The primary purpose of the present study was to investigate a specific area of cognitive functioning to determine if any differences exist between adult children of alcoholics and controls in the processing of emotionally laden word cues. Of secondary importance was the investigation of group differences in self-esteem, extroversion, neuroticism, and attentional control.

A modified version of the Stroop Colour Naming Task was used to investigate selective processing of word cues in a sample of 37 adult children of alcoholics (ACOAs) and 37 adult children of non alcoholics (non ACOAs). All subjects were university students who volunteered for the study. The original form of this task required subjects to name the color of ink in which a word was printed while ignoring word content. Modified versions of this task substitute target words and control words for the words standardly used in order to investigate attentional bias for relevant word cues. As predicted, ACOAs were significantly slower than non ACOAs on this task. There was also a significant group x word type interaction. Compared to non ACOAs, ACOAs displayed a significant attentional bias in favor of alcohol and social threat words compared to neutral and positive words as evidenced by increased response times on the Stroop Task. There was also a
significant main effect for word type with response time slowest for alcohol words and fastest for positive words. There were no significant group differences in self-esteem, extroversion, neuroticism, or attentional control.

The results were discussed in terms of a generalized attentional deficit for the overall slower response time exhibited by the ACOA group. The more specialized Stroop effect of attentional bias for alcohol and social threat words was discussed in terms of the development of danger schemata based on previous life experiences perceived to be threatening.
Differential Processing of Emotionally Laden Cues in Adult Children of Alcoholics and Controls

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DIFFERENTIAL PROCESSING OF EMOTIONALLY LADEN CUES
IN ADULT CHILDREN OF ALCOHOLICS AND CONTROLS

INTRODUCTION

Alcoholism has often been referred to as a family disease because of its apparent familial transmission and because of the impact that living with an alcoholic has on the other family members. These individuals are affected emotionally, physically, socially, and often economically (Ackerman, 1986a; Cermak, 1984; Gravitz & Bowden, 1985; Kritsberg, 1985). Kinney and Leaton (1983) state that for every person in the United States with a drinking problem four family members are directly affected which translates into approximately 53.3 million family members. Potter (1991) speculates that if you consider the population at large, for every person with an alcohol problem five to six people are adversely affected. Out of this population it is estimated that between 22 and 28 million people in the United States grew up with an alcoholic parent (Russell et al., 1985; Sher, 1991). Although there have been no epidemiological studies to determine the number of children under 18 growing up in alcoholic homes, estimates range from six to seven million (Ackerman, 1986b; Hindman & Small, 1984; Roosa et al., 1988).

It is being increasingly recognized that this is a population at risk for a variety of psychological, developmental, and physical problems (Black, 1981; Naiditch, 1986; Parker & Harford, 1988; Roosa et al., 1988; Schuckit, 1987; Sher, 1991; Tarter et al., 1984). Treatment literature indicates that as a group, Adult Children of Alcoholics (ACOA) are at a particular risk for the development of psychological and alcohol-related problems (Black, 1981, 1986; Kritsberg, 1985; Woititz, 1986). During the past decade, there has been increased attention focused on the children of alcoholics (COA) and the effects, both environmental and biological, that parental alcoholism may have on childhood functioning and later adult development.
Despite the obvious importance of information on COAs and ACOAs, post hoc analyses of clinical populations often conflict with experimental research to produce information that is difficult to evaluate, interpret, and generalize to the population at large (Searles & Windle, 1990). Clinical literature portrays the adult child of alcoholic parents as having lower self-esteem, external locus of control, chronic depression and problems with issues such as guilt, trust, and personal relationships (Black, 1981; Woititz 1983, 1986; Sher, 1991). According to Tweed (1991) this has not always been supported by empirical research. Although studies tend to substantiate that parental drinking has adverse effects on children under 18 (Bennett et al., 1988; West & Prinz, 1987), Russell et al. (1985) has noted that these effects appear to diminish in adolescence and are much less clear cut in adulthood.

To compound this problem, symptoms described in the literature are not unique to ACOAs but are also found in other clinical populations. According to Searles and Windle (1990) a distinct clinical syndrome has never been convincingly identified and many clinical assumptions have not been supported by empirical evidence. For example, Clair and Genest (1987) looked at depression and self-esteem for children of alcoholic fathers and controls in a nonclinical sample and found no significant differences. Churchill (1990) also failed to find any significant relationship between locus of control or self-esteem and parental alcoholism in a college aged nonclinical setting. On the other hand, Tweed and Ruff (1991) while not finding significant differences between a nonclinical sample of ACOAs and controls on a variety of psychological measures did find that ACOAs scored significantly higher on measures of depression and anxiety.

In other studies of personality characteristics, differences found in clinical samples (McKenna & Pickens, 1983; Tarter et al., 1984) have often not been found in nonclinical samples (Saunders & Schuckit, 1981; Schuckit, 1983a, 1987). Knowles and Schroeder (1990) argues that these inconsistent findings may be explained partly by sample selection and design differences. In Knowles' (1990) study of 800 college-aged males, small but
statistically significant differences were found between sons of alcoholic fathers and controls on the majority of scales of the Minnesota Multiphasic Personality Inventory (MMPI). It should be noted though that the scale means for the entire sample fell within the normal ranges.

Over the past ten years, more and more research attention has focused on psychophysiological, neuropsychological/cognitive, and biochemical processes in children of alcoholics. This is partly due to several factors. The first is the steadily accumulating body of evidence for a genetic etiology in alcoholism and the four to six-fold increased incidence of alcoholism found in the offspring of alcoholics (Anthenelli & Schuckit, 1991; Cloninger et al., 1986; Cotton, 1979; Goodwin, 1983; Hesselbrock et al., 1983; NIAAA, 1984; Schuckit et al., 1985). Second, given the evidence for a strong genetic component, many researchers have concentrated on identifying possible biological/genetic risk factors. An example of a potential risk factor currently under investigation is lowered monoamine oxidase (MAO) activity. MAO is an enzyme involved in the degradation of many catecholamines such as dopamine and norepinephrine (Cooper et al., 1978) and is important in the regulation of behavior and mood (Chan, 1990). Studies have found significantly lower MAO activity in alcoholics and their relatives than in controls (Alexopoulos et al., 1983; Orelan, 1983; Shaskan, 1983; Yates et al., 1990) with the lowest MAO activity reported in those individuals with the highest incidence of familial alcoholism (Alexopoulos et al., 1983).

Third, researchers have found various deficits in cognitive functioning (Goldman, 1983) as well as increased incidence of Childhood Minimal Brain Dysfunction (MBD) and hyperkinetic symptoms (HK) in many male alcoholics (De Obaldia et al., 1983; Russell et al., 1985; Tarter et al., 1977, 1984; Wood et al., 1983). This sparked interest in the notion that certain cognitive deficits predated the onset of alcoholism and led to the investigation and subsequent discovery of a wide range of neurologically mediated cognitive deficits in the offspring of alcoholic parents. Gabrielli & Mednick (1983) found depressed verbal IQ
scores in 12 year old boys reared away from their biological alcoholic fathers. Bennet et al. (1988) reported significant differences in cognitive performance and emotional functioning between children of alcoholics and children of nonalcoholics. Other studies have found problems in verbal information processing, memory, attention, impulse control, abstracting ability, and visuospatial perception in COAs (Drejer et al., 1985; Ervin et al., 1984; Knop et al., 1985; Schandler et al., 1988; Whipple et al., 1988). Although not all researchers have found differences (Workman-Daniels & Hesselbrock, 1987) and some have found differences that fall within normal ranges (Bennet et al., 1988) the overall body of evidence supporting neuropsychological or cognitive deficits in COAs is strong even if at times subtle.

Finally, EEG activity and event-related brain potentials (ERP) have been studied in high and low risk populations. Gabrielli et al. (1982) reported an excess of fast EEG activity in sons of alcoholic fathers compared to controls and Schuckit et al. (1985) found a deficiency in EEG alpha rhythms in relatives of alcoholics. Elmasian et al. (1982) found a significantly reduced amplitude in event related brain potentials in high risk individuals compared to controls following ingestion of alcohol. Polich et al. (1984, 1988) failed to replicate these findings in a college sample but research is still active in this area.

In summary, there has been a growing body of research on children of alcoholics over the last ten to fifteen years and while certain patterns are beginning to emerge, they are far from clear cut. Information in this area is important for many reasons not the least of which is the sheer number of individuals involved. Decisions of public policy such as school intervention programs and treatment strategies depend on an adequate assessment of the underlying problems.

The main goals of this paper were two-fold. The first was to provide an overview of the current literature on children of alcoholics with particular emphasis on neuropsychological and neurophysiological characteristics and functioning. The second goal was to investigate a specific area of cognitive functioning to determine if any
differences exist between adult children of alcoholics and controls in the processing of emotionally laden word cues. Additionally, group differences in self esteem, extroversion, neuroticism, and attentional control were examined using a variety of test instruments. This study should add to our present knowledge concerning cognitive functioning in this population.

**Genetic Research and Risk for Alcoholism in Children of Alcoholics**

Alcoholism is an extremely complex behavior disorder and diagnosis is frequently difficult in the early stages (Mendelson & Mello, 1979). The prevailing view of both the National Institute of Alcohol Abuse and Alcoholism (1984) and the National Council on Alcoholism (1984) is that alcoholism is a disease with biological, psychological and environmental substrates. According to Sher (1991) alcoholism does not represent a homogeneous diagnostic category but might best be described as heterogeneous. In an attempt to clarify this confusion, some researchers have focused on subtypes that might represent clinically pertinent typologies. For instance, Penick (1978, 1987) has focused on family history differentiating familial from non-familial alcoholism while Cloninger (1987) using discriminant analysis, has distinguished Type 1 and Type 2 alcoholics based on personality characteristics, antisocial behavior, and family history.

Although there is no universally accepted definition of alcoholism, the National Council on Alcoholism (1984) considers it to be a chronic, progressive and potentially fatal disease which is often, but not always, characterized by tolerance, physical dependency, and loss of control over alcohol. It usually manifests itself through increasing physiological and psychological problems. This essentially corresponds to the American Psychiatric Association’s criteria for alcohol dependence as stated in the *Diagnostic and Statistical Manual of Mental Disorders* (Third edition-revised, 1987) (DSM-111-R); currently the most widely used diagnostic criterial in the United States (Sher, 1991).
Although alcoholism may be viewed as a disease with biological and psychological substrates, it may also be viewed as a social disease (Favazza, 1984). There are approximately 10 million American adults with alcohol dependency problems and an additional 3.3 million youths (Institute of Medicine, 1980). According to the National Council on Alcoholism (1984) 80% of all fire deaths, 65% of all murders, 60% of all child abuse incidents, and 50% of all fatal traffic accidents are alcohol related. The estimated economic cost of alcohol related problems is approximately 50 billion annually with nearly 13 billion in health care costs alone (Mayer, 1983). Clearly, alcoholism is a very serious problem with a number of personal and social ramifications.

There is little doubt that alcoholism is a strongly familial disorder with a great deal of evidence for genetic involvement (Ackerman, 1992; Crabb, 1990, NIAAA, 1984; Hesselbrock et al., 1983; Schuckit, 1983b) even though the precise nature of that involvement is still unknown. As with most disorders, it does not follow classical Mendelian paradigms of genetic transmission (Rice et al., 1983). A recent review by Ackerman (1992) describes some of the complexities surrounding the genetics of alcoholism stating that there may be different modes of inheritance and multiple genes involved in the development of different forms of alcoholism. Since the inheritance mode is unknown, it is considered one of the more complex diseases to study. At present, a great deal of research is focusing on the possible biological antecedents of alcoholism and the identification of genetic/biological risk factors. It is hoped that the ability to determine predisposing risk factors would greatly facilitate the ability to isolate and screen high risk individuals.

Evidence for a strong familial component in alcoholism is supported by family, twin, and adoption studies as well as genetic marker and animal research (Anthenelli & Schuckit, 1991; Cloninger et al., 1988; Cotton, 1979; Crabbe & Phillips, 1990; Hesselbrock et al., 1983; Lieber, 1990; Pandey, 1990; Schuckit, 1983a; Thacker, 1984). If a person has a first degree relative who is alcoholic, it is estimated that the individual has a 60% chance of
developing an alcohol related problem (Hesselbrock et al., 1983). In a review by Goodwin (as cited by Saunders, 1982) 149 studies out of 150 showed higher rates of alcoholism in relatives of alcoholics than in the general population. Cotton (1979) reviewed the results of 39 studies involving 6251 alcoholics and 4083 nonalcoholics and found that alcoholism rates were much higher in relatives of alcoholics when compared to relatives of nonalcoholics. This held true even when nonalcoholics were psychiatric patients.

According to Bourne and Light (1979) and Cotton (1979) women have a higher incidence of alcoholism occurring in parents and siblings than do men and that women may be more vulnerable than men to the impact of familial alcoholism.

Some investigators have looked at twins and adoptees in an attempt to answer questions about heritability versus environment. If alcoholism has a strong genetic component one would expect to find a higher concordance rate in monozygotic than in dizygotic twin pairs. Research has shown this to be the case. If one member of a monozygotic pair is alcoholic, the other has been found to be alcoholic in approximately 54% of the cases. For dizygotic twin pairs, the concordance rate is about 28% (Schuckit, 1983a).

Adoption studies also provide good evidence for heredibility factors in alcoholism. In a review by Schuckit (1983a) investigations indicated that the risk for alcoholism in adopted sons of alcoholics was four to five times higher than for adopted sons of non-alcoholics reared under similar circumstances. Incidence of alcoholism in the rearing parent appeared to have little influence. According to Schuckit, sons of alcoholics reared by alcoholics were not at greater risk for the development of alcoholism than if they were reared by nonalcoholics.

The pattern in females appears to be less clear but in an adoption study of 913 Swedish women, Bohrman et al. (1981) found a fourfold increase in the incidence of alcoholism among daughters of alcoholic biological mothers compared to daughters without alcoholism in either parent. It was noted that while increased susceptibility to alcoholism
appeared to be inherited from either parent it was the mother's alcoholism that significantly increased the risk in their adopted out daughters.

Finally, Cloninger and colleagues (Bohrman et al., 1981; Cloninger et al., 1981, 1987, 1988) studied 862 male and 913 female Swedish adoptees in an attempt to look at the interaction of genetic and environmental factors. Two types of alcohol abusers were identified with differing characteristics and backgrounds. Type 1 (milieu-limited) was the most common, ranged from mild to severe, required a genetic predisposition and was influenced by environmental factors. The biological parents were adult onset alcohol abusers (over age 25) with no record of criminality. They were characterized by low levels of novelty seeking, high harm avoidance, and high reward dependence. Women fell into this Type 1 category exclusively. Type 2 (male-limited) was found exclusively in men, was patrilineal, had a heritability factor of 90% and was apparently not influenced by environmental factors (Russel et al., 1985). This type was also associated with early onset of abuse (under age 25) recurrent alcohol treatment and criminality in the biological fathers. They displayed high levels of novelty seeking, low harm avoidance and low reward dependence. Although this study has been faulted on methodological grounds (Searles, 1990) it still represents a landmark study in its attempt to look at the interaction of genetics and environment.

When considering genetic factors in alcoholism, the issue of a specific genetic vulnerability versus a general genetic predisposition to psychopathology in which alcoholism is only one outcome, repeatedly arises. This is an issue that has also plagued genetic research on affective disorders and schizophrenia (Hesselbrock et al., 1983). In alcoholism, there is evidence to support both theories. In general, acetaldehyde research and animal data from ethanol preference and consumption studies indicate a specific genetic vulnerability. Research in altered catecholamine metabolism such as low platelet MAO tend to support a more generalized vulnerability hypothesis (Hesselbrock et al., 1983). Low platelet MAO levels have been associated with other severe forms of psychopathology
including schizophrenia (Barchas et al., 1977; Bowers, 1980). However, the evidence linking genetic factors in the major psychiatric disorders with those that may increase the risk for primary alcoholism is weak (Schuckit, 1986; Schuckit et al., 1985).

As mentioned earlier, MAO constitutes a class of enzymes that are involved in the degradation of many catecholamines such as dopamine and its metabolic products, norepinephrine and epinephrine (Cooper et al., 1978). It also plays an important role in the regulation of behavior and mood (Chan, 1990). Evidence, including twin studies, indicates that MAO activity represents a stable genetic trait among alcoholic and nonalcoholic populations (Oreland, 1983). According to Shaskan (1983) and Yates et al. (1990), there are statistically significant mean value differences between alcoholics and control populations for platelet MAO activity. Studies utilizing alcoholics, their first-degree relatives and normal controls, have found that alcoholics and their relatives exhibited significantly lower platelet MAO activity than controls (Alexopoulos et al., 1983; Pandy, 1990). Other studies have found low MAO activity in Type 2 alcoholics as opposed to Type 1 and in alcoholics with at least one first-degree alcoholic relative (Chan, 1990).

In a review of seven studies, including ones that controlled for other physiological variables that might affect MAO activity, Shaskan (1983) concluded that there is strong support for the notion that lowered MAO activity may be a genetic risk factor in alcoholism. It is lower in alcoholics and their relatives than in controls and animal experiments have shown it to be stable across environmental and nutritional lines including chronic ethanol treatment (Oreland, 1983).

Another area that has generated interest is the relationship between acetaldehyde (AcH) levels and alcoholism. AcH is the first metabolic product of ethanol metabolism and is 10 to 30 times more toxic than ethanol (Dannecker et al., 1983). The basis for using disulfiram (antabuse) is that it blocks the oxidation of acetaldehyde producing violent and unpleasant physical symptoms upon consumption of alcohol (Holman, 1977). When alcohol is ingested, most is oxidized by the enzyme alcohol dehydrogenase (ADH) to
acetaldehyde and then further metabolized to nontoxic substances by aldehyde
dehydrogenase (ALDH) (Pandey, 1990). Research has shown that acetaldehyde levels are
genetically controlled depending upon the activity of ADH and ALDH (Hesselbrock et al.,
1983; Pandey, 1990; Russell et al., 1985. Schuckit (1983b) demonstrated a twofold
higher level of acetaldehyde in the children of alcoholics when compared to matched
controls. It is speculated that an accelerated ethanol metabolism and a reduced ALDH
activity in alcoholics versus controls could result in such differences (Maring et al., 1983).
In specially bred ethanol preferring strains of mice this increase in ethanol metabolism is
referred to as SIAM and is a repeatable phenomenon (Thurman et al., 1983).

Racial differences have been found in aldehyde dehydrogenase (ALDH) and in
alcohol dehydrogenase (ADH); most notably among Oriental populations (Chan, 1990;
Goedde et al., 1983; Pandey, 1990). A study by Goedde et al. (1983) found that
individuals deficient in one form of ALDH ran a higher risk of acetaldehyde related
physiological damage. Goedde stated that this deficient or variant type of ALDH is present
in 40 to 50 percent of individuals in Japan and may serve as protection against alcoholism
because of the physiological aversion to alcohol. This deficiency has not been observed in
European populations and it is speculated that this may in part account for the much lower
rates of alcoholism among the Japanese.

Racial differences have been noted in alcohol dehydrogenase (ADH) as well. A
variant form of ADH is also frequently found in oriental populations. According to
Goedde et al. (1983), 80% of oriental populations and about 10% of caucasian populations
experience subjective symptoms of alcohol sensitivity such as face flushing, nausea, and
dizziness. This may be due to differential base rates of ethanol metabolism and may be
related to variations in ADH (Topel, 1985).

It is difficult at this stage to determine the implications of this research except to say
that various factors such as metabolic rate have proven to be under genetic control and that
variant forms of these enzymes have been found in different racial groups. The
mechanisms are extremely complex and, according to Russel et al. (1985), the practical importance of metabolic rate differences in the etiology of alcoholism is not clear.

One hypothesis, based on the observation of higher acetaldehyde levels in alcoholics and in some high risk groups, is that increased levels may indicate a predisposition for alcohol abuse (Russell et al., 1985). A possible mechanisms for this would be through the production of substances known as tetrahydroisoquinolines (TIQs).

Tetrahydroisoquinolines (TIQs) are morphine-like neurochemicals capable of binding to the opiate receptor. Originally found in several species of plants, and produced as morphine precursors in certain species, TIQs have been shown to be pharmacologically active compounds in mammalian systems (Dietrich & Erwin, 1980; Petrakis, 1985; Rahwan, 1975). Certain members of this group seem to function as catecholamine metabolism inhibitors and as false transmitters (an antagonist that works by blocking post-synaptic receptors without stimulating them thus preventing the neurotransmitter from acting on them). Additionally, TIQs can be produced from the spontaneous condensation of aldehydes and catecholamines (for example, acetaldehyde and dopamine). It is these observations that have led researchers to investigate the possible link between alcoholism and the endogenous formation of TIQs (Dietrich & Erwin, 1980; Topel, 1985). It is speculated that TIQs bind to the opiate receptor inducing a false sense of well being (Blum & Trachtenberg, 1988) and serving as a reinforcer for increased drinking (Russell et al., 1985). The implication is that there may be a common mechanism of physical dependence related to alcohol and opioid addiction in at least some forms of alcoholism.

Support for the TIQs' relationship with alcoholism comes from alcohol preference tests (Deitrich & Erwin, 1980; Myers et al., 1982; Myers & Melchior, 1977; Topel, 1985). Myers and Melchior (1977) surgically implanted cannulae into the cerebral ventricles of rats and subsequently infused them with various doses of tetrahydropapaveroline (THP), a TIQ derivative. When presented with the choice of drinking water or ethanol solutions, the normally alcohol avoiding rats chose alcohol in significantly higher amounts than did the
cannulated controls. Similar effects have also been reported by Myers et al. (1982) using the macaque monkey. Similar experiments have replicated many of the features of the Myers data and noted that animals continued to prefer alcohol up to 10 months after infusion (Blum & Trachtenberg, 1988; Deitrich & Erwin, 1980; Melchior, 1980; Topel, 1985). Additional evidence to support the notion that ethanol influences the activity of endogenous opioid peptide systems comes from investigations using the opiate receptor antagonist naloxone which modifies several biochemical and behavioral effects of ethanol in animals (Seizinger et al., 1983).

In a review by Barnes (1988) it is stated that perhaps the clearest link between behavioral responses to alcohol and its biological action on the central nervous system involves the neurotransmitter Gamma Aminobutyric acid (GABA). GABA is the major inhibitory neurotransmitter in the brain and it appears that many of the effects of alcohol such as motor incoordination and anxiety reduction are related to the GABA system (Barnes, 1988). Barbiturates and benzodiazepines such as librium and valium act on the GABA receptor complex and data indicate that the function of this complex is enhanced by alcohol (Barnes, 1988; Suzdak et al., 1986).

Using the diazepine analog R015-4513, Suzdak et al. (1986) found that the drug blocked the ethanol induced chloride uptake into brain vesicles but had no effect on chloride uptake stimulated by either pentobarbital or the GABA receptor agonist muscimol. These results indicated that the drug was specific for alcohol effects on the GABA receptor. Furthermore, pretreatment of rats with R015-4513 blocked the behavioral effects of ethanol (anticonflict and intoxication behavior). Lastly, administration of the drug to rats that had passed out after acute alcohol ingestion caused them to recover sobriety within two minutes.

Some of the most recent research into the etiology of alcoholism involves the neurotransmitter dopamine. A review by Ackerman (1992) discusses some of the most
recent findings that suggest a variant form of the gene that codes for dopamine receptors in the brain may be associated with the most severe forms of alcoholism.

Finally, there has been renewed interest in the hypothesis of alcohol as a reinforcer that works on the reward system in the brain. Although not well defined in humans, it is thought to be closely associated with circuits in the limbic system that project to nearby dopamine systems (Barnes, 1988). Petrakis (1985, p. 26) suggests that "alcohol may make people 'feel good' because it alters the levels of the neurotransmitters dopamine and norepinephrine, as well as opiate peptides, in a specific brain region. In view of the neurochemical basis of reinforcement, it seems likely that an individual's genetic predisposition to alcoholism could be due to inheritance of neurochemical mechanisms in the brain's reward center that are abnormally responsive to alcohol."

Research in the area of biological/genetic factors in the etiology of alcoholism is not immune from criticism. Pelle (1986) discussed some of the limitations and implications of genetic/biological marker research in a short review of genetic models of alcoholism and other addictions. Not all researchers have been able to replicate the acetaldehyde research by Schuckit (1983b) and criticism has been aimed at the Goodwin studies (Saunders, 1982) on procedural (definitional) grounds.

To conclude, the preceding discussion was an attempt to provide background on research into the etiology of alcoholism and the identification of biological/genetic risk factors. It has also been an attempt to emphasize the complexity of this disorder and the problems inherent in any attempt to definitively characterize the children of alcoholic parents.

**Family Dynamics**

One of the biggest problems concerning the literature on the family dynamics of alcoholism is the discrepancy between clinical observation and empirical research. Any
investigator involved in family studies encounters tremendous problems because of the number of variables involved and the complexity that this creates. Nevertheless, according to Seilhamer & Jacob (1990, p. 170) "in comparison with genetic studies, the literature on family environmental influences in the etiology of alcoholism is much less rigorous. Although clinical observations describe the deleterious effects of living in a home with alcoholism, there is a lack of guiding conceptualizations and systematic investigations of the actual processes and events that occur within these families." Even when dysfunctional family patterns are observed, it is difficult to determine the actual causes of the dysfunction (Sher, 1991). Although there is a general consensus that children of alcoholics represent a population at risk, this population displays a considerable degree of heterogeneity (Russell et al., 1984; West & Prinz, 1987) as do their families. The following discussion presents both a summary of pertinent clinical literature as well as recent empirical research on alcoholic families.

According to clinical observation, there are several concepts central to the understanding of alcoholism and its impact on the family. First, as discussed earlier, alcoholism is extremely complex, difficult to diagnose early, and does not represent a homogeneous diagnostic category. Second, alcoholism is characterized by the concept of denial both by the alcoholic and often, particularly in the early stages, by his or her family. According to Ackerman (1986a, p. 6) "family denial occurs in at least three ways: as systematic denial; as protection against exposure; and, as the primary patient philosophy."

Systematic denial means a refusal or inability to admit that a problem exists. This occurs not only in the family but in society as well and contributes to the use of denial as a way to protect against exposure. Although the past decade has certainly seen a greater willingness on the part of individuals and society to confront alcohol problems, there is still a lingering social stigma against labeling someone alcoholic. The primary patient philosophy refers to the fact that often in an alcoholic family all of the attention is focused on the alcoholic. Life revolves around this person and other family members usually don't receive the attention
they need and deserve. Home life is frequently unpredictable and inconsistent (Gravitz & Bowden, 1984).

Third, not all families or family members are affected in the same way. Kritsberg (1985) discusses the alcoholic family in terms of a family system continuum ranging from severely dysfunctional to highly functional and governed by the rules of denial, rigidity, silence, and isolation. Although Kitsberg considers all alcoholic families dysfunctional, he points out that the dysfunction is a matter of degree and dependent upon many variables. Within this context, Ackerman (1986a) discusses three general variables that should be considered:

1. the severity of the problem
2. the pattern of the person's drinking behavior--belligerent, abusive, binge drinker, daily drinker
3. the individual family members (non-alcoholic) perception of potential harm of the situation.

There is a constant attempt to adapt behavior and develop coping strategies to minimize the impact of the alcoholic's behavior. For children growing up in this type of environment, coping strategies are often a matter of survival (Ackerman, 1986b; Black, 1981; Woititz, 1983).

Based on clinical observation, Woititz (1986) discusses common characteristics of adult children of alcoholics that she perceives as representative of ACOAs as a group but not necessarily true of all ACOAs. These characteristics are thought to be the result of growing up in an uncertain, unpredictable and stressful environment and include such things as not knowing the meaning of normal, difficulty with intimate relationships, difficulty with control issues, and impulsivity. Other clinicians such as Black (1979, 1981), have popularized the notion that children growing up in alcoholic families adopt specific roles as a result of their home environment. One role, the "responsible one" is thought to be most often assumed by the oldest child and involves taking responsibility for
the functioning of the household. Other roles include the "adjustor" who constantly tries to adapt to the changing environment, the "placator" who tries to please everyone, and the "acting out child" or "scapegoat" who attempts to divert attention from home problems by acting out and getting into trouble. Black maintains that although these roles serve a survival mechanism while growing up, they cause problems later in life when they are no longer needed.

Although this concept of adopted roles within the family appears to be treated as fact in the clinical literature, and may be useful in therapeutic endeavors, Sher (1991) maintains that there are no well-controlled studies that substantiate these typologies. In a preliminary study of college-aged ACOAs, cluster analysis of retrospective reports of early coping strategies indicated some support for the "placator" and "adjustor" roles but the finding must be considered tentative due to methodological limitations of the study (Burk, 1985 as reviewed by Sher, 1991).

There have been various studies designed to look at characteristics of alcoholic families. Black et al. (1986) compared 409 adults raised in alcoholic homes with 179 adults raised in nonalcoholic homes on their childhood perceptions of adult interpersonal differences, communication (sibling, parental, school, etc.), violence, sexual abuse, and alcohol related differences in their home life. She found that adults from alcoholic families were significantly less likely to use interpersonal resources such as parents, teachers, and neighbors concluding that these resources were not available to the child either emotionally or physically. Alcoholic families were also characterized as having more disruptions (higher divorce rates and higher premature death rates in siblings and parents), and more physical/sexual abuse during drinking and nondrinking periods. ACOAs reported more psychological and emotional problems in childhood and more frequently married alcoholics than did adults from nonalcoholic families. It should be noted that all subjects were solicited by placing notices in three alcohol oriented journals (U.S. Journal of Alcohol and
Drug Dependence, Alcoholic Magazine and Focus on Family Magazine) which limits the study's applicability to the ACOA population at large.

Several studies have looked at alcoholic families using self report measures of family functioning and environment (Benson & Heller, 1986; Clair & Genest, 1986; Moos & Moos, 1984). In general, these studies found less family cohesion and organization, lower levels of independence, expressiveness, intellectual-cultural orientation, active family recreation, and higher reported levels of conflict and disruption in alcoholic families compared to nonalcoholic control families. However, Moos and Moos (1984) found that families of recovering alcoholics functioned as well as families of nonalcoholic controls indicating that the stress in alcoholic families may be related to actual drinking behavior. They also found that recovering families were no different than community controls in cohesiveness, expressiveness, organization, and conflict. This suggests that 1) a significant factor in offspring adjustment may be the ongoing stress of having an actively drinking parent and 2) the process of recovery may bring about an improvement in the psychological and emotional health of the child.

Benson & Heller (1987), in a study of adjustment in adult daughters of alcoholics, psychiatrically disturbed fathers, and normal fathers, concluded that it might not be parental pathology per se that is most closely associated with negative effects on offspring but rather the disruptive social and family conditions frequently found in alcoholic homes. She argues that some of the deleterious affects of parental alcoholism may be reduced by shifting the focus of intervention programs from parental drinking patterns to strengthening family and community resources.

Finally, Clair & Genest (1987) found that adult children of alcoholic fathers described their families as more dysfunctional than children of nonalcoholics. They engaged in more avoidance coping behavior such as cigarette smoking and drinking and reported less parental guidance and structure. On the other hand, they found that many of the children of
alcoholics were functioning on the same level or higher than the average level for children of nonalcoholics.

In a study of 25 alcoholic families, Wolin et al. (1979) investigated family functioning in terms of family ritual patterns of behavior (e.g., regular dinner times, vacations, celebration of holidays) as a predictor of transmission of alcoholism to the next generation. They found that families able to maintain "family rituals" (termed distinctive families) in spite of the stress of alcoholism were relatively stable and significantly less likely to have alcohol problems in the next generation than were families (subsumptive) that were unable to maintain ritual behaviors. For subsumptive families, alcoholism was a disruptive force that changed the structure of the family unit.

Werner (1986), in a longitudinal study of 49 subjects, tried to assess characteristics in the caregiving environment that differed between children of alcoholic parents that did not develop coping problems and those that did. She found that the negative impact of parental alcoholism could be buffered by early environmental characteristics and constitutional characteristics of the child. Constitutional characteristics included variables such as temperament, intellectual level, and achievement orientation. Environmental variables included sex of the nonalcoholic parent, plenty of attention from primary caregiver during infancy, and absence of parental conflict during first two years of life. Others have included mediating variables such as psychiatric status of nonalcoholic parent, supportive social networks, peer influence, and social resources (Seilhamer & Jacob, 1990).

The last area of interest was the effects of social drinking models on drinking behavior. Chippenfield & Vogel-Sprott (1988) examined the modeling effects of 50 male university students in relation to family history of alcoholism. They found that family history positive (FH+) subjects were significantly more likely to conform to the model than were family history negative (FH-) subjects. Based on these results, the researchers speculated that in a family with problem drinking an individual may not learn appropriate social drinking behavior. This could have serious implications for future drinking patterns.
Although adolescent alcohol use has been correlated to parental alcohol use (Russel et al., 1985) the enduring nature of this influence has not been well studied (Sher, 1991).

According to Sher (1991), research on family factors and their relationship to children of alcoholics is still in the early stages. Much of the work has involved intact families consequently very little is known about COAs growing up in one-parent families. Family research also tends to ignore genetic contributions. It is hoped that future research will address some of these issues.

**Personality Characteristics of Children of Alcoholics**

Clinical literature portrays the adult child of alcoholic parents as having lower self-esteem, external locus of control, chronic depression, and problems with issues such as guilt, trust, and personal relationships (Black, 1981; Woititz, 1983, 1986; Sher, 1991). According to Churchill et al. (1990), the hypothesis that adult children of alcoholics exhibit more external locus of control and lower self esteem than do adult children of nonalcoholic families has not been substantiated by research. Although studies tend to confirm that parental alcohol abuse has adverse effects on children under 18 (Bennett et al., 1988; West & Prinz, 1987), Russell et al. (1985) has noted that these effects appear to diminish in adolescence and are less apparent in adulthood.

A number of studies have specifically investigated children (for review, see West & Prinz, 1987). In a study of 64 children aged 6-18, Bennett and colleagues (1988) concluded that children from alcoholic families functioned significantly worse on certain measures of cognitive and emotional functioning than did children from nonalcoholic homes. However, both groups scored in the normal range and the COA group did not exhibit severe emotional problems. The measure that showed the greatest discrepancy was the Piers-Harris self concept score with the COA group scoring significantly lower than non COAs. The investigators proposed that the lack of a well organized and stable home
environment might explain the lower emotional and cognitive functioning found in the COA group. Callan & Jackson (1986) found no significant differences between children of recovering alcoholics, children of active alcoholics, and matched controls on measures of self-esteem and locus of control but children of active alcoholics reported being less happy with their lives.

Finally, West & Prinz (1987), reviewing a number of studies published between 1975 and 1985, found that the literature generally supported the notion that parental alcoholism is detrimental to childhood development and functioning. In ten out of the eleven studies on emotional functioning reviewed, a positive relationship between parental alcoholism and offspring impairment for lowered self esteem, anxiety, depression, and perceived lack of environmental control was found. Two studies found significantly higher external locus of control in children of alcoholics compared to controls. West & Prinz concluded that while the studies they reviewed as a whole suggested children of alcoholics were at risk for a variety of psychological disturbances, the research was plagued by many problems including sample bias, uncorroborated self-report measures, and lack of appropriate comparison groups.

For adults, the effects of parental alcoholism are sometimes less apparent (Russell et al., 1985). Black et al. (1986), in a study of 588 adults, reported 12 problem areas identified by adult children of alcoholics and comparison groups. They found that ACOAs had significantly more trouble expressing and identifying feelings, taking responsibility, trusting people, expressing their needs, and putting themselves first than did adults raised in nonalcoholic families. Additionally, ACOAs described themselves as having more difficulty with intimacy, depression, and confusion and they reported more work-related, problem solving, and dependency problems. It was interesting to note that a large percentage (40%-50%) of the comparison group, compared to 60%-75% of the ACOA group, also reported having difficulty with intimacy, putting themselves first, and expressing needs. Although this study has implications for assessing and identifying
treatment areas within a potential clinical setting, the ability to generalize to the ACOA population at large is hampered by sampling bias. All respondents were solicited by placing notices in alcohol oriented journals and it could be legitimately assumed that the readership had either a personal or professional (or both) interest in the alcoholism field.

In an analysis of 1772 adults, using data from the 1979 National Drinking Practices Survey, Parker & Harford (1988) found that daughters of alcohol abusers were at elevated risk for depressive symptomatology and that sons and daughters were at risk for marital separation or divorce. Benson and Heller (1987), in a study of adult daughters of alcoholics, psychiatrically disturbed fathers, and normal fathers, found that while daughters of alcoholic fathers reported significantly more acting out and neurotic symptoms than did daughters of normal control fathers, the two groups did not differ in depressive symptomatology or drinking behavior. However, the neurotic and acting out behavior found in daughters of alcoholic fathers was similar to that found in daughters of psychiatrically disturbed fathers who also had significantly higher depression scores than did daughters in the alcohol and control groups.

Berkowitz and Perkins (1988) investigated the relationship between gender specific personality differences and how they related to gender of the alcoholic parent; an area that has received very little attention. College age students (N=860) were screened for parental alcoholism using an abbreviated form of the Children of Alcoholics Screening Test (CAST; Jones, 1982) and the indication that a parent "may have had or may have an alcohol abuse problem" (Berkowitz & Perkins, 1988, p. 207). A personality survey designed to measure other directedness, sociability, need for social support, directiveness, independence/autonomy, lack of tension, impulsiveness, and self-depreciation was administered. They found that the ACOAs were similar to the non ACOAs on most personality measures. The exceptions were self-depreciation in both male and female ACOAs and autonomy in male ACOAs. Both reported greater self-depreciation than did non ACOAs but the difference was significantly greater for women. Additionally, women
with alcoholic fathers (as opposed to women with alcoholic mothers) were significantly more likely to report greater self depreciation. Male ACOAs were rated significantly higher than male non ACOAs on the autonomy measure and the gender of alcoholic parent appeared to have no effect. The investigators concluded that although further attention should be devoted to the effects of parental alcoholism on the well being of their female offspring, in general ACOAs show a high degree of resiliency as evidenced across a wide range of personality measures. The Berkowitz and Perkins (1988) conclusions are compatible with the findings of Werner (1986) in her longitudinal study of COAs from birth to 18. This study indicated that many children of alcoholics are quite resilient in coping with the potentially harmful impact of parental alcoholism.

Studies of personality characteristics of children of alcoholics using the MMPI have shown inconsistent results (Knowles & Schroeder, 1990). Greater differences in personality characteristics between COAs and non COAs have been found in studies using clinical samples (McKenna & Pickens, 1983; Tarter et al., 1984) than in research with non clinical subjects (Saunders & Schuckit, 1981). McKenna & Pickens (1983) compared the MMPI scores of 1929 (1411 men and 518 women) individuals undergoing treatment for alcoholism and found that sons of alcoholics scored significantly higher on one Validity (F) scale and five Clinical scales (4, 5, 7, 8, and 9) than did sons of nonalcoholics. Daughters of alcoholics scored significantly higher on two Clinical scales (4 and 9) than did daughters of nonalcoholics. Gender of alcoholic parent was not determined to be a factor but the number of alcoholic parents was found to be related to elevated levels of aggression and psychopathology in their offspring. Tarter et al. (1984), in a study of 16 delinquent sons of alcoholics and 25 delinquent controls, found that COAs scored significantly higher on three of the MMPI Clinical scales (Hypochondriasis, Depression, and Hysteria) than did sons of nonalcoholics although none of the scores were clinically significant. Saunders & Schuckit (1981) found few differences between Family History positive (FH+) and Family History negative (FH-) young men on the alcoholism scales of the MMPI.
Knowles and Schroeder (1990) speculated that these inconsistencies were partly due to sample selection and size. In order to answer the question of whether personality differences found in clinical samples are also present in nonclinical samples, Knowles and Schroeder compared the scores of 800 college aged males (199 ACOAs, 601 non ACOAs) on all 10 Clinical scales and the 13 Wiggins Content scales of the MMPI. Although all scores fell within the normal range, they found small but statistically significant differences between sons of alcoholics and sons of nonalcoholics on all 10 Clinical scales and 7 of 13 Wiggins Content scales. In their discussion, they speculate that these observed personality characteristics in ACOAs are subtle but reliable and may be related to either 1) the environmental stress of growing up in an alcoholic home or 2) a "higher level of genetic loading" (Knowles & Schroeder, 1990, p. 146).

Since alcoholics have scored higher than nonalcoholics on the Extroversion and Neuroticism scales of the Eysenck Personality Inventory, Schuckit (1983a) and Whipple & Noble (1991) used this inventory to look at extroversion and neuroticism in FH+ and FH- young men. The Whipple and Noble study, using 10-15 year olds and a variety of other personality measures, also compared the scores of the young men's fathers who were either recovering alcoholics with two years sobriety or non alcoholics. The Shuckit sample consisted of 21-25 year old college students and faculty. Neither study found significant differences between the two groups of sons on extroversion or introversion. However, Whipple and Noble did find that recovering alcoholic fathers scored significantly higher on neuroticism than did nonalcoholic fathers although the scores were not extreme and did not indicate psychopathology. This study analyzed a number of other personality characteristics and found that sons of recovering alcoholics scored significantly different than sons of nonalcoholics on measures of self discipline, internalization, warmth, tension, and independence. Whipple and Noble concluded that sons of alcoholics were somewhat more fearful, compulsive, insecure, detached, and dependent than controls. Although this is not indicative of extreme personality deviance or psychopathology, the authors stress that
these sons (and their recovering fathers) "can be differentiated from nonalcoholic men and their sons on the basis of personality variables" (Whipple & Noble, 1991, p. 335). This study is of particular interest because an index derived from the different personality measures was correlated with neurocognitive variables from a previous study (Whipple et al., 1988) which will be discussed in the next section.

Finally, a variety of studies (Churchill et al., 1990; Clair & Genest, 1987; Tweed & Ryff, 1991; and Werner & Broida, 1991) have investigated self esteem, locus of control, anxiety and depression in adult children of alcoholics. In answer to the criticism that ACOA research has focused on either clinical or college populations, Tweed & Ryff (1991) used sampling procedures designed to identify ACOAs in the community. In their study of 114 ACOAs and 125 non ACOAs (both representing community populations) they found significantly higher scores for depression and anxiety in adult children of alcoholics than in controls from a nonalcoholic environment. No significant differences between the two groups were found on a variety of other measures of personality characteristics such as self-esteem and achievement orientation. Clair & Genest (1987), using a mixed sample, also found no significant differences between ACOAs and non ACOAs on measures of self-esteem, but significantly higher scores on "depression proneness" were found in adult children from alcoholic homes. Churchill et al. (1990) found no significant relationship between parental alcoholism and either self-esteem or locus of control in a study of 497 college students.

Werner and Broida (1991) also used a community based nonclinical, noncollege population to look at self-esteem and locus of control in ACOAs but their study was also interested in isolating the effects of alcoholism from those of dysfunction. Subjects (N=195) were placed, on the basis of questionnaire responses, in one of four family groups; 1) alcoholism only 2) dysfunction only 3) alcoholism and dysfunction 4) neither. They found that familial alcoholism was not a predictor for either lower self esteem or external locus of control. Adult children of alcoholics were found to have significantly
lower self esteem only in the presence of familial dysfunction. There were no significant differences between any of the four groups for locus of control.

To conclude, the stereotypical clinical image of the adult child of alcoholic parents as having lower self esteem, external locus of control, increased depression, and a variety of other distinguishing characteristics appears to be, at least partly, incorrect. The experience of clinicians in working with ACOAs within a treatment context may be valid, but there appears to be little empirical support for the notion that these personality characteristics are representative of the general population of ACOAs. Research has not supported the claims that ACOAs have lower self-esteem and external locus of control but some studies of nonclinical populations have found increased levels of depression. Knowles & Schroeder (1990), in their study of college males, found subtle but significant differences between ACOAs and non ACOAs on most of the scales of the MMPI although all scores fell within the normal ranges. Overall, research indicates that small, often subtle, differences across a range of personality characteristics can be seen in nonclinical ACOA populations but the Werner & Broida (1991) study indicated that differences may be more related to familial dysfunction than parental alcoholism per se. According to Searles & Windle (1990, p. 3) "most individuals emerge from these environments relatively intact psychologically and emotionally".

**Psychophysiological and Neuropsychological/Cognitive Functioning**

The past decade has seen increased interest in psychophysiological and neuropsychological/cognitive functioning in children of alcoholics. This was partly due to the observation that many male alcoholics exhibited various deficits in cognitive functioning and reported an increased incidence of Childhood Minimal Brain Dysfunction and hyperactivity (DeObaldia et al., 1983; Goldman, 1983; Russell et al., 1985; Tarter et al., 1977, 1984; Wood et al., 1983). This observation, in addition to genetic research and the
increased incidence of alcoholism found in the offspring of alcoholics (see Introduction), helped generate interest in the idea that certain cognitive deficits predated the onset of alcoholism. Subsequent research led to the discovery of a wide range of neurologically mediated cognitive deficits in the offspring of alcoholic parents. Other studies have found significantly poorer performance on cognitive tasks in male and female alcoholics with a positive family history of alcoholism compared to nonfamilial alcoholics (Schaeffer et al., 1984; Turner & Parsons, 1988). For the sake of clarity, this section will be divided into two broad categories. The first, psychophysiological functioning, will discuss spontaneous electroencephalographic (EEG) activity and Event-Related Potentials (ERPs). The second category, neuropsychological/cognitive functioning, will discuss verbal information processing, learning and memory, attention, abstracting/conceptualizing ability, and visuospatial perception.

Psychophysiology

Brain electrical activity is observed through the use of electroencephalographic (EEG) recordings in the absence of a cognitive task or sensory stimulant. This fluctuating pattern of voltages is referred to as spontaneous or resting EEG activity (Sher, 1991). Propping (1977, 1983) observed that EEG activity appears to be largely under genetic control and, according to Begleiter & Perjesz (1988), an excessive increase in fast (beta) and a moderate deficiency in lower frequency (alpha) activity was observed in male alcoholics. Furthermore, neurophysiological differences have been observed in spontaneous EEG recordings between children of alcoholics and controls. Gabrielli et al. (1982) reported significantly higher percentages of fast beta EEG activity in 11-13 year old sons of alcoholic fathers compared to controls. This was also demonstrated in adult (21-25 years) sons of alcoholic fathers compared to matched controls following the ingestion of alcohol although, unlike the Gabrielli study, no significant baseline differences were found.
between the two groups (Ehlers & Schuckit, 1990). The investigators did find a significantly higher percentage of fast Beta EEG activity 90 minutes after ethanol consumption. They speculated that the increase in beta activity indicated a small mild increase in "alertness" or "arousal". According to Ehlers and Schuckit (1990), fast EEG activity correlates with "arousal" and "attention" and can be associated with anxiety or tension. However, previous measurements on the same individuals revealed no group differences in anxiety. The same ACOA subjects were also found to have significantly faster alpha activity at baseline than controls.

Other studies have failed to find this fast EEG activity (beta and alpha) at baseline. Pollack et al. (1983) found that sons of alcoholics (19-21 years) displayed a significant decrease in fast alpha activity and a significant increase in slow alpha activity after alcohol consumption compared to sons of nonalcoholics.

Because of the inconsistencies in the literature, it is difficult to make any definitive statements at this time concerning the implications of this research. Tarter et al. (1990) speculates that the results as a whole indicate that alcohol has a combination arousing/calming effect on children of alcoholics and that it may have a "differentially more reinforcing effect" (p. 77) in these individuals. It is possible that subtypes within the COA population may exist similar to the previously discussed Type 1 and Type 2 alcoholics described by Cloninger (1988). For example if you had a Type 1 COA partially characterized by low levels of novelty seeking, high harm avoidance and high reward dependence that individual might find alcohol reinforcing for its calming effect. However, a Type 2 with high levels of novelty seeking, low harm avoidance and low reward dependence might find alcohol reinforcing for its arousal effects.

In contrast to spontaneous EEG activity, event-related potentials (ERPs) are discrete waveforms and therefore more amenable to specific analyses of neurophysiological phenomena. ERPs are associated with sensory and information processing and are elicited by engaging the subject in either a cognitive task (making a judgment about a stimulus) or
through direct sensory stimulation (visual signals, tones) (Sher, 1991). According to Tarter et al. (1990, p. 77) "this wave form appears to be a neurophysiological substrate of attentional processes, particularly where there is a concomitant uncertainty regarding stimulus predictability". In general, studies involving cognitive tasks as opposed to direct sensory stimulation have been able to distinguish COAs from non COAs.

One of the first studies to investigate ERPs in ACOA and non ACOA subjects was performed by Elmasian and colleagues (1982). Using a series of tones and requiring a stimuli-related judgment, they found a significantly reduced amplitude in the P300 (or P3) component of the ERP in adult children of alcoholics (21-26 years) compared to controls following ingestion of either placebo or alcohol. The amplitude of P300 indexes has been documented to play a role in memory (Begleiter et al., 1984). In each comparison, ERP components elicited in response to task-related stimuli showed reduction in amplitude in ACOA subjects. Although the groups did not differ on baseline measures, ACOAs exhibited reduced amplitude in the placebo condition as well. This differential response to placebo has been noted in other experimental procedures and, according to Newlin (1985), may indicate novel expectancy or attentional processes in children of alcoholics. In addition to reduced P300 amplitude, the ACOAs in the Elmasian study demonstrated significantly slower reaction times in response to stimuli.

In order to control for the effects of previous alcohol exposure, Begleiter et al. (1984) compared to ERPs of 25 sons of alcoholic fathers and matched controls with a mean age of 11.9 years. Using information processing constructs with complex visual stimuli, Begleiter also found a significantly reduced P300 component in the COA group. More recent studies (Hill et al., 1990; Pfefferbaum et al., 1991; Whipple, 1988) using complex cognitive tasks with both visual and auditory stimuli have also reported significantly reduced P300 amplitude in FH+ subjects compared to FH- controls.

The most interesting of these recent studies was conducted by Whipple and colleagues (1988). Like the Begleiter et al. (1984) study, preadolescent boys with no
previous alcohol (or drug) experience were used in order to control for alcohol effects. This study also included the boy's fathers. Volunteers were recruited from newspaper advertisements and divided into three groups. The high risk group (A+) consisted of sons and their recovering fathers where the father also had a first or second degree alcoholic relative. The second, or low risk group (NA-) was made up of sons and their nonalcoholic fathers who evidenced no history of alcoholism in first or second degree relatives. The third group (NA+) consisted of sons and their nonalcoholic fathers where the father had at least one first or second degree alcoholic relative. This NA+ group was also considered to be at risk for neuropsychological problems because of its family history of alcoholism.

What was unique about this study was 1) its use of the fathers as well as their sons 2) the use of A+, NA-, and NA+ groups and 3) inclusion of both electrophysiological (ERP) and neuropsychological assessments in order to develop neurocognitive profiles on the different groups. A complex visual stimuli task (one that required a judgment) was used for the electrophysiological assessment while neuropsychological performance was evaluated by a series of tests designed to assess visuoperceptual performance and memory. These tasks also included attention, motivation, and sensorimotor processing components.

Whipple and colleagues found significant differences between the A+ and the NA-group for both electrophysiological and neuropsychological function in both fathers and sons. The A+ boys displayed significantly reduced ERP amplitudes and scored significantly lower on memory and visuoperceptual performance than did NA- boys. The A+ and NA- fathers profiles demonstrated similar differences. These results replicate the Begleiter et al. (1984) study on sons of alcoholic fathers. The authors have termed this combination of neurophysiological and neuropsychological traits found in the A+ group of boys an Atypical Neurocognitive Profile stating that (p. 243) "reduced visuoperceptual performance may be the behavioral expression of the attenuated electrophysiological response in high risk sons".
A subsequent study by Whipple et al. (1991) assessed the same A+ and NA- father-son pairs on a variety of personality characteristics. They found that sons of alcoholics were more fearful, compulsive, insecure, detached, and dependent than controls. The key discriminators were the Self-Discipline and Warmth factors from the High School Personality Questionnaire (HSPQ) and the Harm Avoidant scales of the Tridimensional Personality Questionnaire (TPQ). Sons of alcoholics scored significantly higher on the Self-Discipline factor, lower on the Warmth factor, and were significantly more harm avoidant than sons of nonalcoholics. An index of these discriminators was found to be significantly correlated both in father-son pairs and to certain neurocognitive varieties (P300 amplitude, memory and visuoperceptual performance) from the previous Whipple et al. (1988) study. To summarize, the profile exhibited by sons of alcoholics (high on Self-Discipline and Harm Avoidant factors, low on the Warmth factor) correlated significantly with reduced P300 amplitude and decreased memory and visuoperceptual performance.

Although not all studies have demonstrated significant ERP differences in high risk groups compared to controls, over all, the neurophysiological studies indicate the demonstrable differences do exist between COAs and non COAs. According to Sher (1991) studies using direct sensory stimulation (Begleiter et al., 1987; Polich et al., 1988a, 1988b) rather than more complex cognitive tasks have not found significantly reduced ERP amplitudes in high risk subjects. It appears that the more complex the task, the more likely it is to see differences between COAs and non COAs. Although not enough data are currently available to make a definitive statement regarding this research, the results are particularly important given that EEG activity and wave form have been shown to be largely under genetic control (Propping, 1977, 1983). These differences may therefore indicate an inherited vulnerability or abnormalities in the Central Nervous System (CNS) for COAs as compared to non COAs.
Neuropsychological/Cognitive Functioning

Overall, neuropsychological research indicates that a substantial number of children of alcoholics may experience cognitive impairment (Tarter et al., 1990). Neurologically mediated cognitive deficits have been found in COAs across a range of tasks involving verbal information processing, learning and memory, attention, abstracting/conceptualizing ability, and visuospatial perception (Bennett et al., 1988; Drejer et al., 1985; Ervin et al., 1984; Hegedus et al., 1984; Knop et al., 1985; Schaeffer et al., 1988; Schandler et al., 1988; Tarter et al., 1984, 1989; Whipple & Noble, 1991).

Several studies using the Weschler Intelligence Scale for Children-Revised (WISC-R) or the Weschler Adult Intelligence Scale (WAIS) have found significantly lower verbal ability in offspring of alcoholics than in offspring of nonalcoholics (Bennett et al., 1988; Drejer et al., 1985; Ervin et al., 1984; Gabrielli & Mednick, 1983; Sher et al., 1991; Whipple & Noble, 1991). Although all five studies found significant differences, it should be noted that the COA's scores still fell within the normal range. Other studies using different measures of verbal ability have also found significantly lower verbal ability in children of alcoholics compared to controls. Hegedus et al. (1984), using the Peabody Individual Achievement Test (PIAT), found that adolescent sons of alcoholics performed significantly worse than sons of nonalcoholics. Knop et al. (1985), using teacher questionnaire and interviewing techniques, found that 19-20 year old sons of alcoholics were significantly impaired in verbal proficiency when compared to controls. Several studies failed to find significant differences in verbal ability between COAs and non COAs (Johnson & Rolf, 1988; Tarter et al., 1984; Workman-Daniels & Hesselbrock, 1987) but in each case the FH+ group scored lower than the FH- group. Thus, the above research studies demonstrated that offspring of alcoholics scored significantly lower on a variety of measures of verbal ability than did offspring of nonalcoholics. Even though scores fell
within normal parameters, a positive family history of alcoholism had a demonstrable negative impact on verbal ability.

Using a variety of tasks, a number of studies have investigated attention as well as learning and memory performance in offspring of alcoholics (Drejer et al., 1985; Hegedus et al., 1984; Schandler et al., 1988; Tarter et al., 1984, 1989; Workman-Daniels & Hesselbrock, 1987; Whipple & Nobles, 1991). The results of these studies have been inconsistent. For example, Tarter et al. (1984, 1989) using the Stroop Test and attention scales of the Detroit Test of Learning Aptitudes, found significantly greater attentional deficits in sons of alcoholics than in the controls but in the 1984 study another measure of attention and concentration (Weschler Memory Scale subscale) failed to distinguish COAs from non COAs. Drejer et al. (1985) also failed to find significant group differences in attention using the WAIS digit span scale.

The same pattern was observed for learning and memory performance. Hegedus et al. (1984) and Tarter et al. (1984) found that COAs performed significantly worse than non COAs on the Weschler Memory Scale but Workman-Daniels & Hesselbrock (1987) found no significant differences using the same scale. Whipple et al. (1988) used the Rey Auditory Verbal Learning Test and a subtest of the Weschler Memory Scales to evaluate learning and memory performance in sons of alcoholic fathers. They found that the FH+ sons scored significantly worse on both the Rey Test and the Weschler Scale than the FH- sons. Finally, Schandler et al. (1988) found that learning performance, as measured by a visuospatial learning task, was significantly worse for children with a family history of alcoholism than for controls. They took longer to learn the task and made more errors. Additionally, Schandler and colleagues reported their learning pattern closely resembled that of detoxified alcoholics on a similar learning task. Research to date has not shown as strong a pattern for attentional deficits or learning and memory performance impairment in COAs as it has for decreased verbal ability but this area warrants further study.
Abstracting/conceptualizing ability and visuoperceptual functioning in children of children has been investigated using various tasks. Some of the most commonly used include the Block Design and Similarities tests from the Weschler Intelligence Scale for Children-Revised (WISC-R) Weschler Adult Intelligence Scale (WAIS) and the Halstrad Category Test. These tasks are not measures of pure abstraction, but are multidimensional in nature. They require problem solving, concept formation, organizational skills, the ability to perceive and discriminate relationships, and, in the case of the Weschler Block Design, visuoperceptual performance (Drejer et al., 1985; Sher, 1991; Whipple et al., 1988).

Four studies used the Werchler Similarities test to investigate abstraction and conceptual reasoning in COAs. Three of these studies (Ervin et al., 1984; Gabrielli & Mednick, 1983; Sher et al., 1991) found that COAs scored significantly worse than non COAs. The fourth study (Tarter et al., 1984) failed to find any significant group differences.

Using the Halstead Category Test, Drejer et al. (1985) found that adult children of alcoholics performed significantly worse than controls. They made more errors and according to Drejer and colleagues, their error patterns were indicative of an impaired ability to engage in prolonged goal-directed activity. Workman-Daniels & Hesselbrock (1987) failed to find any significant differences between ACOAs and non ACOAs however, the ACOA group did make more errors ($\bar{x} = 36.33$) than the controls ($\bar{x} = 27.19$).

Several studies have investigated abstraction/conceptual reasoning and visuoperceptual functioning using the WISC-R and WAIS Block Design. All five studies reviewed (Drejer et al., 1985; Ervin et al., 1984; Gabrielli et al., 1983; Tarter et al., 1984; Whipple et al., 1988) found that COAs performed worse than non ACOAs on this task, however, only the Whipple et al. (1988) study found significant group differences.

Finally, two other studies used the Raven's Progressive Matrices, a standardized measure
of nonverbal abstracting ability, to investigate abstraction and conceptualization. In the Nagoshi & Wilson (1987) study, adult children of alcoholics scored significantly lower than controls but Tarter et al. (1989) failed to find significant group differences.

To conclude, cognitive deficits have been demonstrated in the offspring of alcoholics across a wide range of tasks involving verbal information processing, learning and memory, attention, abstracting/conceptualizing ability, and visuospatial ability. These deficits are often subtle and usually fall within normal ranges on scales such as the WISC-R and the WAIS. Nevertheless, in the areas of verbal ability and abstraction/conceptual reasoning COAs have shown consistent and statistically significant differences when compared to non COAs. Current research indicates that relative to non COAs, COAs are impaired in these areas of cognitive functioning. Evidence for impairment in learning and memory, attention, and visuospatial performance is less clear. Although some research has found significant differences between COAs and non COAs in these areas, the results have been inconsistent. Hopefully, further research will clarify some of these discrepancies.

The Current Study

Recently, there has been increased interest in the relationship between cognition and mood states and in the use of cognitive-behavioral intervention in treatment settings. Research indicates that depressed, anxious, and phobic subjects show attentional bias in recall toward the encoding of mood congruent material (Burgess et al., 1981; Hope et al., 1990; MacLeod et al., 1986; Mathews & MacLeod, 1985; McNally et al., 1990; Watts et al., 1986; Williams & Nulty, 1986). Several of these studies (Hope et al., 1990; Mathews & MacLeod, 1985; McNally et al., 1990; Williams et al., 1986; Williams & Nulty, 1986) have used versions of the Stroop Colour-Word Naming Task (Stroop, 1935). This is a cognitive functioning task that can be used to investigate attentional bias in the selective processing of word cues. Attentional bias refers to the selective nature of what is being
attended to in the Stroop task. The original form of this task required subjects to ignore word content and name the color of ink in which the word was printed. For instance, the word blue might be printed in red ink, green in blue ink, etc. Color naming has been shown to be slowed under these interference circumstances. It is generally agreed that this interference occurs because there is a competition for processing resources (Mathews & MacLeod, 1985). A conflict arises in trying to name a color when the printed word is itself a different color name. This represents a distraction that makes it more difficult to attend to the task of naming the color while attempting to ignore word content. Research also indicates that "emotional state" (e.g. anxiety, depression, phobia) contributes to this interference. Modified versions of the Stroop often substitute target and control words for the color words (i.e. anger might be printed in blue, fight in green, cloud in red). The subject is then timed as he or she goes through the task (compiled word lists) ignoring the word content and naming only the color in which the word is printed.

For example, Watts et al. (1986) found that spider phobic subjects, compared to nonphobic subjects, were significantly impaired in performance on a modified version of the Stroop Colour Naming Task displaying an attentional bias for spider words. In other words, Watts and colleagues demonstrated that for phobic subjects, spider words selectively interfered on the task in comparison to control words resulting in significantly increased reaction times for the spider word condition. Spider phobics did not differ from nonphobics on the control words. Mathews and MacLeod (1985) investigated selective processing in anxious subjects (as determined by the Trait and State versions of the Spielberger Anxiety Inventory) using physical threat, social threat, and control words. They found that anxious subjects were significantly slower for all words on the Stroop Task but were especially slow on the naming of threatening words. Williams and Nulty (1986) found that depressed subjects were significantly slower naming negative compared to control words. Finally, Hope et al. (1990) investigated color naming in panic disorder and social phobic subjects. They found a selective pattern on the task in which social
phobics displayed increased latencies for socially threatening words but not physical threat words and panic disorder subjects displayed increased latencies for physically threatening words but not social threat words. Mathews and MacLeod (1985) explain this specific response to relevant word cues in terms of a danger schema which may be thought of as a cluster of threat knowledge that has developed around particular life experiences viewed as threatening. It is proposed that this danger schema can bias attention and causes the interference effects found in the Stroop task.

The primary purpose of the present study was to investigate differential processing of emotionally laden word cues in adult children of alcoholics compared to a control group of adult children of nonalcoholics. Using a modified version of the Stroop Colour Naming Task, with alcohol, socially threatening, neutral and positive words, it was hypothesized that ACOAs would show an attentional bias in favor of alcohol related and socially threatening words compared to neutral and positive words. Specifically, it was predicted that ACOAs would display increased reaction times for these task conditions compared to non ACOAs because alcohol and social threat words would cause more interference or distraction on task performance for ACOAs. A memory recognition test (see Appendix I) was also administered immediately following the Stroop in order to determine if any group differences existed in the encoding of task related material.

In addition to the modified Stroop task and a demographic questionnaire (see Appendix II), subjects were evaluated using the following test instruments:

Children of Alcoholics Screening Test (CAST) (Jones, 1982). This is a 30 item screening test designed to identify both individuals presently living with alcoholic parents and those who have previously lived with alcoholic parents. It has proven to be a valid and reliable screening instrument for discriminating COAs from non COAs (Dinning & Berk, 1989; Pilat & Jones, 1985; Staley & el-Guebaly, 1991) with a validity coefficient of .78 (Pilat & Jones, 1985).
**Self Esteem Scale** (Rosenberg, 1965). This is a 10 item scale that was used by Sher et al. (1991) and Tweed and Ruff (1991) in their ACOA research. It was shown to be reliable (r = .85 under test-retest conditions) for college aged students (Robinson & Shaver, 1970) and Tweed and Ryff (1991) found this measure to have an alpha coefficient of .89. Self esteem was investigated because of contradictory reports in the literature. Clinical literature represents ACOAs as having lower self esteem (Black, 1981; Woititz, 1983, 1986) while other research contradicts this finding (Clair & Genest, 1987; Tweed, 1991).

**Eysenck Personality Questionnaire (EPQ)** (Eysenck & Eysenck, 1975). This is a 90 item personality inventory with Extroversion, Neuroticism, Psychoticism, and Lie Scales. The Extroversion, Neuroticism, and Psychoticism scales form the basis of Eysenck's and Eysenck's three dimensional model of personality. These three scales have been shown to be highly internally consistent with coefficient alpha's above .90. They are most easily defined in behavioral terms. Extroversion refers to traits such as impulsivity, outgoingness, aggressiveness, and sociability. A typical extrovert likes to be around people, is easy going but not always reliable, craves excitement, and often has a quick temper. In contrast, an introvert is generally a shy, serious, introspective, and reserved person that does not crave excitement, is well controlled and seldom aggressive.

Neuroticism may be typified by the term anxiety and in fact this scale is considered a good indicator of anxiety (r = .60 - .70) (Zuckerman, 1991). A person scoring high on neuroticism is best described as an anxious worrier who is often moody, depressed, and overly emotional. A person stable on neuroticism is generally calm, even tempered and not prone to worry. The psychoticism scale is associated with unconventionality and certain antisocial characteristics such as lack of empathy and warmth toward others, cruelty, hostility, sensation seeking, and generally lacking in socialization. Eysenck and Eysenck stress that despite the psychiatric terminology, these scales deal with normal behaviors and personality variables that might underly behaviors "which become pathological only in extreme cases." (p. 6). They state that this inventory is suitable for nonpathological
population samples. The EPQ (particularly the Extroversion and Neuroticism Scales) has been used in previous studies of both alcoholics and the offspring of alcoholics (Eysenck & Eysenck, 1970; Schuckit, 1983a; Whipple & Noble, 1991). Schuckit (1983) and Whipple & Noble (1991) found no significant differences between the offspring of alcoholics and controls although the Whipple study found significantly elevated scores on the Neuroticism Scale for recovering alcoholics with first degree alcoholic relatives. The Neuroticism Scale was of particular interest in the present study because some research, using different measures of anxiety, has found increased anxiety in ACOAs compared to controls. The present study was interested only in the Extroversion and Neuroticism Scales.

*Attention Focus/Attention Shift Scale* (AF/AS) (Derryberry & Rothbart, 1988). This is an 18 item true/false scale with possible scores ranging from -18 to +18. For data analyses purposes, final scores were converted to positive numbers producing a scale range of 0 to 36. It is designed to look at attentional control in terms of how effectively attention can be focused on a task to avoid distraction, and how easily attention can be shifted among different components of a task. It was used in the present study to additionally investigate attentional control in ACOAs relative to non ACOAs because, like the Stroop Task, it is also a measure of distractibility.

**Hypotheses**

The present study was designed to investigate differences between ACOAs and non-ACOAs in several areas. The primary research focus was on the investigation of selective processing of emotionally laden word cues in ACOAs compared to non-ACOAs. This was accomplished using a modified version of the Stroop Colour Naming Task with alcohol, socially threatening, neutral, and positive words. Additionally, this study was designed to examine differences between ACOAs and non-ACOAs in self esteem, extroversion,
neuroticism, and attentional control. Using the Rosenberg Self Esteem Scale, the EPQ, and the AF/AS Scale, the following hypotheses were tested:

1) Self Esteem. Based on previous research with college populations, it was hypothesized that there would be no significant differences between ACOAs and non ACOAs on self esteem using the Rosenberg (1965) Self Esteem Scale.

2) Extroversion, Neuroticism. It was predicted that ACOAs would not significantly differ from non ACOAs on these personality dimensions measured by the EPQ (Eysenck & Eysenck, 1975) thus replicating previous studies that have used these scales.

3) Attention Focusing and Shifting. Based on previous cognitive research on attention, it was hypothesized that ACOAs would differ in attentional control relative to non ACOAs.

With respect to cognitive functioning and the Stroop Colour Naming Task, the following hypotheses were tested in this experiment:

1) that there would be a difference in overall functioning between ACOAs and non ACOAs

2) that there would be a group X word type interaction with ACOAs displaying increased reaction times for the alcohol and social threat task conditions compared to non ACOAs.
METHOD

Subjects

The sample consisted of 57 female and 18 male undergraduate students enrolled in lower division psychology courses at Oregon State University. The subjects, who were primarily psychology and business majors, received class credit for their voluntary participation in the study.

Materials

For the modified Stroop Task (see Mathews & MacLeod, 1986), 12 alcohol-related words and 12 words associated with social threat were chosen. Two other sets of 12 words each were chosen on the basis of frequency-matching with the alcohol and social threat words using *Word Frequencies of Spoken American English* (Dahl, 1979). One set included positive words and the other set consisted of words determined to be neutral (see Table 1). Each word set, consisting of 12 words each, was then written a total of eight times on a 13x13 inch card in block letters 0.5 cm high. The words were then written in either blue, green, red, or yellow ink on a randomly assigned basis. In this way, four cards (alcohol, social threat, positive, neutral) of 96 words each were constructed.

The recognition task consisted of six alcohol, social threat, positive, and neutral words for a total of 24 words. Additionally, 24 distractor words were matched for frequency and content (i.e. alcohol, threat, positive, neutral). All 48 words were randomly mixed and typed on a standard 8 1/2 x 11 sheet of paper.
Table 1. Word sets used in the modified Stroop Task

<table>
<thead>
<tr>
<th>Alcohol-related</th>
<th>Social threat</th>
<th>Positive</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drunk</td>
<td>Dumb</td>
<td>Optimistic</td>
<td>Iron</td>
</tr>
<tr>
<td>Intoxication</td>
<td>Failed</td>
<td>Jovial</td>
<td>Parallel</td>
</tr>
<tr>
<td>Alcoholic</td>
<td>Criticized</td>
<td>Playful</td>
<td>Railroad</td>
</tr>
<tr>
<td>Loaded</td>
<td>Clumsy</td>
<td>Gentle</td>
<td>Bookcase</td>
</tr>
<tr>
<td>Hangover</td>
<td>Pathetic</td>
<td>Cheerful</td>
<td>Commonly</td>
</tr>
<tr>
<td>Bottle</td>
<td>Incompetent</td>
<td>Succeed</td>
<td>Earliest</td>
</tr>
<tr>
<td>Bar</td>
<td>Humiliate</td>
<td>Fortune</td>
<td>Deck</td>
</tr>
<tr>
<td>Beer</td>
<td>Inept</td>
<td>Assured</td>
<td>Button</td>
</tr>
<tr>
<td>Addicted</td>
<td>Indecisive</td>
<td>Jolly</td>
<td>Clock</td>
</tr>
<tr>
<td>Scotch</td>
<td>Alienated</td>
<td>Carefree</td>
<td>Lamp</td>
</tr>
<tr>
<td>Booze</td>
<td>Insecure</td>
<td>Humor</td>
<td>Announced</td>
</tr>
<tr>
<td>Drinks</td>
<td>Foolish</td>
<td>Leisure</td>
<td>Canvas</td>
</tr>
</tbody>
</table>
Procedure

In order to isolate the ACOA sample needed for the actual study, 189 college students (122 female, 67 male) were recruited through the use of sign up sheets offering course credit for participating in a study of "Personality and Family Characteristics of College Students". The sign up sheets stated that subjects would be asked to fill out questionnaires and a family profile. In a series of 1-hour testing sessions, subjects were asked to complete an informed consent form and a packet of materials that included 1) family profile (demographic data, 2) Children of Alcoholics Screening Test (CAST) (Jones, 1982), 3) Self-Esteem Scale (Rosenberg, 1965), 4) Eysenck Personality Questionnaire (EPQ) (Eysenck & Eysenck, 1975), and 5) Attention Focus/Attention Shift Scale (AF/AS) (Derryberry & Rothbart, 1988). All packets were number coded to insure confidentiality but subjects were asked to fill out their names and telephone numbers on a cover sheet if they were willing to participate in the "second" part of the study. Subjects were not told on what basis they would be selected for the "second" part of the study or what the study would entail.

The 189 students who completed the questionnaires were then screened on the basis of their CAST scores. According to Pilat and Jones (1985) a score of 6 or above is indicative of growing up in an alcoholic family. On this basis 37 ACOAs (28 female, 9 male) were chosen (CAST $\bar{x} = 14.27$) and to complete the sample 37 non ACOAs (28 female, 9 male) were randomly selected as controls (CAST $\bar{x} = 0.38$).

All 74 subjects were contacted and agreed to participate in the study. They were told that they were selected on the basis of their answers to the questionnaires. They were not told that they were selected solely on the basis of their CAST scores. An appointment was set up for each subject to come in and perform the task.
When each subject arrived, he or she was taken to a small sound proof cubicle and asked to fill out another informed consent. The Stroop task was explained and each subject was given the opportunity to ask clarifying questions. Subjects were randomly assigned to 1 of 4 run orders. Presentation was counterbalanced across all conditions to control for order effects. The four word cards (alcohol, social threat, positive, neutral) were then presented in the assigned order with the instructions to "name the word colors as fast as possible without making any errors and without attending to the word content". The time taken to complete each 96 item card was recorded by stopwatch with 15 seconds between cards. Errors were not recorded. Immediately upon completion of the Stroop Colour Naming Task, subjects were asked to complete the word recognition task. Subjects were then completely debriefed as to the true nature of the study and were given the opportunity to ask questions. They were thanked for their participation in the study and told that if any of the questionnaires had raised personal concerns that they would like to discuss, the Health Educator at Oregon State University (a trained Alcohol and Drug Specialist) was available by prearrangement.
RESULTS

Sample Demographics

Demographic characteristics for the ACOA and non ACOA groups are presented in Table 2. Age, number of siblings, and personal marital status were very similar between the two groups. The most noticeable differences were in family income and parental divorce or separation. The average family income for the ACOA group fell within the $20,000-$30,000 range while non ACOA family income was in the $30,000-$40,000 range. This income difference may be a reflection of the higher divorce rate found in the alcoholic families. The divorce/separation rate for ACOA families was 43% compared to 11% in non ACOA families.

Test Instruments

With the exception of the CAST scores, preliminary data analysis did not reveal any significant sex differences, therefore male and female scores were pooled for further analysis. A series of t tests was performed for the CAST, Self-esteem Scale, EPQ, and AF/AS Scale (see Table 3). There was a significant difference [t(72)=14.41, P<.001] between the ACOA group and the non ACOAs on the CAST with ACOAs scoring substantially higher. Additionally, female ACOAs scored significantly higher than male ACOAs [t(54)=2.43, P<.025]. No significant group differences were found for the Self-Esteem Scale, EPQ, or the AF/AS scale.
Table 2. Demographic characteristics of the sample (N=74)

<table>
<thead>
<tr>
<th>Index</th>
<th>Adult Children alcoholics (ACOA) (N=37)</th>
<th>Adult Children non alcoholics (non ACOA) (N=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (average years)</td>
<td>21.03</td>
<td>19.76</td>
</tr>
<tr>
<td>Number siblings (average)</td>
<td>2.54</td>
<td>2.22</td>
</tr>
<tr>
<td>Family income (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 5,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5,000-10,000</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>10,000-20,000</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>20,000-30,000</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>30,000-40,000</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>above 40,000</td>
<td>32</td>
<td>51</td>
</tr>
<tr>
<td>Personal marital status (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>married</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>divorced</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>single</td>
<td>92</td>
<td>94</td>
</tr>
<tr>
<td>Parental divorce or separation (%)</td>
<td>43</td>
<td>11</td>
</tr>
</tbody>
</table>
Table 3. Means, standard deviations and t-test comparisons of test instruments for ACOAs and non ACOAs

<table>
<thead>
<tr>
<th>Instrument</th>
<th>ACOA (N=37)</th>
<th>non ACOA (N=37)</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{x})</td>
<td>SD</td>
<td>(\bar{x})</td>
<td>SD</td>
</tr>
<tr>
<td>CAST</td>
<td>14.27</td>
<td>5.78</td>
<td>.38</td>
<td>.89</td>
</tr>
<tr>
<td>Self-Esteem Scale</td>
<td>4.92</td>
<td>1.48</td>
<td>4.92</td>
<td>1.40</td>
</tr>
<tr>
<td>EPQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extroversion</td>
<td>13.76</td>
<td>4.50</td>
<td>15.62</td>
<td>4.13</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>12.51</td>
<td>6.41</td>
<td>13.41</td>
<td>5.41</td>
</tr>
<tr>
<td>AF/AS Scale</td>
<td>20.48</td>
<td>6.85</td>
<td>18.05</td>
<td>7.77</td>
</tr>
</tbody>
</table>
Stroop Colour Naming Task

Since preliminary data analysis revealed no significant differences between males and females on the Stroop Task, the data were collapsed across the gender variable. Data were then analyzed using a mixed design (one between and one within subjects) 2x4 analysis of variance (ANOVA) to detect any differences between group (ACOA and non ACOA) and word type (alcohol, social threat, neutral, positive) on the timed Stroop Task and to determine if there was a group x word type interaction. Mean response time (in seconds) and standard deviations of ACOAs and non ACOAs are presented for each of the four word types in Table 4.

As was predicted, a significant main effect was found for group with ACOAs ($\bar{x} = 70.72$) performing significantly slower than non ACOAs ($\bar{x} = 62.57$) [$F(1,72) = 9.9$, $P<.002$]. A significant main effect was also found for word type [$F(3,216) = 13.67$, $P<.001$] indicating that there was a differential response time for alcohol ($\bar{x} = 69.29$), social threat ($\bar{x} = 67.80$) neutral ($\bar{x} = 65.35$), and positive ($\bar{x} = 64.15$) words.

Additionally, as was predicted, the interaction between group and word type was significant [$F(3,216) = 3.05$, $P<.03$] (see Figure 1).

Although it was predicted that ACOAs would perform more slowly than non ACOAs on alcohol and social threat words, they in fact performed more slowly across all four word type conditions. In order to determine where the interaction actually fell, a series of Scheffé's post hoc tests were performed. ACOAs were significantly slower for alcohol words than for neutral [Scheffé $F(3,216) = 8.57$, $P<.001$] and positive [Scheffé $F(3,216) = 11.21$, $P<.001$] words. They were also significantly slower for social threat words compared to neutral [Scheffé $F(3,216) = 2.81$, $P<.05$] and positive [Scheffé $F(3,216) = 4.41$, $P<.01$] words. A similar series of Scheffé's post hoc tests were performed on the task conditions for non ACOAs. None of these comparisons were significant. Non
Table 4. Mean response time (in seconds) and standard deviations of ACOAs and non ACOAs for the four word types

<table>
<thead>
<tr>
<th>Word Type</th>
<th>ACOA</th>
<th>non ACOA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{x}$</td>
<td>SD</td>
</tr>
<tr>
<td>Alcohol</td>
<td>74.82</td>
<td>17.02</td>
</tr>
<tr>
<td>Social</td>
<td>72.10</td>
<td>15.20</td>
</tr>
<tr>
<td>Neutral</td>
<td>68.45</td>
<td>13.07</td>
</tr>
<tr>
<td>Positive</td>
<td>67.53</td>
<td>13.74</td>
</tr>
</tbody>
</table>
Figure 1. Effect of Card Type on Reaction Time for ACOAs and non ACOAs.
ACOAs did not differ in their response to alcohol words compared to neutral [Scheffé $F(3,216) = 0.48$, ns] and positive [Scheffé $F(3,216) = 1.87$, ns] or social threat words compared to neutral [Scheffé $F(3,216) = 0.33$, ns] and positive [Scheffé $F(3,216) = 1.57$, ns] words. Finally, using a t-test, no significant group differences were found for the memory recognition task.
DISCUSSION

The primary purpose of the present study was to investigate a particular area of cognitive functioning. Specifically, it was designed to determine if any differences exist between adult children of alcoholics and controls in the processing of emotionally laden word cues. Of secondary importance was the description of demographic characteristics of both groups and the investigation of group differences on measures of self-esteem, extroversion, neuroticism, and attentional control.

Demographics

ACOAs and non ACOAs were very similar in age, number of siblings, and personal marital status. However there were noticeable differences in average family income and parental divorce/separation status. The average ACOA family income fell in the $20,000-$30,000 range while the non ACOA income was in the $30,000-$40,000 range. Ervin et al. (1984) found this same pattern in a study of COAs using a community based population sample. The reduced average income found for ACOAs in this study may be a reflection of the 43% divorce/separation rate found in these families. In contrast, the non ACOA parental divorce/separation rate was only 11%. Tweed and Ryff (1991), in a sample of 239 ACOAs, found the parental divorce/separation rate to be 29% compared to a rate of 10% for the non ACOA families. Although they found that ACOAs displayed lower socioeconomic status than non ACOAs, unlike the present study, this difference was not statistically significant. The reasons for this are unknown but may be a reflection of the higher divorce rate in our sample.
The failure to find any significant differences in self-esteem between ACOAs and non ACOAs is consistent with much of the current literature. A variety of studies (Churchill et al., 1990; Clair & Genest, 1987; Tweed & Ryff, 1991; Werner & Broida, 1991) have failed to find any significant difference between ACOAs and non ACOAs on self-esteem. Like the present study, Tweed and Ryff (1991) also used the Rosenberg (1965) Self-esteem Scale. However a recent study by Sher et al. (1991) using a large college sample (N=490) did find that ACOAs scored significantly lower than non ACOAs on self-esteem using the same scale. It is possible that inconsistencies in the research are partly due to sample sizes too small to pick up subtle differences on measures of this nature. This is the conclusion of Knowles and Schroeder (1990) in their study of 800 college aged male ACOAs and non ACOAs. Using the MMP1, they found small but statistically significant group differences.

This same pattern was found for the neuroticism scale of the EPQ. The fact that the present study did not find that ACOAs differed significantly from non ACOAs was consistent with the Schuckit (1983a) and Whipple and Noble (1991) studies. However, Sher et al. (1991) using a large college sample (N = 490) found ACOAs scored significantly higher than non ACOAs on the neuroticism scale. Although it may be that these differences are subtle and a large sample is necessary in order to detect any group differences, the present study did not find elevated neuroticism scores for ACOAs. Tweed and Ryff (1991), also using a large sample (N = 239) found that ACOAs exhibited elevated scores relative to non ACOAs on measures of anxiety using the Jackson Personality Inventory Anxiety Scale (alpha coefficient of .86). Like the neuroticism scale of the EPQ which has been shown to be correlated with anxiety (r = .60 - .70) and thus a good predictor of anxiety (Zuckerman, 1991), the Jackson Scale tends to measure excessive worrying. Unlike the present study, Tweed and Ryff used a community based sample and
one could argue that sample characteristics could account for the differing findings. The Extroversion scale of the EPQ revealed no significant group differences which is consistent with other studies (Schuckit, 1983a; Sher et al., 1991; Whipple & Noble, 1991).

No significant group differences were found for the Attentional Shifting/Focusing scale indicating that ACOAs did not differ from non ACOAs on attentional control for this measure of distractibility. Finally, the results of the CAST were similar to other studies (Dinning & Berk, 1989; Rilat & Jones, 1985; Staley & el-Guebaly, 1991) that have used this as a screening device with ACOAs scoring significantly higher than non ACOAs. Unexpectedly, female ACOAs scored significantly higher than did male ACOAs on the CAST. The reason for this is not known but one could speculate that women might be more sensitive to factors effecting the home environment.

**Stroop Colour Naming Task**

Consistent with the hypothesis, there was a significant main effect for group. Adult children of alcoholics were found to be significantly slower in response time on the modified Stroop Task than were adult children of non alcoholics. There was also a significant main effect of word type with response time slowest for alcohol words and fastest for positive words. Most importantly, as predicted, there was a significant interaction between group and word type. Scheffé's post hoc tests found ACOAs to be significantly slower on the alcohol and social threat words than on neutral and positive words. A similar series of post hoc tests found that non ACOAs did not significantly differ in their response to alcohol and social threat words compared to neutral and positive words.

The finding that ACOAs were slower than non ACOAs across all four word conditions argues for a more generalized as well as specific response to the Stroop Task and is consistent with published research on anxious subjects using a modified Stroop (Mathews & MacLeod, 1985). Mathews and MacLeod used a modified Stroop Task to
investigate selective processing in anxious (Spielberger Anxiety Inventory) subjects using physical threat, social threat and control words. They also found subjects to be significantly slower for all words but particularly slow on threatening words. They proposed that the overall slower performance in their sample could be due to a documented general performance deficit found in anxious subjects compared to controls. Other studies, Hope et al. (1990) using panic disorder and social phobic subjects and Watts et al. (1986) using spider phobics, have found specific attentional bias for mood relevant word cues without the overall slowing across all word type conditions.

The fact that ACOAs were slower overall on the Stroop Task appears to be consistent with research demonstrating attentional differences in ACOAs compared to non ACOAs. Whipple & Noble (1988) and Hegedus et al. (1985) found significantly greater attentional deficits in sons of alcoholics relative to controls using the Digit Span subscale of the Weschler Memory Scale. However, there are inconsistencies in the literature and Drejer et al. (1985), using the same scale, failed to find any significant group differences. Inconsistencies are also evident in the present study which failed to find any significant differences between ACOAs and non ACOAs using the AF/AS scale. However, it should be noted that the Stroop Task is considered a better test of distraction or attentional control (D. Derryberry, personal communication) and this may account for the differing results in our own sample. In a study more directly relevant to the present study, Tarter et al. (1989) used a more traditional Stroop Task to investigate attention in sons of alcoholics compared to controls. Using a three part test, the first two parts tested simple perceptual speed using first words then colors while the third assessed perceptual speed under distraction conditions. The recorded times for part one (words) showed that sons of alcoholics were significantly slower than controls and although COAs were slower on part two (color) this difference was not statistically significant. In part three, the interference condition, sons of alcoholics were found to be significantly slower than controls indicating that they were more distracted than the sons of non alcoholics.
The reasons for this overall performance deficit displayed by ACOAs compared to non ACOAs is not known. Although other research has demonstrated significantly higher levels of anxiety in ACOAs relative to non ACOAs (Sher et al., 1991; Tweed & Ryff, 1991) and shown that general performance deficits have been found in anxious subjects compared to controls (see Mathews & MacLeod, 1985), the present study found no significant group differences in anxiety as measured by the Neuroticism Scale of the EPQ. Therefore, it would be difficult in this case to attribute the results to anxiety. Based on previous research and the current study it is speculated that the performance deficit exhibited by ACOAs on the Stroop Task could be the result of a generalized dysfunction in attention that, according to Tarter et al. (1988, 1989, 1990), may be based on neuronal system differences in certain areas of the brain. Tarter et al. (1989, 1990) noted that cognitive deficits found on tasks requiring spatial analysis and planning, psychomotor efficiency, reflectivity, and the ability to suppress distracting stimuli (such as in the Stroop Task) are indicative of anterior cerebral dysfunction. As a result, Tarter and colleagues have hypothesized that cognitive impairment may represent processing differences in the neural systems found along the frontal midbrain axis. An alternative explanation could be that ACOAs are more flexible in their attentional control (thus slowing down response time on the Stroop) and that this may be an adaptive trait for these individuals. To summarize, ACOAs were found to be significantly slower than non ACOAs on the Stroop Task. This result could not be readily attributed to anxiety because ACOAs were not shown to be more anxious than controls. Based on the research as a whole, it was concluded that the results might be a reflection of a generalized deficit in attentional processing due to underlying neuronal system dysfunction. An alternative explanation considers that increased response time may simply reflect a greater flexibility in attentional control for ACOAs.

The overall finding that ACOAs do exhibit differential processing of emotionally laden cues and display attentional bias toward alcohol and social threat words compared to neutral and positive words is generally consistent with Mathews' and MacLeod's (1985)
notion of danger schemata. The term danger schemata refers to a theoretical framework of "cognitive structures involved in evaluating personal threat" (Mathews & MacLeod, 1985, p. 563) or may be thought of as a cluster of threat knowledge that tends to bias attention toward the cues that are threat-related. It was proposed that this cluster of knowledge could develop around particular life experiences viewed as threatening thus biasing attention and causing the interference effects found in the Stroop Task. Research with the Stroop has found these effects to be very specific. The Watts et al. (1986) study of spider phobics found that they were significantly slowed in their ability to perform the Stroop Task when required to color name spider words but not more general threat words or conflicting color words. McNally et al. (1990), working with Vietnam combat veterans, demonstrated that veterans diagnosed with posttraumatic stress disorder (PTSD) were significantly retarded in their naming of PTSD words compared to neutral and positive words relative to controls. This same specificity for selectively processing condition-specific threat words using a modified Stroop Task has been found for anxiety (Mathews & MacLeod, 1985), depression (Williams & Nulty, 1986), panic disorder and social phobia (Hope et al., 1990).

In the case of ACOAs there was a significant effect for both the alcohol word and social threat word conditions although the effect for alcohol words was stronger. It is not unreasonable to speculate that because of life experiences surrounding alcohol and growing up with an alcoholic parent(s), ACOAs might develop a cluster of threat knowledge that would produce strong interference effects on a task, like the modified Stroop, where threat cues were presented. Given the often disruptive and sometimes abusive nature of growing up in an alcoholic family, it would also be reasonable to assume that social threat words might be incorporated into a modification of the alcohol danger schema that would also produce selective processing of social threat related cues on the Stroop. Furthermore, this danger schema appears to be a structure that is stable over time rather than transient as evidenced by research with depressed (Williams & Nulty, 1986) and PTSD (McNally et
al., 1990) subjects. It should be pointed out that while the danger schemata construct generally predicts more anxiety for subjects, this was not found for the ACOAs. It would be interesting in the future to look more closely at family function and dysfunction and its effect on ACOAs performance of the Stroop Task. To summarize, there was a significant interaction between group and word type with ACOAs responding more slowly to the alcohol and social threat words than to positive and neutral words. This selective processing of threat-related word cues is attributed to a danger schema that developed as a result of life experiences growing up in an alcoholic family. This schema appears to be stable over time.

Finally, there was a significant main effect for word type with response time slowest for alcohol words and fastest for positive words. This was primarily due to the ACOA group. Although not predicted, it seems likely, based on growing up in present day society, that most individuals would attend more to threat words than neutral or positive words. This raises questions that will have to be answered by future research.

Limitations of the Study

There were several limitations to the present study. The first is one that plagues a great deal of research, namely, that the population consisted of university students making it difficult to generalize the results to the ACOA population at large. Since college students are considered a highly functional segment of the population it would be useful for future research to look at a community based sample. Another possible limitation was sample size. Although the Stroop Task effects were quite strong the sample size may have been too small to pick up subtle differences on test instruments like the EPQ (Eysenck & Eysenck, 1975). Finally, it would have been interesting to look at subgroups within the ACOA and non ACOA population based on family variables. In particular it would be
interesting to look more closely at family function and dysfunction and its effect on ACOAs performance on the Stroop Task and on the other test instruments.

Summary and Conclusions

The primary purpose of this paper was to investigate the selective processing of emotionally laden word cues in Adult Children of Alcoholics relative to controls using a modified Stroop Colour Naming Task. Of secondary importance was the investigation of self-esteem (Self-esteem Scale, Rosenberg, 1965), extroversion and neuroticism (EPQ, Eysenck & Eysenck, 1975), and attentional control (AF/AS Scale, Derryberry & Rothbart, 1988).

To summarize, the Stroop Task revealed a significant main effect for group with ACOAs performing more slowly than non ACOAs across all word conditions (alcohol, social threat, neutral, positive). This was discussed in terms of a generalized attentional deficit with a possible underlying neuronal system dysfunction involving the systems along the frontal midbrain neuroaxis, or, alternatively, that this might represent an adaptive trait for ACOAs indicating flexibility rather than dysfunction. Additionally there was a predicted significant group x word type interaction that found ACOAs to be significantly slower on the alcohol and social threat words than neutral and positive words compared to non ACOAs. This was discussed in terms of the activation of an alcohol danger schema, and a modification of that schema related to some kinds of social threat words, that interfered with the color naming in the Stroop Task. Unexpectedly, there was also a significant main effect of word type with response time slowest for alcohol words and fastest for positive words. The exact reasons for this are not known, but it was speculated that there might be a tendency for all individuals, given our present culture, to pay more attention to threat or alcohol oriented cues than positive and neutral ones. Finally, no
significant differences were found for self-esteem, neuroticism, extroversion, or attentional control.

The finding that ACOAs were significantly slower than non ACOAs across all four word conditions coupled with their significant attentional bias toward alcohol and social threat words argues for both a generalized and specific response to the Stroop Task. This may be indicative of two overlayed effects:

1) a generalized dysfunction in attention or a flexibility in attentional control
2) danger schemata based on a cluster of threat knowledge that has developed around particular life experiences viewed as threatening.

A variety of research on psychophysiological and cognitive functioning and personality and temperament (for reviews see Cloninger, 1988; and Tarter et al., 1990) argues for generalized cognitive deficits in ACOAs based, at least in part, on neuronal system differences. This offers one possible framework in which to view the present finding of an overall slower performance in ACOAs on the Stroop. It would be interesting for future research to use a modified Stroop to investigate ACOA subtypes such as Cloninger's (1988) Type 1 and Type 2 individuals. It is also recommended that future research look more closely at family variables, function and dysfunction for instance, and their effect on Stroop Task performance. In conjunction with family variables, it would be useful to develop neurocognitive profiles on ACOAs correlating Stroop Task performance with Event-Related Potential data.

The specific interaction effects found in ACOAs are consistent with Mathews' and MacLeod's (1985) notion of danger schemata. The research indicating that this is a stable not transient structure (McNally et al., Williams & Nulty, 1986) has clinical implications. If ACOAs are in fact overly sensitive to threat-related stimuli, this has implications for interventions based on cognitive behavioral approaches for those individuals seeking professional help.
To conclude, the findings from the present study are consistent with the growing body of literature demonstrating cognitive deficits in children of alcoholics. To the best of the author's knowledge, this is the first time this type of modified Stroop Task has been used with ACOAs. It is hoped that the present study will be useful in the design and planning of future research on cognitive functioning in adult children of alcoholics.
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APPENDICES
APPENDIX I

WORD RECOGNITION TASK

Please check ( ) any of the following words that you think appeared on the cards you were just shown.

___ Alienated
___ Smashed
___ Bar
___ Booze
___ Likable
___ Terrycloth
___ Intoxication
___ Jovial
___ Canvas
___ Playful
___ Achievement
___ Contented
___ Whiskey
___ Iron
___ Belittle
___ Sweet
___ Earliest
___ Inept
___ Liquor
___ Jolly
___ Failed
___ Loaded
___ Sober
___ Scolded
___ Hangover
___ Concretely
___ Misunderstood
___ Indecisive
___ Lamp
___ Carefree
___ Honorable
___ Fence
___ Withdrawn
___ Welcome
___ Island
___ Concrete
___ Drunk
___ Pathetic
___ Humiliate
___ Bartender
___ Railroad
___ Cheerful
___ Betrayed
___ Despair
___ Commonly
___ Wine
___ Typewriter
___ Fortune
APPENDIX II

FAMILY PROFILE

AGE: 
SEX: F M
MAJOR:

Please give the names and ages of brothers and sisters (including stepbrothers and stepsisters) who grew up in your family.

<table>
<thead>
<tr>
<th>Brothers</th>
<th>Sisters</th>
<th>Stepsiblings</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>age</td>
<td>name</td>
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</tbody>
</table>

+ PARENTAL STATUS

AGE: Mother Father
OCCUPATION: Mother Father

YEARLY INCOME LEVEL:

<table>
<thead>
<tr>
<th></th>
<th>Mother</th>
<th>Father</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 5,000</td>
<td>20,000-30,000</td>
<td>under 5,000</td>
</tr>
<tr>
<td>5,000-10,000</td>
<td>30,000-40,000</td>
<td>5,000-10,000</td>
</tr>
<tr>
<td>10,000-20,000</td>
<td>above 40,000</td>
<td>10,000-20,000</td>
</tr>
</tbody>
</table>

MARITAL STATUS: Mother

Single Married Separated Divorced Remarried

MARITAL STATUS: Father

Single Married Separated Divorced Remarried

If parents were divorced, did you live with mother or father?
If parents were divorced, how old were you when this occurred?
Did you have a stepmother or stepfather?
Income level of family in which you spent most of your childhood (this family may include a stepparent):

<table>
<thead>
<tr>
<th></th>
<th>under 5,000</th>
<th>10,000-20,000</th>
<th>30,000-40,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>under 5,000</td>
<td>10,000-20,000</td>
<td>30,000-40,000</td>
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<tr>
<td></td>
<td>5,000-10,000</td>
<td>20,000-30,000</td>
<td>above 40,000</td>
</tr>
</tbody>
</table>

+ PERSONAL STATUS

YEARLY PERSONAL INCOME LEVEL:

<table>
<thead>
<tr>
<th></th>
<th>under 5,000</th>
<th>10,000-20,000</th>
<th>30,000-40,000</th>
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<td>5,000-10,000</td>
<td>20,000-30,000</td>
<td>above 40,000</td>
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</tbody>
</table>

PERSONAL MARITAL STATUS:

Single Married Separated Divorced Remarried