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BRIEF REPORT

Autonomic reactions to mutilation pictures: Positive affect facilitates safety signal processing

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Abstract

For survival, humans are continuously vigilant for signs of danger. Equally important, but less studied, is our ability to detect and respond to safety cues. The trait of positive affect may be a key component determining human variability in safety detection. Here we investigate autonomic and self-report reactivity to pictures of mutilated bodies, after reading a text about the art of mimicking injuries in the movies. Participants that scored high in positive affect trait showed attenuated autonomic reactions to the mutilation pictures. Thus, high positive affect facilitated engagement in safety cues and modulated reflexive reactions of the brain's defense system.

Descriptors: Emotion, Heart rate, Electrodermal, Affective pictures, Positive affect, Safety

Contemporary theories of emotion are based on the belief that, in order to survive, animals, including humans, are continuously evaluating the presence or absence of risk in the environment, identifying signals of danger or security. The interaction between risk and safety factors, internal and external to the individual, is a balance that results in adaptive behavior.

Although most research is concerned with the identification of signals that predict danger, relatively little attention has been given to the identification of signals that predict safety. Safety signals can indicate either the absence of danger or its cessation (Lohr, Bunmi, & Sawchuck, 2007). They were also proposed to provide information about potential positive outcomes to reward or facilitate behavior (Rogan, Leon, Perez, & Kandel, 2005).

Pioneer works by Lazarus and colleagues employing threatening films showed that manipulation of beliefs about the scenes could reduce the expected autonomic responses and also that personality traits (measured through the Minnesota Multiphasic Personality Inventory [MMPI]) could modulate this attenuation (Lazarus & Alfert, 1964; Speisman, Lazarus, Mordkoff, & Davison, 1964). Their strategy was to give safety hints that subtly implied a reduced aversiveness of the films' stressful events.

An important internal factor that could modulate safety detection mechanisms is a trait disposition favoring positive affect. Individuals high in positive affect are more actively engaged in the world, show a predominant approach disposition and high reward sensitivity, and experience more persistent positive mood (Whittle, Alien, Lubman, & Yucel, 2006). An instrument widely used[1] to assess affective traits is the Positive and Negative Affect Schedule (PANAS) designed by Watson, Clark, and Tellengen (1988).

In the same vein as Lazarus' studies, here we investigated whether fear-related psychophysiological reactivity to the viewing of mutilation pictures would be attenuated by a preceeding safety text. Furthermore in the present study we explored if positive affect trait, assessed by the PANAS, favors the engagement in safety cues. We hypothesized that those participants high in positive affective trait would be more prone than low-positive affect participants to be engaged by the safety cues, and thus their psychophysiological reactions in the safe context would show relative attenuation.

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[1]ISI Web of Knowledge (http://apps.isiknowledge.com/UA_GeneralSearch.do). The exact number of citations as of July 15, 2008, was 3,749.

Methods

Participants

Ninety-five male students (mean age = 22.0 years old, *SD* = 3.12) from the Federal University of Rio de Janeiro in Brazil participated in the study. Participants reported no neurological or neuropsychiatric diseases, and none were taking medication. A written consent was obtained and the Institutional Review Board and Ethics Committee of the Federal University of Rio de Janeiro approved the study.

Positive Affect Trait

The positive affect trait was measured by the Positive and Negative Affect Schedule–trait version (PANAS-T; Watson et al. 1988). This scale was filled at the start of the experimental session before fixing the electrodes. The PANAS is a 20-item scale consisting of 10 adjectives that describe the positive and the negative moods. Participants are asked to rate the degree to which they feel each emotion in general on a 1–5 scale (1 = *very slightly or not at all*, 5 = *extremely*). Participants with scores for the positive affect trait above the median of the sample (*M* = 34) were assigned to "high" positive trait subgroup and those with scores equal or below the median to "low" positive trait subgroup.

Picture Selection

Twenty-four pictures of mutilated people (valence: mean = 2.1; arousal: mean = 6.1) and 24 pictures of objects and utensils (valence: mean = 4.8; arousal: mean = 2.4) were selected from the International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 1999). Stimulus timing and presentation as well as the recording of responses were controlled by a computer.

Physiological Recording

Skin conductance Ag-AgCl sensors were attached to the second and third phalanges of the nondominant hand. The skin conductance response (SCR) was acquired using a constant voltage (0.5 V) with a GSR100A module coupled to the MP100, amplified (× 2000), low-pass filtered (10 Hz) and sampled at 240 Hz via BIOPAC (BIOPAC Systems Inc.). Skin conductance responses with amplitudes higher than 0.02 μS were analyzed within a temporal window of 1 to 5 s after each picture onset. The number of skin conductance responses to the whole set of pictures was calculated for each block.

Electrocardiogram electrodes were fixed on the chest. The electrocardiogram was recorded from a single lead that ensured a prominent R wave at a sampling rate of 240 Hz through an electrocardiograph ECG100A module coupled to the MP100 system (BIOPAC Systems Inc.). After R wave peak detection, heart rate series were generated and, subsequently, visually inspected for artifacts. Subsequent editing rejected $<1\%$ of the detected events. For each picture presented, the heart rate 1 s before the picture onset and during the following 3 s was estimated by cubic spline interpolation, resulting in evenly spaced heart rate series segments (half-second bins). The heart rates for each picture presentation were then aligned and averaged. Heart rate change was calculated as the peak deceleration during the 3 s following picture onset compared to the 1-s average before the onset, resulting in a heart rate deceleration value for the mutilation block and one for the neutral block.

Procedure

Participants sat in front of a monitor in a sound-attenuated and temperature-controlled room under dim ambient light. They were instructed to watch the monitor and to avoid making movements.

Two fixed sequences of pictures, mutilation and neutral, were presented. To attenuate the aversiveness of the unpleasant block, participants (*N* = 46) read a text about the wonderful makeup tricks used to mimic wounds in movie productions before presentation of the mutilation sequence. Before the neutral picture sequence, they read a text about tool fabrication. The following instruction preceded the presentation of the mutilation pictures: "Now you'll see cinema makeup scenes of violence. Attention: your task while observing each one is to have always in mind that they are cinema makeup productions, even if they look very real." The instruction before the neutral block was: "Now you will see examples of objects and utensils." To further enhance the instructions, a fictitious credit was displayed for 4 s before each picture presentation. Each picture within a block was presented for 3 s followed by 5 s of black screen. The repeated sequences within a block were (a) credits (4 s), (b) black screen (1 s), (c) picture (3 s), and (d) black screen (5 s). The picture stimulus onset asynchrony was then 13 s. The order of presentation of the mutilation and the neutral blocks was balanced across participants.

Another group of participants (*N* = 49) underwent the same procedures except for the text read before the mutilation block, which, in this case, dealt about worldwide violence. The following instruction preceded the presentation of the mutilation pictures: "Now you'll see examples of violent acts from different cultures. Attention: your task while observing each one is to have always in mind that they are real scenes."

Finally participants were thanked and debriefed.

Self-Report Evaluation

At the end of the mutilation block, the participants single rated the set of mutilation pictures on a 10-point Likert-type scale of hedonic valence (1 = *very unpleasant*; 10 = *very pleasant*).

Data Analysis

Five subjects (2 from the group exposed to the text about cinema makeup and 3 from the group exposed to the text about worldwide violence) were excluded from the analyses of skin conductance responses. They presented a difference in the number of responses during the mutilated and neutral blocks more than 3 standard deviations away from the average of the respective group. Due to poor signal quality, the heart rate of 6 subjects (all belonging to the group exposed to the text about worldwide violence) could not be analyzed.

The attenuation of the autonomic responses was analyzed by subtracting the electrodermal and electrocardiographic measures for the neutral block from those of the mutilation block (reactivity index). The reactivity indexes were compared separately through a Student's t test between low and high positive trait subgroups. Additionally, we also compared the reactivity indexes between the positive trait subgroups not exposed to safety cues.

The evaluations of the mutilation block given by participants exposed to the cinema makeup text were compared to those given by the group exposed to the worldwide violence text by means of a nonparametric Mann–Whitney U test. For the safe group, we also compared the valence ratings between the low and high positive affect trait subgroups.

For all analyses the significance level adopted was $p < 0.05$.

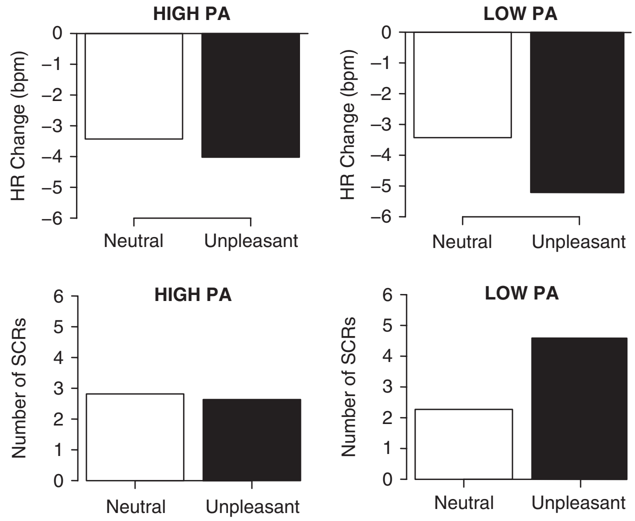

Figure 1. Autonomic responses to pictures after reading the safety text, showing heart rate deceleration (upper row) and number of skin conductance responses (lower row) to mutilation (black) and neutral pictures (white). High positive affective trait (PA) participants are shown on the left and low PA participants on the right.

Results

The autonomic reactions to the mutilation and neutral pictures after exposure to the makeup text are displayed in Figure 1. The presentation of the safety text prior to the viewing of the pictures resulted in reactivity indexes whose magnitudes were significantly lower for the high positive affect subgroup (skin conductance: mean = -0.2, $SD = 2.74$; heart rate: mean = -0.6, $SD = 1.88$) compared to the low positive affect participants (skin conductance: mean = 2.3, $SD = 3.24$; heart rate: mean = -1.8, $SD = 1.85$), skin conductance, $t(42) = -2.76$, $p = .004$, heart rate, $t(44) = 2.16$, $p = .018$, suggesting a more efficient attenuation for the former subgroup.

To examine if a higher positive affect trait per se would render the participants less reactive to unpleasant stimuli, we conducted the same analysis for the sample exposed to the worldwide violence text. The reactivity indexes did not differ for the high (skin conductance: mean = 1.1, $SD = 2.15$; heart rate: mean = -0.8, $SD = 2.00$) compared to the low positive affect participants (skin conductance: mean = 2.0, $SD = 3.34$; heart rate: mean = -1.2, $SD = 2.00$), skin conductance, $t(44) = -1.10$, $p = .138$; heart rate, $t(41) = 0.65$; $p = .259$.

The analysis of the unpleasantness ratings for the mutilation pictures revealed no significant difference between the low and high positive affect subgroups exposed to the makeup text ($p = .940$, Mann–Witney U test). Comparison with the group exposed to the worldwide violence text showed that, indeed, the makeup text significantly attenuated the subjective evaluation of the mutilation block ($p = .004$, Mann–Witney U test).

Discussion

Previous studies have shown that pictures are efficient affect elicitors. Pictures of mutilated people, particularly, have been shown to evoke strong skin conductance responses, marked heart deceleration, and negative affective reports that are associated with increased defensive activation (Bradley, Codispoti, Cuthbert, & Lang, 2001). Some authors found that exposure to these pictures also interferes with simple detection and choice discrimination tasks (Buodo, Sarlo, & Palomba, 2002; Erthal et al., 2005; Pereira et al., 2006) and elicits a "freezing-like" fear posture (Azevedo et al., 2005; Facchinetti, Imbiriba, Azevedo, Vargas, & Volchan, 2006).

Here, we explored if high positive affect trait favors the engagement in safety cues by presenting a safety text prior to the viewing of mutilation pictures and measuring fear-related autonomic responses and self-reports. The safety text informed the participants that pictures were taken from cinema productions and highlighted a more positive and secure framework.

The autonomic responses to the viewing of mutilation pictures after reading the cinema makeup text were attenuated only in the group of participants with higher scores in the positive affect scale, as predicted. This suggests that the positive affect trait affected the susceptibility to engage in a safe context. Indeed, there is ample evidence that positive affect trait increases cognitive flexibility (see Dreisbach, 2006). According to this idea, our results suggest that high positive affect individuals readily accept alternative explanations ("nice makeup tricks") for stimuli strongly associated with unpleasant outcomes ("mutilations signals threat"). Indeed, the positive affect scale of the PANAS includes characteristics of interest and active engagement as already pointed by Watson et al. (1988) and Egloff, Schmukle, Burns, Kolmann, and Hock (2003).

Some studies have suggested a possible link between more positive predispositions and psychophysiological flexibility. Comparing data of resting electroencephalographic brain asymmetry with ratings in the PANAS-trait questionnaire, Davidson (2003) showed that relative left hemisphere activation in frontal and anterior sites was linked to high scores on the positive affect and to low scores on the negative one. Interestingly, Jackson et al. (2003) reported that individuals presenting left-sided frontal brain electrical asymmetry showed a better capacity to psychophysiologically disengage from unpleasant stimuli, which could link "positive affect trait" with "emotional flexibility."

Finally, the sequence of pictures was evaluated as less unpleasant by the group exposed to safety cues, indicating that the text was efficient in attenuating the subjective aversive impact of mutilation pictures. These data revealed a dissociation between the explicit ratings and the autonomous reactions.

The analysis of the evaluative reports revealed no significant difference between the low and high positive affect subgroups exposed to the makeup text, in spite of the difference found in these subgroups for the autonomic reactions. A lack of concordance between evaluative judgments and autonomic reactions was already reported by Bradley et al. (2001). In their view, evaluative judgments are, to some extent, voluntarily controlled and thus modifiable by sociocultural norms.

We conclude that positive affect trait do affect the susceptibility to engage in safety contexts, capturing contextual cues of security and transforming them more efficiently into implicit modulations of the balance between the circuits underpinning predispositions to deal with threat and safe situations.

REFERENCES

Azevedo, T. M., Volchan, E., Imbiriba, L. A., Rodrigues, E. C., Oliveira, J. M., Oliveira, L. F., et al. (2005). A freezing-like posture to pictures of mutilation. *Psychophysology*, *42*, 255–260.

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion*, *1*, 276–298.

Buodo, G., Sarlo, M., & Palomba, D. (2002). Attentional resources measured by reaction times highlight differences within pleasant and unpleasant, high arousing stimuli. *Motivation and Emotion*, *26*, 123–138.

Center for the Study of Emotion and Attention (CSEA-NIMH). (1999). *The International Affective Picture System*. Gainesville, FL: University of Florida.

Davidson, R. J. (2003). Affective neuroscience and psychophysiology: Toward a synthesis. *Psychophysology*, *40*, 655–665.

Dreisbach, G. (2006). How positive affect modulates cognitive control: The costs and benefits of reduced maintenance capability. *Brain Cognition*, *60*, 11–19.

Egloff, B., Schmukle, S. C., Burns, L. R., Kolmann, C. W., & Hock, M. (2003). Facets of dynamic positive affect: Differentiating joy, interest, and activation in the positive and negative affect schedule (PANAS). *Journal of Personality and Social Psychology*, *85*, 528–540.

Erthal, F. S., Oliveira, L., Mocaiber, I., Pereira, M. G., Machado-Pinheiro, W., Volchan, E., et al. (2005). Load-dependent modulation of affective picture processing. *Cognitive, Affective, & Behavioral Neuroscience*, *5*, 388–395.

Facchinetti, L. D., Imbiriba, L. A., Azevedo, T. M., Vargas, C. D., & Volchan, E. (2006). Postural modulation induced by pictures depicting prosocial or dangerous contexts. *Neuroscience Letters*, *13*, 52–56.

Jackson, D. C., Mueller, C. J., Dolski, I., Dalton, K. M., Nitschke, J. B., Urry, H. L., et al. (2003). Now you feel it, now you don't: Frontal brain electrical asymmetry and individual differences in emotion regulation. *Psychological Science*, *14*, 612–617.

Lazarus, R. S., & Alfert, E. (1964). Short-circuiting of threat by experimentally altering cognitive appraisal. *Journal of Abnormal and Social Psychology*, *69*, 195–205.

Lohr, J. M., Bunmi, O. O., & Sawchuck, C. N. (2007). A functional analysis of danger and safety signals in anxiety disorders. *Clinical Psychology Review*, *27*, 114–123.

Pereira, M. G., Volchan, E., Souza, G. G., Oliveira, L., Campagnoli, R. R., Pinheiro, W. M., et al. (2006). Sustained and transient modulation of performance induced by emotional picture viewing. *Emotion*, *6*, 622–634.

Rogan, M. T., Leon, K. S., Perez, D. L., & Kandel, E. R. (2005). Distinct neural signatures for safety and danger in the amygdala and striatum of the mouse. *Neuron*, *46*, 309–320.

Speisman, J. C., Lazarus, R. S., Mordkoff, A., & Davison, L. (1964). Experimental reduction of stress based on ego-defense theory. *Journal of Abnormal and Social Psychology*, *69*, 367–380.

Watson, D., Clark, L. A., & Tellengen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070.

Whittle, S., Alien, N. B., Lubman, D. I., & Yucel, M. (2006). The neurobiological basis of temperament: Towards a better understanding of psychopathology. *Neuroscience and Biobehavioral Reviews*, *30*, 511–525.

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