participating in both phases.

Procedure

The Ethics Committee (ref. 17/2018) approved all procedures. The study was disseminated through social networks and flyers in social spaces close to universities. The data collection took place between March 2018 and April 2019 and involved two phases. Phase one included a survey to measure trait social anxiety/fear, while phase two comprised the experimental manipulation in a laboratory setting, with a minimum interval of 15 days. In both phases, participants signed informed consent. The first consent withheld information regarding the TSST protocol to avoid affecting participants' regulation strategies and to decrease their stress before the tasks (cf. Klumbies et al., 2014). At phase two, participants were informed about the TSST protocol and physiological collection, asked about consent, and reminded that they could withdraw from the study at any time without consequence. Participants completed baseline questionnaires and a 5 min period of HR baseline was recorded. Participants were then randomly assigned to one of two ER groups. First, they listened to the TSST audio instructions and the assigned ER strategies. Next, the researcher asked if any doubts existed and clarified any question that that may arise. Then, participants were asked if the camera could be turned on and the judges entered the room. After the TSST, the judges left the room and the participants completed questionnaires measuring

subjective responses. Followed by the recovery phase (5 min), a post-stimulus period during which the participants are silent and sit resting in a comfortable position, similar to the baseline period. Finally, participants provided sociodemographic data and signed the second informed consent, indicating whether they agree with the data collection and behaviour analysis. The study took about 60 min to complete (15 min in phase one; 45 min in phase two).

Measures

Social Stress Induction and Manipulation of Emotion Regulation Strategies

The TSST comprised four phases: preparation (3 min), tasks (10 min), recovery (5 min), and debriefing. The tasks were recorded with a video camera while the participant gave a speech (5 min) followed by an arithmetic task (5 min) in front of two judges (Allen et al., 2017). Two groups of two judges (one male and one female), unknown to the participants, dressed in white coats, who had received training before the study to maintain a neutral expression and perform similarly to all participants. The TSST script and instructions followed the classical protocol (see supplementary material for details).

To standardise the conditions, the instructions about the TSST and the ER strategies used were recorded and presented to participants via audio, and discussed further, when necessary. In the SEE group, participants received the instruction: “During the tasks, please behave in a way that the observer cannot perceive how you are feeling. Please, regulate your feelings the way suggested throughout the tasks: do not show what you are feeling.” In the CCR group the instruction was: “During the tasks, it is normal to feel discomfort, fear or anxiety. Please try to accept your feelings without judging them. After doing this, take a realistic view of the tasks, recognising that this situation is not a threat and that nothing bad can happen. Please, regulate your feelings throughout the tasks the way suggested: first accept your feelings, understanding that they are normal in these circumstances and then

realise that the tasks offer no threat to you". Both SEE and CCR instructions have been used in previous studies (e.g., Gong et al., 2016; Hofmann et al., 2009).

Manipulation Check

After the TSST, participants were asked to select the strategy or strategies they were instructed to use from a list that included acceptance and reappraise via perspective-taking and SEE. After the recovery phase, participants were asked to report the strategies they used during the tasks by selecting from a list with five choice options: acceptance, reappraise via perspective-taking, SEE, none of the strategies, and/or another strategy, with a space allowing them to write which other strategies, beyond the ones listed.

Self-reported Responses

Self-reports of anxiety and shame were measured before and after the TSST. *Anxiety* state was measured using the State-Trait Anxiety Inventory Form Y (STAI-Y; Santos & Silva, 1997; Spielberger et al., 1983) with 20 items (e.g. "I am worried"), and *shame* using the State Shame subscale of the Shame and Guilt Scale (SSGS, Marschall, Sanftner, & Tangney, 1994) with 5-items "(e.g. "I feel powerless"). Five filler items (e.g. "I feel inspired"), taken from the positive subscale of the *Positive and Negative Affect Schedule Short-Form* (Galinha et al., 2014; Watson et al., 1988) were included to reduce negative response bias. All items were responded on a 4-point scale, ranging from 1 (Not at all) to 4 (Very much so). The anxiety scale showed high reliability in both pre and post evaluations ($\alpha s > .92$). Responses to anxiety states were averaged, with higher scores corresponding to greater anxiety. However, the shame scale presented a floor effect in both phases, with very low variance, indicating that participants have not experienced these feelings at both baseline and after the TSST. Because there were also no score changes from the baseline in 37% of participants, shame was not analysed further.

Participants were asked about *performance satisfaction* (cf. Klumbies et al., 2014) in each task, namely speech task and arithmetic task. This distinction was relevant, since the correlation between satisfaction with speech and arithmetic performance was low (r = .23, p = .021). In addition, we evaluated the participants' satisfaction with the ER process, by asking "How much are you satisfied with how you regulated your emotions?" These three satisfaction items were answered on a 5-point scale ranging from 1 (Extremely dissatisfied) to 5 (Extremely satisfied).

Participant's *subjective perceptions of the TSST* were measured with six items taken from Klumbies et al. (2014), using visual analogue scales ranging from 0 (none) to 100 (extremely) scores. After running a Principal Component Analysis (PCA), using Varimax rotation and Kaiser's criterion (eigenvalue>1), one item (*challenge*) was excluded for showing the lowest communality score (.37) and cross-loadings in two components (<.50): *TSST stress perception* (stressful, uncontrollable, threatening, α = .81) and *TSST novelty perception* (novelty, unpredictable, α = .72).

Physiological Responses

Heart Rate Variability (HRV) was measured as an index of autonomic regulation. The BIOPAC MP150 system was used to record the HRV continuously (baseline, TSST speech task, TSST arithmetic task, and recovery), sampled at a rate of 1000 Hertz. Three disposable electrodes for the electrocardiogram were positioned on the participant and attached to Lead II. We reported RMSSD, a time-domain measurement of HRV, and SRBSI. Both HRV and SRBSI were calculated using Kubios software premium (v3.2).

Psychophysiological data acquisition and reduction

HRV artefact corrections were only needed on six participants, and the percentage of beats corrected in each phase did not exceed 5% (Tarvainen et al., 2018). Because we analysed short-term HRV, the Smoothness priors detrending method (Lambda = 500) was

used, corresponding to a cut-off frequency below the LF band (Tarvainen et al., 2018). The R-R series were converted to an equidistant sample through a cubic spline interpolation, with a sampling rate of 4 Hz. The RMSSD values were log-transformed to obtain approximately normal distributions (e.g., Munoz et al., 2015). In our study, the correlation between log High-Frequency (estimated using parametric autoregressive modelling method) and log RMSSD was high, $r(100) = .94$, $p < .001$. Thus, as recommended (Penttila et al., 2001), we only report the results of the RMSSD. Nevertheless, we presented the mean estimates of RMSSD with the inverse of the log transformation to allow the interpretation of normative reference values.

Behavioural Responses

To be consistent with the self-report measures, for the global assessment we focused on *speech performance* (Beltzer et al., 2014; Sieverding, 2009) and behaviours of *anxiety and shame* displayed by participants, given their particular occurrence in social stress situations (e.g. Clark & Wells, 1995). Behavioural responses during the TSST were recorded with a camcorder with a microphone and later coded by three external assistants, blind to the research hypotheses. One assistant evaluated all participants, the second evaluated 50%, and the third evaluated 32.8%.

In addition to global assessment, discrete behaviours were coded using the Observer XT software (v11.5). These included social approach/involvement in the task (affiliative smile, hand gestures to clarify an idea, talk about the task), and social anxiety/avoidant behaviour (signs of unease, nervous hand gestures, nervous laughter, and talking about one's own difficulties). We also included gaze, used in previous studies as a sign of social approach (e.g. Beltzer et al., 2014) or of avoidance (when inverted, e.g. De France, Lanteigne, Glozman, & Hollenstein, 2017). The coding scheme (see supplementary material) was based

on previous studies measuring social approach, anxiety/avoidance, and shame behaviours (Beltzer et al., 2014; De France et al., 2017; Segrin & Kinney, 1995).

Behavioural data acquisition and reduction

For the assessment of anxiety, shame and speech performance, the assistants filled a short questionnaire for each participant right after coding the video. As proposed by Beltzer et al. (2014), *shame* was composed of four items (embarrassed, ashamed, disengaged, and confidence, the latter reversed) and *anxiety* was composed of three items (nervous, anxious, and comfort, the latter reversed). These items were rated on a 5-point scale, ranging from 1 (no responses) to 5 (very much). For shame there was no variance in the item "disengaged", therefore it was not included in the analyses. The remaining shame items were averaged and acceptable reliability was achieved (α = .76) in both tasks. Anxiety behavioural scores also showed good reliability in both tasks (α = .86) and were averaged. Throughout the speech task, the degree of speech performance was analysed using the average of the evaluation of performance at each minute to reduce recency levels (cf. Beltzer et al., 2014). At each minute, coders were asked to rate the performance of the speech using a 5-point scale, ranging from 1 (not convincing at all / context inappropriate) to 5 (convincing / context appropriated). Reliability was high over the five minutes (α = .97). The inter-rater reliability was estimated with intra-class correlations (ICC) with two-way random-effects for consistency for the average means (cf. Hallgren, 2012). Agreement between the coders was acceptable on both tasks for *anxiety* (ICC > .79, 95% CI [.50, .91]), *shame* (ICC > .82, 95% CI [.67, .94]) and *speech performance* (ICC > .80, with 95% CI [.51, .92]).

Regarding discrete behaviours, observers spend a total of 227 hours coding these behaviours. The average inter-rater agreement was reasonable κ = 0.78 (.66 < κs < .94) with a 5s tolerance window. Because both TSST tasks had the same duration for all participants, we summed the total duration of each specific behaviour (600 sec). A PCA was conducted to

check whether the approach/involvement and anxiety/avoidant behaviours could be aggregated into distinct factors. However, results showed that nervous laughter and talking about one's difficulties presented no significant correlations with the other behaviours. Also, most participants did not display these behaviours. Thus, we have not analysed them further. Although conceptually related, these two factors showed low internal consistency ($\alpha < .50$). Therefore, we decided to not aggregate the behaviours into a single construct. Instead, we analysed the two types of behavioural responses using a multivariate analysis approach.

Covariates

Although not focal to the study's main aims, we examined trait social anxiety/fear, age, and gender differences, because they may affect the responses in each of the three systems.

Trait Social Anxiety/Fear. Individuals high in social anxiety for speech tasks tend to show more anxiety and shame, perform poorly (Beltzer et al., 2014), show moderate HRV response (Holzman & Bridgett, 2017), display a limited ER repertoire and lack of ER flexibility (Dryman & Heimberg, 2018). Although we have not included participants with social anxiety disorders, we measured trait social anxiety to account for this disposition. Trait Social Anxiety/Fear was assessed using the Liebowitz Social Anxiety Scale - Self Report (Caballo et al., 2019; Clark & Wells, 1995). As proposed by Caballo et al. (2019), we only used the social anxiety/fear subscale as a measure of general trait social anxiety/fear. The social anxiety/fear subscale has 24 items (e.g., "Acting, performing or giving a talk in front of an audience"). Responses were given in a 4-point scale, ranging from 0 (none) to 3 (severe) ($\alpha = .92$). Responses were summed, with higher scores corresponding to greater trait social anxiety/fear.

Age. Age may be an important factor during the TSST, with a stronger heart rate increase in young adults than older adults (Kudielka et al., 2007). Allen et al. (2017) also indicated that even though younger people may be more comfortable being filmed, because

they are at an early stage of their career, the camera can increase the stress levels. Furthermore, older adults may find the arithmetic task less stressful than younger participants, due to generational differences in the usage of calculation aids.

Gender. Gender is also relevant for physiological HRV self-regulatory system (Holzman & Bridgett, 2017). Women tend to report higher levels of stress (Brugnera et al., 2018), fear, confusion and irritability than men after speech tasks (Allen et al., 2017).

Data Analysis

Data analyses were performed with IBM SPSS Statistics (Version 25.0). Each scale was inspected for missing data. Only Trait Social Anxiety/Fear presented nonresponses in six items (< 10%), corresponding to four participants with one item missing, and one with two items. These items were replaced with the Expectation-Maximisation (EM) method because missing responses were completely random (MCAR), Little's MCAR test, X2 (68) = 53.720, p = .897.

To check whether the groups presented similar characteristics at baseline, chi-square tests were used for categorical variables and *t*-tests for continuous variables. Pearson bivariate correlations were computed to analyse the associations between the variables. For comparison of the outcomes between groups, analyses of covariance were conducted with univariate or multivariate analyses. The latter was used to adjust for multiple testing and reduce the likelihood of Type I error. Only the covariates that showed significant correlations with the outcomes were included in the analyses (see Covariates in the supplementary material). For the Multivariate Analysis of Covariance (MANCOVA) we reported Pillai's trace statistics for violations of variance-covariance homogeneity. When estimated epsilons (ε) were less than 0.75 for factorial designs with repeated measures, violations of sphericity were corrected with Greenhouse-Geisser tests.

To correct for false positives (Type I error) from the multiple MANCOVA tests, the False Discovery Rate (FDR) was applied. We used the two-stage step-up method of Benjamini, Krieger and Yekutieli (2006) because it is considered more powerful than the original method (Benjamini & Hochberg, 1995). FDR was calculated using the PRISM software (Version 9.0.2) and applied a $q < .05$. Both the uncorrected *p*-values and the FDR-adjusted *p*-values were presented. The CI 95% of the effect sizes were calculated using the MOTE package in the software R (Buchanan et al., 2019).

The dataset and its associated file description are available in the Open Science Framework repository at https://osf.io/3ta6e/?view_only=6d925c9d0170401eb2f7caf318be9952

Results

As shown in Table 1, groups did not differ on most sociodemographic variables, apart from marital status. No participant reported having a mental disorder, and both groups had similarly low levels of trait social anxiety/fear (M = 27.03, SD = 11.20). At baseline, both groups reported mild states of anxiety (M = 2.40, SD = 0.48), and showed normative physiological HRV index (RMSSD: M = 39.21, SD = 22.73) and stress indexes (M = 11.03, SD = 3.56). Correlations between physiological measures and alcohol consumption, caffeine, tobacco, and sleep routine were all non-significant. Thus, we chose not to dismiss any participant to bring more variability to the data.

Insert Table 1 about here

Manipulation Check

As previously mentioned, only two participants were eliminated from the analyses because they did not follow instructions. The great majority reported receiving instructions related to the group they were assigned (96% in the CCR group and 92% in the SEE group). Responses to the first question of the manipulation check indicated that only six participants

did not answer the type of strategy assigned. However, in the second question, after the recovery phase, they indicated using the strategy or strategies (with the CCR group) that were assigned to them. Therefore, we did not eliminate them. Also, based on the participants' responses, we constructed a variable with the number of extra strategies reported by the participants. This information allowed us to identify differences between groups ($X^2(3, 100) = 28.59$; $p < .001$), with a high effect size (Cramer's V = .535), with the majority of the CCR group participants using the induced strategies (n = 20, 40%) or only one more (n = 12, 240%) and none using more than two extra strategies. On the other side, in the SEE group, participants were using three or more strategies (n = 16, 32%), with others using one more (n = 12, 24%) or two more (n = 19, 38%).

Correlations

An analysis of the correlation between all dependent variables was performed to understand the relationship between dependent variables and to examine the correlation between the three-systems of emotion. The complete matrix of correlations can be found in the supplemental material. Correlation between dependent variables reinforced the theoretical ground that supported the multivariate analyses performed, namely between satisfaction of performance and satisfaction with the ER process ($.23 < r < .55$, ps $< .05$), between TSST stress and novelty perception ($r = .30$, $p < .01$), between behavioural perception of shame and anxiety ($r = .80$, $p < .01$), between discrete approach behaviours ($.30 < r < .47$, ps $< .01$) and between avoidance behaviours ($r = .35$, ps $< .01$).

Three-systems of emotion

The analysis of the correlation between the three-systems of emotion showed no significant correlations between physiological responses and self-report and behavioural responses, although there were significant correlations between self-report and behavioural responses (see Table 2).

Insert Table 2 about here

The strength of the relations was weak to moderate (.22 < *r* < .39, *p*s < .05), except for the strong relation between the duration of talking and speech satisfaction, *r* (99) = .56, *p* < .001. As shown in Table 2, behavioural shame and anxiety were positively correlated with anxiety state and TSST stress perception, while they were negatively associated with satisfaction. Discrete behaviours of social anxiety were positively associated with state anxiety and negatively associated with satisfaction. Also, perceived performance during speech and talking duration was positively correlated with speech performance satisfaction and negatively with TSST stress perception.

Self-reported Responses

An Analysis of Covariance (ANCOVA) 2 (Group: CCR, SEE) X 2 (Phase: pre-and-post-TSST), controlling for trait social anxiety/fear, age, and gender, was conducted for state anxiety. No main effects or interaction group X phase were found (*p*s > .05), showing that the manipulated ER strategies did not affect the self-report of anxiety. However, the effects of the covariate trait social anxiety/fear remained significant, indicating that higher trait social anxiety/fear predicted higher feelings of anxiety, $F(1, 95) = 8.60$, $p = .004$, $\eta_p^2 = .08$, 95% CI [0.01, 0.20] (see Table 3).

Insert Table 3 about here

For satisfaction of performance (with the speech task and the arithmetic task) and ER process, a MANCOVA was conducted to analyse differences between groups (SEE vs CCR), controlling for trait social anxiety/fear and age. There was a significant multivariate effect of group, Pillai's Trace = .09, $F(3, 94) = 3.10$, $p = .030$, FDR-adjusted $p = .047$, $\eta_p^2 = .09$, 95% CI [0.00, 0.18]. Follow-up univariate testing only showed effects for ER process satisfaction, $F(1, 96) = 8.94$, $p = .004$, FDR-adjusted $p = .013$, $\eta_p^2 = .09$, 95% CI [0.01, 0.21], with the

SEE group reporting less satisfaction than the CCR group. Both covariates did not maintain their significance (*p*s > .05).

A MANCOVA was used to compare groups on TSST perception (stress and novelty), controlling for trait social anxiety/fear and gender. No multivariate effect of group on the combined two outcomes was found ($p > .05$). These results indicate that the stress manipulation had similar effects on both groups, with the TSST being perceived on average as very novel ($M = 79.22$, $SD = 19.13$) and moderately stressful ($M = 47.32$, $SD = 26.37$). There was a significant multivariate effect of trait social anxiety/fear, Pillai's Trace = .13, $F(2, 95) = 7.64$, $p < .001$, $\eta_p^2 = .14$, 95% CI [0.08, 0.25], although only for the TSST stress perception the covariate remained significant, $F(1, 96) = 13.65$, $p < .001$, $\eta_p^2 = .12$, 95% CI [0.03, 0.25].

A post-hoc analysis, using an independent samples t-test, was performed for all self-report measures (see supplemental material). Similar results were observed, except for satisfaction with performance in the speech task ($t(98) = -2.14$, $p = .035$, $d = -0.43$, , 95% CI [0.03, 0.26], with the CCR group ($M = 2.74$, $SD = 1.08$) reporting more satisfaction in comparison with the SEE group ($M = 2.28$, $SD = 1.07$).

Physiological Responses

The mixed between-within repeated measures ANCOVA 2 (Group: CCR, SEE) X 4 (Phase: baseline, speech task, arithmetic task, recovery) on RMSSD (log), after adjusting for the covariates age and gender, revealed an interaction Group X Phase, $F(1.54, 148.07) = 3.70$, $p = .038$, $\eta_p^2 = .04$, 95% CI [0.00, 0.11]. Simple group effects within each phase showed lower HRV values for the SEE group than for the CCR group in both TSST tasks: speech, $F(1, 96) = 6.85$, $p = .010$, $\eta_p^2 = .07$, 95% CI [0.00, 0.19]; and arithmetic, $F(1, 96) = 4.83$, $p = .030$, $\eta_p^2 = .05$, 95% CI [0.00, 0.16]. In contrast, no group differences were found at baseline and recovery phases (*p*s > .40), and the RMSSD values at these two phases were

within the normal range (27-72 ms), also indicating that both groups returned to normative levels of RMSSD at the end of the experiment (see Figure 1). Simple effects of phase within each group revealed that only the SEE group showed HRV differences between the two tasks. SEE group presented lower HRV levels during the speech than during the arithmetic task, which were below the normative range (Tarvainen et al., 2018). Finally, there were significant effects of the covariates age, $F(1, 96) = 12.39$, $p < .001$, $\eta_p^2 = .11$, 95% CI [0.02, 0.25], and gender, $F(1, 96) = 7.39$, $p = .008$, $\eta_p^2 = .07$, 95% CI [0.01, 0.19].

Insert Figure 1 about here

Regarding stress levels, a mixed between-within ANCOVA 2 (Group: CCR, SEE) X 4 (Phase: baseline, speech task, arithmetic task, recovery), with age and gender as covariates, yielded a main effect of group, $F(1, 96) = 4.53$, $p = .036$, $\eta_p^2 = .05$, 95% CI [0.00, 0.15]. The SEE group displayed higher values of stress than CCR group. As expected, the Group X Phase interaction was also significant, $F(1.61, 154.22) = 3.79$, $p = .034$, $\eta_p^2 = .04$, 95% CI [0.00, 0.11], indicating that group differences only occurred during the two TSST tasks, with the SEE group showing higher stress than the CCR during the speech, $F(1, 96) = 5.84$, $p = .018$, $\eta_p^2 = .06$, 95% CI [0.00, 0.17], and arithmetic tasks, $F(1, 96) = 5.36$, $p = .023$, $\eta_p^2 = .05$, 95% CI [0.00, 0.17]. Additional analyses indicated that for the CCR group, stress levels did not change significantly throughout the experience ($p > .05$), whereas for the SEE group the stress levels increased significantly during the TSST and then decreased during the recovery phase, $F(3, 94) = 10.24$, $p < .001$, $\eta_p^2 = .25$, 95% CI [0.09, 0.38], with no differences between baseline and recovery phases. There was also a significant decrease of stress between the speech and arithmetic task ($p = .024$). Based on the Baevsky Stress Index (Tarvainen et al., 2018), the stress levels registered at baseline and recovery phases were within the normative range (7.1-12.2) in both groups. However, during the TSST tasks the stress levels registered for the SEE group were outside the normative range.

The post-hoc analyses using independent samples t-tests performed for physiological measures indicated similar results (see supplemental material).

Behavioural Responses

A MANCOVA was conducted to compare the groups on the observer's subjective ratings of emotions (shame and anxiety), controlling for trait social anxiety/fear. There was no group effect on the combined emotional behaviours, Pillai's Trace = .02, $F(2, 95) = 0.95$, $p = .392$, $\eta_p^2 = .02$, 95% CI [0.00, 0.09]. Trait social anxiety/fear was also not associated with the outcomes, $p = .133$.

However, for the overall performance during the speech task, an ANOVA yielded a significant effect of group, $F(1, 97) = 4.27$, $p = .042$, $\eta_p^2 = .04$, 95% CI [0.00, 0.16], with the CCR group perceived as performing better than the SEE group.

To compare the groups on discrete approach and avoidance behaviours, two MANCOVAs were conducted, both controlling for trait social anxiety/fear and age. The first combined the approach/involvement behaviours, which included the duration of smile, hand gestures for clarification, and talking about the task as dependent variables. The multivariate effect of group on these three outcomes was significant, Pillai's Trace = .10, $F(3, 93) = 3.52$, $p = .018$, FDR-adjusted $p = .009$, $\eta_p^2 = .10$, 95% CI [0.00, 0.22]. Univariate testing showed significant results for the affiliative smile, $F(1, 95) = 7.48$, $p = .007$, FDR-adjusted $p = .007$, $\eta_p^2 = .07$, 95% CI [0.01, 0.20], and hand gestures, $F(1, 95) = 5.18$, $p = .025$, FDR-adjusted $p = .009$, $\eta_p^2 = .05$, 95% CI [0.00, 0.17]. The CCR group spent more time smiling and using gestures to clarify ideas. However, no differences were observed during time spent talking, $p = 343$, FDR-adjusted $p = .090$. Additionally, there was a significant multivariate effect of age, Pillai's Trace = .16, $F(3, 93) = 6.01$, $p < .001$, $\eta_p^2 = .16$, 95% CI [0.03, 0.29], that remained significant for affiliative smile, $F(1, 95) = 18.18$, $p < .001$, $\eta_p^2 = .16$, 95% CI [0.05, 0.31].

The second MANCOVA for the social anxiety/avoidant behaviours, which included signs of unease and nervous hand gestures as dependent variables, showed no effect of group, Pillai's Trace = .04, $F(2, 94) = 2.14$, $p = .123$, $\eta_p^2 = .04$, 95% CI [0.00, 0.13]. However, there were multivariate effects of trait social anxiety/fear, Pillai's Trace = .13, $F(2, 95) = 7.19$, $p < .001$, $\eta_p^2 = .13$, 95% CI [0.02, 0.25] for both measures, indicating that those who reported higher levels of trait social anxiety/fear were perceived as showing higher unease levels and using their hands to express nervousness. Gaze was analysed independently with an ANCOVA (controlling for age), because the correlation with the variable unease was not significant. The results showed a marginal effect of group, $F(1, 96) = 3.93$, $p = .050$, $\eta_p^2 = .30$, 95% CI [-0.04, 63.76], and of age, $F(1, 96) = 19.51$, $p < .001$, $\eta_p^2 = .17$, indicating that older people maintained their gaze over the judges during more time.

Post-hoc analyses using independent samples t-tests were performed for all behavioural measures (see supplemental material). Similar results were observed, except for signs of unease ($t(97) = 2.07$, $p = .041$, $d = 0.42$, , 95% CI [0.02, 0.81], with the SEE group ($M = 42.44$, $SD = 93.53$) being perceived as showing more discomfort in comparison with the CCR group ($M = 12.10$, $SD = 42.48$).

Discussion

This study investigated the impact of the combination of two cognitive reappraisal strategies on self-report, physiological, and behavioural responses in a socially stressful context. To the best of our knowledge, our study is the first proposal for combining these two strategies. We investigated whether the use of CCR would be more appropriate than SEE for each of the outcomes.

Contrary to our expectations, results on subjective self-report measures have not confirmed our initial hypothesis (H1). No differences between groups were found on anxiety self-report, as Hofmann et al. (2009) reported. Gross and Levenson (1993) have also stressed

the absence of differences between suppression and control groups. These findings contrast with prior studies suggesting that the use of cognitive change strategies decrease negative affect and anxiety when compared with suppression (e.g. Gong et al., 2016; Jamieson et al., 2013). A recent study found the regulation strategy (i.e., positive reappraisal or catastrophy) had no impact on the reduction, maintenance or increase of fear or on subjective anxiety, although it seemed to have an impact on physiological responses (Wiemer et al., 2021).

Our data confirm the hypotheses related to HRV, namely RMSSD and stress levels (H2). As expected, the SEE group showed greater stress levels and a greater decrease in HRV during the TSST, compared to the CCR group. Other research studies have found similar results (Dan-Glauser & Gross, 2015; Gong et al., 2016; Jentsch & Wolf, 2020; Troy et al., 2018). Our results suggest that CCR strategies can be a more effective strategy for social stress situations than SEE. The HRV values for the CCR group remained within the normative range throughout the TSST, whereas for the SEE group the HRV decreased below normative values during the TSST. This is relevant since HRV is an important index of autonomic nervous system balance and considered a reliable index of emotional processing, namely the response to stress (Laborde et al., 2017). Furthermore, stress levels of the SEE group during the TSST increased above the normative values, revealing difficulties in the ER process. Our findings thus indicate that CCR enables participants are better at heart rhythm management (Baevsky & Berseneva, 2008). Since low HRV is related to lower demand and lower performance of the prefrontal cortex (Beauchaine & Thayer, 2015), CCR would save cognitive effort that can be applied to other tasks, such as in academic assessments or occupational tasks.

Behavioural responses results were mixed. First, the subjective behavioural ratings showed no differences between groups for anxiety or shame, contrary to our hypotheses (H3a and H3b). Still, the CCR group was perceived as better in their speech performance than the

SEE group, in accordance with the hypothesis (H3c) and contrary to the Sieverding (2009) study. Additionally, discrete behaviour analysis showed that the CCR group expressed more social approach/involvement behaviours than the SEE group, and in particular, more affiliative smiling and use of hand gestures to clarify an idea, confirming our hypothesis (H4a), which is in line with previous studies reporting acceptance as beneficial in social interactions, (Dan-Glauser & Gross, 2015) and reappraise via perspective-taking as advantageous in acute social stress contexts (Jentsch & Wolf, 2020). However, no differences between groups were found for social anxiety/avoidant behaviours, showing that both CCR and SEE can be beneficial when dealing with anxious feelings, as in Gong et al. (2014) contrary to our hypothesis (H4b).

Overall, our results indicate that CCR strategies can be more beneficial than SEE in a social stress situation such as a job interview. This is especially true considering our behavioural and physiological findings. This study supports the proposal that CCR is more advantageous than SEE, since CCR decreases physiological costs and enables participants to be perceived as more convincing and competent given the context.

One criticism of reappraise via perspective-taking is the cost of using the strategy in highly stressful situations. We proposed that the cognitive effort addressed to reappraise via perspective-taking in highly stressful situations could be tackled if one also uses acceptance (i.e. reappraisal of the emotional response). This latter strategy also seems to be “easier” to deploy and effective in changing physiological and behavioural responses (Goldin et al., 2019; Jentsch & Wolf, 2020; Troy et al., 2018). Moreover, their combination may facilitate the regulation of negative affect (Kivity et al., 2016). Recent research has also suggested that using more adaptative ER strategies promote better outcomes than maladaptive ER strategies (Southward & Cheavens, 2020). Even though the adaptability of a strategy is context-related,

CCR strategies have been showing to be more adaptative than suppression based on their association with mental health difficulties (Dryman & Heimberg, 2018).

Based on our multi-method assessment approach, we were not able to find statistically significant correlations between physiological responses and subjective or behavioural measures. In contrast, subjective and behavioural responses of anxiety were positively correlated, as in Avero and Calvo (1999) and Evers et al. (2014). These results were also found regardless of the emotional regulation strategy that was manipulated in our study. Thus, our results do not fully support our initial expectations predicting correlations between the responses of the three-systems. However, previous studies have also indicated some inconsistency and lack of coherence between distinct emotional systems (Campbell & Ehlert, 2012; Evers et al., 2014; Quigley et al., 2013). One possible interpretation of our findings may relate to the dual-process model, in which coherence is more likely to be found separately: between reflective responses (measured with self-report and behavioural data) and between automatic processes (e.g. physiological responses and other automatic indexes of the same underlying construct). However, coherence is not found between the two groups (Evers et al., 2014). The lack of coherence between automatic versus reflexive channels, due to a dual-process, could be further investigated by including other autonomic measures of stress and anxiety. Either using complementary physiological measures or, as suggested by Evers et al. (2014), using tasks that allow the assessment of accessibility to stress/anxiety constructs, such as lexical recognition tasks.

Our findings regarding the subjective measures need more discussion. The lack of differences between groups may be due to the time participant had to wait before responding to these subjective measures (i.e., participants were only asked to report their feelings after the judges had left the room and the camera was switched off). Thinking about their emotions may also change the way participants felt since they had to reflect upon experience (Quigley

et al., 2013). Thus, the process of reflecting upon anxiety and shame after waiting could have decreased their subjective reports. The instruction to use suppression may have also contributed to suppressing the emotional experience by reducing the negative affect and perceived anxiety. This is in line with Lemaire et al. (2014) study in which they found that suppression decreased the duration of the emotional response, thus lessening the negative affect. On the other hand, the non-significant difference in anxiety levels between groups could also result from the characteristics of the CCR strategies concerning their timing effect. The two strategies were combined and included in the early stage of the ER process. Consequently, they require less effort, and their efficacy is less affected by the intensity of the emotion (Sheppes & Gross, 2011).

Regarding the exploratory analyses, it was found that both groups perceived the TSST as novel/unpredictable and stressful, supporting the idea of a successful stress induction in both groups. Likewise, after TSST anxiety increased from the baseline. Regarding satisfaction, our results showed no differences in the arithmetic task performance satisfaction, but the CCR group reported more satisfaction for the speech task and the ER process, in comparison with the SEE group. Satisfaction with the process increases the likelihood of behaviour repetition (Kwasnicka et al., 2016). Knowing that satisfaction is a consequence of feeling control during a self-regulation process (McCraty, 2015), our results support techniques that rely on cognitive reassessment or acceptance, such as acceptance and commitment therapy or other forms of cognitive and behavioural therapy.

As in previous studies, our results also suggest that we tend to use more than one strategy during an emotion regulation process (Aldao & Nolen-Hoeksema, 2013; Ford et al., 2019). In our study, most of the participants used two or three strategies. In particular, the SEE group reported using multiple strategies, and prior studies has indicated that the use of many ER strategies may be associated with difficulties (e.g. because of the intensity of the

emotion) and/or failure in the regulation process (Aldao & Nolen-Hoeksema, 2013). In contrast, the CCR group used fewer extra strategies and reported more satisfaction, suggesting that the CCR combination is better to regulate emotions during the stressful event.

Although only healthy participants were included, we controlled for trait social anxiety/fear, which correlated with self-report and behavioural variables (Beltzer et al., 2014; Dryman & Heimberg, 2018). As reported in the literature, we also found gender and age differences associated with psychophysiology measures (Allen et al., 2017; Brugnera et al., 2018).

This study has some limitations. First, the manipulated ER strategies without previous practice might also depend on the participants' emotional lexicon, their repertoire of ER strategies, beliefs about outcomes (Ford & Gross, 2018) and habitual use (Jentsch & Wolf, 2020). As in most of the research in this field, the protocol did not include a training session. Even though we acknowledge its importance in the ER process efficacy, participants were instructed how to regulate their emotions according to similar studies. Nevertheless, future studies should include a training period; this would allow participants to try specific strategies and further investigate these strategies' role in the effectiveness of the ER process. To diminish the lack of a training session before the participants faced the panel of judges, the researchers asked the participants if they had any doubts regarding ER strategies instructions and/or tasks instructions. Therefore, the protocol included the possibility of an extended, but optional, discussion where participants could learn more about the ER strategies.

Second, we did not include participants with social phobia or other anxiety disorders, even though we measured trait social anxiety/fear as a control variable. Although the examination of how participants with these disorders cope with stress is relevant, it is also advisable that studies using such vulnerable participants may be extra cautious in the research

planning, e.g. by having a trained therapist on-site to provide instant care if needed and/or also by having a follow-up to account and provide help for possible negative effects of participants. Third, our sample had mainly female participants, despite our efforts to disseminate the study. We highlight the importance of future studies to be more cautious about heterogeneity within samples because female participants generally have a more expressive behavioural and physiological reaction to stress and anxiety as literature (Allen et al., 2017; Brugnera et al., 2018) and our results confirm.

Finally, even though we recognise the importance of a control group, as mentioned in Zaehringer et al. (2020 meta-analysis, we did not include one. Our choice for not using a control group was related to the fact that people use various strategies to regulate affect. For example, in negative contexts, acceptance and reappraisal are the most commonly used strategies while suppression seems to be the least common (Szasz et al., 2018). Furthermore, we allowed participants to indicate which strategies they had used. Thus, in a control group, we could have most people using acceptance and/or reappraisal, with others using various other strategies, not allowing us to properly understand the differences between the groups. Also, a control group could diminish the possibility of finding significant effects of emotion regulation, leading to the results having small or null effect sizes (Troy et al., 2018).

For an in-depth understanding of the combination proposed, future studies should differentiate and compare the strategies, including each one as a condition and in the reversed sequence. We manipulated participants of the CCR group to first use acceptance and then reappraise via perspective-taking. According to Ford et al. (2019) polyregulation may occur both sequentially and concurrently. During a lengthy ER process in which participants had an anticipation phase and then performed two tasks, lasting a total of 13 min, participants may have begun to use the strategies sequentially, as they were told to, but at some point, may have also used them concurrently. We did not address the TSST anticipation period,

although, during the debriefing, several participants spontaneously shared that the anticipation period was very stressful because the judges were already present. Thus, future studies may consider this period for analyses, taking advantage of new, faster subjective and physiological measurement methods. For example, with TSST, participants could use their phones to answer a brief measure before, between and after the event. This method allows for more privacy, confidentiality and therefore, subjective feelings could be more accurate.

The present research increases the understanding of the ER process in a simulated job search. These results apply to people who face other situations of social exposure and performance, such as oral presentations. Furthermore, these findings may help the design of ER intervention programs expand to include social anxiety symptomatology, which is persistent, prevalent, complex and debilitating (Clark & Wells, 1995; Wells et al., 2016). Our results showed that trait social anxiety/fear was related to subjective, physiological, and behavioural parameters.

Literature indicated that understanding the strategies' consequences and practising them positively affects the ER process (Beauchaine & Thayer, 2015; Ford & Gross, 2018; Gross, 2015). This can be achieved by extending ER strategies repertoire and enhancing ER flexibility (Dryman & Heimberg, 2018), which may lead to better mental health and resilience (Aldao & Nolen-Hoeksema, 2013; McCraty & Shaffer, 2015). In conclusion, our results showed that healthy individuals, regardless of their trait social anxiety/fear, age, or gender, seem to benefit from using CCR for social stress management. Our methodology supports the dual-process perspective and showed that CCR contributes to a better-perceived performance, less physiological cost in the short-term, and more satisfaction with the ER process.

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Table 1.

Demographic Characteristics of the Total Sample and for the Groups at Baseline

Variable	Total sample		Group				χ^2	*p*
			SEE		CCR			
	N	%	*n*	%	*n*	%		
Gender							0.05	.826
Women	71	71	36	72	35	70		
Men	29	29	14	28	15	30		
Portuguese nationality	98	98	49	98	49	98	0.00	1.00
Marital Status							6.35	.012
Single/Divorced	85	85	47	94	38	76		
Married/Partnership	15	15	3	6	12	24		
Occupation							5.51	.138
Student	60	60	33	66	27	54		
Employed	22	22	7	14	15	30		
Employed & Student	16	16	8	16	8	16		
Unemployed	2	2	2	4	0	0		
Academic qualifications							2.58	.108
Secondary School	54	54	31	63	23	46		
College education	46	46	19	38	27	54		
Study/Work field							8.95	.111
Exact and Natural Sciences	3	3	2	4.1	1	2.1		
Engineering sciences	6	6	3	6.1	3	6.3		
Health and medical sciences	15	15	6	12.2	9	18.8		
Social sciences	59	59	32	65.3	27	56.3		
Humanities	10	10	2	4.1	8	16.7		
Other (does not apply)	4	4	4	8.2	0	0		
Previous job interview	61	61	30	60	31	60	0.04	.838
Plan to apply for a job	67	67	33	66	34	68	0.05	.832
Health-related behaviours								
Alcohol consumption 24h before	7	7	1	2	6	12	3.84	.050
Thein consumption 2h before	7	7	4	8.3	3	6	0.20	.654
Smoked 2h before	18	18	8	16.7	10	20	0.18	.670
Followed sleep routine	72	72	37	74	35	70	0.20	.656
	M	*DP*	*M*	*DP*	*M*	*DP*	*t*	*p*
Age	24.71	7.40	23.90	7.62	25.52	7.16	-1.10	.276
BMI	21.11	6.28	21.17	5.29	21.05	7.19	0.09	.926
Amount of job interviews	5.66	4.54	5.42	3.81	5.88	5.18	-0.36	.718
Trait social anxiety/fear	27.04	11.20	28.59	10.19	25.48	12.03	1.39	.167
Anxiety State	2.40	0.48	2.42	0.42	2.38	0.53	0.41	.685
Shame	1.28	0.37	1.23	0.30	1.32	0.43	-1.19	.236
RMSSD	39.21	22.73	39.10	20.97	39.31	24.58	-.05	.963
SRBSI	11.03	3.56	11.02	3.28	11.04	3.86	-0.03	.975

Note. BMI = Body mass index; RMSSD = Root Mean Square of Successive RR interval Differences; SRBSI = Square Root of the Baevsky Stress Index

Table 2.

Zero-Order Person Correlations between Self-report and Behavioural measures.

Self-report	Behavioural responses (observer ratings)								
	Anxiety	Shame	Speech performance	Smile	Hands clarification	Time talking	Hands nervousness	Signs of unease	Gaze
Anxiety Post-TSST	.26*	.23*	-.11	-.06	.01	-.28**	.33**	.22*	-.08
Satisfaction with speech task	-.32**	-.32**	.36**	.25*	.25*	.56**	-.40**	-.35**	.23*
Satisfaction with arithmetic task	-.14	-.26**	-.04	-.10	-.13	.07	.00	.01	-.03
ER satisfaction	-.36**	-.34**	.30**	.19	.11	.33**	-.25*	-.25*	.15
Stressful TSST	.35**	.30**	-.23*	-.13	-.11	-.39**	.27**	.11	-.01
Novelty TSST	.05	.12	.04	.04	.03	-.06	.26**	.05	-.07

Note. *$p < .05$; **$p < .01$. ER: Emotion regulation; TSST: Trier Social Stress Test.

Table 3.

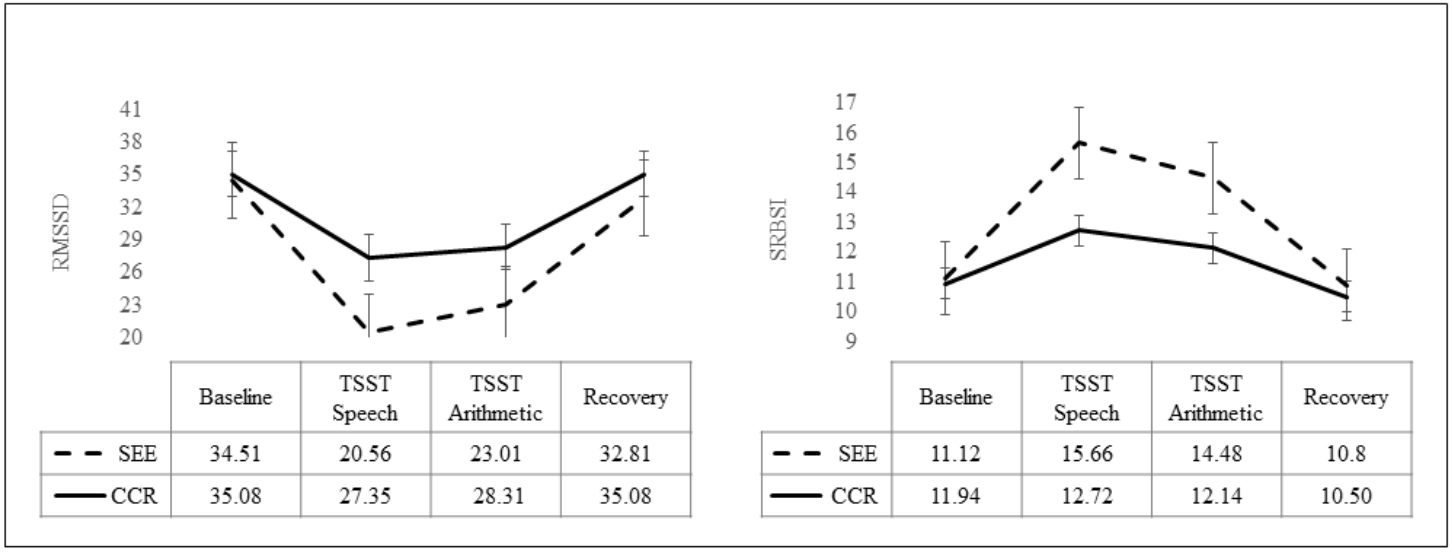
Results for the group comparison on self-report and behavioural responses

	Group								
	SEE		CCR						
Variables	*M*	*SD*	*M*	*SD*	*F*	*p*	adjusted *p*	η_p^2	95% CI
Self-reported responses									
Group X Phase[1]					0.57	.451		.00	[0.00, 0.07]
Anxiety Pre-TSST	2.42	0.42	2.38	0.53					
Anxiety Post-TSST	2.97	0.62	2.80	0.70					
Satisfaction[1]					3.10	.030	.047	.09	[0.00, 0.18]
Satisfaction Task 1	2.28	1.07	2.74	1.08	3.00	.086	.090	.03	[0.00, 0.13]
Satisfaction Task 2	1.78	1.09	1.82	1.00	0.24	.628	.495	.00	[0.00, 0.06]
ER satisfaction	2.22	1.04	2.94	1.15	8.94	.004	.013	.09	[0.01, 0.21]
TSST perception[2]					0.81	.448		.02	[0.00, 0.08]
Stressful	51.63	26.10	43.01	26.19					
Novelty	79.18	18.87	79.25	19.58					
Behavioural responses									
Emotional[3]					0.95	.392		.02	[0.00, 0.09]
Anxiety	2.37	0.91	2.10	0.69					
Shame	2.04	0.70	1.89	0.59					
Speech performance	3.97	0.91	4.31	0.68	4.27	.042		.04	[0.00, 0.16]
Social approach Duration (sec)[4]					3.52	.018	.009	.10	[0.00, 0.22]
Affiliative Smile	11.25	9.44	20.19	18.82	7.48	.007	.007	.07	[0.01, 0.20]
Hands clarification	81.62	71.74	123.93	99.14	5.18	.025	.009	.05	[0.00, 0.17]
Talk about the task	224.80	46.56	236.69	43.04	0.91	.343	.090	.01	[0.00, 0.08]
Social anxiety Duration (sec)[3]					2.15	.122		.04	[0.00, 0.13]
Hands nervousness	64.15	98.32	67.28	112.74					
Signs of unease	42.44	93.53	12.09	42.48					
Gaze	195.21	97.64	171.88	73.67	3.93	.050		.04	[0.00, 0.14]

Note. CCR: Combined cognitive reappraisal; SEE: Suppression of Emotional Expression; ER: Emotion Regulation; TSST: Trier Social Stress Test; [1]Covariates: Trait Social Anxiety/Fear, Age & Gender; [2]Covariates: Trait Social Anxiety/Fear & Gender; [3]Covariate: Trait Social Anxiety/Fear; [4]Covariates: Trait Social Anxiety/Fear & Age.

Figure 1.

Heart rate variability (left) and stress levels (right) as a function of groups (combined cognitive reappraisal strategies; suppression group).



	Baseline	TSST Speech	TSST Arithmetic	Recovery
SEE	34.51	20.56	23.01	32.81
CCR	35.08	27.35	28.31	35.08

	Baseline	TSST Speech	TSST Arithmetic	Recovery
SEE	11.12	15.66	14.48	10.8
CCR	11.94	12.72	12.14	10.50

Note. Error bars represent -/+ standard error of the mean. CCR: Combined cognitive reappraisal; SEE: Suppression of Emotional Expression; RMSSD: Root Mean Square of Successive R-R interval Differences; SRBSI: Square Root of the Baevsky Stress Index; TSST: Trier Social Stress Test.