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Repressors vs. low- and high-anxious coping styles: EEG differences during a modified version of the emotional Stroop task

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ABSTRACT

In this study of 49 undergraduate university women, those exhibiting a repressive coping style – characterized by defensiveness against negative emotions – were compared to women with low-anxious and high-anxious coping styles during neutral and negative versions of a computerized emotional Stroop task (EST). Using Weinberger, Schwartz, and Davidson's (1979) approach, the present study implemented the Marlowe–Crowne Social Desirability and the Spielberger Trait Anxiety scales for selection. Participants viewed neutral or negative words during the EST but responded to the color of the word. Analysis of continuous EEG recordings for the negative vs. neutral words revealed that the repressor group differed significantly from the other two groups in many aspects but that low- vs. high-anxious groups differed in fewer aspects. Based upon Eysenck and Derakshan's (1997) model, repressor women appear to differ from low- and high-anxious women by utilizing an inhibitory process to avoid perceiving low-intensity threatening stimuli.

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1. Introduction

Repression combines high defensiveness with low sell-reported anxiety (Weinberger et al., 1979). The default coping mechanism for repressors – characterized by defensiveness against negative emotions – entails shifting attention away from negative or threatening stimuli when the intensity level of threat is low but to implement a more active reinterpretation strategy when the intensity level of threat is high (Kline et al., 1993; Langens and Mörth, 2003). While some might view the repressive coping style as maladaptive, recent studies indicate an adaptive benefit to this coping style (e.g., Coifman et al., 2007), which encourages more research in this area.

Contemporary repressor research evolved with Byrne's repression-sensitization model (Byrne et al., 1963), and was psychometrically refined throughout the 1970's (Kahn and Schill, 1971; Weinberger et al., 1979). Especially relevant to the repressive coping research is the theoretical conceptualization of "repressors" by Weinberger and his colleagues (Weinberger and Davidson, 1994; Weinberger and Schwartz, 1990) along with the electroencephalographic (EEG) findings of Kline et al. (1998b).

Repressors differ from low- and high-anxious individuals in how they process and react to negative stimuli (Weinberger et al., 1979). When exposed to cognitive and physiological stressors, low-anxious individuals report a low level of anxiety and demonstrate low autonomic arousal, while high-anxious individuals report high levels of anxiety and demonstrate high autonomic arousal. By contrast, repressors appear to dissociate from their perceptions of negative information and report low anxiety while showing enhanced autonomic arousal typically associated with high anxiety. Thus, repressors exhibit a combination of (perceived) low-anxiety and high defensiveness (Bonanno et al., 1991). Repressors cope with external and internal stimuli by increased unconscious processing of emotion in the service of inhibition of threatening material (Kline et al., 1998b; Langens and Mörth, 2003). Weinberger et al. (1979) suggested that repressors have a "heighted recognition threshold" for anxiety provoking stimuli. In high-defensive individuals the increase in unconscious processing may facilitate active inhibition during high levels of threat (Kline et al., 1993). In instances of low levels of threat, repressors may instead rely on their default strategy of avoiding negative information in order to perform the task at hand.

Eysenck and Derakshan (1997) proposed a four factor theory of cognitive processing for threatening information in low-anxious, high-anxious, and repressor personality types. According to this theory, low-anxious individuals process threatening information without altering their perception of its nature, while high-anxious individuals engage in attentional bias by shifting their attention towards the threatening stimuli. By contrast, repressors shift their attention away from negative stimuli.

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According to Krohne (1989), cognitive avoidance and vigilance are general cognitive strategies applied to the environment by repressors and high-anxious individuals. Derakshan and Eysenck (1997) reinterpreted cognitive avoidance as opposite attentional bias or the tendency to shift attention away from negative stimuli and towards positive or neutral stimuli in the environment. They considered vigilance an attentional bias towards negative environmental stimuli. If Krohne's theory were accurate, then the reaction times of high-anxious and repressor individuals should be consistent across all conditions of an emotional Stroop task (hereafter referred to as EST). Repressors would respond slower to task related stimuli in neutral and negative versions of an EST, while high-anxious participants would respond more quickly. In contrast, if Eysenck and Derakshan's (1997) four factor theory were correct, then differences between repressors and high-anxious individuals should only be apparent during the negative condition of an EST. Low-anxious individuals who utilize neither bias should have no differences across tasks according to either theory.

Not only does the type of stimuli elicit different responses between the coping styles but the requirements of the task may also moderate cognitive task performance (Brosschot et al., 1999). When threatening information is presented separately, either spatially or temporally, repressors seem to exhibit an attentional bias away from a probe or may inhibit negative information, thus facilitating task performance (E. Fox, 1993, 1994; N. Fox, 1994). If, however, threatening information is presented simultaneously with the probe, forcing attention toward the threatening information, repressors may have difficulty inhibiting the negative information (Dawkins and Furnham, 1989; Derakshan and Eysenck, 1998). Other researchers, however, have not been able to replicate these results (e.g., Myers and McKenna, 1996). A potential reason is that the cognitive task must actively engage the participants in order to detect the ongoing processes associated with the coping style (Houtveen et al., 2001).

While behavioral studies provide one method of investigating coping style differences, electrophysiological studies provide another. EEG studies have reported different patterns of cortical activity, usually in alpha or theta frequency bands, between coping styles during rest and task performance (Lorig et al., 1994–95; Wexler et al., 1992). Assuming that increased alpha power is associated with decreased cortical activity in that cortical region (Shagass, 1972), emotion research has often reported that less relative alpha power in the right (compared to left) frontal region – and sometimes anterior temporal area – is correlated with greater dysphoric affect and greater withdrawal motivation, while an opposite relation is observed in happy affect (e.g., Sobotka et al., 1992; Tomarken et al., 1990).

However, there are important caveats to this conceptualization. Harmon-Jones et al. (in press) argue that motivation provides a better explanation for hemispheric asymmetries in cortical activity than affective valence. Individuals experiencing mania have been shown to have greater left frontal activation (Kano et al., 1992), and individuals with a proneness to hypomania/mania symptoms demonstrated left-frontal activation when stimuli evoked anger (Harmon-Jones et al., 2002). Harmon-Jones and Gable (2009) have also found that in the experimental environment, increased motivational factor such as the amount of time since a previous meal significantly impacted cortical asymmetry when viewing positive food stimuli, but not other positive images. Their findings suggest that a motivation to perform well in the experimental environment may create conditions that facilitate of left frontal activation in repressors, because they are motivated to be perceived positively.

Crawford et al. (1996) demonstrated differences in low (7.5–9.45 Hz), mid (9.5–11.45 Hz), and high (11.5–13.45 Hz) alpha – as opposed to just "general" alpha – during self-recall of positive and negative memories. The type of memory impacted low alpha but did not affect mid nor high alpha recordings. While sustained attentional abilities and alertness influence low alpha readings, general mental workload may play into high alpha frequencies (Sterman et al., 1994). Increased low alpha frequencies are also thought to indicate poor cognitive performance (Bosel, 1992), while fluctuations in attentional resources seem to desynchronize mid alpha (Crawford et al.). If differences in coping styles impact transient attentional processing we would expect to see differences within the mid alpha band.

Theta power, on the other hand, is oftentimes associated with focused attention (Schacter, 1977), particularly if it is higher theta (Crawford et al.). Specifically, low theta (3.5–5.45 Hz) may be affected by drowsiness and inactivity whereas high theta (5.5–7.45 Hz) may be affected by efficient or attentive performance (Schacter). With respect to coping styles, Stenberg (1992) found stronger frontal theta in high-anxious individuals than low-anxious. The theta rhythm has also been implicated in emotional and cognitive processes (for reviews, see Crawford et al. and Schacter). If the task impacts emotional processing and attentional processing than greater theta power should occur during the neutral task. However, if the task only impacts the transient aspects of attention processing, high theta may occur.

While the repressor literature has largely overlooked beta power, the present study investigated this band because of the effects that negative emotions (Cole and Ray, 1985), vigilance (Makeig and Inlow, 1993), and recall of negative emotional stories (Crawford et al.) all increase beta activity. As the EST requires ongoing vigilant attention, it is anticipated that the EST will be correlated with increases in beta activity.

At rest, repressor women showed a significant anterior asymmetry – left greater than right – in broad band alpha power (7.5–13.45 Hz) in the midfrontal and lateral frontal sites that differed from non-repressor women (Tomarken and Davidson, 1994). Interestingly, Kline et al. (1998a) found this replicated for women but not men. Greater left frontal activation was correlated with positive affect across many paradigms (Tomarken et al., 1992). Based upon Davidson's model for differential hemispheric activation for positive emotional approach (right > left alpha power) and negative emotional avoidance (left > right alpha power), these findings suggest that repressors' EEG activation patterns may reflect underlying anxiety (Johanson et al., 1992).

Repressors appear to have a unique EEG activation pattern when engaged in tasks that produce cognitive and physical stress. During recall of positive and negative memories, broad band theta power (4.5–7.45 Hz) across all measured regions was reduced in repressors when compared to non-repressors (Lorig et al., 1994–95). Most importantly, theta asymmetry differences were observed in the posterior region: repressors exhibited reduced theta power in the right hemisphere, while low-anxious and high-anxious participants exhibited the opposite. Lorig et al. proposed that reduced right hemisphere theta power in repressors indicated less emotional arousal to negative memories than exhibited in low- and high-anxious individuals. This suggests repressors may possess an under-activated right posterior region, an area that Heller's model (1993) associates with emotional arousal.

When repressors are not given the opportunity to use the ongoing avoidant, attention switching strategy, such as during a word recognition task, they showed decreased posterior alpha power following registration of emotional words in comparison to neutral words (Kline et al., 1998b). When word trials contained sexually taboo words, which most significantly affected repressor task performance, alpha power (7.5–13.45 Hz) markedly decreased in the right hemisphere (Kline, Schwartz, et al.). Increase in behavioral measures combined with decrease in broad band alpha power suggests that the task with sexually taboo words demanded the greatest cognitive involvement and thus activated the right hemisphere. It follows that active cognitive processing suppresses alpha waves (which are usually associated with a relaxed and alert state).

The studies reviewed here required repressors to direct their attention toward the meaning of the word and process the emotional

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