RESPONSES BY PSYCHOPATHS
TO EMOTIONAL WORDS

By
SHERRIE WILLIAMSON
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Department of Psychology

The University of British Columbia
1956 Main Mall
Vancouver, Canada
V6T 1Y3

Date Jan 27, 85
ABSTRACT

Reaction time, P300 latency, and P300 amplitude were used as measures to assess psychopathic responses to emotional words. Negative, positive, and neutral words were presented to psychopaths and nonpsychopaths in a lexical decision task. Relative to nonemotional words nonpsychopaths responded with faster reaction times to emotional words. This differential responding was not found in psychopaths. Additionally, emotional words increased P300 latency for nonpsychopaths and decreased it for psychopaths when the two groups were compared. It is suggested that these results lend some credence to Cleckley's (1982) belief that psychopaths suffer from semantic dementia.
# TABLE OF CONTENTS

Abstract ........................................................................................................ ii.
List of Tables ................................................................................................ vi.
List of Figures ............................................................................................... vii.
Acknowledgements ...................................................................................... x.

I. Introduction ............................................................................................. 1
II. Review of the Literature
   A. Shallow affect in Psychopaths......................................................... 6
   B. The affective salience of emotional words:
      Evidence for the independent processing of the
      emotional and referential aspects of word
      meaning ................................................................. 10
      1. Memory and association factors ................................. 11
      2. Thresholds and reaction times ................................. 20
      3. Hemispheric differences in the processing of
         emotional and nonemotional words
         i. Brain damage evidence ................................. 25
         ii. Divided visual-field studies ......................... 29
4. Electrocortical responses: Differential processing of emotional and nonemotional words as measured by the EEG. 30

C. Models of lexical access. 37
D. Words and word meaning. 42
E. An hypothesis: Emotional words do not mean to the psychopath what they mean to the nonpsychopath. 44

III. Method
A. Subjects. 46
B. Stimulus presentation. 47
C. Physiological recording. 49
D. Procedure. 50

IV. Results
A. Reaction time, P300 latency and amplitude data. 52
   1. Reaction time. 53
   2. P300 latency. 55
   3. P300 amplitude. 60
B. Additional results. 60
C. Word rating data. 63
D. Additional analyses. 63
E. Individual subject data. 73
F. Accuracy data ........................................ 73
G. Qualitative observations .......................... 79
V. Summary of results .................................. 80
VI. Discussion ............................................. 80
References ................................................... 90
Appendix A .................................................. 103
LIST OF TABLES

Table I. Group mean reaction times for emotional and neutral words collapsed across visual-fields .......................... 56

Table II. Group mean P300 latency for emotional and neutral words collapsed across visual-fields .......................... 58

Table III. Group mean P300 amplitudes for emotional and neutral words collapsed across visual-fields ...................... 61

Table IV. Group means for negative, positive and neutral words on the word rating form ............ 64

Table V. Group mean reaction times for negative, positive and neutral words collapsed across visual-fields .......................... 67

Table VI. Group mean P300 latency for negative, positive and neutral words collapsed across visual-fields .......................... 68

Table VII. Group mean P300 amplitudes for negative, positive and neutral words collapsed across visual-fields ...................... 69
Table VIII. Group mean accuracy scores for negative, positive and neutral words collapsed across visual-fields ................. 78
LIST OF FIGURES

Figure 1. ERP Waveforms ........................................... 54
Figure 2. Group means for reaction time data for emotional
and neutral words collapsed across the left and
right visual-fields............................................. 57
Figure 3. Group means for P300 latency data for emotional
and neutral words collapsed across the left and
right visual fields........................................... 59
Figure 4. Group means for P300 amplitude data for emotional
and neutral words collapsed across the left and
right visual fields........................................... 62
Figure 5. Group means for reaction time data for negative,
positive, and neutral words collapsed across the
left and right visual fields................................. 70
Figure 6. Group means for P300 latency data for negative,
positive, and neutral words collapsed across the
left and right visual fields............................... 71
Figure 7. Group means for P300 amplitude data for negative,
positive, and neutral words collapsed across the
left and right visual fields............................... 72
Figure 8. Degree of facilitation across subjects and groups for negative words over neutral words with reaction time as the dependent measure .................. 74

Figure 9. Degree of facilitation across subjects and groups for positive words over neutral words with reaction time as the dependent measure .................. 75

Figure 10. Degree of facilitation across subjects and groups for negative words over neutral words with P300 latency as the dependent measure .................. 76

Figure 11. Degree of facilitation across subjects and groups for positive words over neutral words with P300 latency as the dependent measure .................. 77

Figure 12. Group mean reaction time data for negative, positive, and neutral words across the left and right visual-fields .................. 85
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I. INTRODUCTION

Cleckley (1982), has probably provided the most comprehensive description of the psychopathic personality through a number of clinical case histories and a sixteen item list of the main features of the syndrome. Most of these sixteen listed traits are concerned with an affective deficit, a notion central to the concept of the psychopath from its earliest inception (for a review see Craft, 1964). Cleckley (1982) further postulated that the central psychopathic defect was one of semantic dementia: a dissociation between thought and affect, feeling and intent.

However intelligent, he [the psychopath] apparently assumes that the other persons are moved by and experience only the ghostly facsimiles of emotion or pseudo emotion known to him. However quick and rational a person may be and however subtle and articulate his teacher, he cannot be taught awareness of significance which he fails to feel. He can learn to use the ordinary words and, if he is very clever, even extraordinarily vivid and eloquent words that signify these matters to other people. He will also learn to reproduce appropriately all the pantomime of feeling; but, as Sherrington said of
the decerebrated animal, the feeling itself does not come to pass (p. 230).

Unfortunately, little direct experimental evidence has surfaced to support this hypothesis. Recent neuropsychological studies indicate that the psychopath may possess unusual patterns of cerebral asymmetries with respect to language (Hare and Jutai, 1986; Hare and McPherson, 1984), but the connection between these findings and Cleckley's hypothesis is unclear.

These, and most other studies involving normal individuals, have focused almost exclusively on the denotative aspects of language even though the meaning of words involves both referential and affective components. Generally, there has been little attempt to analyze the affective component of word meaning, how this information is stored and accessed, whether the affective component is subsumed under the denotative components and stored in the lexicon as an integral part of the word's semantic meaning, or whether it is accessed in a separate system by way of a different process. From the relatively small amount of work that has been done it would appear that words carry affective information that may be processed and responded to independently of their denotative meaning (eg. Gardner and Denes, 1973; Landis, Graves and Goodglass, 1982; Wickens and Clark, 1968), and that the system responsible for this processing probably resides in the right-hemisphere (eg. Graves, Landis and Goodglass, 1981; Brownell,
Recently, Jutai (1980) attempted to further develop the concept of Cleckley's semantic dementia by hypothesizing a deficit in the semantic structure of the psychopath's language. It would seem that this notion somehow misses the essential nature of Cleckley's hypothesized syndrome. Cleckley was stressing the affective alteration of experience whereas Jutai was investigating the organization of the referential system of meaning. Cleckley (1982) likened the psychopathic disorder of semantic dementia to the semantic aphasia of Head (1926), "... characterized by want of recognition of the ultimate significance and intentions of words and phrases."(p. 234). Other authors, such as Grant (1965), have also commented on the psychopath in a similar vein, "... ideas of mutuality of sharing and identification are beyond his [the psychopath's] understanding in an emotional sense; he knows only the book meaning of words."(p. 50).

So if in normal discourse a psychopath has learned to use words correctly in a referential sense, and has even learned to use emotionally toned words correctly, it may still be that "emotional" words fail to have any real significance for him. Cleckley (1982) has pointed out that it may seem nonsensical to say that the experience of life is not meaningful to the psychopath. A similar objection could also apply to the conceptual hypothesis that affectively toned words do not mean to the psychopath what they mean to the nonpsychopath, but as
Cleckley (1982) states, all this means is that "a good deal of the affective substance that people find in life experience is lacking in the psychopath's responses . . ."(p. 231).

Some tangential evidence for this comes from a study by Eichler (1965). In an analysis of the speech of pathological groups he found that psychopaths scored higher than normals on negation (no, not, nothing etc.), retraction (concurrently illogical statements), and evaluation (value judgements). An example of a retractor is "John is an honest person. Of course he has been involved in some shady deals." It may be that the psychopath is unaware of this incongruity because he is unaware of the real significance of the words he uses. By employing an excessive number of evaluators he seems to have learned how to use them, but their salience is lost through their indiscriminate application.

If in fact the psychopath lacks an evaluative system that is responsive to either the salience or polarity of emotional words, then tasks that have shown differences in the way that nonpsychopathic individuals respond to affective and neutral words should not result in differential responding in psychopaths. A paradigm that has found such effects in normals is the lexical decision task, where emotionally toned words can, depending on their valence, increase or decrease speed of responding and accuracy relative to nonemotional words (Bray, 1984; Graves et al, 1981; Strauss, 1983). Additionally, the basis for this effect probably lies in the right-hemisphere
(Graves et al, 1981; Landis et al, 1982). This is most likely a reflection of the more general finding that the right- as opposed to the left-hemisphere seems to predominate in the processing of the emotional content of a stimulus (eg. Borod, Koff and Caron, 1983; Bryden, Ley and Sugarmen, 1982; Carmon and Nachson, 1973; Moscovitch, 1983; Ross and Mesulam, 1979; Strauss and Moscovitch, 1981; Wapner, Hamby and Gardner, 1981).

Another correlate of the differential processing of emotional and nonemotional words and of emotional word polarity is the event-related potential or ERP. Investigators have found that ERPs to positively and negatively toned words can be differentiated through multivariate analysis with success rates more than twice those of chance (Chapman, 1979; Chapman, Bragdon, Chapman and McCrery, 1977; Chapman, McCrery, Chapman and Bragdon, 1978; Chapman, McCrery, Chapman and Martin, 1980). Others have found latency and amplitude differences in some of the endogenous components of the ERP relative to affective and neutral words (Begleiter and Platz, 1969; Begleiter, Porjesz and Garozzo, 1977; Kostandov and Arzumanov, 1977).

Past investigations then, have demonstrated a dissociation between the referential and affective components of word meaning. Two dependant measures of this effect are lexical decision response times, and latency and amplitude measures of the ERP. This study is concerned with the
hypothesis that an evaluative system responsive to emotional word salience is present in nonpsychopaths but lacking in psychopaths.

What follows is a review of the relevant literature. Clinical descriptions and empirical evidence which address the question of an emotional deficit in the psychopath are covered first. It is then suggested that in contrast to the usual methods of investigating this proposed defect, a direct test of Cleckley's hypothesized syndrome of semantic dementia should be carried out. It is suggested that this can be accomplished by comparing psychopathic and nonpsychopathic responses to emotional words in a lexical decision task. Literature concerning responses to emotional and nonemotional words by normal individuals is then reviewed. Following this is a discussion of the main models of lexical decision, and distinctions are made between various definitions of word meaning. Finally, a way to empirically test whether or not semantic dementia exists in psychopaths is suggested.

II. REVIEW OF THE LITERATURE

A. SHALLOW AFFECT IN PSYCHOPATHS

The current Diagnostic and Statistical Manual of Mental Disorders (DSM - III; American Psychiatric Association, 1980) makes little reference to emotional responsiveness in
describing the category of Antisocial Personality Disorder. The manual outlines a series of criteria for the diagnosis that are only tangentially related to the issue of affect. This is unfortunate, as it appears that the tack taken by the authors is to focus on the "moral" as opposed to the emotional deficit traditionally associated with the psychopathic personality. The authors list criteria that mostly include the consequences of the deficits that the more traditional and clinically based literature suggests as actually defining the psychopathic personality. These deficits are usually described in terms of emotional coldness or a lack of feeling. Cleckley (1982) has probably given the most complete clinical picture of the psychopath. He lists 16 traits that form a syndrome which distinguishes the psychopath from other pathological groups. Three of these characteristics pertain directly to affect: 6. Lack of remorse and shame, 9. Pathologic egocentricity and incapacity for love, and 10. General poverty in the major affective reactions. Cleckley (1982) feels that a psychopath may effectively simulate an affective response, but that the real feeling is missing. Hare (1980) used a three point rating scale to assess 143 prison inmates on Cleckley's 16 criteria and then performed a principle components analysis on the resultant trait scores. Five factor were extracted which accounted for 64% of the total variance. The largest factor, which accounted for almost 30% of the total variance, was found to load heavily on the emotional criteria in
Cleckley's list of psychopathic traits. These traits included the three previously mentioned plus two more: 5. Untruthfulness and insincerity, and 12. Unresponsiveness in general interpersonal relations.

Hare (Hare, 1980; Hare, 1985; Schroeder, Schroeder and Hare, 1983) has developed a research scale for the assessment of psychopathy in criminal populations. Inmates can be rated on 22 items which were originally chosen as being representative of the type of information used in making "global ratings" of psychopathy as based on Cleckley's criteria. The factor structure of the checklist produces five factors. The second major factor accounts for approximately 13 per cent of the variance and loads on items representative of the emotional deficit of the psychopath.

Karpman (1961) describes the psychopath as callous and emotionally immature. McCord and McCord (1964), after a review of the literature, concluded that the two essential features of psychopathy are lovelessness and guiltlessness, and that an individual should not be classified as such unless he manifests these deficits.

Generally, most of the knowledge concerning psychopaths and emotion is clinical and anecdotal in nature. More empirical information comes mainly from self-report measures or autonomic correlates of affective situations. Many of these studies focus on the identification of personality characteristics through self-report inventories (eg.
Schalling, 1978), or the identification of autonomic correlates thought to be related to emotional functioning (eg. Hare, 1970). Self-report inventories typically include scales that measure empathy, thrill-seeking, or anxiety. Lack of demonstrated validity for many of these scales is a serious problem, as is the likelihood of dissimulation in answering.

Investigations into the autonomic correlates of emotional reactivity in psychopaths have concentrated on the arousal of fear or anxiety (Hare, 1965; Hare, 1970). It has been found that psychopaths are poor electrodermal conditioners to aversive stimuli (Hare, 1978), this finding being interpreted to mean that psychopaths experience little anticipatory fear to noxious situations (see Hare and Cox, 1978 for a discussion of this finding). However their cardiovascular responses are conditioned more easily than for nonpsychopaths (Hare, 1978).

Another way to investigate the postulated affective deficit of the psychopath would be to directly test Cleckley's (1982) concept of semantic dementia. Cleckley (1982) has long argued that the speech of the psychopath, although mechanically correct, masks a profound semantic disorder that may involve a dissociation between the semantic and affective components of language. Hare and McPherson (1984) suggest that this may be due to a poor integration between the cerebral hemispheres or between semantic and emotional processes. Following is a discussion of the literature that suggests that in normal individuals emotional words are processed and/or
responded to differently than nonemotional words. Finally, a way to empirically test the hypothesized dissociation between affect and semantics in psychopaths' language is suggested.

B. THE AFFECTIVE SALIENCE OF EMOTIONAL WORDS: EVIDENCE FOR THE INDEPENDENT PROCESSING OF THE EMOTIONAL AND REFERENTIAL ASPECTS OF WORD MEANING

A number of studies have investigated the differential processing of emotional and nonemotional words. This difference has been assessed electrodermally, electrocortically, and through behavioural measures. Additionally, affective memory structure has been looked at through investigations into the semantic organization of language. This has been accomplished in factor analytic studies and experimental memory paradigms. Differential hemispheric processing of affective and neutral words has also been investigated through studies of persons with damage to only one hemisphere and in normal individuals by way of divided visual-field studies. Most of the studies pertinent to these areas of investigation have found that the referential and emotional aspects of words are dissociable and that the affective aspect of a word is probably responded to relatively early in the information processing continuum.
1. MEMORY AND ASSOCIATION FACTORS

Osgood and his colleagues (Osgood, 1967; Osgood and Hoosain, 1983; Osgood, May and Miron, 1975; Osgood and Suci, 1955; Osgood, Suci and Tannenbaum, 1957; Snider and Osgood; 1969) have suggested that semantic space is actually an affective space and that words possess three affective dimensions: evaluation (good - bad), potency (strong - weak), and activity (fast - slow). The evaluation factor is the largest, accounting for approximately half of the total variance across many cultures (Osgood et al, 1975). They arrived at their conclusions after factor analyzing hundreds of responses to words rated on a number of bipolar dimensions. They hypothesized that semantic space is Euclidian and can be defined maximally by determining the minimum number of orthogonal or independent dimensions that can be passed through it. They assumed that an individual's response to a word is a function of both direction and distance from the origin. Direction of a point in semantic space will correspond to what reactions are elicited by the word, and distance from the origin will correspond to the intensity of the reaction (Osgood et al, 1957). This work would suggest that words carry affective information and that words are organized internally along affective dimensions.

Perhaps the earliest investigations into this area centre on word association tests given to psychiatric patients. These
tests involve giving a stimulus word to an individual who must then respond with the first thought or word that comes to mind. If a stimulus word is "emotional" for a patient then no association may be given. In a mnemonic sense, word associates that should be easily remembered will not be if they have a negative connotation (Jung, 1906).

In 1922, Whately Smith conducted a number of experiments involving associations to emotional words using a galvanometer. Words were read to normal subjects and they were required to provide associates as quickly as possible. Positively (eg., love), negatively (eg., evil), and neutrally (eg., head) toned words were used as stimuli. Galvanometer deflections were recorded as being largest for the most positive and negative words. His results are in accordance with more modern day authors who have found that there is generally an increase in electrodermal responses to emotional as compared to nonemotional stimuli (Andreassi, 1980); a result also found specifically to emotional as compared to nonemotional words (Dixon, 1958; Levinger and Clark, 1961; Maltzman, Kantor and Langdon, 1966; Manning and Melchori, 1974; Rossman, 1984). Smith (1922) also found that there was a tendency for associate reaction times to be longer to the affectively toned words. He suggested that this may have been due to subjects taking extra time to consciously reject relatively more associates from emotionally negative words as they would not want to supply them to the experimenter.
In 1961, Levinger and Clark published the results of a similar study. They had subjects provide associates to words of a traditional Jungian word association test during which skin resistance responses (SRRs) were recorded. The word list was then presented a second time and subjects were required to recall their free associations. Emotional words produced larger SRRs than neutral stimuli and associations to the affective stimuli were more likely to be forgotten. The latter effect and its causes have recently come under debate (Parkin, 1984; Parkin, Lewinsohn and Folkard, 1982; Rossman, 1984).

Parkin et al (1982) demonstrated that associations to emotional words were least well remembered on immediate recall, but the effect was reversed on delayed retention testing. The authors attributed this finding to an arousal based retention theory in which emotional words increase arousal resulting in greater trace consolidation, but the consolidatory processes interfere with immediate recall. Rossman (1984) presented data to show that associations to emotional as opposed to nonemotional words were more readily forgotten regardless of retention interval. He suggests his reported effects as being due to differential encoding or retrieval strategies based on the emotional nature of the stimulus word. Parkin (1984) points out that Rossman's words may have been "too" emotional. This would cause enough arousal to approach the other side of the curve thought to represent the relationship between arousal and performance.
Additionally, he suggests that because Rossman's emotional words form better categories than his, they result in a smaller number of associates per se. This may also result in reduced recall.

Perhaps a better explanation of these conflicting results may be found through taking a closer look at Parkin's word stimuli. An inspection of the nonemotional stimuli used reveals words such as hay, sing, hunger, cold, and lake. These words would rate quite highly on the unpleasant/pleasant dimension of Toglia and Battig's (1978) word norms or on Osgood's good/bad dimension. It is therefore not surprising that the "neutral" stimuli show results similar to the more emotional words.

Rossman's results may be better explained by a short investigation into the relationship between cued and uncued recall and emotional and nonemotional words. Eight experiments that involve the recognition or recall of emotionally toned words are first briefly reviewed (Elms, Dye and Herdelin, 1983; Maltzman, Kantor and Langdon, 1966; Manning and Julien, 1975; Moore, Craven and Faber, 1982; Smith, 1922; Strongman, 1982; Vallina and Valle-Inclan, 1982; Warren, Platz and Hauter, 1976).

In most of the experiments word frequency (Manning and Julien, 1975; Moore et al, 1982; Strongman, 1982; Vallina and Valle-Inclan, 1982; Warren et al, 1976), length (Manning and Julien, 1975; Moore et al, 1982; Strongman, 1982; Vallina and
Valle-Inclan, 1982) and imagery value (Moore et al, 1982; Warren et al, 1976) were equated across the affective and neutral words. The experimental procedures varied widely as the recall or recognition tasks were not always the primary focus of the investigation. Additionally, two of the experiments involved verbal presentation of stimuli (Elmes et al, 1983; Moore et al, 1982), and the others depended on visual presentation. Most of the experiments required immediate recall and/or recognition (Elmes et al, 1983; Maltzman et al, 1966; Manning and Julien, 1975; Moore et al, 1982; Warren et al, 1976), while others depended on delayed retention of half an hour (Maltzman et al, 1966), an hour (Valina and Valle-Inclan, 1982) or even days (Smith, 1922). Of the eight experiments, the only factors seeming to influence whether or not emotional words were better recalled than nonemotional words were: 1. Subjects being told they would be tested on recall before the words were presented (forewarned recall), and 2. Subjects being given some type of recall cue when the mnemonic segment of the experiment commenced (cued recall).

In experiments involving cued recall (including recognition) positive and negative words are not recalled any better than neutral words (Strongman, 1982; Valina and Valle-Inclan, 1982; Warren et al, 1976). In investigations involving forewarned recall, positive words are recalled to the same degree as negative words (McDowall, 1984), and positive and
negative words are no more likely to be recalled than neutral words (Moore et al, 1982), unless the neutral words are massed together in practice (Elmes et al, 1983). The only cases of improved memory for emotional over nonemotional words occurs in nonwarned uncued recall situations (Maltzman et al, 1966; Smith, 1922; Strongman, 1982; Valina and Valle-Inclan, 1982). Why these two different effects should occur is not immediately obvious. It may be that a separate memory system exists for encoding and responding to the emotional component of affective words. This system may be differentially affected by forewarned or cued recall and nonwarned or free recall.

More evidence for a separate memory for emotional and nonemotional words comes from an experiment recently done by Posner and Snyder (1975). They had subjects read a list of sentences, of the form "James is a _____", where each sentence was followed by a list of one to four trait adjectives. After a short delay a probe word was presented which could match or not match one of the list words, or match or not match the emotional tone of the list words. Subjects had to respond as to whether the probe matched the emotional content of the sentence. As the number of adjectives decreased from four to one, reaction time for specific word matches decreased, but it increased for emotional tone matches. The investigators concluded that two separate memory structures exist, one for emotional tone and one for discrete items, and that they can be oppositely affected in the same task.
Additionally, they remarked that emotional information is probably stored as an habitual associate to a given word or constellation of words and that presentation of a word automatically activates associated emotional responses. In other words, emotional memory for words involves first the activation of a word which then activates emotional associations, although there is another point of view which suggests emotional attributes themselves serve to organize words (Osgood et al, 1957; Wickens, 1972; Wickens and Clark, 1968). Whichever view is correct, the evidence suggests that two independent memory sets exist.

Elmes et al (1983), supply evidence for this assertion in an experiment that investigated the role of affect in the spacing effect (for a review of the spacing effect see Glenberg, 1976). They found the recall of positively and negatively toned words to be differentially affected as compared to neutral words, depending on whether word study involved spaced or massed practice. As expected in spaced practice the recall of neutral words increased as the spacing interval increased. For emotionally toned words recall remained essentially the same whether practice was spaced or massed. This again suggests two memory structures that can be affected differently in the same task. Wickens and Clark (1968) provide evidence that indicates that emotional memory for words may involve encoding along an extra dimension not present in neutral word memory. They found that words on one
end of Osgood's dimension of evaluation caused proactive inhibition (P.I) when presented as successive triads in a release from P.I. paradigm. If on the fifth trial, a triad was presented from the opposite end of the scale, release from P.I. occurred. The investigators felt this indicated that subjects were encoding the words by meaning defined by the ends of Osgood's dimension. Other researchers have found that individuals will use the evaluative dimension to organize words for later recall when no other encoding dimension is available (Haygood, 1966; Taylor and Haygood, 1968). These studies demonstrate that affective value as well as the referential meaning of a word is an important encoding variable in memory.

In 1982, Strongman conducted an experiment that involved individuals being presented with emotional or nonemotional sentence frames. Each sentence had a single blank for which subjects chose one of two alternative words that were either emotional or nonemotional. Afterwards, the subjects were given either cued (sentence frames provided) or uncued (sentence frames not provided) recall for the target words. For uncued recall subjects remembered more emotional words, but for cued recall subjects recalled more nonemotional words. In neither case was recall forewarned. Strongman (1982) suggests that emotional word memory is better only for uncued recall because affective valence can act as a recall cue. In the cued recall case, a relatively full description of what is sought is
provided and the emotional cue adds little. However, this explanation fails to take into account the author's finding that nonemotional words are better remembered in cued recall. It would also fail to account for the results of previously mentioned studies in which forewarned, but uncued recall provides no increased memory for emotional words. This would be expected if subjects consciously implemented emotional valence as an encoding dimension. When subjects are told to look for such an encoding dimension (Taylor and Haygood, 1968) or told explicitly what the encoding dimension is (McDowall, 1984), emotional word recall increases.

If the assumption is made that the emotional response to, and encoding of, the affective element of a stimulus is incidental and primary (Izard, 1971, 1972, 1978; Izard and Beuchler, 1980; Tompkins, 1981; Wundt, 1907; Zajonc, 1980a, 1980b, 1984; Zajonc, Pietrmonaco and Bargh, 1982), but that this response may be overridden by more cognitive strategies, then the differential memory effect may become more explainable. When recall is unwarned, emotional words may be encoded on a primary affective dimension as a matter of course, resulting in superior recall. When recall is forewarned, subjects may encode stimuli using more cognitive strategies. In cued recall, where an associate or sentence frame is given, subjects may again use more cognitive strategies (eg. semantic associations) to generate responses. If the initial encoding was primarily affective then recall
for the emotional words would be relatively inferior.

Whatever the exact explanation for these findings, it appears that memory for emotional words is different than that for nonemotional words. Additionally, it should be pointed out that in cases of superior recall for affective words, the effect cannot be attributed solely to increased arousal or an orienting response (Maltzman et al, 1966), as some studies show retention for emotionally toned words to be decreased even though SRRs are relatively higher than those to nonemotional words (Levinger and Clark, 1961).

These findings should now provide a basis for explaining Rossman's (1984) results in which memory for emotional word associates is inferior to the recall of nonemotional associates. Rossman (1984) presented a cue by providing the original associate word on recall trials. As discussed, cued recall can be lower for affective words than for neutral words (Strongman, 1982).

2. THRESHOLDS AND REACTION TIMES TO EMOTIONAL WORDS

Early recognition threshold experiments were concerned with the hypothesis that stimulus perception may be inhibited (perceptual defense) or enhanced (perceptual vigilance) as a function of stimulus emotionality. Inquiry into this area has long been marked by controversy (eg. Erdelyi, 1974; Postman, 1953; Postman, Bronson and Gropper, 1953). Techniques
surrounding the establishment of perceptual thresholds are also beset with difficulties and disagreement (Cheesman and Merikle, 1985; Holender, 1985). However, the issue pertinent to this study is not whether thresholds have been adequately defined, but that emotional material may be differentially responded to when compared to nonemotional stimuli. Johnson, Thomson and Frinke (1961) demonstrated that "good" words have lower visual duration thresholds than "bad" words. The words were classified as such according to Osgood's evaluation dimension. Newbigging (1961) found a similar result. He included neutral words however, and found that their thresholds were equal to those of the good words.

A possible explanation for these findings may be found in a recent word processing model put forth by Cheesman and Merikle (1985). The first part of their model is based on the work of Allport (1977) and Marcell (1983). These authors suggest that the visual presentation of a word activates functionally independent processing modules which collect evidence concerning the specific attributes of that word. It is hypothesized that there are different modules corresponding to semantic, phonemic, graphemic and visual information. Stable conscious percepts of the stimuli are only produced through integration of these perceptual records. Cheesman and Merikle (1985) then propose a model for the understanding of threshold studies. If information is insufficient for the formation of any perceptual records (they refer to this as the
objective threshold), then no evidence for perceptual processing will be revealed. If stimulus information is sufficient to allow the formation of at least a limited number of perceptual records then all measures of perceptual processing, including verbal report, will indicate that some processing has occurred (they refer to this as the subjective threshold). There would be no phenomenal awareness though, since the perceptual records would be insufficient to allow the formation of stable integrated percepts. It is possible that there is an additional "module" corresponding to the processing of emotional information contained in a word. Some might argue that the emotional module would be primary and even control the rate of input into consciousness (Izard, 1971; Zajonc, 1984). It might then be suggested that the affective valence of a word can speed or slow the formation of a final integrated percept or raise or lower the objective threshold by the degree of its contribution to the formation of perceptual records.

Bower (Anderson and Bower, 1976; Gerrig and Bower, 1982) presents another point of view. He hypothesizes that words are organized into emotional networks subsumed under memory nodes representing emotional states. An individual's mood can activate state related words such that if a person is happy words like joy or bliss will be more easily activated than words like hate or sad. A happy subject, in a tachistoscopic experiment, will therefore have a lower threshold for mood
congruent words like merry. Bower describes this as perceptual vigilance. In a test of this theory no evidence for simple mood influences on the perception of mood related words was found (Gerrig and Bower, 1982), although the investigators did discover that angry subjects showed lowered perceptual thresholds for all word types (mood congruent, mood incongruent and neutral). The cause of this effect is open to speculation. One possibility is that it may reflect arousal differences between happy and angry subjects. McDowall (1984) does present some support for Bower's theory in an experiment involving clinically depressed subjects however. Uncued forewarned recall of pleasant and unpleasant words resulted in greater memory for the negative stimuli.

In contrast to recognition thresholds, some researchers have used lexical decision tasks to investigate differential responding to emotional and nonemotional words, bypassing many of the methodological problems surrounding threshold studies. The first such investigation was carried out by Graves, Landis and Goodglass (1981). They used two word lists, one made up of neutral words and the other consisting of negative words; both being matched for frequency and imagery values. Words and their constructed nonword counterparts were shown at an exposure duration of 150 msec. For both male and female subjects the negative words were reported more accurately than the neutral words.

Strauss (1983) attempted to replicate and extend these
findings by including reaction time data in her analysis. In the first experiment, emotionally positive and negative words were compared, with the result that positive words were responded to more quickly than negative words and positive words were also identified more accurately. Exposure duration was 25 msec. In a second experiment, using Graves et al's (1981) stimuli, but with a 50 msec. exposure duration, it was again found that negative words were responded to more accurately than the neutral words; they were also responded to more quickly. Recently, Bray (1984) carried out a study involving positive, negative, and neutral words equated for frequency and imagery value. In a lexical decision task she found that positive words were responded to more quickly than negative words. Neutral word reaction times fell between the two, but no statistical comparisons were carried on them.

The strong effect from these studies is that responses to positively toned words are quicker and more accurate than responses to negatively and neutrally toned words. The weak effect lies in the relationship between neutral and negative words. Threshold studies would suggest reaction times to negative words should be longer than those to neutral words. Strauss (1983) found an opposite effect and Bray (1984) found a trend in the hypothesized direction. Word frequency is unlikely to be the cause of this discrepancy as Bray's words were equated on this dimension. Strauss's results are in a direction contrary to what word frequency effects would
predict. At present, it is difficult to reconcile these incongruent results.

The studies of Graves et al (1981) and Strauss (1983) are similar in that they both used divided visual-field (DVF) paradigms, short exposure duration, and presented two words or a word and a nonword at the same time. Bray (1984) used central presentation, an unlimited exposure duration, and presented only one word at a time. The subject's in Strauss's experiment produced reaction times 100 (positive words) to 200 (negative words) msec. faster than those in Bray's. It may have been that with dual word presentation the subjects found it easier to recognize the negative emotional words as being different from the nonwords or nonemotional words they were paired with. Unfortunately, Strauss (1983) presents no comparative data on reaction times to negative words paired with nonwords versus negative words paired with nonemotional words.

3. HEMISPHERIC DIFFERENCES IN THE PROCESSING OF EMOTIONAL AND NONEMOTIONAL WORDS

i. BRAIN DAMAGE EVIDENCE

Hughlings Jackson (1879) was the first to suggest that the right-hemisphere (RH) plays a role in processing some of the emotional aspects of language. Evidence has been
accumulating which would seem to support this hypothesis. Individuals with RH damage are impaired in the production and perception of emotionally toned linguistic material (Bryden, Ley and Sugarman, 1982; Heilman, Scholes and Watson, 1975; Ross, 1981; Ross and Mesulam, 1979; Speedie, Coslett and Heilman, 1984) and in the recall of emotionally toned versus neutral narrative texts (Wapner, Hamby and Gardner, 1981; Weschler, 1972). Additionally, RH damage specifically affects the understanding of the meaning of affective words (Brownell, Potter, Michelow and Gardner, 1984; Gardner and Denes, 1973; Zurif, Caramazza, Myerson and Galvin, 1974). This may be a reflection of the more general finding that the RH is specialized for the processing of emotional material (eg. Moscovitch, 1983) and stands in contrast to one of the oldest findings in neuropsychology: that it is lesions of the left-hemisphere (LH) that impair the perception and production of language (Benson, 1979). Clinically, authors have mentioned that individuals with pathology restricted to the RH seem to focus on only the literal or denotative meaning of utterances and tend to ignore aspects of affectivity (Gardner, 1975; Meyers, 1981). It is only recently that experimental evidence to support this contention has begun to appear.

Brownell et al (1984) presented word triads to unilaterally LH and RH damaged patients as well as normal controls. Subjects were to group together the two words closest in meaning. They could use a number of grouping
dimensions including antonymy (eg. hateful - loving) and polarity (eg. deep - loving). The researchers found that RH patients based their categorizations almost entirely on antonymy. They also used an overall category of the presence or absence of human personality descriptors (wise - foolish, loving - hateful vs. deep - shallow, warm - cold). This type of semantic categorization is thought to be representative of LH processing strategies (eg. Butterworth, Howard and McLoughlin, 1984). In contrast LH patients used word polarity to group words with an overall category of evaluation (wise - deep, warm - loving vs. foolish - shallow, cold - hateful).

Normal subjects used both antonymy and polarity for word groupings. These findings suggest a hemispheric double dissociation for the affective and referential aspects of word meaning. Other researchers have also found LH damaged aphasic individuals to be relatively unimpaired in abstracting affect from word meaning when using a modified version of Osgood's Semantic Differential Technique (Gardner and Denes, 1973; Mostofsky, VandenBossch, Sheinkopf and Noyes, 1971).

Cicone, Wapner and Gardner (1980) conducted a series of studies to measure sensitivity to emotional situations and expressions in LH damaged and RH damaged individuals as well as normal controls. They specifically found that, across a wide variety of tasks, RH patients show a loss in sensitivity to the polarity of emotions. They suggest that this may indicate a breakdown of the "spatial" organization among
emotional concepts so that the interrelations among oppositely
toned emotions can no longer be appreciated. RH patients must
then resort to various semantic associations. They also found
that inferring an appropriate emotion may remain intact in the
RH patients, but that relating this emotion to the stimulus is
lost. In other words, there is a dissociation between what one
knows and how to apply it.

A study by Landis, Graves, and Goodglass (1982) focused
specifically on the reading and writing of emotional and
nonemotional words by LH damaged aphasic patients. They found
that emotional words were read and written more accurately
than nonemotional words, whether or not the emotional words
were concrete or abstract (19 out of 22 patients) and also
found this effect to be independent of word frequency and
imageability. It was also found that the emotional words
resulted in more semantic substitutions when subjects wrote to
dictation (eg., killing for dead and rape for nude). This
occurrence has been found to be related to RH processing
(Zaidel, 1978; Benson, 1981) when nonphonemic reading takes
place. The word grapheme evokes an image which is subsequently
misnamed (Benson, 1981).

In summary, it would appear that emotional words may be
processed in the RH where their relative polarity may be
assessed. Emotional salience per se is the important factor
and not imageability or frequency. This again suggests a
differential processing of the referential and emotional
ii. DIVIDED VISUAL-FIELD STUDIES

The two major studies in this area have already been discussed so only a brief description of their relevant findings will follow. Graves et al (1981) found an attenuation in the usual right visual-field - left-hemisphere (RVF - LH) advantage for words when a negative emotional component was added to the stimuli. This result was based on accuracy data. Strauss's (1983) data shows a similar trend in accuracy, but her results are not significant. It is interesting to note that although nonemotional words in the LVF showed only 50 percent accuracy, emotional words showed 65 percent correct. Reaction time data showed a trend for both emotional and nonemotional words to be responded to more quickly in the left visual-field - right-hemisphere (LVF - RH). This may reflect the priming effects that emotional words can have on RH.

Bryden and Ley (1983) demonstrated that RVF - LH task effects can be attenuated by priming the RH with either high imagery or highly affective words. The investigators used face recognition and dichotic presentation of consonant vowel pairs as the tasks thought to invoke either RH or LH processing. Initially, these tasks produced the expected VF advantages. After subjects studied negatively, positively and neutrally toned words, which also varied on imagery value, subsequent
performance on the same tasks resulted in a significant decrement in the previously found Vf effects. The authors concluded that remembering a list of high imagery or highly emotional words has the effect of priming the RH. They further speculated that this may be the result of these types of words having significant RH lexical components. Presentation of such words would activate both the LH and RH elements of the lexical representation. As a result it would be expected that high imagery or highly emotional words would attenuate the usual RVF superiority for word recognition. Bryden and Ley (1983) found that RH priming effects due to emotion are independent of those caused by imagery. The study of Graves et al (1981) also demonstrated that the reduced VF advantage for emotional words was independent of word imagery value.

4. ELECTROCORTICAL RESPONSES: DIFFERENTIAL PROCESSING OF EMOTIONAL AND NONEMOTIONAL WORDS AS MEASURED BY THE EEG

Electroencephalography or EEG has been used as a dependent variable in studies investigating responses to emotional material (eg. Gliddon, Busk and Galbriath, 1971; Harmon and Ray, 1972; Ray and Cole, 1985). It has also been used to specifically study subject responses to emotional words (Beglieter and Platz, 1969; Beglieter, Porjesz and Garozzo, 1977; Cacioppo and Petty, 1980; Chapman, 1977;
Chapman et al, 1977; Chapman et al, 1978; Chapman et al, 1980; Heineman and Emrich, 1971; Kostandov and Arzumanov, 1977; Moore et al, 1982; Warren et al, 1976). These emotional word studies can be divided into two types; those which rely on a simple arousal model under which alpha activity (8 to 12 Hz) or power is assumed to be inversely related to mental processing, and those which use summed cortical evoked responses (average evoked potential or AEPs) whose significance depends on which components of the response wave are under investigation (Donchin, Ritter and McCallum, 1978). Those studies involving alpha measurement will be discussed first.

Power measures have been used to study the differences in the relative participation of the cerebral hemispheres during tasks thought to elicit either RH or LH processing. There are a number of methodological and conceptual problems related to this paradigm (Beaumont, 1983; Donchin, Kutas and McCarthy, 1977; Donchin, McCarthy and Kutas, 1977), but some interesting results have emerged. Generally, studies have shown alpha suppression over the RH for tasks thought to engage its processors and over the LH for tasks thought to be specific to it (eg. Moore, 1979; Orenstein, Johnstone, Heron and Swencionis, 1980; Robbins and McAdam, 1974). With this in mind it might be expected that emotional words would produce relatively less RH alpha than nonemotional words. However, it should probably be stressed that many researchers feel that
task dependant cerebral asymmetries in alpha have not been adequately demonstrated (Gevins, 1983).

Warren et al (1976) and Moore et al (1982) found no differences in the overall amount of alpha activity when comparing subject responses to emotional and nonemotional words. The first group of investigators did find that negative words produced relatively less alpha in the left- than right-hemisphere whereas neutral words produced an opposite effect. The second group of authors found no such hemispheric effects. Heineman and Emrich (1971) found that when subjects were presented with neutral and emotional words, of an unspecified polarity, more alpha was recorded from a left occipital lead for the affective stimuli. As the investigators do not report right hemisphere power measures it can not be assumed that this was accompanied by a relative decrease in RH alpha. Cacioppo and Petty (1981) found that after they had subjects respond to a question concerning positive, negative, or neutral trait words, relatively less RH alpha was recorded for the positive and negative words.

These investigations have failed to show any consistent results and only one experiment shows the expected effect. It has recently been suggested that studies using alpha activity as a dependent measure may be confounding the effects of task induced attentional factors with task material (Ray and Cole, 1985). Alpha activity may actually be more influenced by an external (intake) - internal (rejection) attentional dimension
than by experimental stimuli. Analysis of task material effects on the higher frequency beta band may be a better measure of the processing of emotional stimuli (Ray and Cole, 1985). Additionally, three of the emotional word studies suffer from severe methodological problems. Warren et al (1976) used a bipolar lateralized recording montage which can obscure or accentuate recorded effects. Moore et al (1982) used a midline reference site that can confound alpha amplitude with interhemispheric phase relationships. Heineman and Emrich (1971) do not even report what their reference site was.

In summary, power measures have failed to provide consistent evidence for the differential processing of affective and neutral words across or within the cerebral hemispheres.

Another measure commonly used in EEG research is the event-related potential (EP) seen as a gross potential change elicited by events both internal and external to the organism. With many stimulus presentations an averaged event-related potential or AEP can be calculated. The AEP is viewed as a sequence of positive and negative fluctuations that reflect serially activated processes called components. Components are not considered synonymous with peaks and troughs, but are representative of evaluatory processes (Donchin et al, 1978). Endogenous as compared to exogenous components, can be elicited in the absence of external stimulation and their
parameters are only partially related to the physical parameters of the invoking stimulus. Of particular interest to this study is the P300 component of the AEP. This positive going wave has a latency that ranges from about 275 to 700 msec. and is usually largest over the central and parietal regions. Rugg (Rugg, 1983; 1984) has demonstrated that P300 usually occurs at about 670 msec for real word decisions in lexical decision tasks, and has named it the P670.

McCarthy and Donchin (1983) have demonstrated that P300 latency is only minimally affected by the experimental manipulations of speed-accuracy trade-off and stimulus response compatibility, whereas reaction time latency is strongly affected by these experimental demands. P300 latency is mostly affected by manipulations of stimulus discriminability and stimulus categorization (Duncan-Johnson, 1980; Kutas, McCarthy and Donchin, 1977). Kutas et al (1977) used three categorization tasks of differing difficulty in conditions which emphasized either speed or accuracy of responding. As expected, reaction time varied with instructions and between tasks. P300 latency also varied with task difficulty, but was much less affected by the speed-accuracy instructions (19 msec. vs 90 msec.) In other words, P300 latency appears to be sensitive to the processes of perception and evaluation, but is unaffected by changes in response criteria. If faster responses to emotional words are a function of increased arousal (Walker, 1967) then P300
latencies for emotional and nonemotional words should be equal, but reaction time should be faster for the affective words. If emotional words are actually being processed more quickly, then P300 latency should be faster for the affective stimuli.

In addition to latency effects, there are a number of experimental dimensions across which P300 amplitude varies. Of particular relevance to the present experiment are signal value and salience. Giving stimuli signal value by having the subject press a button at their occurrence increases the amplitude of the P300 they elicit (e.g. Duncan-Johnson and Donchin, 1977). Roth (1983) describes salience as a dimension denoting qualities of the stimulus that make it stand out regardless of its probability or relevance in a subject's task.

An experiment done by Kostandov and Arzumanov (1977) suggests that word affectivity may be representative of such a dimension. The experimenters required subjects to count the number of times an emotionally significant or nonsignificant word appeared on a screen. Subjects showed larger amplitude P300s to the emotional stimuli for occipital (Oz) recordings. The latency of the P300 was also reduced for emotional words at the Oz site (34 out of 37 subjects showed this effect). The authors attributed both their latency and amplitude results to increased cortical activation caused by "unspecific impulses" from the limbic structures which integrate emotional
reactions. The authors also found similar results when they presented the words subliminally. Additionally, differences were also seen in an earlier component of the AEP. The N200 was found to be of greater amplitude for emotional as opposed to nonemotional words. The investigators felt that this indicated that even when a verbal stimulus is not recognized, some analysis of its verbal content occurs. Beglieter (Beglieter et al, 1977; Beglieter and Platz, 1969) has also found facilitation in the early components of the AEP for emotional words presented at a short exposure duration. Unfortunately, none of these studies controlled for other stimulus dimensions such as word frequency and word length. Additionally, none of them makes the distinction between positive and negative emotional words. Chapman and his colleagues (Chapman, 1979; Chapman et al, 1977; Chapman et al, 1978; Chapman et al, 1980) have extensively studied AEPs to emotional words as rated by the evaluation dimension of Osgood's Semantic Differential. They have provided evidence that specific AEP components can identify words on opposite ends of the Osgood's good/bad bipolar scale. This seems to suggest that polarity may be an important factor in processing emotional words and that an internal system for grouping words on the good/bad dimension exists. Unfortunately, the authors provide no data on nonemotional words for comparison purposes. However, these studies taken together with those previously mentioned do provide some tentative evidence that AEPs may
distinguish emotional from nonemotional words.

C. LEXICAL DECISION TASKS: MODELS OF LEXICAL ACCESS AND FACTORS CONTRIBUTING TO LEXICAL DECISIONS.

There are two main theories concerning the processes involved in lexical decision. The first assumes that there are actually two stages, one involving lexical access and the other involving the determination of meaning (Becker, 1980; Forster, 1978; Jackson and Morton, 1984; Morton, 1969). These stages are seen as being serial where access to the lexical entry involves matching the visual characteristics of the word with an internal representation. When the visual characteristics and internal representation have sufficient overlap, the appropriate lexical entry has been located, and a lexical decision is made. Once lexical access is accomplished, meaning, pronunciation, and other information associated with the word become available. Within this model, the meaning of a word plays no role in facilitating lexical access. In other words, a lexical decision does not require semantic information because it is not logically necessary.

One author who has put forth such a model is Paivio (1971). He has suggested that familiarity, as measured by frequency, is a function of the representational dimension in lexical access. This means that the availability of a verbal code for processing will be increased as frequency increases.
Imagery, concreteness, and semantic factors are thought to be representative of referential meaning and involve processing later on in the information processing sequence. Therefore, at near threshold exposure, only familiarity should affect recognition, but at longer exposure durations higher level processing may occur and word meaning becomes important (Paivio, 1971). Imagery and concreteness have been extensively studied as referential codes which may affect lexical decision response times. Boles (1983) presents a good review of this research with the conclusion that there are no consistent results in finding or not finding effects on lexical response times for these two variables. Subsequently, his own work indicated that word frequency is the only variable affecting lexical decisions. Unfortunately, and somewhat surprisingly, he chose response accuracy and not latency as a dependent variable in his investigation. Richardson (1983) found that response latency was affected by word imagery, but not concreteness, especially in the LVF - RH. It is interesting to note that in Boles (1983) experiment the only condition that did not give a strong RVF effect for accuracy was the one in which a majority of high imagery words was used. These results suggest that imagery may be an important factor to control for in DVF experiments.

The other major model of lexical access and decision assumes that the visual features of a word make available a number of different types of codes that can be used for
further processing (Allport, 1977; Cheesman and Merikle, 1985; Marcel, 1983). These codes are assumed to be activated in parallel. The model implies that subjects in a lexical decision task could use a number of codes such as visual features, phonological representations, and semantic characteristics of the visual stimulus in retrieving a word. Word recognition involves integration of these activated representations.

Chumbley and Balota (1984) recently carried out a series of experiments to investigate the relative merits of the two lexical decision models. With data collected from these investigations they performed a regression analysis using the following variables as predictors of lexical decision response latencies; the likelihood that a word will be given as an instance of a category, word frequency, word length, the number of dictionary meanings of a word, the number of different word associates elicited by a word, word associate reaction time, and word pronunciation reaction time. They found that when physical properties of the stimuli, such as word length, made it possible to use response strategies unrelated to lexical access, then the effects of these strategies were seen in the data. When it was not possible to use these types of strategies, then subjects depended on the meaning of the stimulus to make lexical decisions. The authors claimed that meaning was being measured by the likelihood that a word would be given as an example of a category, the number
of dictionary meanings, and associate reaction time. The investigators found that word frequency effects operated whether subjects were using simple visual cues or more in depth processing to make their decisions. These results are obviously incompatible with a two-stage serial model of lexical decision. However, it is difficult to reconcile Chumbley and Balota's definitions of word meaning with what could be intuitively described as meaningfulness. Two of their definitions of meaning could be reduced to frequency measures: frequency of dictionary meanings and frequency of category inclusion. When inspecting the stimuli they used, it might be suggested that a word such as "suicide" is somehow more meaningful than the word "essay", regardless of the relative number of dictionary meanings. The authors themselves suggest that word recognition is probably affected by some other very powerful but unidentified variable that is independent of known variables, such as word frequency, word length, and their definition of word meaning. It may be that Chumbley and Balota's definition of word meaning is suspect, and that if it were adequately defined, their results might be more meaningful. Meaningfulness as previously defined by Osgood's dimension of evaluation would probably constitute a better definition.

An important variable that is usually not controlled for in lexical decision tasks is affective tone. If a two stage model of lexical access is correct, this should not matter at
short exposure durations. However, it would appear that this is not the case. Word recognition thresholds can be raised or lowered for affective words, when compared to neutral ones, even when they are equated for frequency (Johnson et al., 1960). Additionally, at short exposure durations emotional words are responded to more quickly than nonemotional words (Strauss, 1983). Semantic category information can also affect lexical decision response times. Studies have found priming effects for subthreshold words on related words (e.g., Schvanerveldt and McDonald, 1981; Underwood and Thwaites, 1982).

It is for these reasons that a parallel processing scheme, such as that of Allport (1977) or Marcel (1983), may provide a better model of lexical decision effects. Information such as referential meaning or affective tone may be available relatively early on in the information processing sequence and contribute to the decision as to whether a letter string is a word or not. Boles (1983) states that by taking this point of view, it must be assumed that all sources of word meaning should influence word recognition, including verbal associative meaning since associates would be activated regardless of overt recognition.

In summary, the literature on the processes involved in lexical decision tasks is somewhat equivocal. Two main models have been put forward. There is evidence to support both of them, although the one which involves the parallel activation
of a number of physical and semantic codes seems to best account for the effects noted in brief exposure lexical decision tasks and in threshold studies. The ubiquitousness of word frequency effects certainly support a two stage model of lexical access although investigations into the role of imagery and semantic priming would seem to offer evidence against it. Additionally, the affective value of words also exerts a strong affect on lexical decision response latencies.

D. WORDS AND WORD MEANING

Cognitive psychology has focused mainly on the denotative meaning of words by looking at how they are grouped and represented in memory, usually focusing on demonstrating the existence of semantic networks and hierarchies (Howard, 1984), which relate words in terms of their referential or prototypical qualities. Osgood (1967) has attempted to do the same for the affective aspect of word meaning through his Semantic Differential Technique.

Unfortunately, many affective word studies use stimuli that are emotional as defined by the researcher or idiosyncratic subject significance. Many investigators also fail to make two important distinctions, one between affective words and arousal words, the second between positive words and negative words. Words should be described in terms of their affective valence as good words may be responded to
differently than negative words (Bray, 1984; Strauss, 1983). Additionally, there is evidence that arousal words may be processed differently than affectively negative words. Manning and Julien (1975) found that taboo or high arousal words (eg. fuck or shit) result in increased retention even in forewarned recall. Emotionally negative words (eg. war or rape) do not show this effect. Taboo words also produce larger skin conductance responses (SCRs) than do emotionally negative words (Manning and Melchoriori, 1974) and positive emotional words may not even produce electrodermal responses appreciably greater than those to neutral words (Pickersgill, 1982). This would suggest that high arousal taboo word represent a separate category not congruent with emotional words as defined by Osgood’s good/bad dimension.

In this study emotional words are defined by the pleasant/unpleasant dimension of Toglia and Battig (1978) which has been found to correlate highly with Osgood’s evaluation dimension. This assures affective meaning will not be solely subjective, but will be taken to mean cross-cultural structure (Osgood et al, 1975). For example, a particular word such as "table" may have a negative meaning for a particular individual, but be relatively neutral when rated on Osgood's evaluation dimension across a large number of people. However, the word "dead" would produce relatively large affectual responses across a large number of people as well as idiosyncratic responses. It is the general response that is
used as a measure of word emotionality in this study.

E. AN HYPOTHESIS: EMOTIONAL WORDS DO NOT MEAN TO THE PSYCHOPATH WHAT THEY MEAN TO THE NONPSYCHOPATH

Although there is currently a debate over the relationship between cognitive and affective processes, there seems to be increasing speculation that affective processing may be representative of a system that is separate from that involved in "cognition" and that affective responses may even be primary (Izard, 1971; 1972; 1978; Izard and Beuchler, 1980; Sheffrin and Snyder, 1977; Tompkins, 1981; Wundt, 1907; Zajonc, 1980a; 1980b; 1984). Izard's Differential Emotion Theory (Izard, 1971; 1980) postulates that it is affective processes that determine the rate of input into consciousness by controlling the process of awareness. Zajonc (Zajonc, 1984; Zajonc et al, 1982) maintains that affective responses are primary and that stimuli can have a direct link to emotional responses without intervening "cognitive appraisal". By this he seems to mean that affective processing is not necessarily made by serial or feature analysis as Mandler (Mandler, 1980; 1982) and Lazarus (Lazarus, 1982; 1984) have argued, but that the first analysis of an emotional stimulus may be affective, leading to a primary emotional response. The present study is based on the hypothesis that this affective analysis may occur for emotional words and that it is impaired or missing in the
psychopath. As a result of this deficit, a psychopath would be expected to extract less information from an affective word than would a nonpsychopath. In this sense, it could be said that emotional words may fail to have the same significance or meaning for the psychopath as they do for the nonpsychopath. If this hypothesis is correct, then it provides a basis for empirically testing Cleckley's concept of semantic dementia.

As previously outlined, it is possible that emotional information does in fact aid in making lexical decisions. There is also evidence to suggest that this effect is localized to the RH. In the present study psychopaths and nonpsychopaths were required to perform a lexical decision task involving affectively negative, positive and neutral words. These words were presented in a DVF paradigm. It was predicted that psychopaths would show no facilitation in making decisions to affective as opposed to the neutral stimuli. However, nonpsychopaths were expected to show this effect through speeded responses. It was also predicted that the nonpsychopaths would show a reduced VF advantage for emotional as compared to nonemotional words whereas this effect was predicted to be absent in psychopaths. It was hypothesized that if the affective value of an emotional word helps in a lexical decision then P670 latency for emotional words would be changed as compared to nonemotional words. Whether this would result in an increased or attenuated latency in nonpsychopaths was not clearly predictable since
P670 presumably measures word processing time and not simply affective categorization. However, psychopaths were predicted to show no change in P670 latency across emotional and nonemotional words as affective information was not expected to affect word processing time. If affective value were to simply aid in response, but not processing time then P670 latency would not be changed, but reaction time would be quicker for the nonpsychopaths. P670 amplitude was also compared in psychopaths and nonpsychopaths for emotional and nonemotional words. It was predicted that only nonpsychopaths would show larger amplitude P670s for the affective as compared to the neutral stimuli. Subjects were also required to fill out a post-experiment word rating form to ascertain if they would correctly identify experimental words as being positive, negative or neutral.

III. METHOD

A. SUBJECTS

Subjects were male prisoners recruited at the Okalla Lower Mainland Regional Correctional Institute. They had initially participated in an interview session for the assessment of psychopathy during which they were asked if they would like to perform in the present experiment. Volunteers were selected to participate if they were 18 to 40 years of
age, had learned English as their first language, and had normal or corrected to normal vision. The Annet Handedness Questionnaire (1970) was completed by all volunteers. One was scored for each task performed by the right hand, zero for the left hand, and one-half for a response of "either". Subjects were considered to be right handed if they scored 9.0 or greater. Subjects were also rated on the long version of Hare's Checklist for Psychopathy (Hare, 1980) which has been shown to be both valid and reliable for selecting psychopaths for research (Hare, 1985; Schroeder, Schroeder and Hare, 1983). A cut-off score of 32 was used with subjects scoring at or above this point being assigned to the psychopathic (P) group. P group scores ranged from 32 to 38 with a mean of 36. Nonpsychopathic (NP) scores ranged from 10 to 28 with a mean of 20. Mean years of education for the P group was 8.9 and 9.9 for the NP group. Subjects in the P group ranged from 18 to 40 years of age with a mean of 24.7. Subjects in the NP group ranged from 18 to 28 years of age with a mean of 22.1. There were 10 subjects in the P group and 11 subjects in the NP group. Subjects were paid $10.00 for participating in the experiment.

B. STIMULUS PRESENTATION

All word stimuli were presented on a Gigatek video screen on which a central fixation cross was always present. Stimulus
presentation and inter stimulus interval were controlled by a Compaq microcomputer which also collected and stored data. As the experiment was performed in empty prison cell block it was not possible to provide for soundproofing and electrical shielding. Subjects therefore listened to white noise through stereo headphones at 65 dbs\(^1\).

Thirteen affectively negative, positive, and neutral words were selected from the pleasant/unpleasant dimension of Toglia and Battig's (1978) word norms. Osgood and Suci (1955) have reported factor analytic data showing that ratings of good/bad and pleasant/unpleasant both load heavily on the same factor which they term evaluation. Pleasantness ratings should therefore be considered equivalent with emotionality ratings. The words selected were matched across emotional valence for word length, number of syllables, and imagery value (Toglia and Battig, 1978). Each group of 13 words contained a 2 syllable word and 12 one syllable words. Two of the words contained 5 letters, eight contained 4 letters and three had 3 letters. Words were also matched for frequency (Kucera and Francis, 1967) on an individual basis as closely as possible.\(^2\) Negative words ranged from 1.98 to 2.89 (mean = 2.32) on the

\(^1\)This could not control for loud random noises such as cell doors being closed or other inmates yelling in the hallways. Fortunately, noise interruptions of this type were relatively rare.

\(^2\)A look at the word stimuli in Appendix A shows that negative words were probably of higher frequency than norms would dictate considering the population of this experiment.
seven point pleasant/unpleasant dimension. Neutral words ranged from 3.74 to 4.19 (mean = 3.66) and positive words from 5.34 to 6.23 (mean = 5.81). Thirty-nine pronounceable nonwords were created by altering a single letter, other than the first, for each of the selected words. Full details of the words and nonwords used can be found in Appendix A.

On the screen, words and nonwords appeared in white uppercase letters against a dark background. They subtended a visual angle of $2.3^\circ$ (3 letter), $3.3^\circ$ (4 letter), or $4.3^\circ$ vertically. The inner edge of each word appeared $3.2^\circ$ from the central fixation cross. Subjects sat approximately 39 cm from the screen.

C. Physiological Recording

EEG was recorded from frontal (Fz), central (Cz), parietal (Pz), and occipital (Oz) midline sites as well as from the left and right parieto-temporal (Pt3, Pt4) cortex referenced to linked ears (A1 A2). Signals were obtained via Beckman silver chloride EEG electrodes and amplified with a Beckman Type R-711 polygraph, with Type 9806A A.C. couplers with bandpass filters set to produce 3dB rolloff at 0.013 and 30 Hz. All sites were cleaned thoroughly with Redux electrode paste and abraded lightly with a blunt needle. Electrodes were glued in place with Collodian and Medi-trace EEG Gel acted as an electrolyte. Electrical impedances were measured at all
sites at the beginning and end of the experiment and at
neither time exceeded 5 Kohms. Eye movements (EOG) were also
recorded via Beckman miniature electrodes placed both above
and on the outer canthus of the right eye.

EEG and EOG were digitized on-line by a Compaq
microcomputer at 512 Hz for 250 msec pre-stimulus onset and
for 2000 msec post-stimulus onset and were stored on a Compaq
hard disk for off-line analysis. A 50 microvolt calibration
signal was recorded on each channel at the beginning of the
session for subsequent amplitude measurements. Reaction times
were calculated to the nearest millisecond for each trial and
were stored with the digitized EEG. Each subject's data was
later transferred to Scotch magnetic tape cartridges for
permanent storage.

D. Procedure

Testing was carried out in an empty cell-block in the
Okalla prison. As the prison environment did not allow the
request that coffee, tea, cigarettes and street drugs be
avoided prior to testing, it is not known what the levels of
the active ingredients of these drugs were in subjects. Prior
to beginning testing subjects were given a brief description
of what the experiment entailed after which they filled out a
consent form agreeing to participate. Electrodes were then
attached and impedances recorded. Resting EEG was then taken,
20 seconds with eyes open and 20 seconds with eyes closed. Subjects were then given detailed instructions for performing the experiment and told that there would be a prize of $20.00 for the best performance which was equated with both speed and accuracy.

Trials were presented in blocks during which subjects were asked not to move around, not to look away from the central cross and to blink as little as possible. The beginning and the end of blocks were signalled by a message on the screen and subjects were given brief 15 to 25 second rest periods between each block. During a block stimuli were presented for 176 msec at intervals varying randomly between 3 and 5 sec.

Subjects were instructed to rest the index finger of the right hand on a response key placed in front of them at midline and to respond to a real word as "as quickly as you can, but accurately". Each of the 6 sets of 13 positive, negative, and neutral words and their corresponding nonwords were presented 3 times in each visual-field resulting in a total of 468 trials. Words and their corresponding nonwords always appeared in separate blocks.

Subjects were given 36 practice trials in 2 blocks of 18 using a different set of all nonemotional words. They were first asked to read a list of the words and nonwords and to circle the real words.

The experiment began with subjects reading an intermixed
list of the 78 experimental words and nonwords, and circling those they thought were real words. This was intended to reduce the effects of priming which can facilitate reaction time to a word presented more than once (Scarborough et al, 1977). It was also intended as a check to ensure that subjects could read. Then the subject performed 468 trials in blocks of 18. Throughout the experiment subjects were reminded not to blink during testing, to maintain fixation on the central cross and not to look towards a word when it appeared. In addition they were reminded that both speed and accuracy were important. At the end of the experiment subjects were required to fill out a 7 point rating scale (good to bad) on each word they had seen during the experiment.

IV. RESULTS

A. REACTION TIME, P300 LATENCY AND AMPLITUDE DATA

AEPs for each subject were calculated in each condition that required and recorded a correct response. Trials contaminated by vertical eye movements of more than 50 microvolts were excluded from data analysis. Total number of trials per average ranged from 14 to 39 with no differences between groups. Grand averages for each group in each condition were then calculated and a large positive peak was
identified at approximately 650 msec. Individual averages for Pz in each condition were then smoothed with a 20 Hz digital filter to facilitate accurate peak identification, and maxima and minima were identified between 450 and 900 msec after stimulus onset. The maximum peak was scored as the P670 and its latency and amplitude was recorded for each subject. Baseline was the 250 msec prior to stimulus onset. Group waveforms for each condition are plotted in Figures 1.

For reasons mentioned previously, predictions based on emotional word valence were difficult to make. Positive and negative word data was therefore collapsed to form a single category.

A (2 x 2 x 2) manova was performed on the data with group as a between factor (NP and P), and word type (emotional and neutral) and visual-field (RVF and LVF) as within factors. Reaction time, P300 latency, and P300 amplitude were the 3 dependent variables. The only significant overall effect was the (group x word type interaction), (F(3, 17)=7.52, P<.002). Simple main effects for this interaction are discussed separately below and represent individual anovas.

1. Reaction Time

As predicted, the (group x word type) interaction was significant (F(1, 19)=8.80, P<.008). Planned comparisons were carried out to determine whether response times for affective
Figure 1. ERP waveforms for psychopaths (P) and nonpsychopaths (NP) across the right visual-field (RVF) and left visual-field (LVF) for negative, positive and neutral words.
words differed from those for neutral words in the NP group and to determine if these effects differed from those in the P group. Comparisons were based on the Dunn Method using the Bonferonni inequality with a family-wise error rate of .05 (Glass and Hopkins, 1984). For eight planned comparisons across the three dependent variables the critical t-value was calculated to be 3.07 (Scheffle's critical t-value would be 3.77). In NPs affective words were responded to significantly faster than to neutral words \( t(19)=5.19, P<.05 \) and this effect was significantly different from that in Ps \( t(19)=4.21, P<.05 \). From Table I it can be seen that affective words showed facilitation over neutral words for NPs by 67.3 msec whereas for Ps this difference was -9.8 msec. These relationships are plotted in Figure 2.

2. P300 Latency Data

The (group x word type) interaction was significant \( F(1, 19)=7.53, P<.01 \). The same planned comparisons as were carried out for reaction time group differences were done on this data. NPs did not show a significant difference between P300 latency for emotional and nonemotional words \( t(19)=2.96, P>.05 \). However, there was a significant group interaction when compared to Ps \( t(19)=3.88, P<.05 \). Table II shows that NPs demonstrated an increased latency of 47.4 msec for emotional over nonemotional words whereas Ps showed a
TABLE I

Group Mean Reaction Time Data (msec) for Emotional and Neutral Words Collapsed Across Visual-fields

<table>
<thead>
<tr>
<th>Group</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>827.6</td>
<td>824.3</td>
</tr>
<tr>
<td>Type</td>
<td>896.9</td>
<td>814.2</td>
</tr>
<tr>
<td>Group Mean</td>
<td>862.3</td>
<td>819.3</td>
</tr>
</tbody>
</table>
Figure 2. Group means for reaction time data for emotional and neutral words collapsed across the left and right visual-fields. NP: Nonpsychopaths; P: Psychopaths.
TABLE II

Group Mean P300 Latency (msec) for Emotional and Neutral Words Collapsed Across the Visual-fields

<table>
<thead>
<tr>
<th>Group</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>Emotional</td>
<td>664.7</td>
</tr>
<tr>
<td>Type</td>
<td>Neutral</td>
<td>617.3</td>
</tr>
<tr>
<td>Group Mean</td>
<td></td>
<td>641.0</td>
</tr>
</tbody>
</table>
Figure 3. Group means for P300 latency data for emotional and neutral words collapsed across the left and right visual-fields. NP: Nonpsychopaths; P: Psychopaths.
decreased latency of 31.0 msec. The results and are summarized in Figure 3.

3. P300 Amplitude

Contrary to prediction the (group x word type) interaction was not significant \(F(1, 19) < 1, P > .38\) indicating that P300 amplitude did not vary across groups for the 2 word types.

B. Additional Results

Although the overall NP/P difference on the three measures was not significant \(F(3, 17) = 2.56, P > .08\) there was an interesting trend present for this data as indicated by the simple main effect for P300 amplitude \(F(1, 19) = 5.36, P < .03\). As can be seen from Table III NPs showed P300's that were, on the average, 3.57 microvolts larger than those for Ps. Amplitude data for word types and groups are plotted in Figure 4. Additionally, simple effects indicate a trend for NPs' P300 amplitude data to differentiate between the two word types \(F(1, 19) = 3.05, P > .08\), but not in Ps \(F(1, 19) < 1, P > .67\).

It was predicted that there would be a (group x word type x visual-field) interaction for reaction time data. The manova test was not significant \(F(3, 17) = 1.48, P > .25\). There was also no overall visual-field effect across the two groups \(F(3, 17) = 1.09, P > .37\).
TABLE III

Group Mean P300 Amplitude (microvolts) for Emotional and Neutral Words Collapsed Across Visual-fields

<table>
<thead>
<tr>
<th>Groups</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Emotional</td>
<td>9.60</td>
<td>5.69</td>
</tr>
<tr>
<td>Type Neutral</td>
<td>8.65</td>
<td>5.44</td>
</tr>
<tr>
<td>Group Mean</td>
<td>9.13</td>
<td>5.56</td>
</tr>
</tbody>
</table>
Figure 4. Group means for P300 amplitude data for emotional and neutral words collapsed across the left and right visual-fields. NP: Nonpsychopaths; P: Psychopaths.
C. WORD RATING DATA

Group means for the word rating data can be seen in Table IV. For both NPs and Ps means for negative words differed significantly from those for neutral words (NP: \( t(10)=2.47, P<.05 \); P: \( t(10)=3.20, P<.01 \)). The same held true for differences between positive and neutral words (NP: \( t(10)=3.27, P<.01 \); P: \( t(10)=3.24, P<.01 \)).

D. Additional Analyses

As there is some evidence that positive and negative words may be responded to differently in normal individuals a separate analysis was carried out with word type differentiated into negative, positive and neutral categories. A \( (2 \times 3 \times 2) \) manova was performed with group as a between factor and word type (negative, positive and neutral) and visual-field as within factors. As before, reaction time, P300 latency and P300 amplitude were the dependent variables. The (group x word type) interaction was again found to be significant (\( F(6, 14)=3.54, P<.02 \)). This interaction was also significant specifically for reaction time (\( F(2, 38)=7.53, P<.002 \)). Scheffle post hoc comparisons were carried out to determine whether response times for positive and/or negative words differed from those for neutral words in the NP group and to determine if these effects differed from those in the P
TABLE IV

Group Means for Negative, Positive, and Neutral Words for the Word Rating Form

<table>
<thead>
<tr>
<th>Group</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Word</td>
<td>5.10</td>
<td>4.54</td>
</tr>
<tr>
<td>Positive Type</td>
<td>2.00</td>
<td>2.07</td>
</tr>
<tr>
<td>Neutral Type</td>
<td>3.21</td>
<td>3.00</td>
</tr>
</tbody>
</table>
group. The critical t-value with alpha equal to .05 was calculated to be 4.78.

In NPs positive words were not responded to significantly faster than to neutral words (t(38)=4.23, P>.05) and this result did not differ from that found in Ps (t(38)=2.55, P>.05). NPs were found to respond more quickly to negative than neutral words (t(38)=5.71, P<.05) and this effect was significantly different from that in Ps (t(38)=5.49, P<.05). From Table V it can be seen that positive words showed facilitation over neutral words for NPs by 58.9 msec whereas for Ps this difference was 8.45 msec. NPs responded to negative words 79.8 msec faster than they did to neutral words. Ps responded to negative words 28.8 msec slower than they did to neutral words. These relationships are plotted in Figure 5.

The (group x word type) interaction was also significant for P300 latency data (F(2, 38)=4.98, P<.01). The same post hoc comparisons as were carried out for reaction time data were performed on this data. NPs did not show a significant difference between P300 latency to positive and neutral words (t(38)=1.53, P>.05) nor was this effect different from that in Ps (t(38)=1.72, P>.05). Although NPs showed an increased latency of 67.2 msec for negative over neutral words this effect was not significant (t(38)=3.73, P>.05) nor different from that in Ps (t(38)=4.44, P>.05) who showed a decreased latency of 45.8 msec. These results are summarized in Table VI.
and plotted in Figure 6.

P300 amplitude did not vary across groups for the three word types ($F(2, 38)=1.2, P>.33$). This data can be examined in Table VII and Figure 7.
TABLE V

Group Mean Reaction Times (msec) for Negative, Positive and Neutral Words Collapsed Across Visual-fields

<table>
<thead>
<tr>
<th>Group</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Word Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>817.15</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>838.05</td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>896.95</td>
<td></td>
</tr>
<tr>
<td>Group Mean</td>
<td>850.72</td>
<td></td>
</tr>
</tbody>
</table>
TABLE VI

Group Mean P300 Latency (msec) for Negative, Positive, and Neutral Words Collapsed Across Visual-fields

<table>
<thead>
<tr>
<th>Group</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>684.5</td>
<td>641.9</td>
</tr>
<tr>
<td>Word Positive</td>
<td>644.9</td>
<td>671.6</td>
</tr>
<tr>
<td>Type Neutral</td>
<td>617.3</td>
<td>687.7</td>
</tr>
<tr>
<td>Group Mean</td>
<td>648.9</td>
<td>667.1</td>
</tr>
</tbody>
</table>
**TABLE VII**

Group Mean P300 Amplitudes (microvolts) for Negative, Positive, and Neutral Words Collapsed Across the Visual-fields

<table>
<thead>
<tr>
<th>Groups</th>
<th>Nonpsychopaths</th>
<th>Psychopaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Word</td>
<td>9.88</td>
<td>5.50</td>
</tr>
<tr>
<td>Positive Type</td>
<td>9.33</td>
<td>5.88</td>
</tr>
<tr>
<td>Neutral Type</td>
<td>8.55</td>
<td>5.44</td>
</tr>
</tbody>
</table>

Group Mean 9.25 5.60
Figure 5. Group means for reaction time data for negative, positive, and neutral words collapsed across the left and right visual-fields. NP: Nonpsychopaths; P: Psychopaths.
Figure 6. Group means for P300 latency data for negative, positive, and neutral words collapsed across the left and right visual-fields. NP: Nonpsychopaths; P: Psychopaths.
Figure 7. Group means for P300 amplitude data for negative, positive, and neutral words collapsed across the left and right visual-fields. NP: Nonpsychoapths; P: Psychopaths.
E. INDIVIDUAL SUBJECT DATA

Individual subject facilitation in reaction time for negative over neutral words is plotted in Figure 8. It can be seen that differences between groups are not dependent on a few subjects, but are consistent across subjects. Only one P out of the ten has an amount of facilitation that overlaps with the NP group. The facilitation for positive over neutral words for individual subjects can be seen in Figure 9. Facilitation is more consistent for the NP than the P group, but group differences are not as obvious as they are for negative words.

Comparable differences for P300 latency data can be seen in Figures 10 and 11. It can again be seen that individuals perform more consistently within groups for the negative as opposed to the positive words.

F. ACCURACY DATA

To check for possible speed accuracy trade-offs accuracy data was analyzed. A (2 x 2 x 3 x 2) anova was carried out with group as a between factor and response type (yes and no), word type (negative, positive, and neutral), and visual-field as within factors. The overall effect of word type approached significance (F(2,38)=3.00, P>.06). As can be seen from
Figure 8. Degree of reaction time facilitation across subjects and groups for negative words over neutral words. NP: Nonpsychopath; P: Psychopath.
Figure 9. Degree of reaction time facilitation across subjects and groups for positive words over neutral words. NP: Nonpsychopath; P: Psychopath.
Figure 10. Degree of P300 latency facilitation across subjects and groups for negative words over neutral words. NP: Nonpsychopath; P: Psychopath.
Figure 11. Degree of P300 latency facilitation across subjects and groups for positive words over neutral words. NP: Nonpsychopath; P: Psychopath.
### TABLE VIII

Group Mean Accuracy Scores (% correct hits and % false positives) for Negative, Positive, and Neutral Words Collapsed Across the Visual-fields

<table>
<thead>
<tr>
<th>Response Type</th>
<th>Word type</th>
<th>Hits</th>
<th>False Positives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NP</td>
<td>P</td>
<td>NP</td>
</tr>
<tr>
<td>Negative</td>
<td>76.57</td>
<td>79.36</td>
<td>17.72</td>
</tr>
<tr>
<td>Positive</td>
<td>74.35</td>
<td>79.11</td>
<td>21.79</td>
</tr>
<tr>
<td>Neutral</td>
<td>71.20</td>
<td>71.75</td>
<td>18.52</td>
</tr>
<tr>
<td>Mean</td>
<td>74.04</td>
<td>76.74</td>
<td>19.34</td>
</tr>
</tbody>
</table>

(NP=nonpsychopath; P=psychopath)
Table IV there was a trend for emotional words to be responded to more accurately than nonemotional words across both groups. There was no evidence to suggest the presence of speed accuracy trade-offs. No other effects approached significance including the (group x word type) interaction (F(2,38)=1.09, P>.347).

G. QUALITATIVE OBSERVATIONS

There was only one part of the experiment during which Ps seemed to differ in their response to instructions as compared to NPs. When asked to fill out the word rating form NPs appeared to understand the task immediately and asked few questions concerning what was required of them. In contrast, four of the Ps thought the instructions related to how the words had appeared on the screen so that one of the subjects actually marked of all three letter words as "good" and the five letter words as "bad". For these subjects instructions were given again and the word rating was redone. Even after instructions were given a number of times one P still did not seem to understand and ended up marking all words as "good". Whether or not the trouble Ps had with the task reflected dissimulation, "playing dumb", or a true difficulty could not be ascertained.
V. SUMMARY OF RESULTS

As predicted nonpsychopaths, but not psychopaths demonstrated faster reaction times to emotional as opposed to nonemotional words. Over the nonpsychopathic group faster reaction times were accompanied by an increase in P670 latency. Group differences appeared to be larger and more consistent for negative as opposed to positive words. Although psychopaths showed no response facilitation for emotional words they correctly classified the word stimuli into positive, negative, and neutral groupings as measured by a word rating form. P670 amplitude data did not differentiate between words in either group; however there was a trend for such differentiation in the nonpsychopathic group. Predictions based on visual-field differences were not supported. There were no significant visual-field differences for either group across any word type. There was a trend for both groups to respond more accurately to emotional words. There was also an unexpected finding which suggests that the P670 is of larger amplitude in nonpsychopaths when compared to psychopaths.

VI. DISCUSSION

As predicted nonpsychopaths showed faster reaction times to emotional as compared to nonemotional words. Psychopaths
showed no such facilitation. P670 latency data for nonpsychopaths would suggest that affectivity increases word processing time while at the same time decreasing speed of responding. Individual subject data would suggest that this effect is most consistent for reaction time facilitation to negative words. More remarkable than the group mean difference of 121 msecs of facilitation is the fact that the range of scores for the two groups overlapped by only 26 msecs. Only one psychopath showed facilitation which overlapped with that shown by the nonpsychopathic group. P670 amplitude hypothesis were not supported. It was predicted that nonpsychopaths would show larger amplitude P670s to affectively toned words as compared to neutral words whereas psychopaths would not show this effect. Results showed no (group x word) interaction for amplitude data, however there was a trend for such an effect in the nonpsychopath's data.

A possible criticism that could be laid against the results of this experiment relate to floor effects. Although there was no overall group differences in reaction times, nonpsychopaths appear to respond very much slower to neutral words than do psychopaths. It could be argued that psychopaths are simply responding so quickly to neutral words that they cannot respond any faster to emotional words. One argument against this position relates to the way in which nonpsychopaths responded. It could be argued that decreased reaction times to emotional words actually represents
increased reaction times to nonemotional words. Studies that have found faster responses to affective words have always presented emotional and nonemotional words together. It is possible that this results in subjects selectively responding to emotional words at the expense of nonemotional words. This hypothesis could be tested by having subjects respond to separate groups of emotional words and nonemotional words. This position does not seriously challenge the hypothesis of the present study however since it would be assumed that this differential response should also be found in psychopaths if emotional words invoke similar reactions. In a larger context, differential attention and responses to emotional as opposed to nonemotional words, while listening to a stream of conversation would certainly make sense as affective words may carry information that is important for normal social interactions.

A trend for psychopaths, like nonpsychopaths, to show increased accuracy for nonemotional words, as well as their performance on the word rating form underscores an important point. It has often been suggested that there is a large dissociation between what psychopaths know and what they do. Their performance on these measures would suggest that at one level of understanding they know that emotional words are different from nonemotional words, but that evaluation and response processes for such stimuli, as are related to P300 latency and reaction time do not reflect this knowledge in
what may be crudely stated as an "emotional sense". Psychopaths are often described as being socially adept in their interactions with others. For this reason, psychopaths would need to know that emotional words are different than nonemotional words, because they may require a different social responses, but as Cleckley (1982) has pointed these words are not perceived as significant in psychopaths in the same way that they are in nonpsychopaths.

It is not altogether surprising that nonpsychopaths appeared to show more reaction time facilitation to negative words than to positive words. Past work on normals has shown more facilitation for positive words, but this may be a function of what constitutes emotional significance for different groups. It might be expected that negative words in the present study would be more emotionally salient to criminals than to noncriminals. A group of noncriminals might be expected to show more reaction time facilitation for the positive words as opposed to the negative words, dependent on their backgrounds and personal history. This is not meant to imply idiosyncratic differences but rather a group similarity.

The failure to find the expected visual-field differences could be related to a number of factors. All the words used in this experiment were highly imageable. For stimuli of this type a visual-field advantage is not always found (Day, 1977). Also, as previously noted, priming effects for emotional words might be expected to reduce a right
visual-field advantage in a lexical decision task. However, it is uncertain whether or not psychopaths, who fail to show reaction time effects for emotional words, would still show the expected pattern of lateralization to emotional stimuli. It is possible therefore that the two groups showed a similar reduced right visual-field advantage for different reasons. Nonpsychopaths show a consistent, though nonsignificant right visual-field advantage for all word types and psychopaths do not. This effect may be seen by an inspection of Figure 12.

A previous study involving subjects having to count the number of times an emotional word appeared produced data to show P300 latency to be decreased for affective stimuli (Kostandov and Arzumanov, 1977), however P300 latency has been found to increase when stimuli provide more information (Friedman, Simson, Ritter and Rapin, 1984). The data from the present study would suggest that stimulus evaluation time increases for nonpsychopaths, relative to psychopaths, when words have an affective tone. It is possible that the previous study was actually measuring an earlier AEP component (cf. Squires, 1975) than was done here. This earlier component may be a better measure of the "initial affective categorization of a stimulus" that researchers such as Zajonc (1984) have referred to. The late wave identified in this experiment however, is more likely to be a measure of actual word processing time (Rugg, 1983; 1984). Whether or not an earlier component is present could be evaluated by performing a
Figure 12. Group mean reaction time data for negative, positive, and neutral words across the left and right visual fields. NP: Nonpsychopaths; P: Psychopaths.
principle components analysis on the AEPs for different conditions to ascertain if earlier components differentiate between emotional and nonemotional stimuli.

One other finding in this study warrants further comment. Although there appeared to be an overall difference between groups in P300 amplitude it failed to reach significance so any speculation concerning its meaning should be treated with caution. Reduced P300 amplitude in psychopaths could be related to a greater variability in P300 latency (Donchin et al, 1978), as compared to nonpsychopaths. This possibility could be investigated by the use of a Woody Filter (Woody, 1967) which can examine amplitude differences on a trial by trial basis. There are a few studies that have found differences between psychopaths and nonpsychopaths in the amplitude of the P300 (Syndulko, 1978). However most of these investigations have involved AEPs related to simple sensory stimuli and have not required that subjects perform complex processing such as that invoked when reading words. If in fact this finding holds up in future experiments it would certainly be interesting as other pathological groups have been found to exhibit a similar effect, although no description of the events that could lead to its occurrence have been offered (eg. Duncan-Johnson, Roth and Kopell, 1984). Perhaps in psychopaths it represents an overall attenuation in the amount effort involved in processing words.

One area of the literature that has not been extensively
covered in this paper concerns just exactly how language and emotional systems interact. Cognitively based theories have already been briefly mentioned. Implicit in such theories is the assumption that some prior learning has occurred linking the word with a positive or negative experience. Unfortunately, there is very little research that addresses the question of how emotional words acquire meaning. Gray (1982), in discussing his theory of anxiety speculates that language systems in the neocortex can control the activities of the limbic structures through the prefrontal and cingulate regions. Anxiety can therefore be triggered by verbal stimuli. Such a system is still contingent on an emotional word being somehow tagged as significant which would again require access to past learning experiences. Almost 20 years ago in a discussion of word meaning Marjorie Creelman (1966) made this comment:

Although such areas of inquiry and operation as training, education, child rearing, psychotherapy, diplomacy are usually separate disciplines and approached in different ways, they are intimately related in that they depend upon words as their principle tools . . . We need to know more about the function of emotion: Its role in meaning, in learning, whether emotion serves to organize or disorganize, facilitate or inhibit, or all of these: what determines which function it serves; how the
exercise of the various functional properties of emotion can be regulated (pg.216).

Since this was written very little progress has been made in these directions although studies cited in the present paper would suggest that researchers are beginning to take an interest in these types of issues.

If in fact the lexical decision task invoked some type of an emotional response to the affective words in nonpsychopaths, and this increased their speed of response, how is this finding important if compared to psychopaths who showed no such effect? A main assumption of this study is that there is a dissociation between the referential and affective components of word meaning and that affective information speeds responses relative to neutral information in a lexical decision task. Cleckley (1982), based on clinical experience, hypothesized that psychopaths suffer from a deep semantic disorder involving a deficit in understanding the emotional significance and intent of words. It may be a quantum leap to suggest that a pattern of responding in a lexical decision task would be indicative of such a deficit, but if the evidence is accepted which suggests that the referential and affective components of word meaning can be dissociated, and that psychopaths, for one reason or another cannot respond to or process a word's affective information, then such an assumption is not altogether improbable and the results of this experiment may be seen as providing some support for the
presence of semantic dementia in psychopaths. Whether or not this finding is a simple manifestation of a more generalized affective deficit is a question that could be addressed in future research.


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### APPENDIX A

**List of Words used in the Experiment**

**Positive Words**

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<th>Word</th>
<th>I</th>
<th>P</th>
<th>F</th>
<th>Nonword</th>
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**Mean** 5.82 5.81 86.61

**SD** .53 .31 122.97
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Neutral Words

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| Mean   | 5.62 | 3.95 | 90.60 |
| SD     | .39  | .24  | 112.69 |

I=Imagery rating  P=Pleasantness/Unpleasantness rating - both from Toglia and Batig (1978)
F=Frequency - from Kucera and Francis (1967)