Overt head movements moderate the effect of depressive symptoms on mood regulation

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Abstract

A dysfunction in the regulation of negative mood states is one of the core symptoms of depression. Research has found that levels of depression are associated with the intensity of the mood regulation deficit. The present study aimed to explore the role the body plays in mood regulation processes. More specifically, we studied whether head movements can influence mood persistence in dysphoric states. Subsequent to a sad mood induction, participants were presented with a set of positive pictures immediately after performing either vertical (i.e., nodding) or lateral (i.e., shaking) head movements. We considered changes in mood from before to after the experimental task as an index of the effectiveness of mood regulation. As expected, the results showed that higher initial levels of depressive symptoms were associated with greater persistence of sad mood. More importantly, this association was present in participants who shook their heads, but not in those who nodded. These results show that body movements can contribute to mood regulation processes, thus expanding our knowledge of the psychopathology of mood disorders.

Key Words: Embodiment, mood regulation, head movements, moderation, sad mood induction, dysphoria.
Overt head movements and mood regulation

According to Thompson (1994), “emotion regulation consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating and modifying emotional reactions, especially their intensive and temporal features” (pages 27-28), and such a regulation implies the activation of emotional, cognitive or behavioral strategies (Hervas, 2011). Deficits in mood regulation characterize many different psychological disorders and, in particular, may play a significant role in the onset and maintenance of depression (Hervas & Vazquez, 2013). Using a longitudinal design, Beevers and Carver (2003) found that individuals who experienced a slower recovery from a sad mood induction were more likely to show an increase in depressive symptoms after a period of a few weeks. Other studies corroborate this relationship of deficits in mood regulation and depression. For example, Peeters, Nicolson, Delespaul, and DeVries (2003) found that negative mood states associated with daily negative events lasted longer in depressed patients compared to a non-depressed control group. In another study, Gilboa and Gotlib (1997) found that after a negative mood induction formerly depressed individuals, who were not currently depressed, remained in a negative mood for a longer period of time than never depressed controls. Whereas the studies outlined above focused on the regulation of negative mood, the level of dysphoria (i.e., depressive symptoms in non-clinical samples) also has an impact on the regulation of positive mood. In a laboratory study, McMakin, Santiago, and Shirk (2009) found that dysphoric participants have difficulties in maintaining positive emotional states in response to positive stimuli (i.e., positive emotion eliciting video clips) compared to nondysphoric controls. Research has also found that the severity of depressive symptoms is associated with difficulties regulating mood states (e.g., Williams,
Fernández-Berrocal, Extremera, Ramos, & Joiner, 2004). These results suggest a bidirectional relationship between mood regulation and depression. On one hand, impairments in the ability to regulate mood are considered to be a vulnerability factor to depression and, on the other hand, the more severe the symptoms are, the less able are individuals to regulate their mood states.

There is ample evidence that cognitive factors play an important role in emotional regulation deficits in depression (see e.g., Joorman & D’Avanzato, 2010). Yet, the contribution of bodily factors to regulatory processes has received much less attention in the literature, although it has long been known that body states, postures and gestures can influence psychological processes. As a prominent example, the psychologist William James suggested that body states precede higher order processes, such as affect. More recently, the embodiment approach has inspired researchers to analyze influences of body states on cognitive, social and affective processes (for a review see Niedenthal, Barsalou, Winkielman, Krauth-Gruber & Ric 2005). For example, Kraft and Pressman (2012) found that facial gestures influence physical and psychological reactions to stress. In this study, participants were divided into three groups; two of them were asked to maintain a facial expression in which muscles involved in smiling were active, whereas the third group was asked to maintain a neutral expression. Participants in the smiling groups showed lower heart rates during stress recovery and reported smaller decreases in positive affect during the stressful task than the neutral group. These results indicate that the activation of muscles related to facial expressions moderate the impact of stress in terms of affective and physical reactions.

Other studies have investigated whether gestures involving parts of the body other than the face are related to attitudes towards presented material (e.g., Cacioppo, Priester, & Berntson, 1993; Tom, Pettersen, Lau, Burton, & Cook, 1991). For example,
Tom et al. (1991) found that head movements associated with approach or avoidance (i.e., nodding and shaking) influenced participants’ attitudes when making decisions or showing preferences during an experimental task. Recent research has replicated and extended these findings (e.g., Briñol & Petty, 2007), allowing us to conclude that “some forms of motor biases or their sensory consequences can subtly influence a person’s attitude” (Cacioppo et al., 1993, p. 15).

From a theoretical point of view, the Interacting Cognitive Subsystem (ICS) theory proposed by Teasdale and Barnard (1993) provides a useful framework to integrate the existing findings. The ICS model specifically proposes that body states can directly affect emotional experience without the mediation of verbal/propositional codes. Similarly, Damasio states that “the essence of sadness or happiness is the combined perception of certain body states with whatever thoughts they are juxtaposed to” (Damasio, 1994; p. 146). Despite these theoretical considerations, empirical studies testing the hypothesis of a direct influence of body signals in maladaptive psychological processes are very scarce. One example which supports the ICS model is the study by Riskind and Gotay (1982). The authors found that posture (i.e., upright or slumped) affected participants’ emotional persistence. Likewise, Duclos et al. (1989) reported that facial gestures and bodily postures associated with anger, sadness or disgust affected participants’ emotional experience.

In the present study, we explored whether head movements juxtaposed to the visualization of positive material can moderate the influence of depressive symptoms on how efficiently participants regulate their mood after a sad mood induction. Head movements have been shown to affect participants’ emotions in previous research (Briñol & Petty, 2007). According to the ‘embodied validation’ hypothesis (Briñol, Petty, & Wagner, 2011, p. 1043), “the confidence that emerges from one’s body and its
position or movements can magnify the effect of anything that is currently available in people’s minds, including [...] cognitions, emotions, goals, and so forth. That is, confidence applies to whatever mental contents are salient and available at the time.” This theory predicts that body movements can moderate the influence that processing positive contents can have on participants’ mood. Based on this theory, we predicted that recovery from a sad mood would be facilitated by nodding head movements (as opposed to shaking head movements) during exposure to positive material. After a sad mood induction, participants were assigned to one of two experimental conditions. In one condition, participants performed vertical head movements (i.e., nodding), in the other condition they performed lateral head movements (i.e., shaking). We measured symptoms of depression and anxiety at the beginning of the experiment and the mood state prior to the mood induction, after the mood induction and after the experimental task.

According to the current literature, we first hypothesized that after the sad mood induction, participants with higher levels of depressive symptoms would show poorer mood regulation than participants with lower levels of depressive symptoms. Our second hypothesis was that performing nodding-like head movements accompanying the positive images would make it easier for participants to recover from their sad mood state better than performing shaking-like head movements would, particularly among participants with higher initial levels of depressive symptoms.

**Method**

*Participants*

42 undergraduate students (24% men, $M = 21.4$ years old) participated in this 20-minute experiment and received course credits for their participation. All
participants stated that they were right handed, had normal hearing and normal or corrected-to-normal vision.

Stimuli and apparatus

For the sad mood induction a 9-minute sad music piece (i.e., Prokofiev’s Russia under the Mongolian Yoke played at half speed) and three negative scenes were used. A similar procedure has been shown to be effective in inducing sad mood states (see Hervas & Vazquez, 2013 for a detailed description of the mood induction). The mood induction was introduced as an imagination ability task. Participants were instructed to imagine three negative scenes as vividly as possible, while listening to a piece of sad music which would help them to focus on the imagination task. All participants were exposed to the three scenes. In the first scene, participants had to imagine that they met a close friend, who quite affected revealed that his girlfriend died recently in an accident and he lost his job. In the second scene, participants had to imagine that they were lying a long time in bed, bored and frustrated as they were affected by a flu that impeded them to do anything. In the third scene participants had to imagine that they visit the hospital to see a close friend who is terminally ill. It is important to note that participants were on no occasion asked to modify or manipulate their mood states.

In order to facilitate participants’ mood regulation during the experimental task, participants were presented a sample of 25 pictures\(^1\) with positive valence \((M = 7.4\) in a scale ranging from 1 to 9\) and medium arousal \((M = 4.9\) in a scale ranging from 1 to 9\) were selected from the International Affective Picture System database (IAPS; Lang, Bradley, & Cuthbert, 2008). Pictures were presented on a black background (0.23 cd/m\(^2\)) in the middle of a 15-inch computer screen.

\(^1\) The 25 IAPS images used in the present study were 1440, 1463, 1540, 1720, 1810, 1811, 2030, 2040, 2057, 2080, 2091, 2160, 2224, 2344, 2346, 2362, 2391, 4609, 4610, 4617, 4623, 4640, 5270, 5480, 5628, 5660, 5820, 5830, 5890, 5982, 7200, 7260, 7410, 7570 and 7580.
Four visual references were used as visual guides to direct participants head movements. Each visual reference consisted of a green square (23 x 23 mm) in the middle of a yellow rectangle (38 x 51 mm). The visual references used to guide participants’ nodding-like movements were located in front of the participant; one situated at a height of 1.80 m and the other at a height of 0.8 m. The other two references were used to guide participants’ shaking-like movements and were placed to the left and right of the individual, at a height of approximately 1.2 m.

**Measures**

Measures of positive and negative mood state, symptoms of depression (Beck Depression Inventory-II; BDI-II; Beck, Steer & Brown, 1996) and anxiety (Beck Anxiety Inventory; BAI; Beck, Epstein, Brown & Steer, 1988) were collected. Internal consistencies of BDI-II and BAI were $\alpha = .83$ and $\alpha = .93$, respectively. To assess mood state, we used a visual analogue scale (EVEA; Sanz, 2001). In particular, we used the positive (e.g., cheerful, happy, optimistic) and negative (e.g., sad, depressed, melancholic) subscales (each consisting of 4 items). Participants were instructed to report how they feel at the present moment on Likert scales ranging from 0 to 10. This instrument has proved to be very reliable and highly sensitive to change (Sanz, 2001). In addition to the positive and negative mood evaluations, an overall mood scale (total EVEA) was calculated merging positive and reversed score negative items. In the present study, internal consistencies of positive, negative and total subscales collected at time 1 were $\alpha = .91$, $\alpha = .88$ and $\alpha = .81$, respectively.

**Procedure and design**

At the beginning of the experiment participants read and signed the consent form. Participants were then asked to complete a set of questionnaires consisting of
EVEA (time 1), BDI-II and BAI. These measures were considered baseline measures. Once the first set of questionnaires was completed, participants were induced into a sad mood state. Immediately after the mood induction, participants completed a second EVEA (time 2). Once the questionnaire was completed, participants were randomly assigned to one of the two experimental conditions. Participants in the nodding condition were asked to look twice at the visual references placed up and down in front of them, alternating between the two, whenever a cross appeared on the computer screen. In contrast, participants in the shaking condition were asked to look twice at the visual references placed at their left and right. In both conditions participants were told to just look at the pictures once they appeared on the screen. To hide the purpose of the research, the study was presented as an investigation of how directing foveal attention to peripheral regions may influence memory processes. To avoid that participants would move only their eyes, they were told that in order to maximize foveal attention it was necessary for them to move their heads, so their eyes could remain centered in their orbit, thus maximizing foveal attention.

The experimental block consisted of 50 experimental trials and lasted approximately 10 minutes. Each experimental trial consisted of a blank screen (1,500 ms), which was followed by a fixation cross (4,000 ms), followed by one of the selected pictures (3,500 ms) and a blank screen (2,500 ms). Each picture appeared twice during the experimental block. During the experimental task, participants nodded (shook) their head for approximately 3 minutes. At the end of the experimental block, participants were asked to complete a third EVEA (time 3) questionnaire.

Finally, participants were asked to guess the purpose of the experiment and then debriefed. None of them reported to be aware of the real aim of the study.

Statistical analyses
All statistical analyses were performed using the software package SPSS 15.0 for Windows.

A series of t-tests were performed on baseline measures (BDI-II, BAI, positive, negative and total EVEA at time 1) in order to ensure that both groups did not significantly differ in terms of the relevant variables at the beginning of the experiment. Similarly, a within participants t-test comparing raw EVEA scores at time 1 (t1) and time 2 (t2) was performed in order to test the effectiveness of the mood induction procedure. To test the possibility that the effectiveness of the mood induction procedure varied as a function of depressive symptoms, three stepwise linear regression analyses were carried out with positive, negative and total EVEA scores at t2 (post mood induction) as dependent variables. Positive, negative or total EVEA scores at t1 were introduced at Step 1 and symptoms of depression, as measured by BDI scores, were introduced at Step 2.

To test the two main hypotheses of the present study, stepwise linear regression analyses were performed. EVEA mood scores after the experimental task (t3) served as the main dependent variable. As variability among initial scores is a problem common to many pre-post comparisons, we entered post-induction (t2) EVEA scores at the first step of the regression models. Therefore, subsequent variables in the models predict residual change in EVEA scores. The centered continuous predictor “Symptoms of depression” was introduced in the second step, the categorical predictor “Type of movement” (0 = nodding; 1 = shaking) in the third step, and their interaction in the fourth step. In the case of statistically significant interactions, we conducted tests of the simple slopes of symptoms of depression conditioned at each of the two levels of Type of movement (head nodding versus head shaking; Aiken & West, 1991).
Results

Participants in the nodding condition did not significantly differ at Time 1 from participants in the shaking condition in any of the relevant variables (BDI-II, BAI, positive, negative and total EVEA, all p > .11). Descriptive statistics of t1 measures were BDI-II (M = 9.69, SD = 5.97), BAI (M = 10.38, SD = 9.66), positive (M = 23.02, SD = 7.19), negative (M = 11.50, SD = 9.64) and total EVEA (M = 51.52, SD = 12.76).

The sad mood induction procedure produced a significant decrease in positive mood (M_{t1-t2} = -8.90, t = 10.13, p < .001) and total mood (M_{t1-t2} = -16.57, t = 8.57, p < .001), as well as a significant increase in negative mood (M_{t1-t2} = 7.56, t = -6.00, p < .001). Symptoms of depression did not influence the effectiveness of the mood induction procedure on any of the EVEA mood subscales (all p > .65).

The results of the stepwise regression analyses are presented in Table 1. Cook’s distances ranged from .00 to .28, with a mean value of .03. Since values below 1 are considered to be acceptable, this analysis suggests that our results were not due to a small number of influential observations.

As can be seen in Table 1, Symptoms of depression was a significant predictor of change in negative and total mood, but not in positive mood. Type of movement was not associated with changes in mood state. Yet, most importantly, the interaction between Symptoms of depression and the Type of movement was significant for changes in positive and total mood state, and marginally significant for changes in negative mood state. These results indicate that the type of movement performed moderated the influence of Symptoms of depression on mood state changes, as it can be seen in Figure 1.
Simple slope analyses (Aiken & West, 1991) clarified the form of these interactions. Symptoms of depression was not a statistically significant predictor of changes in residual negative (β=.12, p=.43), positive (β=.09, p=.43), or total mood (β=-.08, p=.60) after the experimental task when participants nodded. Yet, symptoms of depression predicted changes in residual negative (β=.56, p<.01), positive (β=-.35, p=.03), and total mood (β=-.65, p<.01) when participants shook their heads. As expected, among participants who shook their heads, the severity of depressive symptoms was associated with a worsened mood after the experimental task. However, among participants who nodded, the effect of Symptoms of depression on the ability to regulate mood was not statistically significant.

Insert Figure 1

Discussion

The aim of the present work was to examine whether body movements may have an impact on mood regulation processes. Specifically, we examined whether overt head movements could moderate the relationship between symptoms of depression and mood regulation. In line with previous results, and confirming our first hypothesis, severity of depressive symptoms was associated with higher persistence of a sad mood after a sad mood induction. In general, participants with higher levels of depressive symptoms showed higher mood persistence when exposed to a set of positive stimuli than participants with lower levels of depressive symptoms. More importantly, overt head movements moderated this relationship, thus confirming our second hypothesis. Specifically, the association between symptoms of depression and the persistence of a sad mood was only present among those participants who performed shaking head
movements. The act of nodding the head seemed to weaken the effect of depressive symptoms, improving participants’ ability to regulate mood.

Earlier research has found that facial gestures moderate the influence of stress in affective and physical reactions (Kraft & Pressman, 2012) and that body posture and movement affect emotional reactions (e.g., Duclos et al., 1989; Riskind & Gotay, 1982). Our study expands these findings in two directions. First, it demonstrates that besides facial gestures, which are physiologically more directly linked to emotional neural circuitry, overt head movements affect mood regulation. This finding suggests that body movements, other than facial gestures, can influence the recovery from sad mood in dysphoric individuals, which could have important clinical implications. Secondly, the present study shows that the influence of body movements on emotional processes is not restricted to stress, but also applies to sad mood, potentially extending implications to the field of mood disorders.

Moreover, our results can help to explain some results found in previous studies from a different perspective. For example, previous research has reported that some strategies, which are efficiently used by non-depressed participants to regulate their mood, such as recalling positive information when they are in a sad mood (Joorman, Siemer, & Gotlib, 2007) or watching a positive clip (McMakin et al., 2009), are not equally effective when used by individuals with high levels of depressive symptoms. There is not a clear explanation for this null effect of standard strategies of mood regulation in depressed individuals. In light of our results, a plausible hypothesis is that body movements, gestures or facial expressions present in dysphoric individuals might be incongruent with the mood-enhancing task, preventing its effectiveness.

The present results support the theoretical principles that guide ICS theory, since modifying body states affected the efficacy of mood regulation. Actually, ICS theory
suggests that body signals directly affect the implicational level (i.e., schematic models of experience) in maintaining mood states. Specifically, this theory proposes that schematic models related to affect have to be continuously “regenerated” in order to maintain mood (Teasdale & Barnard, 1993). Bodily states in combination with propositional information (i.e., declarative knowledge) are considered to be responsible for mood maintenance. The present study provides initial evidence of the influence of the body (in our case, body movements) in the persistence of dysphoric states. Future research should assess more directly whether changes in body states may induce changes at the implicational level. The present study gives further support to the embodiment approach and underlines its potential clinical implications. In this sense, if this line of research is extended to clinical populations, it could help to enrich therapeutic approaches, making them more comprehensive by involving motor and corporal components in therapy, aimed at modifying the information received through body channels.

It must be noted, however, that the present study presents some limitations. First, no comparison was made between the movement conditions and a control condition involving no movement. Such a comparison would help to clarify the specificity of the movement effects. Considering that the experiment did not include such a control condition, it cannot be determined whether the effect was caused by the act of shaking one’s head. To promote the study’s potential clinical applications more convincingly, it would be necessary to examine whether the interaction pattern obtained here persists when comparing nodding with a ‘no movement’ condition. Second, the present study does not address the mechanisms involved directly. As suggested by Briñol and Petty (2007), bodily movements could influence mental processes by affecting some underlying processes (e.g., producing a bias, serving as peripheral cues for attitude
change). Although our design does not allow conclusions to be drawn about the mechanisms involved, our results are in line with the ‘embodied validation’ hypothesis proposed by Briñol et al. (2011), extending this approach to mood regulation processes.

In summary, the present study provides further evidence for the role of body states in mental processes, revealing their influence in mood regulation, a process closely related to emotional disorders. As stated by Damasio (1994, p.118) “the separation between mind and body is probably just fictional”.
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References


Table 1. Stepwise multiple regression analyses predicting changes in positive, negative and total mood state at t3.
### Table 1

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| * p < .05; † p < .10
Figure 1

1. Lower negative mood at T4 for higher depressive symptoms with nodding compared to shaking.
2. No significant difference in positive mood at T4 for low and high depressive symptoms with either nodding or shaking.
3. Lower total mood at T4 for high depressive symptoms with nodding compared to shaking.
Figure Captions

Figure 1.

Interaction effects between Symptoms of depression and Type of Movement when the change in negative (upper graph) positive (middle graph) and total mood (lower graph) between time 2 and time 3 is considered. Graphs are constructed from coefficients obtained in moderation analyses, following the recommendations for interpreting moderation effects by Jeremy Dawson (see http://www.jeremydawson.co.uk/slopes.htm for further information).