



Negative social emotions and cognition: Shame, guilt and working memory impairments

Cavalera Cesare^{a,*}, Pepe Alessandro^b, Zurloni Valentino^b, Diana Barbara^b, Realdon Olivia^b, Todisco Patrizia^c, Castelnovo Gianluca^a, Molinari Enrico^a, Pagnini Francesco^a

^a Catholic University of Milan, Via Nirone 15, 20132 Milan, Italy

^b University of Milan-Bicocca, Via Thomas Mann, 8, 20162 Milan, Italy

^c Center of Eating Disorders, Casa di Cura Villa Margherita, Via Costacolonna, 6, 36057 Arcugnago, Italy

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ABSTRACT

Negative emotions can have an impact on a variety of cognitive domains, including Working Memory (WM). The present work investigated whether shame and guilt modulate WM performance in a dual-task test both in a non-clinical and a clinical population. In Experiment 1, 76 non-clinical participants performed a dual-task before and after being randomly assigned to shame, guilt or neutral inductions elicited by the writing of autobiographical past experiences. Shame and guilt elicitation were related to impaired WM performances. In Experiment 2, 65 clinical inpatients with eating disorders were assigned to the same procedure. The negative relationship of self-conscious emotions and WM was confirmed. Taken together these results suggest that shame and guilt are related to impairments of WM in both clinical and non-clinical participants.

1. Introduction

Emotional processing exerts a strong influence over different types of cognitive performance (Gong, Xiao, & Wang, 2016; Pessoa, 2008; Yiend, 2010). Working memory (WM) in particular seems to be strongly affected by emotional processing (Course-Choi, Saville, & Derakshan, 2017; Jordan, Dolcos, & Dolcos, 2013). WM is a dynamic encoding process, whereby information is acquired and updated repeatedly with new information (Miyake & Shah, 1999). Research on cognitive processes evidenced that resources are utilized flexibly during attentional operations according to processing priorities (Yiend, 2010). Affective factors can modulate how information is stored and operated in WM (Baddeley, 2012), which is limited in terms of the amount of information that can be processed (Conway, Cowan, & Bunting, 2001; Stout & Rokke, 2010). Research on cognitive and affective tasks has evidenced that pervasive negative state emotions presented as distracting stimuli have associations with deterioration of WM performance (Magee & Zinbarg, 2007; Mitchell & Phillips, 2007; Storbeck, Davidson, Dahl, Blass, & Yung, 2015). Following preliminary findings, there are several aspects of the relationship between negative emotions and WM that still need to be explored related for example to negative social emotions implications on cognitive processes. Shame and guilt

are distinctive negative self-conscious emotions that arise from self-relevant transgression and failures (Tracy, Robins, & Tangney, 2007). Despite many similarities, the two emotions differ in their trajectories. Whereas guilt involves self-criticism towards a specific personal action and is associated with the harm that it may have caused to others, shame is related to a negative evaluation of the self, with the subsequent desire to hide or escape from a bad situation (Lewis, 1971; Tangney, Stuewig, & Mashek, 2007).

Although the relationship between negative ‘basic’ emotion (anger, sadness, disgust, fear) and WM has been widely examined in both clinical and non-clinical populations (Allen, Schaefer, & Falcon, 2014; Magee & Zinbarg, 2007; Schweizer & Dagleish, 2016), there is limited evidence about the influence of ‘negative’ self-conscious emotions, such as shame and guilt, on WM and cognitive control processes. Accessible and vivid memories related to self-conscious emotions provide the structure for personal autobiographical narratives and the reference points from which we make attributions and inferences in everyday life (Tracy et al., 2007). As shame and guilt convey crucial information about the way we consider ourselves, their elicitation can have a big impact on WM process especially if WM is concurrently acquiring other information. Dopamine plays a crucial role in enhancing WM processes (Söderqvist et al., 2012) and as recursive shame and guilt experiences

* Corresponding author at: Department of Psychology, Via Nirone 15, 20123 Milan, Italy.

E-mail addresses: cesarem.cavalera@unicatt.it (C. Cavalera), alessandro.pepe1@unimib.it (A. Pepe), valentino.zurloni@unimib.it (V. Zurloni), barbara.diana@unimib.it (B. Diana), olivia.realdon@unimib.it (O. Realdon), ptodis@tin.it (P. Todisco), gianluca.castelnovo@unicatt.it (G. Castelnovo), enrico.molinari@unicatt.it (E. Molinari), francesco.pagnini@unicatt.it (F. Pagnini).

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are related to depressive symptoms and to a diminished dopaminergic response (Kim, Thibodeau, & Jorgensen, 2011), these emotions could be both related to negative WM performances. Moreover, evidences showed that shame is strongly implicated in cortisol increases (Gruenewald, Kemeny, Aziz, & Fahey, 2004a, 2004b) that are related to WM impairments and memory retrieval (Oei, Everaerd, Elzinga, Well, & Bermond, 2006). Therefore shame may have greater impact than guilt in terms of predicting worse WM performances.

As a lot of studies that involved people with psychiatric diagnoses (Adler, Holland, Schmithorst, Tuchfarber, & Strakowski, 2004; Christopher & MacDonald, 2005; Williams et al., 2007) showed a detrimental effect of negative emotions on cognitive performances, it may particularly useful assess the link between negative self-conscious emotions and cognitive performances both in healthy populations and in those clinical populations with a susceptibility to negative self-conscious emotions. Within this perspective shame and guilt are considered to have a key role in people with eating disorders (Cavallera et al., 2017; Ferreira, Matos, Duarte, & Pinto-Gouveia, 2014; Gilbert & Miles, 2014; Levinson, Byrne, & Rodebaugh, 2016; Manzoni et al., 2009). Whereas anorexics often try to cope with guilt and shame prompted by the 'indulgent' act of eating, bulimic episodes of overeating are also marked by a profound sense of loss of control that elicits guilt and self-criticism (Garner & Garfinkel, 1985). Moreover, evidences underlined a link between WM capacity and cognitive strategies that are crucial for symptoms reduction in eating disorders (Brooks, 2016; Israel et al., 2015). More recently, Brooks, Funk, Young, and Schiöth (2017) evidenced that in some subtypes of eating disorder such as anorexia, working memory capacity may underlie excessive cognitive control and attention to details that can be related to the management cognitive control of appetite. Therefore, more evidences are needed in order to assess a possible link between negative self-conscious emotions and WM performances. Such a study may highlight a strong detrimental effect of negative self-conscious emotions on WM and it could better direct psychotherapy for eating disorders throughout the clinical practice in order to reduce the effect of such negative emotions before learning cognitive strategies.

The present study aims to explore the nature of the relationship between negative self-conscious emotions and WM performances, evaluated through a dual-task condition in two experiments involving a non-clinical group (Experiment 1) and a group composed by inpatients presenting different subtypes (anorexic, bulimic, binge eating, OSFED) of eating disorders (Experiment 2). We hypothesized that: (1) guilt and shame both have negative effects on dual-task performances; (2) shame has greater impact than guilt in terms of predicting worse WM performances. We tested the hypotheses in a sample from the general population and in a clinical sample composed of people with eating disorders.

Proportional performance in tracking was calculated by measuring the change in tracking between single- and dual-task conditions. Proportional performance in both tasks combined (1) was calculated by adding proportional performance in tracking and in digit recall task (Della Sala, Foley, Beschin, Allerhand, & Logie, 2010).

In the second step, participants were randomly assigned to one of the three different writing disclosure instructions of 15 min to elicit different negative social emotion experiences (Tangney & Dearing, 2002):

- Shame writing condition (SWC): 'In the next 10 min I would like you to write about an unpleasant experience in which you felt really ashamed. It should be a situation where you felt so bad about yourself that you wanted to deny it or to hide and run away. Try to let go and express all your thoughts and innermost feelings. Write freely without worrying about mistakes. This paper will not be read by anyone and you can do whatever you want with it'.
- Guilt writing condition (GWC): 'In the next 10 min I would like you to write about an unpleasant experience in which you felt really

guilty. It should be a situation where you felt so inadequate that you wanted to confess or amend the situation. Try to let go and express all your thoughts and innermost feelings. Write freely without worrying about mistakes. This paper will not be read by anyone and you can do whatever you want with it'.

- Neutral writing condition (NWC): 'In the next 10 min, I would like you to write about the furniture of the room you are in. Describe what you see avoiding emotional content or stressful thoughts. Write freely without worrying about mistakes. This paper will not be read by anyone and you can do whatever you want with it'.

Participants were randomly assigned to one of these three different writing conditions (GWC = 25, SWC = 25, NWC = 26). Before the writing disclosure task, the experimenter reassured all participants that no one would ever read the contents of the written text, that their personal privacy would not be violated and that any bias related to social desirability would be eliminated. Then the experimenter left the room to avoid interfering with the emotional experience disclosure.

In the third step, the experimenter re-entered the room and administered the digit recall and tracking task simultaneously again in order to evaluate potential differences in WM performances. As before, proportional performance in both tasks (2) combined was calculated by adding proportional performance in tracking and in digit recall task (Della Sala et al., 2010). Immediately after this, participants were administered the Italian version of the Shame and Guilt State Scale (SGSS-8) (Cavallera, Pepe, Diana, Zurloni, & Realdon, 2017) in order to assess the current levels of shame and guilt elicited by the different writing tasks. SGSS-8 is a self-rating scale of current (state) feelings of shame and guilt. Eight items (four for each subscale) are rated on a five-point Likert scale.

Finally, a debriefing session at the end of the procedure was provided for all the participants in order to offer a help to cope with possible negative emotions elicited or to provide further information about the study protocol.

1.1.1. Data analysis

Based on Cohen (1992), and assuming a large effect size (> 0.60) (Cavallera & Pepe, 2014), a power sample analysis was performed in order to detect an effect at the level of $p < 0.05$ with 80% power. The analysis was conducted with the software G-power (version 3.1.9), a minimum of 21 participants would be necessary when entering three groups in a repeated-measures ANOVA (Cohen, 1992).

To analyze the results, we used a repeated measures analysis of variance (ANOVA), with main effects for time and group, and a Time X Condition (GWC, SWC, NWC) interaction term. Specifically, we focused on Time X Group interactions, which suggest differential change over time by group, considering the dual-tasks scores obtained before (1), and after (2) the emotional writing procedure as dependent variables. Subsequently, in order to determine the relative contributions of shame and guilt to increases in deterioration of dual-task performances, a one-block hierarchical regression with enter method was applied (see Pedhazur, 1997 for further information). The regression model was set with the Δ dual task (2-1) as target variable and state shame and guilt scores from SGSS-8 as independent determinants.

In order to determine the relative contributions of shame and guilt on working memory performances for participants assigned to GWC and SWC, both state guilt and state shame were added in step 1. For participants assigned to NWC, a last regression was run with both state shame and state guilt included in step 1. Regression assumptions (e.g., homoscedasticity, multivariate normality) were checked and found to be fulfilled for all variables. Finally, a $p < 0.001$ Mahalanobis' distance criterion was used to identify and skip multivariate outliers. Two different measures were created on the based of both 4 items of guilt and shame. As a result, four cases were excluded from the sample, three

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