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No Effects of Verbal Versus Imaginal Cognitive Strategies on Emotional Responses to AversiveSlides

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A number of studies have indicated that the right hemisphere is specialized for (negative) emotions. Some authors have suggested that this specialization stems from the cognitive characteristics of this hemisphere. More specifically, the verbal and analytic approach that characterizes left hemisphere functioning would inhibit emotional reactions, whereas the imaginal and global approach that characterizes right hemisphere functioning would facilitate emotional reactivity. The present study examined whether these two cognitive strategies have, indeed, different effects on emotional responsivity. Subjects were exposed to a series of aversive slides. One group (n = 14) was instructed to process the slides in a verbal/analytic manner. The second group (n = 14) employed an imaginal/global strategy while viewing the slides. The third group (n = 14) was a control group that received no explicit instructions. Self-reported emotions, skin conductance responses, heart rate frequency, and eye blink startles were recorded. There were no differences between the three groups with regard to any of these variables. Thus, no evidence was obtained to support the idea that processing modes (i.e., verbal/analytic versus imaginal/global) have a differential impact on emotional reactivity. The implications for theories about lateralization of emotions and for cognitive therapy are discussed.

Introduction

Neurological studies have shown that when the left hemisphere is inactivated with sodium amytal, patients tend to display depressive-catastrophic reactions, presumably mediated by the right hemisphere (e.g., Terzian, 1964). Likewise, experiments using visual half-field techniques in normal subjects have indicated that aversive material flashed to the right hemisphere evokes stronger psychophysiological reactions than aversive material flashed...
to the left hemisphere (e.g., Dimond and Farrington, 1977; Hugdahl, 1987). On the basis of these and other studies, a number of authors have concluded that the right hemisphere plays a more dominant role in affect, especially negative affect, than the left hemisphere (see e.g., review by Silberman and Weingartner, 1986; Gainotti, Caltagirone and Zoccolotti, 1993).

Some researchers (e.g., Tucker and Newman, 1981) argue that the differential involvement of the two hemispheres in emotion results from their cognitive characteristics: the verbal and analytic approach that presumably characterizes left hemisphere functioning would inhibit emotion, whereas the imaginal and global style that presumably characterizes the right hemisphere would facilitate emotional reactivity. If true, this hypothesis might have important clinical implications. For example, if emotionality is, indeed, related to a right hemisphere style of thinking then it seems plausible to assume that people who habitually rely on such a style of thinking are more prone to extreme or pathological emotions such as phobias. Furthermore, one expects that these pathological emotions can be played down if a person is trained in employing a left hemisphere type of ideation.

There is some evidence to suggest that a right hemisphere style of thinking is related to phobic fear and depression. For example, Merckelbach, Muris and de Jong (1990; see also Merckelbach, 1992; de Jong, Merckelbach and Nijman, 1993; study 1) asked normal subjects to complete a paper-and-pencil test measuring hemisphere preference and self-report questionnaires measuring neurotic symptoms. Subjects who preferred right hemisphere thinking strategies (i.e., an holistic and imaginal approach) were found to report more fear and depression symptoms than subjects who preferred left hemisphere thinking styles (i.e., an analytic and verbal approach). However, this study used a correlational design and, consequently, it remains possible that negative emotions affect thinking style rather than the other way around.

Few studies have examined the effects on emotions that occur when the cognitive styles that are commonly ascribed to the two hemispheres are directly manipulated. In a series of experiments by Smith and associates (e.g., Meyers and Smith, 1987; Smith, Meyers, Kline and Bozman, 1987), subjects heard nonverbal affective sounds (e.g., a baby cooing, a woman screaming) twice: once under “affective” instructions and once under “cognitive” instructions. The affective instructions asked subjects to call up vivid images associated with each sound. The “cognitive” instructions asked subjects not to focus on their feelings but rather to concentrate on “coming up with a series of steps involved in responding to the sounds” (Meyers and Smith, 1987, p. 72). Overall, EEG activity and skin conductance activity were found to be smaller under cognitive instructions than under affective
instructions. However, differences in EEG activity between the two hemispheres as a function of instructions were less clear-cut. In a study of Tucker and Newman (1981; see also Shearer and Tucker, 1981), undergraduate subjects saw a series of positive and negative slides. Subjects were instructed "to minimize the intensity of the positive or negative emotion they experienced" (p. 198) by using either an imaginal/global or a verbal/analytic approach. Subjective evaluations and skin temperature measured at both hands served as dependent variables. Results indicated that only for the positive material, the verbal/analytic approach was more successful in inhibiting subjective emotions than the imaginal/global strategy. However, throughout the experiment (i.e., on both positive and negative trials), the verbal/analytic approach was associated with higher skin temperatures (i.e., less sympathetic arousal) than the imaginal/global approach.

Taken together, the findings of Smith and colleagues (Meyers and Smith, 1987; Smith et al., 1987) and of Tucker and Newman (1981) seem to sustain the idea that a right hemisphere type of thinking increases emotionality and/or that a left hemisphere approach inhibits emotionality. However, there are some important methodological limitations in these studies. Firstly, in the Tucker and Newman experiment, all subjects were explicitly instructed to inhibit their emotions. Smith et al. requested subjects in the cognitive condition to avoid making any emotional response to the stimuli. Such instructions might have introduced demand characteristics into the experiment. Secondly, both Tucker and Newman and Smith et al., confronted their subjects with positive as well as negative stimuli. With such a procedure, carry-over effects from one to the other condition cannot be ruled out. Thirdly, Tucker and Newman (1981) failed to include a control or no-instructions group in their experiment. Smith et al. (1987) did employ a no-instruction group, but confronted them with neutral rather than affective material. Therefore, it is difficult to assess the net effect of instructional sets in these experiments.

Despite their methodological shortcomings, the studies of Tucker and Newman (1981) and Smith et al. (1987) are relevant to the area of emotional disorders. For example, the studies cited earlier are entirely consistent with the finding that verbal articulation of phobic material (e.g., textual descriptions of phobic scenes) reduces psychophysiological responding to this material, whereas imagination of phobic material enhances psychophysiological responding (e.g., Vrana, Cuthbert and Lang, 1986). Another example is provided by recent studies on worrying, a critical feature of generalized anxiety disorder (GAD). There are good reasons to believe that worrying is a predominantly verbal-linguistic activity. Furthermore, there is strong evidence to suggest that worrying leads to an immediate suppression of
psychophysiological and affective responding in patients with GAD (Borkovic and Lyonfields, 1993; see also Butler, Wells and Dewick, 1992).

Given the potential clinical relevance of findings like those of Tucker and Newman (1981), the present study attempted to replicate and extend their experiment. There were three groups of subjects: one group was instructed to engage in a verbal/analytic strategy while viewing emotional material, the second group was instructed to follow an imaginal/global approach, and a third group received no explicit instructions. To avoid carry-over effects, all subjects saw only aversive slides. Aversive slides were chosen because this type of material seems to have the greatest clinical relevance. Self-reported emotion, skin conductance reactions (SCRs), and heart rate (HR) in response to the slides were measured. In addition, eye blink startle responses induced by auditory probes were recorded during the slides. Recent research of Lang and associates (Lang, Bradley and Cuthbert, 1990) demonstrates that the eye blink startle is sensitive to emotional valence such that the more negative an emotion, the larger the accompanying startle response.

In sum, then, the present experiment tested the hypothesis that engaging in a verbal/analytic thinking style reduces emotional reactivity (in terms of subjective evaluations, SCRs, HR, and startle magnitudes) as compared to a control condition, whereas engaging in an imaginal/global approach potentiates emotional reactivity as compared to a control condition.

Method

Subjects

The subjects were 42 male undergraduate students. Their mean age was 21 years (range: 18–29 years). Five additional subjects were run but their data were excluded from the analyses because these subjects indicated after the experiment that they had not complied with the instructions (see below). Subjects participated in the experiment in return for a small financial compensation.

Apparatus and stimulus material

To record SCRs, two Beckman Ag-AgCl electrodes (8 mm) filled with isotonic paste were attached with adhesive collars to the medial phalanges of the left and the third finger of the subject's non-dominant hand. The electrodes were connected to a Beckman Skin Conductance Coupler (type 9844). The method of constant voltage was used (0.5 volts). The coupler allowed for a maximum sensitivity of 0.02 micromho. Respiration was measured using a respiration belt, fastened around the subject's chest. The
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respiration belt was connected to a Beckman Pressure/Pulse/Voltage Coupler (type 9853a). Tonic heart rate was recorded from Beckman electrodes arranged according to a lead II placement and connected to a Beckman Pressure/Pulse/Voltage Coupler (type 9853a). Eye blink startles were elicited by acoustic probes (50 msec, 95 dB pink noise with immediate rise time). They were measured by recording EMG from the orbicularis oculi muscle beneath the left eye. This was done with Beckman miniature electrodes filled with Hewlett Packard Redux paste and connected to a Beckman EMG coupler (type 9852a). Raw EMG activity was filtered and amplified (60 Hz high pass) and then rectified and integrated by a contour following integrator of the type described by Fridlund (1979). Time constant was set at 1/16 sec. SCRs, respiration, HR, and integrated eye blink EMG were continuously monitored by a Beckman R 711 polygraph.

Slides depicted straightforward and clearly recognizable aversive scenes (mutilated bodies, accidents etc.). There were 8 slides. They were taken from the International Affective Picture System (Lang and Greenwald, 1985). Slides were presented with a Kodak Carousel and projected on a white wall, 2.5 m in front of the subject. The size of the projected image was approx. 150 × 175 cm.

A microcomputer (Compaq Deskpro 486) controlled onset and offset of the slides, inter-trial intervals, and response registration.

Procedure

Subjects were tested individually. They were seated in a comfortable chair placed in a dimly lit chamber. Recording apparatus and computer were located in an adjacent room. After recording sites had been cleaned and the electrodes and respiration belt had been fastened, subjects were randomly assigned to one of three groups. All subjects were informed that they would be exposed to several slides. Subjects in the imaginal/global group were told to pay attention to the whole scene depicted by the slides and to engage in imaginations and fantasies about that scene. Subjects in the verbal/analytic group were instructed to pay attention to the different details and aspects of each scene and to verbalize them subvocally. Care was taken not to reveal to the subjects that the experiment was about emotional reactivity. Thus, in the instructions, words like "emotion", "feeling", "affect", "aversive" etc. were avoided. Subjects in the control condition received no instructions with regard to the slides. They were asked to look carefully to the slides and to keep their eyes fixated on the slides. Before the experiment proper started, baseline values of skin conductance level (SCL) and HR were obtained during a 30 sec rest period. Then, subjects were given one mildly aversive practice slide. Following this, the experimenter asked the
subjects how well they managed to carry out their task and, if necessary, gave additional instructions. Next, subjects saw 8 aversive slides. Each slide was preceded by a warning slide. This warning slide showed a word that summarized the task of the subject (i.e., “fantasy” for the imaginal/global group, “details” for the verbal/analytic, and “start” for the neutral group). The warning slide lasted for 3 sec. Duration of the aversive slide was 30 sec. Intertrial intervals were approx. 15 sec. Immediately after slide offset, subjects indicated on a 100 mm visual analog scale (VAS) how they had felt during the aversive slide (−50 = extremely positive; 0 = neutral; +50 = extremely negative).

During half of the aversive slides, 2 or 3 monaural probes were presented to the left ear in order to induce eye blink startles. The probes occurred at least 10 sec after slide onset and could not interfere with SCRs (see below). In total, 10 probes distributed over 4 slides were used. To enhance the unpredictability of the startle probes, 4 additional probes were administered during the intertrial interval. Within each group, different subjects were given probes during different slides. After the experiment, subjects indicated on a 100 mm VAS to what extent they had complied with the instructions given by the experimenter (0 = “not at all”, 100 = “completely”). Subjects with a score below 65 were excluded from the analyses.

Response definition and analyses
SCR was defined as the maximum deflection occurring 1–6 sec after onset of the aversive slide. SCRs were measured in micromho and square root-transformed prior to any statistical analysis. Respiration was used as a control variable: SCRs due to respiratory irregularities were excluded from statistical analyses. Such irregularities occurred on less than 1% of the trials (i.e., slides). SCR values for these trials were estimated on the basis of the SCRs on adjacent trials. Tonic heart rate during the aversive slides was converted to beat per minute frequencies. To obtain a measure of cardiac reactivity (ΔHR), baseline HR was subtracted from HR during slides. Magnitude of integrated startle EMGs were scored in arbitrary units (a.u.s). SCRs, ΔHR, and startle magnitudes were averaged over slides and then subjected to one-way analyses of variance (ANOVA). A one-way ANOVA was also performed on the subjective evaluations (VAS scores).

Results
Table 1 shows mean self-reported emotions, SCRs, ΔHR, and startle magnitudes during the aversive slides. Groups did not differ with regard to self-reported emotions (F(2, 39) = 0.05, p = 0.94). Neither were SCR and ΔHR differentially affected by the experimental manipulations: F(2, 39) = 1.2, p
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= 0.30 and \( F(2, 39) = 0.23, p = 0.79 \), respectively. Thus, no evidence was found to suggest that autonomous arousal was greater in the imaginal/global group or lower in the verbal/analytic group as compared to the control group. The absence of a significant effect of cognitive instructions on autonomous arousal can not be attributed to pre-experimental differences: groups had comparable SCLs and tonic HR levels during the pre-experimental baseline period \( F(2, 39) = 0.66, p = 0.52 \) and \( F(2, 39) = 0.15, p = 0.86 \), respectively.

Due to apparatus failure, startle data of one subject were missing, leaving 13 subjects in the imaginal/global group, 14 subjects in the verbal/analytic group, and 14 subjects in the control group. A one-way ANOVA yielded no evidence to suggest that startle responses were greater in the imaginal/global group and smaller in the verbal/analytic group as compared to the control group \( F(2, 38) = 0.70, p = 0.50 \).

To ascertain that slides were effective in eliciting emotional reactions, several additional analyses were carried out. Thus, a Kolmogorov-Smirnov test showed that the subjective evaluations (VASs) averaged over all subjects significantly deviated from 0 (VAS position that indicated "feeling neutral"): K-S Z = 3.1, \( p \leq 0.01 \). Furthermore, a t-test made clear that mean HR during the slides was significantly higher than that during the pre-experimental baseline period, the means being 75.1 (9.6) and 73.1 (10.7), respectively \( (t(41) = 1.7, p \leq 0.05, \text{one-tailed}) \). A t-test also revealed that the eye blink startles elicited during the slides were reliably greater than those elicited during the intertrial intervals, the means being 0.28 (0.23) and 0.23 (0.20) respectively \( (t(40) = 3.4, p \leq 0.01, \text{one-tailed}) \).

| TABLE 1. Mean subjective evaluations (VAS: 0 = neutral; 50 = extremely negative), SCR (\( \sqrt{\text{micromho}} \)), \( \Delta \text{HR} \) (beats per minute), and startle magnitudes (arbitrary units) during aversive slides of the imaginal/global group (gr 1), the verbal/analytic group (gr 2), and the control group (gr 3). |
|---------------------------------|-------|-------|-------|
| Subjective evaluation          | gr 1  | gr 2  | gr 3  |
| (\( \sqrt{\text{SCR}} \))      | 0.41  | 0.37  | 0.30  |
| (\( \Delta \text{HR} \))      | 0.52  | 1.23  | 1.64  |
| Startle magnitude               | 0.34  | 0.28  | 0.23  |
| (arbitrary units)               | (0.23)| (0.23)| (0.22)|
Discussion

As Tucker and Newman (1981) pointed out, "common sense would hold that rational ideation, analytic, sequential, and linguistically structured, is less susceptible to emotion than is imaginative thought" (p. 201). Some studies (e.g., Tucker and Newman, 1981; Shearer and Tucker, 1981; Smith et al., 1987) have yielded results that seem to confirm this common sense view and have related these results to the literature on hemispheric differences. However, these studies suffered from several shortcomings (e.g., no control group, possibility of demand characteristics etc.). Meanwhile, the view that type of ideation (i.e., verbal/analytic versus imaginal/global) modulates emotional reactivity is widespread and can also be found among behavior therapists. For example, Borkovec and Hu (1990) reported that engaging in worrisome thinking inhibits cardiovascular reactions to phobic imagery. In an attempt to explain this effect, the authors suggested that worry involves primarily left hemisphere operations such as abstract and conceptual thinking as opposed to imagery activity (see also Borkovec and Inz, 1990; Borkovec and Lyonfields, 1993).

The current study examined the effects of type of ideation on emotion by manipulating ideation. Instructions were given in such a way that demand characteristics were avoided. In addition, a control group was included in the study. Engaging in verbal and analytic thinking was not found to reduce emotional reactivity. Neither were there indications that a global and imaginal type of ideation leads to a potentiation of negative affect. It is worth noting that these null findings can not be attributed to the way in which emotional reactivity was measured or to the material that was employed to elicit emotions: the present study relied on several aspects of emotional reactivity (i.e., subjective, autonomous, muscular). Furthermore, the slides used to induce a negative emotional state were taken from a standardized set of evocative emotional stimuli. Parametric studies of Lang and colleagues (e.g., Lang, Öhman and Vaitl, 1988) have clearly documented that these slides normally elicit a negative emotion in subjects. The results strongly suggest that this was also the case in the present study. For example, heart rate frequency as well as startle magnitude increased during the slides.

Several limitations of the present study deserve comment. To begin with, instructions given to the subjects did not attempt to make the slides self-relevant. Although unlikely, it remains possible that differential effects of type of ideation on emotional responding only emerge when stimulus material is made self-relevant. Secondly, the warning slides that were used might have elicited anticipatory arousal. This, in turn, might have reduced
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overall responding to the aversive slides to the extent that differences between groups were obscured. However, the fact that there were strong indications that the aversive slides elicited negative affect in the subjects weighs against this interpretation. Thirdly, one could argue that the task compliance measure used in the present experiment is sensitive to demand characteristics. An one-line measure of how much subjects' thoughts consisted of images, verbal activity or both would have provided a better alternative (see e.g., Borkovec and Inz, 1990). Fourthly and most importantly, the instructions given to the subjects focused on mixed and heterogeneous processes. These instructions were based on the widespread idea that the cognitive differences between the two hemispheres can best be conceptualized in terms of verbal and analytic versus imaginal and global ideation (e.g., Zenhäusern, 1978). Accordingly, subjects were instructed to follow either a verbal and analytic or an imaginal and global strategy. Thus, subjects were asked to carry out two simultaneous tasks. Although Tucker and Newman (1981) employed similar instructions and did find differential effects on emotional responding, it is conceivable that the two tasks that subjects were required to carry out are, in fact, incompatible. For example, it might be difficult to attend to the global scene depicted by a slide and at the same time engage in fantasies about that scene. Furthermore, the present study did not include a measure of the amount of time that subjects allocated to each of the tasks. A useful direction for further research would thus be to test whether instructions that stress one type of ideation (e.g., verbalization) rather than two types of ideation (e.g., verbalization and analytic approach) do affect emotional responding. Similarly, it might be fruitful to examine how types of ideation interact with cognitive mechanisms such as attention (see also Wells, 1991).

Although the primary focus of the present experiment was on the emotional effects of cognitive strategies, it has some bearings on the discussion about the origins of hemispheric asymmetry in emotions. Two positions on this issue have been advanced. One asserts that the two hemispheres represent the biological substrate of a fundamental approach-withdrawal continuum, with the right hemisphere sustaining withdrawal behaviour and the left hemisphere sustaining approach behaviour (Fox & Davidson, 1984). The involvement of the right hemisphere in emotions and especially in negative emotions would originate from this hemisphere's biologically prepared tendency towards avoidance. The other view (e.g., Shearer and Tucker, 1981; Tucker, 1981) holds that cognitive characteristics of the two hemispheres underlay hemispheric asymmetry in emotions. The holistic and global characteristics of the right hemisphere would make it difficult for this hemisphere to handle emotions. In contrast, the verbal
and analytic strategy of the left hemisphere would promote inhibition of emotional reactivity. The results presented above are difficult to reconcile with this cognitive view in that they illustrate that emotional reactivity can not be reduced or increased by the mixed cognitive characteristics that are commonly ascribed to the two hemispheres.

In sum, then, the present results cast some doubts on the claim that "inhibiting emotion is easier with a rational than with an imaginative approach" (Shearer and Tucker, 1981; p. 91). Obviously, they do not refute the idea that cognitions can modulate emotions and that cognitive techniques are useful in reducing pathological emotions. However, they suggest that it might be more fruitful for cognitive therapist and researchers to focus on cognitive content (e.g., expectations, interpretations etc.) and cognitive mechanisms (e.g., attention, memory) than on the broad and heterogeneous classes of ideation that are said to characterize the two hemispheres (i.e., verbal/analytic versus imaginal/global).

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