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Psychophysiological and Personality Correlates of Repression and Sensitization

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Psychophysiological and Personality Correlates of Repression and Sensitization

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by

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THESIS ACCEPTANCE

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Abstract

This study assessed relationships among indices of modulation of stimulus intensity by the autonomic and central nervous systems, perceptual defense, and repressive coping. Subjects were twenty female and nine male paid volunteers between the ages of 19 and 38. Perceptual defense, defined as the difference in recognition thresholds for unpleasant versus pleasant words, was assessed with a tachistoscopic masking paradigm. Auditory evoked potentials (AEPs) were obtained in an augmentation reduction paradigm that evaluated cortical responses to discrete tones of varying intensity. Cardiac responses to these same tones were also obtained. Amplitude/intensity slopes were determined for P2 amplitudes obtained from the CZ electrode site, prestimulus to poststimulus heart rate change was determined for each tone intensity, and change/intensity slopes were calculated. Scores from Neuroticism and Lie Scales of the Eysenck Personality Questionnaire were also obtained. Subjects were assigned to four groups of high and low Lie Scale scores and high and low Neuroticism Scale scores. High Lie Scale scores were associated with a reducing pattern of the P2 component of the AEP, and with increased recognition thresholds for unpleasant as compared to pleasant words. This relationship held regardless of scores on the Neuroticism Scale. There was a general trend for subjects to accelerate heart rate at three to four seconds post-stimulus. There were no between group

differences with respect to heart rate acceleration. General conclusions about the physiological and perceptual components of coping style are presented and some theoretical implications of these conclusions are discussed.

Psychophysiological and Personality Correlates of Repression and Sensitization

A commonly accepted theory of defense mechanisms and coping styles views repressive defenses and sensitization defenses as opposite poles of a bipolar dimension of personality that is inextricably bound to anxiety and maladjustment (Maddi, 1989; Millimet, 1972; 1970). In this view, repression is a rubric for avoidance defenses (eg. denial, repression) that serve to decrease stimulus impact. Sensitization encompasses those defenses (eg. rationalization, reaction-formation) that are manifested in approach tendencies to threat and perceptual and cognitive distortions of the threat. What is often neglected in discussion of defenses, is that both repression and sensitization must ultimately serve to decrease stimulus impact, unless sensitization is defined as the absence of defensiveness. If sensitization were the absence of defensiveness, then cognitive distortions would not be constitutive of its description.

The view of sensitization as a means of decreasing stimulus impact contravenes common language usage, but this matter of semantics. If both of these defense mechanisms serve to decrease stimulus impact, then the question arises as to whether it is useful to distinguish between them.

A central premise of this thesis is that repression

involves a reactive desensitization to stimulus intensities that have become too high for a given individual, whereas sensitization involves desensitization to virtually all stimulus intensities. It is hypothesized that the fundamental difference between the two is that Repression is a reactive mechanism, whereas Sensitization is a proactive mechanism. Note that in this view, the two defenses are not mutually exclusive bipolar opposites. This position allows for the possibility for the simultaneous occurrence of repression and sensitization.

Thus, repression can be defined in terms of avoidant coping, reactive desensitization and subsequent debarment from consciousness of information related to threat. Sensitization can be defined in terms of approach tendencies, proactive desensitization, and subsequent hyperawareness of information related to threat. Thus designated, the issues of avoidant coping, debarment from consciousness and protective desensitization can potentially be defined in psychometric, perceptual and physiological terms respectively.

Psychometric studies of repression and sensitization

The Byrne Repression-Sensitization Scale (Byrne, 1961), the Taylor Manifest Anxiety Scale (Taylor, 1953) , and the Eysenck Personality Questionnaire's (Eysenck & Eysenck, 1987; EPQ) Neuroticism Scale load on a common factor, are

highly intercorrelated and therefore appear to measure the same underlying construct (Golin, Herron, Lakota & Reineck, 1967). This construct has been variously described as neuroticism, emotionality, and emotional maladjustment (Eysenck & Eysenck, 1987; Eysenck, 1967; Millimet, 1972). Thus, for the remainder of this paper, the labels of "Neuroticism", "Anxiety" and "Sensitization" will be treated as psychometrically synonymous. When a distinction needs to be made between these labels for semantic purposes, the distinction will be made explicitly.

It has been assumed that those who score at the sensitization end of the continuum on these scales are truly characterized by high anxiety and sensitization defenses, and that those who score at the repression end are either dissimulating, are truly well adjusted, or are repressors. This belief has lead researchers (eg. Schill, Emanual, Pedersen, Schneider & Wachowiak, 1970; Warrenburg, Levine, Schwartz, Fontana, Kerns, Delaney & Mattson, 1989; Jamner, Schwartz & Leigh, 1988) to combine Lie Scale-type instruments such as the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1964 ;MCSD) with an anxiety scale to separate repressors from those who are well adjusted. This practice has been criticized as meaningless on the basis of relatedness of the measures (Millimet & Cohen, 1973), and the question of whether a given study addressed

self-deception or other-deception can not be resolved by this method (Warrenberg, et al.,1989; Schwartz, 1990).

Schalling, Edman & Asberg (1983) reported that scores on the MCSD Scale and the EPQ Lie Scale correlate highly, but scores on neither correlate significantly with those of the Neuroticism Scale. Eysenck & Eysenck (1976) have reported that inverse correlations between Lie and Neuroticism Scales on the EPQ arise only in situations where subjects have a high degree of motivation for dissimulation. Based on the findings of Millimet & Cohen (1973) and Eysenck & Eysenck (1976), orthogonality of these scales should not automatically be assumed. A test should be conducted in each study that uses such a pairing to justify the assumption of orthogonality. Furthermore, such orthogonality is more likely to obtain if subjects are recruited in a manner that minimizes their motivation for dissimulation.

Autonomic reactivity and repression-sensitization

The literature related to autonomic reactivity and repression-sensitization reveals varied and contradictory results. Galvanic skin response (GSR) and heart rate measures have yielded results consistent with the hypothesis that anxiety is associated with decreased autonomic lability during stress (Hoehn-Saric, McLeod & Zimmerli, 1989). However, anxiety may be heterogeneous with regard to

autonomic lability. Kopp, Mihaly, Linka & Bitter (1987) reported that anxious subjects who exhibited GSR lability also showed higher degrees of heart rate reactivity, and those with low degrees of GSR lability showed diminished heart rate reactivity but higher baseline heart rates.

Paige, Reid, Allen, and Newton (1990) reported that patients with posttraumatic stress disorder showed heart rate reactivity to high intensity tones, but not to low intensity tones, and that this pattern of heart rate augmentation showed a moderate positive correlation with scores on the Hamilton Anxiety Scale. Warrenburg, Levine, Schwartz, Fontana, Kerns, Delaney & Mattson (1989) reported that MCSD and anxiety scores were both positively related to systolic blood pressure reactivity, but that this relationship was additive rather that interactive. Because they defined repression as diminished anxiety in the presence of a high degree of socially desirable responding, the lack of an interaction was taken to mean that repressive coping was not uniquely related to blood pressure reactivity.

Weinberger (1990) reviews evidence that high anxiety is associated with decreased autonomic reactivity. He cites evidence that low anxiety when paired with high defensiveness is associated with the highest autonomic reactivity of all, and concludes that some of the results

obtained may have been due to "how individuals' nervous systems are calibrated". Weinberger, Schwartz and Davidson (1979) found that there were no differences between repressive, high anxious and low anxious subjects with regard to their resting heart rates, or with their cardiac responses to biofeedback. Weinberger (1990) has concluded that there is no evidence that repressors differ from other groups in terms of the "innate reactivity of their peripheral physiology".

Perceptual defense/vigilance and perceptual distortions.

Perceptual defense/vigilance paradigms have potential to provide a means for operationally defining repression and sensitization that allows for inferences about the unconscious nature of these defenses. Perceptual Defense is generally defined as increased recognition thresholds for unpleasant as compared to pleasant stimuli. Perceptual Vigilance is similarly defined as decreased recognition thresholds for unpleasant as compared to pleasant words (Erdelyi, 1974).

Although not without criticism, studies of this nature report results consistent with both repressive and sensitizing coping styles (Maddi, 1989; Erdelyi, 1974). Anxiety conditioned to nonsense syllables by pairing such syllables with electric shock has been associated with lower tachistoscopic recognition thresholds for those syllables,

which has been interpreted as indicative of sensitization defenses (Bruner & Postman, 1947). However, stimuli that are inherently anxiety provoking, (eg. taboo words) have been associated with higher tachistoscopic recognition thresholds and increased galvanic skin conductance to subthreshold presentations (McGinnies, 1949). On the basis of these findings, it seems that anxiety is independent of perceptual defense and vigilance, and by inference, could be independent of both repression and sensitization.

Whether anxiety is inherent to the situation or is a trait of the individual warrants consideration. Bruner & Postman (1947) employed a paradigm that entailed experimentally conditioning approach tendencies to nonsense syllables, and (McGinnies, 1949) used socially taboo words. Rao & Potash (1985) reported that high trait-anxious subjects produced greater size distortions on the Bender-Gestalt than did how trait-anxious subjects, but that this trend reversed with anxiety induced by a stressful situation, where low trait anxious subjects produced greater size distortions. Thus, it is clear that anxiety can distort either perception or response tendencies. The direction of these distortions may change depending on whether anxiety is a trait of the individual (trait anxiety) or induced by a specific situation (state anxiety).

If people who score high on the Lie Scale are

repressors and perceptual defense is a true index of repression, people who score high on the Lie Scale should show a greater degree of perceptual defense. Note that the familiar distinction used by many (eg. Weinberger, 1990; Schwartz, 1990) is not made here between "repressive" and "defensive high-anxious". If repression can occur in the presence of high or low anxiety, the relationship between Lie Scale scores and perceptual defense should occur regardless of anxiety level.

The above arguments are constrained by the internal validity of perceptual defense paradigms. Holmes (1990) suggested that perceptual defense is an artifact of variations in the familiarity of the words chosen for its elicitation, and response inhibition on the part of the subjects. Maddi (1989) supplies some strong counterarguments to the position taken by Holmes's (1990), but both seem to agree that any study that attempts to address the issue of perceptual defense must match stimuli for familiarity, and must choose stimuli such that the probability of response inhibition is minimized.

If the assumption is made that perceptual defense/vigilance can be measured without the confounding influences of response inhibition and word familiarity, it is tempting to argue that if high trait anxious persons are sensitizers and perceptual vigilance is a measure of

sensitization, then high-trait anxious individuals should show a trend toward perceptual vigilance. Obviously this argument poses a logical dilemma. By definition, perceptual defense and perceptual vigilance can not characterize the same individual subjected to the same paradigm, and their simultaneous occurrence would be logically necessary in the case of high neurotic high deceptors. In order to reconcile this problem, the variability of recognition thresholds should be examined as well as the means. Thus if high anxiety is synonymous with sensitization, high neurotic/high deceptors should have more variability than high neurotic low deceptors in their recognition thresholds for unpleasant as opposed to pleasant words. Such a pattern would be consistent with the simultaneous occurrence of repression and sensitization for high neurotic/high deceptors.

Evoked potentials and augmenting and reducing: Gating of stimulus intensity

It is unfortunate that Rao and Potash (1985) did not report the direction of subjects' errors, as 'augmenting' (i.e. overestimating the size of a stimulus) may index a different defense style than 'reducing' (i.e underestimating the size). This augmenting/reducing dimension was originally conceived as a predictor of pain tolerance (Petrie, 1967), but has been extended to encompass a description of generalized stimulus processing (Paige, Reid,

Allen & Newton, 1990; Zuckerman, 1983; Sandman, 1987; Knorring, Monakhov & Perris, 1978; Dragutinovich, 1987). Augmenting/reducing as measured by psychophysical, electrophysiological and questionnaire methods, appears to relate to approach and avoidance tendencies to high levels of stimulation (Zuckerman, 1983; Buchsbaum, 1972; Buchsbaum & Silverman, 1968; Petrie, 1967; Dragutinovich, 1987), which brings about the question of whether this dimension is related to repression and sensitization.

Averaged evoked potential (AEP) studies define 'reducing' as a tendency for evoked potential component amplitudes to decrease as stimulus intensity levels increase, and 'augmenting' as the opposite tendency (Buchsbaum & Silverman, 1968). Typically, augmenting and reducing are defined with respect to an amplitude/intensity function, defined as the slope of the best fitting linear regression equation for a given AEP component amplitude as a function of stimulus intensity. Measured this way, the augmenting-reducing phenomenon has been related to the neo-Pavlovian notion of "strength of the nervous system", which holds that a weak nervous system is characterized by a greater resting level of arousal, and therefore has a lower threshold for entering a state of protective inhibition, whereby excess stimulation is gated out (Neblitsyn, 1972). The relationship described resembles the inverted 'U'

function of the Yerkes-Dodson law (Yerkes & Dodson, 1908).

Consistent with the notion of AEP amplitude attenuation accompanying sensitization defenses, both neurotic depressives and anxiety patients have shown attenuated AEP amplitudes, and no consistent relationship between AEP amplitude/intensity slopes and these syndromes is apparent (Buchsbaum, 1979; Buchsbaum, 1978; Buchsbaum, 1976; Khanna, Mukundan & Channabasavana, 1989; Knorring, Monakhov & Perris, 1978; Sandman, Gerner, O'Halloran & Isenhart, 1987).

Amplitude/intensity slopes may relate to repression. Endorphin levels in the cerebrospinal fluid have shown inverse correlations with amplitude/intensity slopes (Knorring, Almay, Johansson & Terenius, 1979), and blood immunological correlates of opioid peptide metabolism indicate a central role for opioid peptides in repressive defenses (Jamner, Schwartz & Leigh, 1988). Moreover, the EPQ Lie Scale has been reported to predict self reports of pain and tolerance to nociceptive electric shock (Jamner & Schwartz, 1986). It appears that repressive defenses may relate to opioid peptide mediated stimulus intensity modulation. If this is the case, then High Deceptors (high scorers on the EPQ Lie Scale) should have lower amplitude/intensity slopes than low or medium deceptors.

<u>An integrative framework for the study of repression</u>

In the present study, self-report measures of

neuroticism and avoidant coping (the Neuroticism and Lie Scales of the EPQ, respectively) were correlated with differences in recognition thresholds for unpleasant and pleasant words (i.e perceptual defense), cortical augmenting-reducing and heart rate reactivity. It was predicted that Lie Scale scores would be positively associated with AEP reducing and perceptual defense. It was also predicted that Neuroticism Scale scores would relate to AEP amplitudes, and when high Neuroticism Scale scores were paired with high Lie Scale scores, would result in greater variability of recognition thresholds for unpleasant words. Finally, it was predicted that Neuroticism scores and lie scores would relate uniquely to heart rate reactivity to tones, such that high neurotics would be generally more reactive, and high deceptors would show greater reactivity to high levels of tone intensity.

Methods

Subjects

Volunteers were recruited from the University and general public, and were paid $25.00 for participation. All subjects were literate, native speakers of English. One subject was excluded because she was taking codeine regularly, one because she reported that she had been drinking alcoholic beverages before she arrived for her session, and one declined to participate on account of fear

of the needle that would have been used to abrade his scalp. One subject's evoked potential and heart rate data were eliminated from the analysis because of an equipment malfunction during the session. The final sample consisted of 20 women and 9 men between 19 and 38 years of age ($\bar{X}$ = 24.07, s = 5.73). If subjects reported use of prescription glasses, they wore them during the testing session.

Apparatus, Materials and Stimuli

Electroencephalograms (EEGs) were recorded following the International 10-20 System (Jasper, 1958), from midline frontal (FZ), central (CZ) and parietal (PZ) scalp sites, and bilateral temporal (T3,T4) and central (C3,C4) sites with linked ears as reference. Electrooculograms (EOGs) were monitored by electrodes fixed to the inferior orbital ridge of the right eye and also referenced to linked ears. Electrocardiograms (EKGs) were recorded by two electrodes, one pasted to the left and the other pasted to the right lateral chest wall. Pulse pressure amplitude was measured by a Grass photoplethysmograph attached to the left index finger.

All EEG data were amplified with Grass Model P511 amplifiers (bandpass .01 to 100 Hz), stored on the audio track of VHS stereo high fidelity tapes via a Bio-Logic banker, and digitized by an AT&T 6386 WGS computer with an 80-387 math coprocessor at a sampling rate of 200 Hz for 640

msec for each tone presentation, the first 100 msec of which were prestimulus activity. Software for digitization was specially prepared in the lab (D. Fitzpatrick, personal communication, September, 1989) for use with the RC-electronics Computerscope EGAA system (R.C. electronics, 1990). Electrical impedances for all EEG and reference electrodes were kept below 5000 ohms.

An IBM model 30 computer with a high resolution VGA monitor was used to trigger tone presentations and tachistoscopic word presentations, and special software was prepared in the lab for these purposes (D. Fitzpatrick, personal communication, November, 1989). The tones presented were 780 Hz sine wave tones of 500 msec duration with rise and fall times of 25 msec. The tones were presented binaurally through headphones at four intensities: 74, 84, 94, and 104 dB sound pressure level.The words used were 15 pleasant and 15 unpleasant words randomly selected from A Handbook of Semantic Word Norms (Toglia & Battig, 1978). The handbook has several standard scales, including "Pleasantness" (PLS) and "Familiarity" (FAM) that have ranges of 1-7. For this study, unpleasant words were those words with PLS ratings of ≤ 2.50 and pleasant words were those words with PLS ≥ 5.00. The mean PLS value of words in the manual is 4.010, s = 1.130. Words were matched for differences in length (i.e number of letters in the word)

and FAM between PLS conditions (Table 1). T tests were conducted to confirm this independence. These values of *t* were negligible and nonsignificant.

Heart rate was scored off-line by a computer program written in the lab (D. Fitzpatrick, personal communication, July, 1990) that determined R-R intervals and converted this information to second by second heart rate in beats per minute (Paige et al., 1990). Heart rate data were digitized at 5 kHZ. Each trial consisted of 2048 data points, the first 1024 of which were prestimulus activity. Eight 1 sec epochs, four prestimulus and four poststimulus, were defined with respect to the onset of the stimulus as the zero point. In order to calculate second by second heart beat, the percentage of the heart rate for each R-R interval that fell into a particular epoch was determined for each trial and the mean over trials for each epoch was taken.

Table 1

Words used for tachistoscopic presentations and their Familiarity Ratings

Unpleasant Words	Familiarity	Pleasant words	Familiarity
Cancer	6.10	Lawn	6.30
Morgue	5.48	Lips	6.21
Pimple	6.31	Magazine	6.15
Kill	6.23	Maple	5.92
Slavery	5.86	Mattress	5.98
Suffocate	5.48	Raspberry	6.02
Murder	6.08	Rum	6.26
Dead	6.21	Spice	5.92
Ashamed	5.90	Beaver	6.02
Bad	6.32	Pearl	5.82
Rejected	5.97	Sail	5.78
Sick	6.45	Triumph	5.97
Ugly	6.16	Wisdom	6.34
Weak	6.21	Liberty	5.72
Bomb	6.40	Passion	5.71

Mean Length = 5.47, $\underline{s}$ = 1.77 Mean Length = 5.87, $\underline{s}$ = 1.77

Mean Familiarity = 6.08 Mean Familiarity = 6.01

$\underline{s}$ = .296 $\underline{s}$ = .207

The mean of familiarity for all words in the manual is 5.59, $\underline{s}$ = 1.130 .

The Eysenck Personality Questionnaire (Eysenck & Eysenck, 1987; Appendix A.) was administered in its entirety. The questionnaire is an embellishment of the earlier Eysenck Personality Inventory (Eysenck & Eysenck, 1968), in that it contains a Psychoticism scale as well as well as the previously included Extraversion, Neuroticism and Psychoticism scales (Eysenck & Eysenck, 1987). All of the scales have satisfactory reliability coefficients for normal adults, with test-retest reliabilities of .78, .89, .86 and .84 for the psychoticism, extraversion, Neuroticism and Lie Scales respectively. Internal consistencies for the scales for normal males are .74, .85, .84 and .81, and for normal females are .68, .84, .85 and .79 for psychoticism, extraversion, Neuroticism, and Lie Scales, respectively (Eysenck & Eysenck, 1987).

Procedures

Following the administration of standardized informed consent (Appendix B.), subjects completed the EPQ. Recording electrodes were applied, and subjects were fitted with an electrode cap. The EKG electrodes and pulse sensor were positioned, and subjects were brought into the testing room and seated in a comfortable chair approximately 1 m from a 33 cm diagonal video screen. Subjects were instructed to watch the screen, and asked after each presentation to report the word seen. The subjects were

assured that guessing in the absence of certainty was allowable and desirable.

The order of word presentation was varied randomly, and no two subjects received the presentation in the same order. Each presentation consisted of a 50 msec random letter forward mask, the target, and a 50 msec random letter backward mask. The letters for mask and target words were presented on the computer screen in block style capital letters 0.5 cm high. The masks were used in order to control for computer screen decay time. The initial presentation time for each word was 14.7 msec, and each successive presentation was incremented by 14.7 msec until the recognition threshold for that word was determined. The 14.7 msec time increment is a physical limitation of the apparatus, and the times reported are according to manufacturer specifications. Recognition threshold was defined as the number of trials required for correct verbal report of the word presented. After the threshold was established for a given word, that word was not presented again.

After the word trials, subjects were fitted with headphones and asked to relax, keep their eyes open, fixate on a cross positioned on the wall in front of them, and listen to the tones. The tones were presented in two runs. In the first run, EEG was recorded while a total of 256

tones was presented in 16 blocks of 4 tones repeated 4 times following a Latin square design. The interstimulus interval (ISI) was variable with a mean of 3 sec (range 2-4 sec). Following a 5 min rest period, subjects were tested with the same tones arranged in 5 blocks of 4 tones, repeated 4 times in a Latin square design for a total of 80 tones. For purposes of analyzing HR changes to the tones, the ISI was variable with an average of 15 $\pm$4 sec while EKG was measured. After these procedures, auditory thresholds to the 760 HZ tone were determined by the ascending and descending staircase method. All had auditory thresholds within 10 dB of the all subjects' mean threshold.

Design and Analysis

Subjects were grouped depending on their responses, according to all possible combinations for two levels of scores on the Neuroticism and Lie Scales. The cutoffs for assignment to the Lie groups were as follows: 7 and above 'High Deceptors', and less than 7 'Low Deceptors'. The cutoff for assignment into a 'High Neurotic' group was a Neuroticism score of $\geq$11. Subjects with Neuroticism score of <11 were designated 'Low Neurotic'. These groupings for Lie and Neuroticism scores were used for analysis of auditory evoked potential, tachistoscopic, and heart rate data.

Independence of the Lie Scale (i.e. from Neuroticism

and Psychoticism) was assessed by analysis of variance (ANOVA) with the above groupings of for Neuroticism as an independent variable and the Lie Scale as a dependent variable, and by linear zero-order correlations for lie with Neuroticism and psychoticism scale scores.

For each subject, the digitized 640 msec EEG epochs were averaged separately for each of the four stimulus intensities. Special software was written in the laboratory for this purpose (D. Fitzpatrick, personal communication, June, 1989). The software was constructed so as to allow for manual acceptance or rejection of trials. During averaging, each trial was examined for eye blink and alpha artifact. Artifactual trials were manually eliminated from the averages. AEP components were scored as the maximum amplitude deflection (peak or trough) with reference to the prestimulus conditions within the following latency ranges: 80-140 msec (N1) 140-230 msec (P2).

Peak amplitudes were obtained for N1, and P2 at CZ for each subject. Augmentation/reduction was determined on the basis of P2 differences in reference to a prestimulus baseline (Ackerman, Holcomb & Dykman, 1984; Paige, Reid, Allen & Newton, 1990; Buchsbaum, 1976). N1 and P2 differences for each subject were obtained for each of the four tones, and the 4 differences were fitted with regression lines by the least squares method, with positive

slopes implying increasing differences are a function of tone intensity. After slopes were found for all subjects, they were classified as augmenters or reducers in terms of whether their slopes were >10 degrees (augmenters) or <10 degrees (reducers). Data analyses were accomplished with the SPSS-X statistical software. Mixed model analyses of variance (specified with the MANOVA command) contrasted main effects and interactions for two levels of Neuroticism, three levels of lie, and four tone intensities on N1 and on P2 amplitudes taken at CZ. Degrees of freedom for the within subjects' factors were epsilon adjusted (Greenhouse & Geisser, 1959).

Because the means and standard deviations for trials to recognition were highly but non-uniformly intercorrelated, (table 2), a univariate approach would have lead to severe violations of the sphericity and compound symmetry assumptions essential univariate repeated measures ANOVA strategy. A multivariate analysis of variance (MANOVA) approach was therefore adopted. Both Neuroticism and Lie scores were entered into the design matrix as dichotomous factors, and means and standard deviations for pleasant and unpleasant words were entered as dependent variables for a total of four dependent variables. Significant overall MANOVAs were followed with univariate ANOVAs and Roy-Bargman Stepdown ANOVAs. All of these analyses were conducted with

the SPSSx statistical package with the MANOVA command.

ANOVA was conducted to contrast the effects of two levels of Neuroticism and three levels of lie as between subjects factors with four levels of tone intensity and eight levels of time epoch as within subjects factors on heart rate as a dependent variable. Degrees of freedom for within subjects factors and their interactions were epsilon adjusted (Greenhouse & Geisser, 1959).

Table 2

Correlations, Among Word Recognition Variables.

	MU	SU	MP	SP
MU	1.0000	.7192**	.8519**	.5639**
SU	.7192**	1.0000	.4916**	.4819**
MP	.8519**	.4916**	1.0000	.6870**
SP	.5639**	.4819**	.6870**	1.0000

** - Alpha ≤ .01 (2-tailed)

MU = Mean trials to recognition, unpleasant words

MP = Mean trials to recognition, pleasant words

SU = Standard deviation of trials to recognition, unpleasant words

SP = Standard deviation of trials to recognition, pleasant words

Results

Scores on the Lie Scale ranged from 0 to 13 ($\bar{X}$ = 4.96, s = 3.21) and scores on the Neuroticism scale ranged from 3 to 18 ($\bar{X}$ = 9.11, s = 4.40). The analysis of variance conducted to assess the independence of Neuroticism and Lie Scale scores did not invalidate the assumption of their independence $F(1,26) = 0.18$, $p>.67$. Linear correlations between lie and Neuroticism and lie and psychoticism were .026 and .068 respectively. Figures 1 and 2 are scatterplots for Lie and Neuroticism scores and Lie and Psychoticism scores respectively.

Figure 1

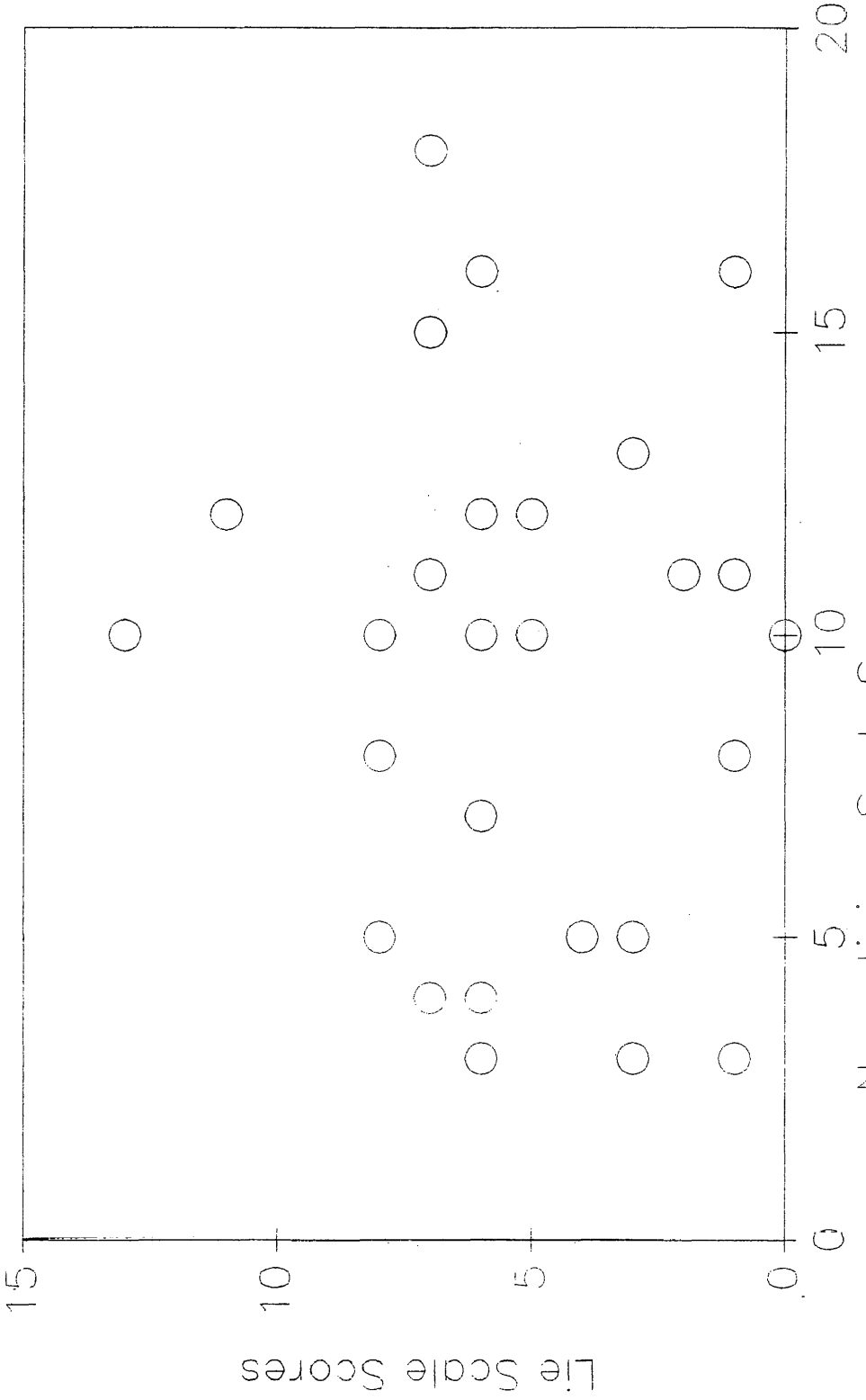


Figure 1: Lie scores (ordinate) plotted in relation to Neuroticism scores (abscissa).

Figure 2

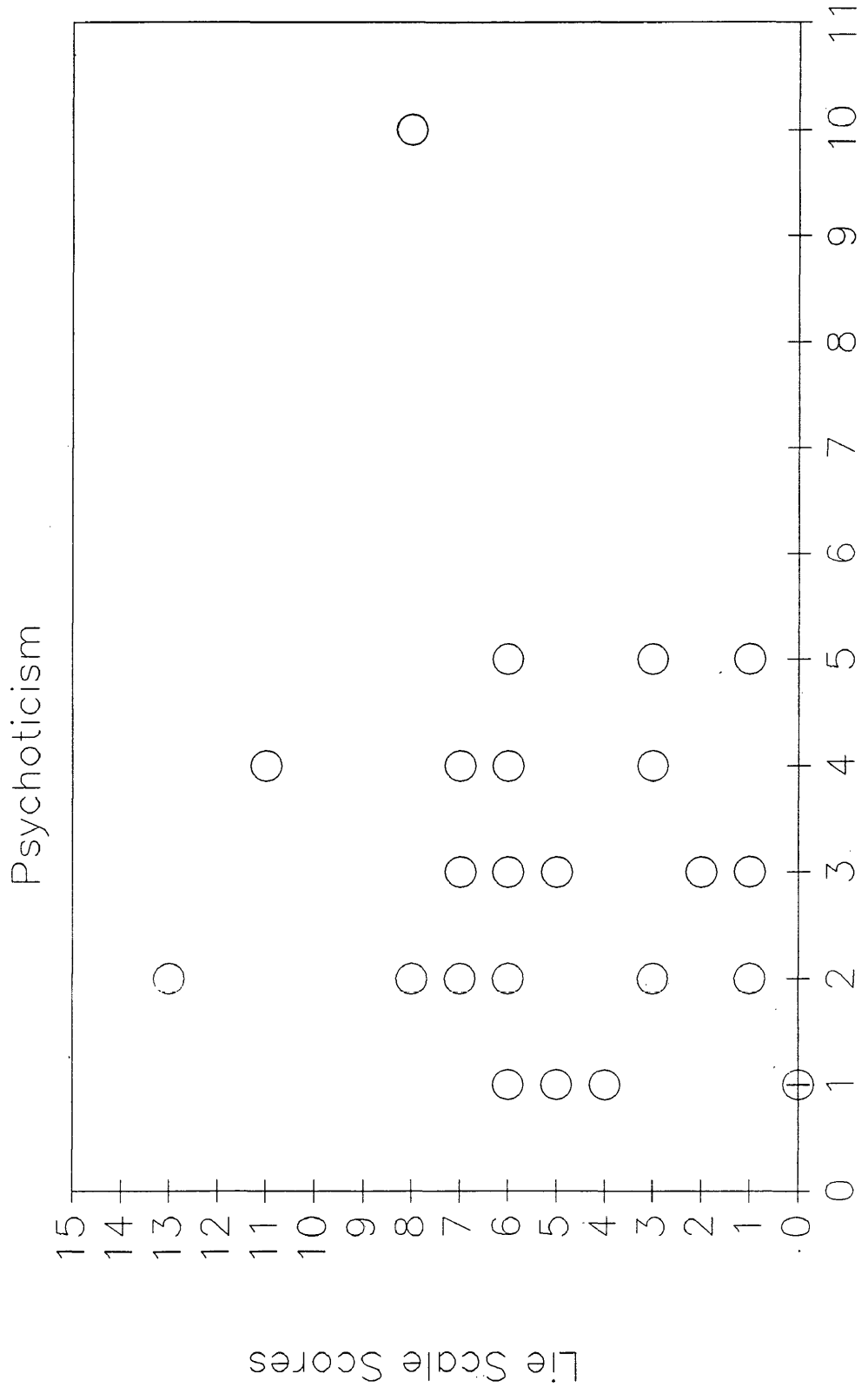


Figure 2: Scatterplot of Lie and Psychoticism scores.

Auditory evoked potentials

AEPs were analyzed at CZ, because previous research (eg. Paige et al., 1990; Knorring, Monakhov & Perris, 1978) revealed that the N1 and P2 components are strongest at this lead. A significant overall main effect was found at N1 for Tone intensity $F(2,41) = 13.75$, $p<.01$. No other significant effects were found at N1.

An overall main effect was found for Tone intensity at $F(3,43) = 15.96$, $p < .01$. Figure 3 shows grand averages of AEP waveforms for low, medium and high deceptors. Figure 4 illustrates the significant Lie by Tone intensity interaction $F(3,43) = 6.37$, $p < .01$.

Simple effects analyses revealed significant effects for Lie at 94 dB $F(1,43)= 6.90$, $p < .05$, and at 104 dB $F(1,43) = 24.35$, $p<.01$. Analyses for simple main effects of Lie at other stimulus intensities were nonsignificant.

Simple effects analyses revealed a significant simple main effect for tone intensity at the High Deceptor category $F(3,43) = 35.89$, $p<.01$. Trend analysis revealed a significant linear trend for Intensity and the Low Deceptor category $F(1,43) = 35.89$, $p<.01$. There was no simple main effect for tone intensity at the High Deceptor category.

ANOVA applied to assess the effects of two levels of Lie and two levels of Neuroticism on P2 amplitude/intensity slope showed a significant main effect for Lie $F(1,24) =$

10.52, $p<.005$. Figure 5 illustrates that the mean amplitude/intensity slope for High Deceptors was significantly less than that of Low Deceptors.

Figure 6 depicts the significant difference in the number of Augmenters and Reducers per Deceptor category. $\chi^2(1) = 10.22$, $p<.005$, Fishers exact probability = .00278. Seven of nine (78%) High Deceptors were Reducers. Sixteen of nineteen (84%) of the Low Deceptors were Augmenters.

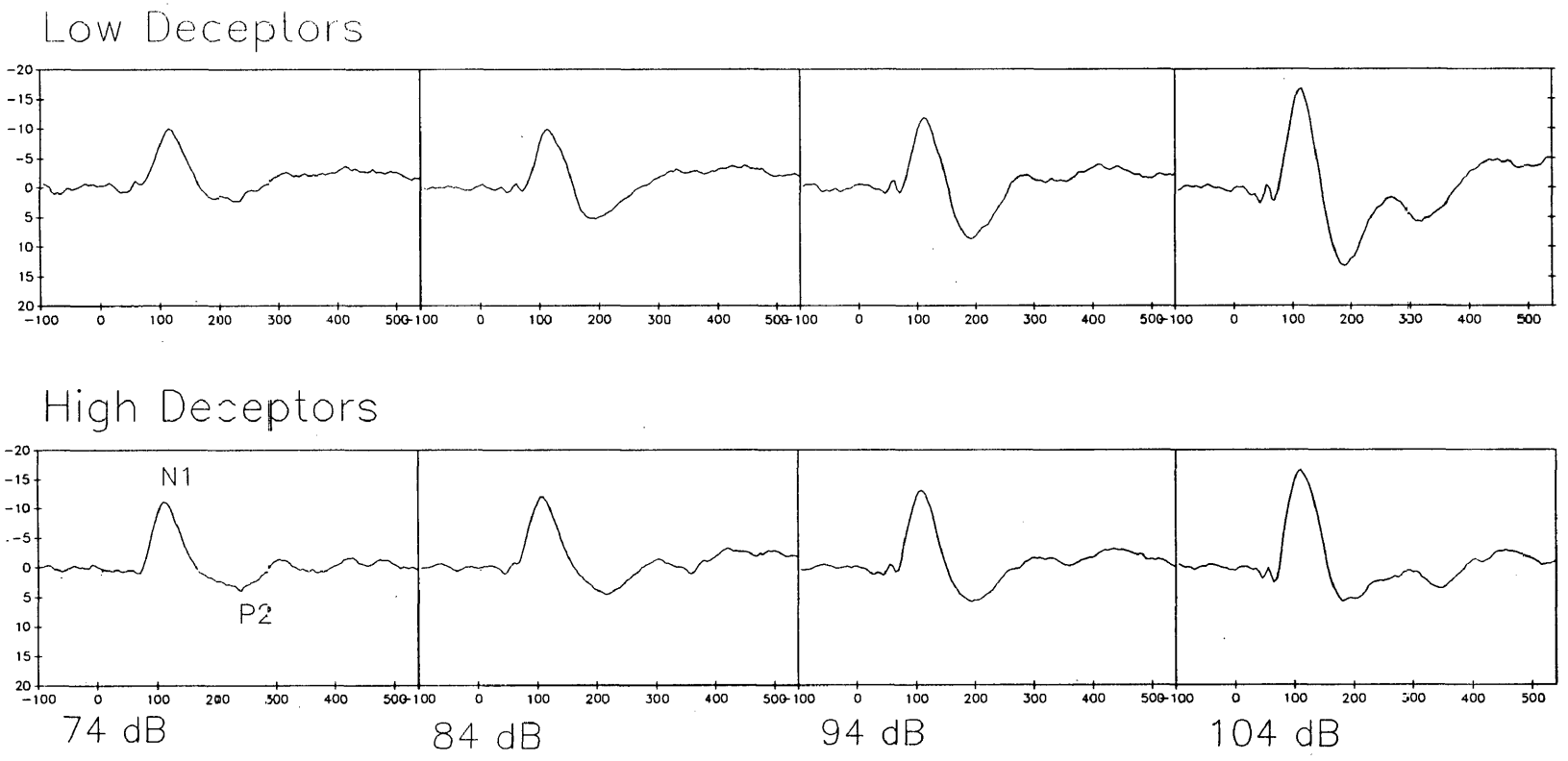
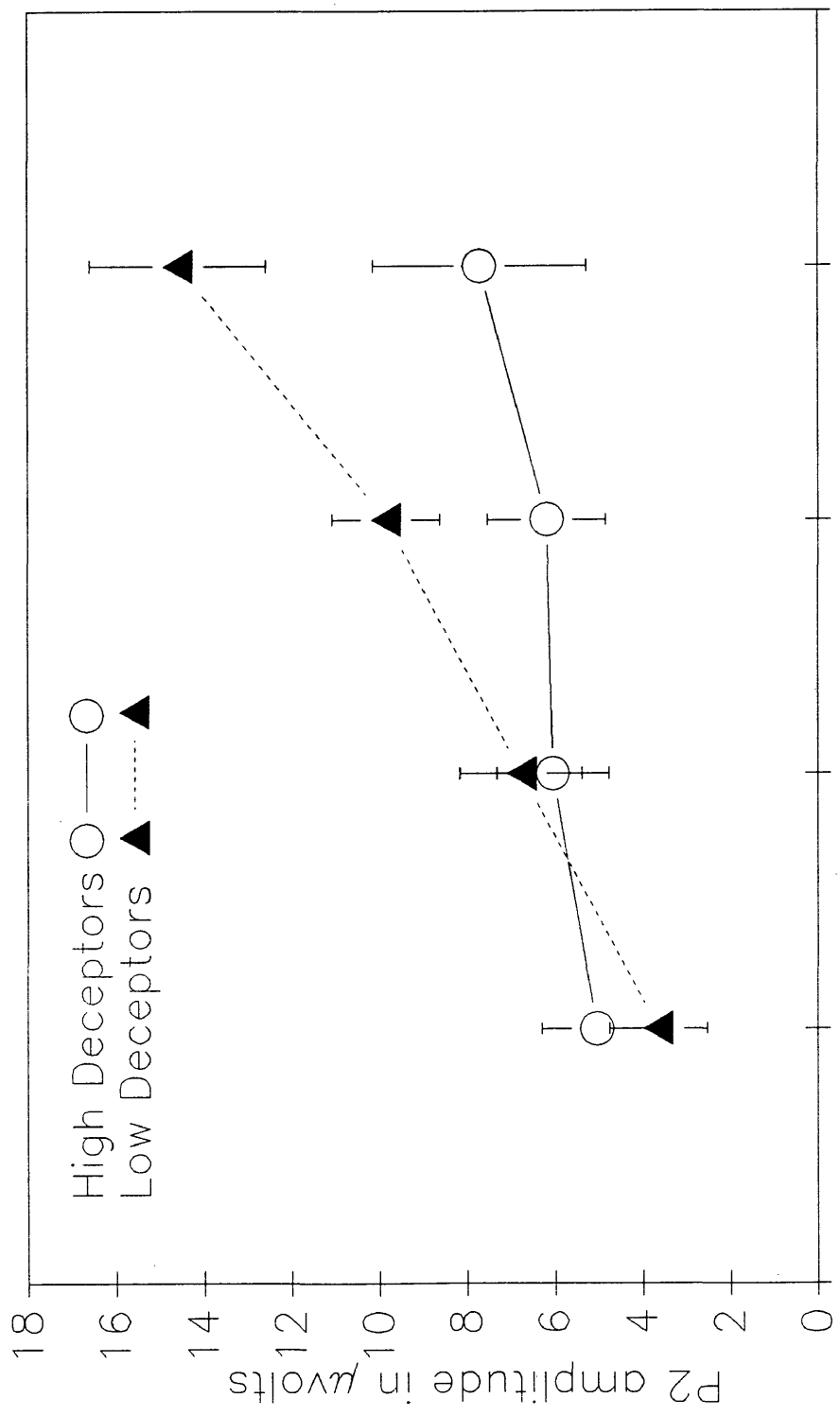


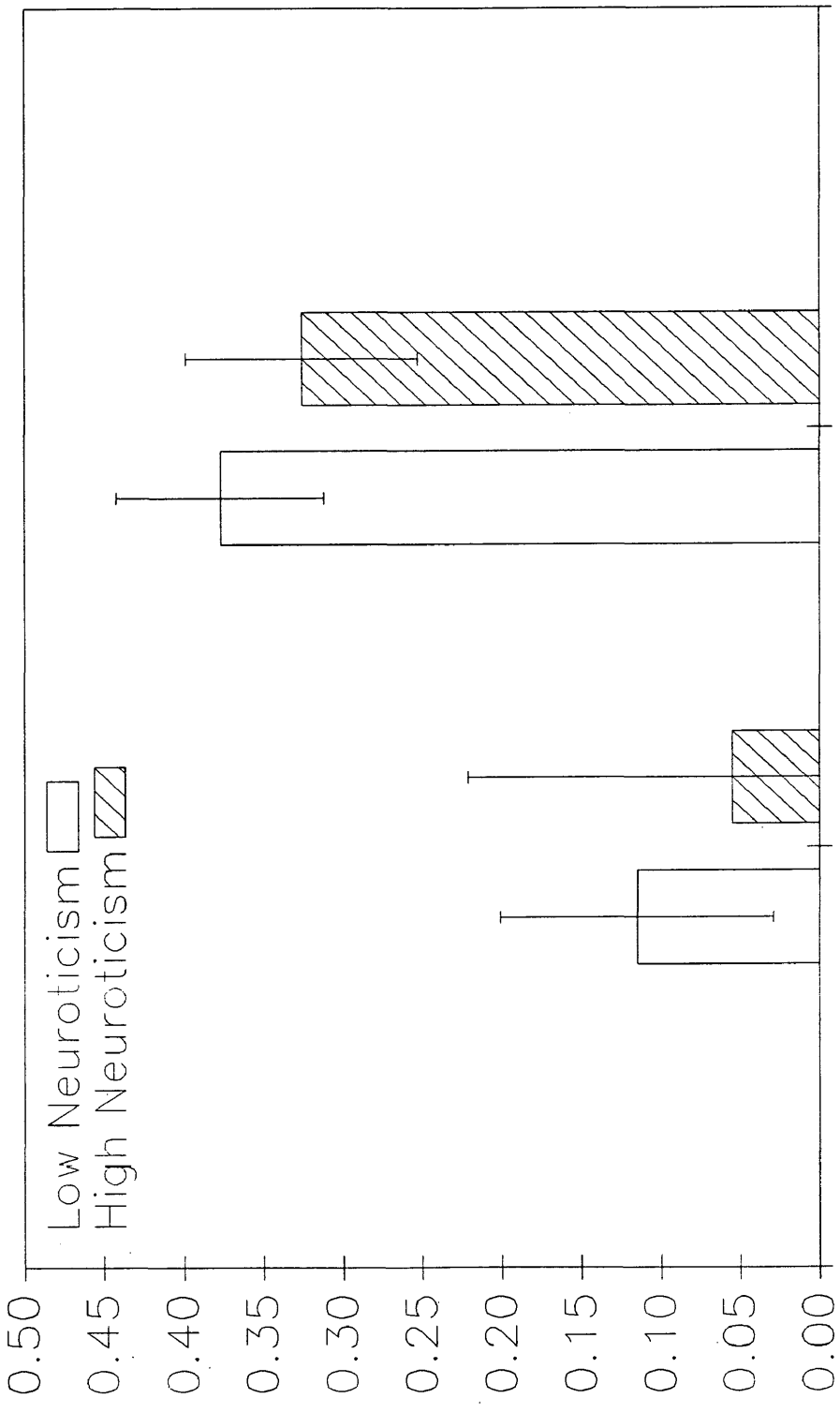
Figure 3: Ordinate, Microvolts
Abscissa, Tone intensity in dB SPL (large print), Milliseconds (small print)

Figure 4



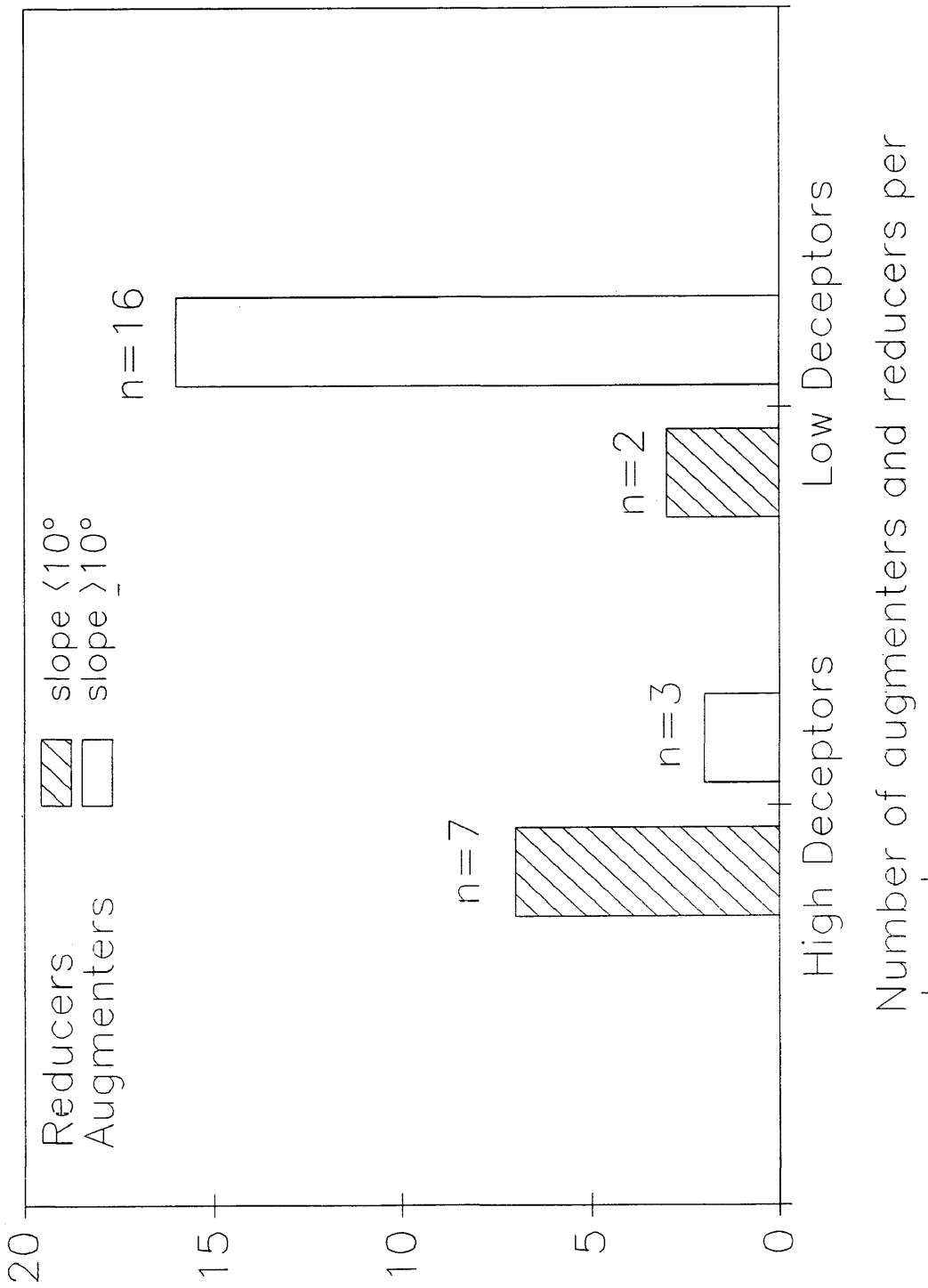
Graph illustrating the significant Group x Tone Intensity interaction effect.

Figure 5



Graph illustrating significant main effect for deceptor category on P2 amplitude/intensity slope.

Figure 6


Number of Subjects
20
15
10
5
0
Reducers
Augmenters
slope <10°
slope ≥10°
n=7
n=3
n=2
n=16
High Deceptors
Low Deceptors
Number of augmenters and reducers per deceptor group.

Recognition times for word stimuli

There was a significant overall main effect for Lie on the linear combination of dependent variables. Subsequent univariate ANOVAs revealed no significant main effects for lie on any of the dependent variables. As the apriori hypothesis was that High Deceptors would have elevated recognition thresholds for unpleasant words, the mean recognition threshold for unpleasant words was entered last into a Roy-Bargman Stepdown Analysis, directly after the mean recognition threshold for pleasant words. This analysis allowed for the statistical removal of variance due to the other dependent variables (Norusis,1988). High Deceptors had elevated recognition thresholds for unpleasant words in comparison to Low Deceptors by this analysis. Table 3 shows the summary tables for these analyses, as well as the obtained and adjusted means for the mean recognition threshold for unpleasant words.

Table 3

Summary Statistics for the Multivariate Analysis: Effects of Lie Scale Scores on Word Recognition Means and Standard Deviations.

Multivariate statistics for Lie

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.36179	3.11790	4.00	22.00	.036
Hotellings	.56689	3.11790	4.00	22.00	.036
Wilks	.63821	3.11790	4.00	22.00	.036
Roys	.36179				

Note.. F statistics are exact.

Roy-Bargman Stepdown F - tests for Lie

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. DF	Error DF	Sig. of F
SU	.80132	.74436	1.07652	1	25	.309
SP	.65670	.39112	1.67901	1	24	.207
MP	1.15765	.58416	1.98175	1	23	.173
MU	1.48425	.23057	6.43740	1	22	.019

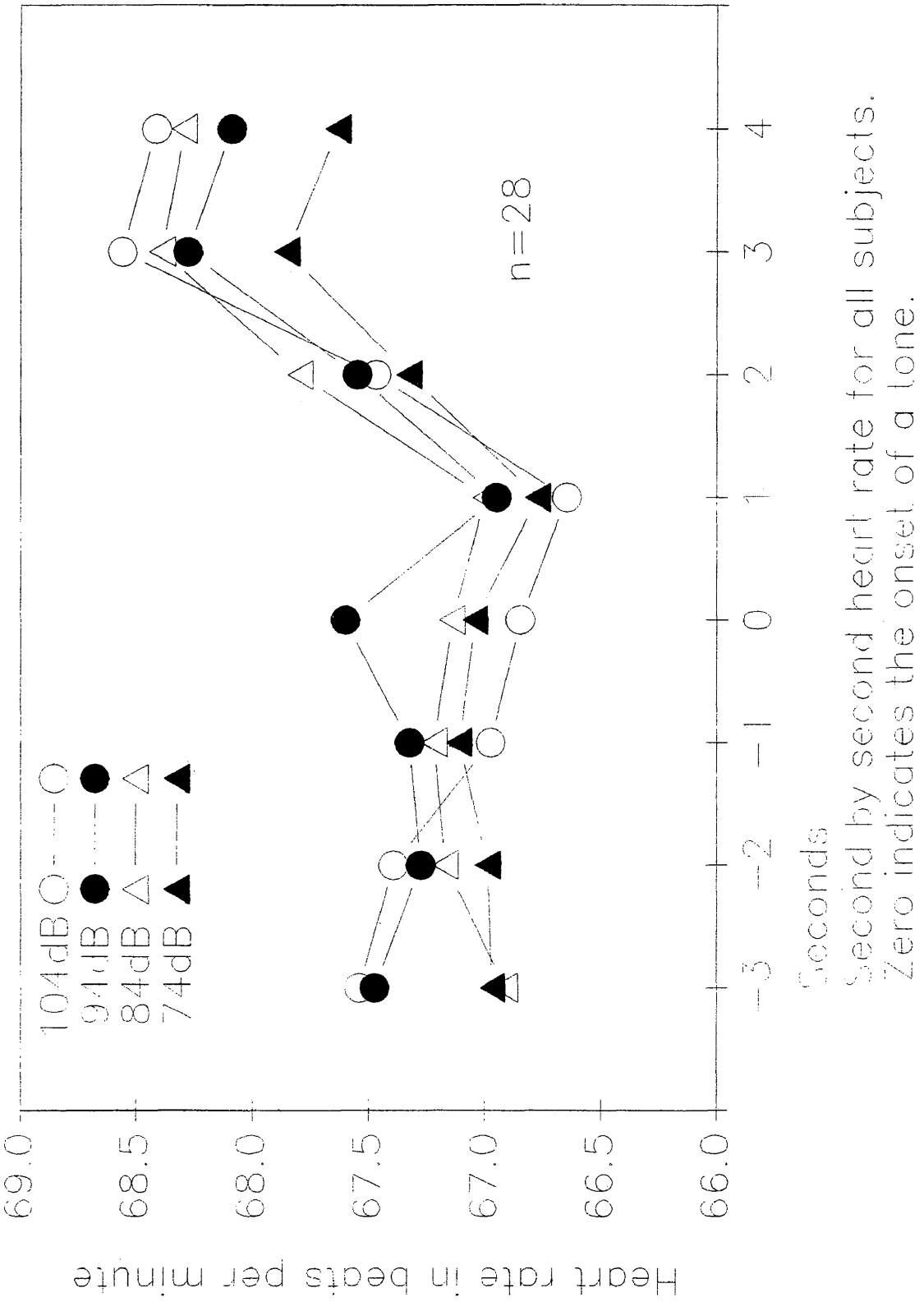
Observed and Adjusted and Means
Variable .. MU

	N	Observed Mean	Sdev.	Adjusted Mean
High Neurotic High Deceptors	4	8.084	2.069	7.833
Low Neurotic High Deceptors	5	7.080	1.111	7.640
High Neurotic Low Deceptors	8	7.575	1.194	7.077
Low Neurotic Low Deceptors	12	7.119	1.219	7.307

MU = Mean trials to recognition for unpleasant words
MP = Mean trials to recognition for pleasant words
SU = Standard deviation of trials to recognition for unpleasant words
SP = Standard deviation of trials to recognition for pleasant words

Heart Rate Response ANOVA was used to contrast effects on heart rate for four levels of tone intensity over eight one sec. epochs as within subjects factors with two levels of Neuroticism and two levels of Lie as between subjects factors. Figure 7 illustrates a significant main effect for seconds on heart rate $F(3,65) = 10.50$, $p<.01$. Dunnett's t procedure was used to contrast each of seconds -2 through 4 (negative numbers indicate prestimulus seconds) with second -3. The contrasts revealed a greater heart rate at 3 sec $t(65) = 6.12$, $p < .01$ and at 4 sec poststimulus $t(65) = 5.38$, $p < .01$. None of the prestimulus seconds differed from second -3.

Figure 7


Heart rate in beats per minute
69.0
68.5
68.0
67.5
67.0
66.5
66.0
104dB
94dB
84dB
74dB
n=28
−3
−2
−1
0
1
2
3
4
Seconds
Second by second heart rate for all subjects.
Zero indicates the onset of a tone.

Discussion

The results of the present study are consistent with a formulation of defensiveness as independent of Neuroticism with respect to both physiology and self-reports. Not only was there no correlation between Neuroticism and Lie Scale scores, but the physiological responses described on the basis of Neuroticism were qualitatively and quantitatively different from those described on the basis of defensiveness. The general profile of defensiveness that emerged, was one marked by avoidant coping (high Lie Scale scores), reactive desensitization by the CNS to high intensity stimulation (reduction of AEP slope), and perceptual defense (increased recognition threshold for unpleasant words). Neuroticism showed no significant relationships with any of the variables in the study.

Independence of the Lie Scale

It can be concluded that the Lie Scale of the EPQ did not measure primarily dissimulation in this study. If a subject is motivated to lie, then the subject 1.) would not be expected to endorse items with overt pathological content and 2.) should endorse items that reflect unlikely, but socially desirable personality attributes. Thus, if dissimulation was the primary construct measured by the Lie Scale, then scores on the Lie Scale would have correlated negatively with either scores on the Neuroticism Scale or

scores on the Psychoticism Scale. Such correlations were not found.

It is possible however, that denial of psychopathology (i.e low scores on the Psychoticism and Neuroticism Scales) has different motivational antecedents than does overreporting of socially desirable attributes (i.e. high Lie Scale scores), in which case the scales may not have correlated even had dissimulation been operating. Thus, the assumption that dissimulation is a unitary factor and would result in diminished self reports of <u>all</u> undesirable attributes must be recognized as an assumption, and conclusions made on the basis of this assumption must be treated carefully.

It is possible that elevated Lie Scale scores observed in this study were due to self deception, but not necessarily so. High scores on the Lie Scale may have described persons who were unusually honest and devoid of character flaws. That is, under conditions where motivation for dissimulation is low, it is possible that persons who score high on the Lie Scale are telling the truth, and are not prone to self deception. This possibility will be taken up later in the discussion of perceptual defense.

Because the Neuroticism and Lie Scales could be assumed to be independent, it seems reasonable to conclude that the other results obtained were not merely artifacts of

measurement, as was the case for some of the studies criticized by Millimet and Cohen (1973). It must be kept in mind, however, that the independence of the scales, though reasonable based on the analyses, is an assumption. The hypothesis, "there is no difference in the Lie Scale scores as a function of Neuroticism scale scores", was stated in the null form, and therefore can not be proven by failure to find a difference.

Because of the small sample size, the probability of a Type II error is of concern. On the other hand, the probability of obtaining a large correlation due to chance factors also increases with small sample sizes, and the correlations obtained for the Lie Scale with the Neuroticism and psychoticism scales were negligible.

Auditory Evoked Potentials

As was predicted, Lie Scale scores were associated with a reduction pattern of the P2 AEP slope. Specifically, high deceptors showed no significant increases in P2 amplitudes with increased tone intensities, whereas Low Deceptors showed a strong linear increase. The difference between the high and low deceptors with regard to tone intensity effects on P2 amplitude was apparent only at the high tone intensities (i.e. 94 and 104 dB).

Jamner and Schwartz (1986) found that high deceptors had pain thresholds and tolerances that were greater than

those of low deceptors. Furthermore, Jamner et al. (1988) reported that high scorers on the MCSD show increased serum glucose levels, and decreased monocyte and eosinophile counts, which may indicate elevated central opioid tonus. Based on these results, Jamner et al. (1988) and Jamner and Schwartz (1986) have proposed that high scorers on the EPQ Lie Scale have elevated levels of endogenous opiates.

Buchsbaum, Davis, and Bunney (1977) reported that naloxone changed a reducing pattern in somatosensory AEPs to an augmenting pattern in pain tolerant individuals, and von Knorring et al. (1979) correlated slope reduction of visual AEPs with increased endorphin levels in the cerebrospinal fluid of chronic pain patients. Thus, the results of the present study may be consistent with the opioid peptide hypothesis of repression (Jamner Schwartz & Leigh, 1986). This hypothesis holds that repressive coping is associated with elevated levels of endogenous opioid peptides, which could lead to reducing of the AEP. A caveat to this conclusion, is that AEP reducing is probably modality specific (Raine, Mitchell & Venables, 1981), and even though the effect of opioid peptides on reducing has been demonstrated for somatosensory (Buchsbaum, Davis & Bunney, 1977) and visual stimuli (von Knorring et al., 1979), it is not correct to assume that the same relationship holds in the auditory modality.

As was noted earlier, the opioid peptide hypothesis of repression is based largely on indirect evidence. Schwartz (1990) reviews support for the hypothesis, and in none of the studies that he mentions in that review is the actual level of opioid peptide activity measured. Future research could correlate repressive or defensive coping to positron emission tomography profiles of opiate ligand binding in the brain as a more direct means of testing the opioid peptide hypothesis of repression. Further support might come from a study that includes the effects of opioid antagonists such as naloxone and naltrexone as well as defensiveness on augmenting and reducing.

In this study, the P2 component was defined as the largest positive deflection between 140 and 230 msec. The latency of this peak may be important for conceptualizing defensiveness. The N1 component, that is the component that occurs around 100 msec, has been discussed as a correlate of selective attention (Naataanen 1982), and the N2 component, or the negative deflection that occurs just after the P2 component has been discussed with regard to passive attention (Loveless, 1983). However, the major component that occurs between N1 and N2, i.e. the P2 component, is less well understood.

In the present study, attenuation of the P2 component amplitude with increased stimulus intensity was correlated

with defensiveness. Thus, defensiveness for tone intensity could be viewed as being related to a neural process that took place between 140 and 230 msec (i.e. the parameters that defined the P2). It is not clear if the same neural mechanism mediates all defensiveness, or even stimulus intensity defensiveness across modalities (Buchsbaum, Haier & Johnson, 1983), but it appears that the avoidant strategy reflected in answers to questions on the EPQ Lie Scale parallels the avoidant strategy reflected in the reduction of the auditory AEPs. The results of the present study and that of Paige et al. (1990) indicate that P2 probably relates to some sort of defensive response, but it is not clear if this defensive response is permeable to cognitive manipulations. Whatever cognitive factors that may affect the P2 are as yet unknown.

Heart Rate Reactivity

Contrary to what was predicted, there were effects for neither Neuroticism nor Lie on heart rate changes to tone presentation. Kopp et al., (1987) reported that anxious subjects who showed diminished heart rate reactivity had higher baseline heart rates. Although the present study did not examine baseline heart rate per se, higher baseline heart rates might have been evidenced by a main effect for Neuroticism on epoch by epoch heart rate. Such an effect was not found, and these results are apparently inconsistent

with those of Kopp et al., (1987). However, because the present experimental protocol was lengthy, and no true measure of baseline heart rate was taken, the present results may not be comparable to those of Kopp et al., (1987). Furthermore, Weinberger (1990) has reviewed evidence that suggests that defensive low-anxious subjects have higher autonomic reactivity than other subjects. The present study found no such relationship.

Perceptual Defense

As was predicted, elevated scores on the Lie Scale were associated with increased perceptual defense. Though this effects was predicted, and seemed to support the initial hypothesis, possible sources of internal invalidity need to be examined.

As Holmes (1990) has stated, Erdelyi (1974) has offered a compelling explanation for perceptual defense, but despite a lapse of over ten years, there is still no conclusive evidence for perceptual defense that is free of confounds. The two reasons that he cites for doubting the available evidence, are that subjects are less willing to say "dirty" words or say sentences with sexual content, and that stressful words have been generally less familiar than non-stressful words. Studies such as that of Schill & Althoff (1968) make it clear that these are valid criticisms, but Holmes suggests that these factors alone are sufficient to

explain the results of all of the past perceptual defense studies.

The present study attempted to control for response inhibition and familiarity by the choice of unpleasant but not "dirty" words that were of equal familiarity to the non-stressful pleasant words. Thus, it seems that the present study successfully minimized the impact of the criticisms of Holmes (1990) and has strengthened the case for perceptual defense. It must be emphasized here that "strengthened" does not mean "settled".

If it can be assumed that the present study did indeed address perceptual defense, then it also seems that those who score high on the Lie Scale in this study also showed a greater degree of perceptual defense. It was concluded earlier that the Lie Scale probably did not measure dissimulation. However, it was also suggested that the Lie Scale could have measured either self-deception, or unusual honesty and integrity. There are several possible interpretations for the relationship of the Lie Scale to the differential recognition thresholds to unpleasant versus pleasant words observed in this study. One interpretation, is that Lie scale scores are affected by social desirability, and the same social desirability manifested longer recognition thresholds for less desirable or unpleasant words. Another interpretation, is that subjects

prone to lying about negative self-attributes are also prone to lying about words with negative emotional meaning. A third interpretation, is that the Lie Scale measures self deception that results in unawareness of ones own undesirable attributes, and that the relationship between the Lie Scale and perceptual defense was due to a general tendency on the part of individuals predisposed to self deception to be predisposed to repression. The resolution of this ambiguity will be accomplished only when either the Lie Scale or perceptual defense is unambiguous.

Summary of Conclusions

In sum, it was concluded that neuroticism and defensiveness are distinctive personality constructs with separate physiological manifestations, and that perceptual defense and reducing of the AEP are related to defensiveness. It was also concluded that an opioid peptide hypothesis of defensiveness warrants further investigation.

It is likely that the relationship between perceptual defense and scores on the Lie Scale was due to defensiveness. It seems reasonable to conclude that individuals who underreport undesirable self-attributes, display increased perceptual defense, and physiologically protect themselves from high stimulus intensities are defensive, but it is not clear that defensiveness necessitates self-deception. Defensive individuals may

employ strategies for avoidant coping that have little to do with self deception or lack of awareness.

Gurr and Sackheim (1979) have offered a set of criteria that they deem necessary and sufficient for describing self deception, and have developed a questionnaire to this end (Sackheim & Gurr, 1979). This instrument might prove useful to clearly identifying repression.

Contrary to the suggestion of Holmes (1990), that the concept of repression should be filed under the category of "interesting and unsupported", repression should instead be filed under the category of "worthy of further study". To cease study of this phenomenon would be to sweep it under the rug before we have tested it adequately.

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Appendix A., Eysenck Personality Questionnaire

Occupation

_____

Age _____ Sex _____

Instructions: Please answer each question by blackening the appropriate circle on the answer sheet that corresponds to the answer A = "YES" or the B = "NO". There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the questions.

PLEASE REMEMBER TO ANSWER EACH QUESTION

---

1. Do you have many different hobbies? .....YES NO
2. Do you stop to think things over before doing anything?.....YES NO
3. Does your mood often go up and down?.....YES NO
4. Have you ever taken praise for something you knew someone else had really done?.....YES NO
5. Are you a talkative person?.....YES NO
6. Would being in debt worry you?.....YES NO
7. Do you ever feel "just miserable" for no reason?.....YES NO
8. Were you ever greedy by helping yourself to more than your share of anything?.....YES NO
9. Do you lock up your house carefully at night?.....YES NO

10. Are you rather lively?.....YES NO

11. Would it upset you a lot to see a child or an animal suffer?.....YES NO

12. Do you often worry about things you should not have done or said?.....YES NO

13. If you say you will do something do you always keep your promise no matter how inconvenient it might be?.....YES NO

14. Can you usually let yourself go and enjoy yourself at a lively party?.....YES NO

15. Are you an irritable person?.....YES NO

16. Have you ever blamed someone for doing something you knew was really your fault?.....YES NO

17. Do you enjoy meeting new people?.....YES NO

18. Do you believe insurance schemes are a good ideas?.....YES NO

19. Are your feelings easily hurt?.....YES NO

20. Are **all** your habits good and desirable ones?.....YES NO

21. Do you tend to keep in the background on social occasions?.....YES NO

22. Would you take drugs which may have strange or dangerous effects?.....YES NO

23. Do you often feel "fed-up"?.....YES NO

24. Have you ever taken anything (even a pin or button) that belonged to someone else?....YES NO

25. Do you like going out a lot?.....YES NO

26. Do you enjoy hurting people you love?.....YES NO

27. Are you often troubled about feelings of guilt?.....YES NO

28. Do you sometimes talk about things you know nothing about?.....YES NO

29. Do you prefer reading to meeting people?..YES NO

30. Do you have enemies who want to harm you?.YES NO

31. Would you call yourself a nervous person?.YES NO

32. Do you have many friends?.....YES NO

33. Do yo enjoy practical jokes a that can sometimes really hurt people?.....YES NO

34. Are you a worrier?.....YES NO

35. As a child did you do as you were told immediately and without grumbling?.....YES NO

36. Would you call yourself happy-go-lucky?...YES NO

37. Do good manners and cleanliness matter much to you?.....YES NO

38. Do you worry about awful things that might happen?.....YES NO

39. Have you ever broken or lost something belonging to someone else?.....YES NO

40. Do you usually take the initiative in making new friends?.....YES NO

41. Would you call yourself tense or "highly strung"?.....YES NO

42. Are you mostly quiet when you are with other people?.....YES NO

43. Do you think marriage is old-fashioned and should be done away with?.....YES NO

44. Do you sometimes boast a little?.....YES NO

45. Can you easily get some life into a rather dull party?.....YES NO

46. Do people who drive carefully annoy you?..YES NO

47. Do you worry about your health?.....YES NO

48. Have you ever said anything bad or nasty about anyone?.....YES NO

49. Do you like telling jokes and funny stores to you friends?.....YES NO

50. Do most things taste the same to you?.....YES NO

51. As a child were you ever cheeky to your parents?.....YES NO

52. Do you like mixing with people?.....YES NO

53. Does it worry you if you know there are mistakes in your work?.....YES NO

54. Do you suffer from sleeplessness?.....YES NO

55. Do you always wash before a meal?.....YES NO

56. Do you nearly always have a "ready answer" when people talk to you?.....YES NO

57. Do you like to arrive at appointments in plenty of time?.....YES NO

58. Have you often felt listless and tired for no reason?.....YES NO

59. Have you ever cheated at a game?.....YES NO

60. Do you like doing things in which you have to act quickly?.....YES NO

61. Is (or was) your mother a good woman?.....YES NO

62. Do you often feel life is very dull?.....YES NO

63. Have you ever taken advantage of someone?.YES NO

64. Do you often take on more activities than you have time for?.....YES NO

65. Are there several people who keep trying to avoid you?.....YES NO

66. Do you worry a lot about your looks?.....YES NO

67. Do you think people spend too much time safeguarding their future with savings and insurance?..YES NO

68. Have you ever wished that you were dead?..YES NO

69. Would you dodge paying taxes if you were sure you could never be found out?.....YES NO

70. Can you get a party going?.....YES NO

71. Do you try not to be rude to people?.....YES NO

72. Do you worry too long after an embarrassing experience?.....YES NO

73. Have you ever insisted on having your own way?.....YES NO

74. When you catch a train do you often arrive at the last minute?.....YES NO

75. Do you suffer from "nerves"?.....YES NO

76. Do your friendships break up easily without it being your fault?.....YES NO

77. Do you often feel lonely?.....YES NO

78. Do you always practice what you preach?...YES NO

79. Do you sometimes like teasing animals?....YES NO

80. Are you easily hurt when people find fault with you or the work you do?.....YES NO

81. Have you ever been late for an appointment or work?.....YES NO

82. Do you like plenty of bustle and excitement around you?.....YES NO

83. Would you like other people to be afraid of you?.....YES NO

84. Are you sometimes bubbling over with energy and sometimes very sluggish?.....YES NO

85. Do you sometimes put off until tomorrow what you ought to do today?.....YES NO

86. Do other people think of you as being very lively?.....YES NO

87. Do people tell you a lot of lies?.....YES NO

88. Are you touchy about some things?.....YES NO

89. Are you always willing to admit it when you have made a mistake?.....YES NO

90. Would you feel sorry for an animal caught in a trap?.....YES NO

Appendix B, Informed Consent Form

IRB # 319-90

TITLE OF STUDY

PSYCHOPHYSIOLOGICAL AND PERSONALITY CORRELATES OF REPRESSION AND SENSITIZATION.

INVITATION TO PARTICIPATE
You are invited to participate in this experiment which will study brain responses to stimulation by sounds or words.

BASIS FOR SUBJECT SELECTION
You were selected as a potential subject because you are between the ages of 19 and 45.

PURPOSE OF THE STUDY
The purpose of the study is to determine if changes in recordings of brain electrical activity and heart rate following sounds of varying loudness can tell us more about the way the human brain protects itself from threat and harm.

EXPLANATION OF PROCEDURES

GENERAL INFORMATION
The experimental session will take less than three hours and will be conducted in the Psychophysiology Laboratory at the Department of Psychiatry. The procedures will be as follows:

INTERVIEW AND TEST
You will be asked some questions about your mood, and then you will fill out a questionnaire that has to do with how you respond to the world around you.

WORD STIMULATION
Your head will be measured and a cap fitted with electrodes will be placed on your head. Also, electrodes will be taped to your earlobes, face and chest. Your skin will be pricked with a sterile needle at the electrode sites and electrode paste will be placed on your skin. You will then sit in a comfortable chair while you view some words presented on a computer screen. You will be in front of the screen for less than one hour.

TONE STIMULATION

You will then remain seated, put on some earphones and listen to brief sounds through the earphones. You will be in the chair listening for about one hour.

RISKS AND DISCOMFORTS

When we prick your skin it may irritate for a moment but no real pain is involved. The paste we use will stick in your hair, but it will wash out easily. You may become bored and restless sitting for two hours. Some of the words that you will see may be unpleasant.

POTENTIAL BENEFITS

You are unlikely to obtain any direct benefits by participating in this experiment. However, the experiment may help us to better understand how the nervous system responds to different types of stimulation.

ALTERNATIVES TO PARTICIPATION

It is not necessary for you to participate in this study, and the decision to participate or not will in no way affect your status at any branch of the University of Nebraska.

EMERGENCY MEDICAL TREATMENT

In the event of a research related injury or if you experience an adverse reaction, please immediately contact Dr. Jasbir Kang or Dr. Benjamin Graber, telephone 559-5056 during the day or 559-5000 at night.

FINANCIAL OBLIGATIONS

There will be no costs to you as a consequence of your being in this experiment.

COMPENSATION FOR PARTICIPATION

You will be paid $25.00 for each experimental session in which you participate.

COMPENSATION/IN-CASE-OF-INJURY

If injury occurs as a direct result of the procedure described above, the emergency medical care required to treat the injury will be provided at the University of Nebraska at no expense to you, providing that the cost of such medical care is not reimbursable through your own health insurance. However, no additional compensation for physical care, hospitalization, loss of income, pain, suffering, or any other form of compensation will be provided for any injury that occurs as a direct consequence of the non-negligent performance of the procedures described above.

ASSURANCE OF CONFIDENTIALITY
Any information obtained during this study which could identify you will be kept strictly confidential. The information obtained in this study may be published in scientific journal or presented at scientific meetings, but your identity will be kept strictly confidential.

WITHDRAWAL FROM THE STUDY
Participation is voluntary. Your decision whether or not to participate will not affect your present or future medical care at the University of Nebraska Medical Center. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time.

OFFER TO ANSWER QUESTIONS
If you have any questions, please do not hesitate to ask and they will be answered at this time. If you think of questions later, please feel free to contact one of the investigators listed below.
If you have any questions concerning your rights as a research subject you may contact the University of Nebraska Institutional Review Board (IRB), telephone (402) 559-6463.

YOU ARE VOLUNTARILY MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE CERTIFIES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ AND UNDERSTOOD THE INFORMATION PRESENTED. YOUR SIGNATURE ALSO CERTIFIES THAT YOU HAVE HAD AN ADEQUATE OPPORTUNITY TO DISCUSS THIS STUDY WITH THE INVESTIGATOR AND YOU HAVE HAD ALL YOUR QUESTIONS ANSWERED TO YOUR SATISFACTION. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

_____

Signature of Subject Date

MY SIGNATURE AS WITNESS CERTIFIES THAT THE SUBJECT SIGNED THIS CONSENT FORM IN MY PRESENCE AS HIS/HER VOLUNTARY ACT AND DEED

_____

Signature of Witness Date

IN MY JUDGEMENT THE SUBJECT IS VOLUNTARILY AND KNOWINGLY GIVING INFORMED CONSENT AND POSSESSES THE LEGAL CAPACITY TO GIVE INFORMED CONSENT TO PARTICIPATE IN THIS RESEARCH STUDY.

_____

Signature of Investigator Date

INVESTIGATORS

Benjamin Graber, M.D.	559-5056 (day)	559-5000 (night)
Shelton Hendricks, Ph.D.	559-5056 (day)	559-5000 (night)
Jasbir S. Kang, M.D.	559-5056 (day)	559-5000 (night)
Denis Fitzpatrick	559-5116 (day)	559-5000 (night)
Scott Balogh, M.D.	559-5116 (day)	559-5000 (night)
John Kline	559-5116 (day)	559-5000 (night)