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# The Effects of Upright and Slumped Postures on the Recall of Positive and Negative Thoughts

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*This study assessed whether it was easier to generate positive and negative thoughts in either an upright or slumped position. Twenty-four participants, who reported no clinical depression or anxiety, completed the Tellegen absorption questionnaire and a self-assessment of imagery ability. Surface electromyography (sEMG) of zygomaticus major, heart rate, and respiratory rate were assessed across four 1-min counterbalanced conditions of either upright or slumped posture and either positive or negative thought generation. Posttrial checks of compliance were completed. At the end of the study, participants rated which thought was easiest to generate in the two postures. Significantly more participants (22), or 92%, indicated it was easiest to generate positive thoughts in the upright position. ANOVA of sEMG activity significantly distinguished positive and negative thoughts in both positions. Significant correlation coefficients were observed between scores on the Tellegen scale of absorption and the ability to generate thoughts quickly and between self-perceptions of imagery ability with the maintenance of thoughts across time. This study supports the finding that positive thoughts are more easily recalled in the upright posture.*

**KEY WORDS:** posture; sEMG; cognition; heart rate; absorption; thoughts.

## INTRODUCTION

Students and patients often report that when they stand up tall with their head up it seems easier to think positively or create positive images or thoughts and when collapsed it appears easier to access negative images or thoughts. Similarly it has been noted that depressed people in psychiatric facilities tend to walk in a slumped posture with their head down. As early as 1947, Lederer-Eckardt, in a psychoanalytical journal, hypothesized a relationship between posture and mood (Lederer-Eckardt, 1947).

Tangential research contains suggestions regarding aspects of the relationship between posture and mood. Riskind (1983) manipulated facial expression and posture to determine if they helped "prime" memory retrieval. He found that positive facial and posture (upright-expansive) expressions facilitated recall of positive past memories more than negative

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memories and vice-versa. This was particularly true for positive or pleasant memories. Riskind (1984) also found that if the posture of the participant (upright or slumped) matched the outcome of the experiment (winning or losing) moods were affected. If individuals slumped after experiencing failure or helplessness, the slumping minimised feelings of helplessness, depression, and motivation. If they slumped after success, they lost motivation and feelings of control. These findings were interpreted as incongruence between outcome (task success) and slumped posture (negative affect). Schouwastra, Sanneke, and Hoogstraten (1995) found that individuals assigned different emotions to various postures as depicted by stick figures. Straight upright posture of the stick figure was assigned the most positive emotions, whereas shoulder and head forward was assigned the most negative emotion.

Although the above research was based upon self-report, surface electromyography (sEMG) of facial expression during affective states has received extensive study (for reviews see Bradley, 2000; Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000). Surface EMG differences in the zygomaticus major or cheek facial muscles have been shown to distinguish happiness from sadness (Gehricke & Shapiro, 2000; Jaencke, 1994; Sirota & Schwartz, 1982). More extensive and recent work by Larsen, Norris, and Cacioppo (2003) found that the corrugator supercilii responds to both positive and negative affect, whereas the zygomaticus major distinguishes more clearly positive affect.

Boiten (1996) and Levenson and Ekman (2002) found differences in heart rate when they had participants manipulate their facial expressions. These differences were not attributed to either the difficulty or the time needed to make the facial configuration or the activation of other nonfacial muscles. This suggests that more than one psychophysiological system is activated when facial expressions change.

This study explores whether an individual's slumped or upright posture will affect his/her recall of positive and negative thoughts. The study also explored the relationships between psychophysiological measures and self-reports of mood state, absorption, and imagery ability.

## METHOD

### Participants

Eleven males, mean age of 24, and 13 females, mean age of 32, voluntarily participated in the study. The students were from a holistic health class at a metropolitan university and were naive as to the expectations of the study.

### Instruments

The participants completed a paper and pencil background questionnaire that asked about injuries or disorders related to the head, neck, chest, or abdominal region. They were asked about whether they were experiencing or had experienced depression or anxiety that required medical or psychological intervention. Because the purpose was to use nonclinical participants, one person was not included in the study as she was receiving treatment for depression. They also completed the Tellegen Scale (Tellegen & Atkinson, 1974) that assessed their ability to create and be "absorbed" by one's thoughts or images. Studies using factorial analyses (Glisky, Tataryn, Tobias, Kihlstrom, & McConkey, 1991; Roche & McConkey, 1990) report that absorption is similar to but not identical to hypnotisability, and is significantly correlated with measures of a broader dimension of openness to experience (awareness of inner feelings, unusual perceptions, etc). Additionally, the participants were asked to self-rate their imagery ability. The question, "When you imagine something, how well do you generally see, feel, smell, or talk your way through the image?" was rated on a scale from 0 = *nothing* to 10 = *extremely vivid and clear*.

Prior to the psychophysiological recordings, each person was asked to rate her/his mood state from 0 = *depressed* through 5 = *feel OK* to 10 = *top of the world*, *very happy*. This was included to eliminate any individuals who may have been experiencing a very depressed state on the day of the testing. No individuals were excluded.

Physiological signals were recorded by a ProComp + (Thought Technology Ltd). Surface electromyography (sEMG) was recorded with two active electrodes placed over the left zygomaticus major muscle (cheek) and the reference electrode placed equidistant from the active electrodes. The band pass filter was set at 100–200 Hz. Heart rate (HR) was derived from a photoplethysmyograph recorded from the second finger of the left hand. Respiration assessment was included to ascertain whether the postures of the participants were differentially affecting their breathing and perhaps modifying sEMG or HR. Respiration was recorded with a strain gauge sensor placed 2.5 cm above the umbilicus. Respiration rate (RR) was calculated by counting the number of breaths per minute excluding segments that contained movement artifacts.

## Procedure

Participants filled out the subjective questionnaires, physiological sensors were applied, and the physiological signals were calibrated while the participants sat comfortably in a chair. Then the participants were asked to sit comfortably with their eyes closed for a 5-min resting baseline while they were asked to "soften their eyes, smooth the forehead, maintain space between their back teeth and to empty their mind." These same instructions were repeated for a 1-min relaxation period between each experimental condition. The experimental conditions were counter-balanced and consisted of the following four 1-min conditions: either an upright posture ("sit up tall and with your back straight, head up, eyes closed") or a slumped posture ("sit in a slumped position, head down, eyes closed") using either negative thoughts ("think or feel of past events that make you sad, depressed, or bad") or positive thoughts ("think or feel of past events that make you happy, joyous, or good"). At the end of each experimental trial, participants rated the following questions on a scale from 0 = *not at all* through 5 = *somewhat* to 10 = *extremely well*. "Overall, how well were you able to obtain the requested thought or mood?" "How intense were the thoughts/feelings of the thoughts or mood "? "How much time (in 10-s blocks from 0 to 60 s) were you able to maintain the thoughts or mood?" Individuals who were unable to maintain the appropriate thought for at least 40 s at a moderate intensity (scale of 5) were eliminated from the data analysis. Three individuals were eliminated from the data analyses for failure to meet this criterion.

At the end of the experiment, each participant was asked which thought or mood state, positive or negative, was easiest to generate in the upright postures. This question was repeated for the slumped posture. Participants were then debriefed and asked not to disclose the nature of the experiment to others.

## Data Analysis

Chi-square was used to examine group rating comparisons. Pearson correlations were used to elucidate the relationships between or among the dependent variables, and a one-way ANOVA with repeated measures was used for all physiological measures with the post-hoc analysis being the Newman–Keuls. Significance was set at the $p < .05$ level for all assessments. The means of each 1-min trial of the physiological data were calculated following the exclusion of movement artifacts.

# RESULTS

Positive thoughts were significantly easier to create in the upright posture for 22 of 24 participants, $\chi^2(1, 23) = 10.08$, $p < .01$. There was no significant statistical difference for negative thoughts being created in the slumped posture even though 17 of 24 participants rated negative thoughts easier to produce, $\chi^2(1, 23) = 2.14$, $p = .14$.

Positive thoughts were significantly associated with an increase in sEMG from the zygomaticus major muscle. An ANOVA with repeated measures of the sEMG data of baseline and four experimental conditions showed significant differences, $F(4, 80) = 3.18$, $p < .05$. The Newman–Keuls post-hoc analysis indicated significantly more sEMG in the positive thought versus the negative thought or baseline conditions, in both the upright and the slumped positions (see Fig. 1). Three of the individuals failed to maintain the positive or negative thought for at least 40 of the 60 s in each of the trials with a moderate intensity and, thus, were eliminated from the psychophysiological analyses.

There were no significant differences in the RR and HR physiological measures when comparing across all conditions. There were no significant correlations between the

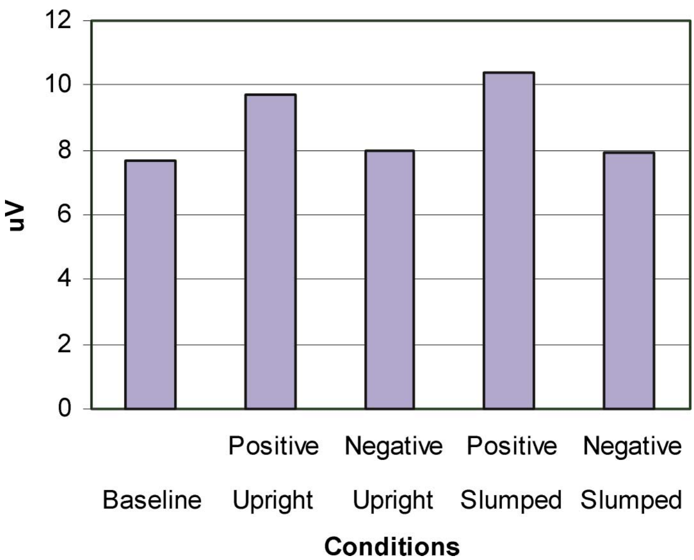


**Fig. 1.** Mean zygomaticus major muscle sEMG activity for all participants across all postural conditions.

self-report measures of current mood state and any of the posttrial questions in-length of time to recall and maintain the thoughts nor the intensity of the thoughts recalled. There were significant correlations ($p < .05$) between the prestudy self-report question on imagery ability and the amount of time the person was able to maintain the image in the positive ($r = .49$) and negative ($r = .51$) trials. The group average for the Tellegen absorption scale was 24.0 compared with a normative average of 19.8. Scores on the Tellegen absorption scale were significantly ($r = -.41$) and negatively correlated with the individuals' reports of how quickly they could obtain a negative thought in the slumped position. The Tellegen score was also significantly ($r = .46$) correlated with their prestudy self-rating of their imagery ability.

A comparison of the subgroup of individuals who thought negative ($n = 14$) from those who thought positive ($n = 7$) in the slumped position, showed trends suggesting that they have different physiological patterns for sEMG and HR ($p < .10$). The participants who reported that thinking positive was the easiest to generate even in the slumped position had a trend of higher zygomaticus major sEMG activity for the positive thoughts in both postural conditions than those who reported that negative thoughts were easiest to generate. In addition, the positive thinking subgroup had lower physiological arousal levels across conditions as indicated by HR.

## DISCUSSION

Participants self reported that positive thoughts are significantly easier to generate in the upright position. This is similar to Riskind (1983) and Schouwastra, Sanneke, and Hoogstraten (1995) in that their individuals assigned more positive thoughts to an upright position. The higher sEMG in zygomaticus major found in the positive thought condition compared to the negative condition was also in agreement with earlier findings where only thoughts but not postural positions were considered (Gehricke & Shapiro, 2000; Jaencke, 1994; Sirota & Schwartz, 1982). In this study, zygomaticus major sEMG also remained high in the slumped postural position when participants were asked to think of positive thoughts.

The failure in this study of the sEMG of left zygomaticus major muscle (cheek) to distinguish between a negative thought and a pretrial rest period agrees with Larsen, Norris, and Cacioppo's (2003) recent work. They reported that only the corrugator supercilii reciprocally responds to both positive and negative thoughts. Future work on facial expressions as markers for thought patterns should include the sEMG of at least the zygomaticus major and the corrugator supercilii. Future studies should also explore other physiological measure such as right and left frontal EEG for identifying positive and negative thoughts, because depression appears to change the EEG activity in those regions (Lane, Reiman, Ahern, & Schwartz, 1997).

Unlike Boiten (1996) and Levenson and Ekman's (2002) participants, the HR of our participants did not differ when expressing either positive or negative thoughts. The participants did report being able to recall and maintain both positive and negative thoughts and the sEMG confirmed positive thought production but perhaps the thought production was not significantly strong enough to evoke cardio-respiratory responses. Or, the differences may be due to their studies (Boiten, 1996; Levenson & Ekman, 2002; Riskin, 1983) actively asking their participants to manipulate their facial expression and that may have more strongly activated other psychophysiological systems. In addition to asking participants just to think/feel thoughts without reference to muscle manipulation, as was done in this study, future studies should also include active muscle manipulation with the postural adjustments.

Although twice as many participants reported that negative thoughts were easier to generate in the slumped position, it was not statistical significant. Perhaps failure to obtain significant differences may be due to what appears to be a unique subgroup of participants who found positive thoughts easier and more preferable to think all the time. We recommend a replication of this study with a larger sample size and measures of positive versus negative orientations or traits to determine if there are distinct sub-groups which may be reflected in differing psychophysiological responses. This possibility needs further study as it may have important implications for researchers who may use psychophysiological measures without accounting for the thought orientation of the participants.

Clinicians may wish to adapt their therapeutic strategies and incorporate posture manipulation when applying cognitive restructuring techniques that involve positive and negative thought manipulation. Body position could possibly be used as a cue and physiological amplifier to enhance or inhibit positive or negative thoughts.

Participants who scored higher on the Tellegen absorption scale were able to generate negative thoughts more quickly than those who had lower absorption scores, but only in the slumped position. Whether posture is more responsible for this relationship or whether it is the negative thinking that causes one to be more absorbed needs further investigation. Surprisingly, the Tellegen scale did not correlate to an individual's ability to maintain an image or thought across time nor the intensity of that image or thought. This is unlikely to be due to the absorption ability of the participants as their average score was higher than the average reported by Tellegen.

Participants who reported better imagery abilities were able to maintain the positive or negative thoughts for a longer time period during the experimental trials. This finding supports the belief that not all individuals can image equally and that it may be prudent to determine a person's ability to image when asking individuals to sustain thoughts or images across time.

In summary, this study suggests that posture may significantly affect evocation of positive or negative thoughts. In particular, positive thoughts are easier to produce in an upright position. Clinicians may need to account for, and incorporate posture, when applying cognitive restructuring techniques that involve positive and negative thought manipulation.

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## REFERENCES

Boiten, F. (1996). Autonomic response patterns during voluntary facial action. *Psychophysiology*, *33,* 123–131.

Bradley, M. M. (2000). Emotion and motivation. In J. T. Cacioppo, L. G. Tassinary, & G. Berntson (Eds.), *Handbook of psychophysiology* (2nd ed., pp. 602–642). New York: Cambridge University Press.

Cacioppo, J. T., Berntson, G. G., Larsen, J. T., Poehlmann, K. M., & Ito, T. A. (2000). The psychophysiology of emotion. In R. Lewis, & J. M. Haviland-Jones (Eds.), *The handbook of emotion* (2nd ed., pp. 173–191). New York: Guilford.

Gehricke, J., & Shapiro, D. (2000). Facial and autonomic activity in depression: Social context differences during imagery. *International Journal Psychophysiology*, *41,* 3–64.

Glisky, M., Tataryn, D., Tobias, B., Kihlstrom, J., & McConkey, K. (1991). Absorption, openness to experience and hynotizability. *Journal of Personality and Social Psychology*, *60,* 263–272.

Jaencke, L. (1994). An EMG investigation of the coactivation of facial muscles during the presentation of affect-laden stimuli. *Journal of Psychophysiology*, *8,* 1–10.

Lane, R. D., Reiman, E. M., Ahern, G., & Schwartz, G. E. (1997). Neuroanatomical correlates of happiness, sadness and disgust. *American Journal of Psychiatry*, *54,* 926–933.

Larsen, J. T., Norris, C. J., & Cacioppo, J. T. (2003). Effects of positive and negative affect on electromyographic activity over zygomaticus major and corrugator supercilii. *Psychophysiology*, *40,* 776–785.

Lederer-Eckardt, G. (1947). Gymnastics and personality. *American Journal of Psychoanalysis*, *7,* 48–52.

Levenson, R. W., & Ekman, P. (2002). Difficulty does not account for emotion-specific heart rate changes in the directed facial action task. *Psychophysiology, 39,* 397–405.

Riskind, J. H. (1983). Non-verbal expressions and the accessibility of life experience memories: A congruence hypothesis. *Social Cognition*, *2,* 62–86.

Riskind, J. H. (1984). They stoop to conquer: Guiding and self-regulatory functions of physical posture after success and failure. *Journal of Personality and Social Psychology*, *47,* 479–493.

Roche, S. K., & McConkey, K. M. (1990). Absorption: Nature, assessment and correlates. *Journal of Personality and Social Psychology*, *59,* 91–101.

Schouwstra, S., Sanneke, J., & Hoogstraten, J. (1995). Head position and spinal position as determinants of perceived emotional state. *Perceptual and Motor Skills*, *81,* 673–674.

Sirota, A. D., & Schwartz, G. E. (1982). Facial muscle patterning and lateralization during elation and depression imagery. *Journal of Abnormal Psychology*, *91,* 25–34.

Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-experiences "absorption": A trait related to hypnotic susceptibility. *Journal of Abnormal Psychology*, *83,* 268–277.