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THE RELATIONSHIP OF ALCOHOLISM AND CEREBELLAR DAMAGE TO POSTURE AND FIELD DEPENDENCY

by

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ABSTRACT

An alternative to Witken's "predispositional hypothesis" was considered as a means of accounting for determinants related to field dependency among alcoholics. Alcoholics and controls were tested on the Witken rod and frame test and on tests of posture, locomotion, and equilibrium. Contrary to previous findings, alcoholics did not differ significantly from controls in field dependency.

Consistent with Goldstein's observations, the data indicated that the variability of alcoholics in the perceptual and postural tests was greater than that of controls. The view that postural variables are related to rod and frame performance was supported by significantly high correlations among tests.

The performance of some alcoholic subjects was similar to that of cerebellar patients. This similarity is in line with neurological observations which suggest organic dysfunction in alcoholics.

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C. Bellows

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CHAPTER I

INTRODUCTION

Brain damage (BD) is not an exceptional occurrence among individuals who consume alcohol. Lemere (1956) reports irreversible cerebral degeneration in alcoholics in their thirties. Because of the high incidence of alcoholism reported in many areas e.g. 23,000 alcoholics in Manitoba (2.3% of the population) the effects of alcohol on the central nervous system (CNS) has become a public health problem (Alcoholism Foundation of Manitoba 1971). Other Canadian rates are listed in Table 1.

Past methods of assessing permanent organic complications have relied almost exclusively on clinical neurological examinations (e.g., finger to nose test). Recent methods have introduced the use of the pneumoencephalogram (NEG), the cerebrospinal fluid test (CSF), and the electroencephalogram (EEG). The increasing use of these tests has revealed that there is a very high frequency (50-78%) of CNS damage among alcoholic patients (Bennett, Mowery, and Fort, 1960; Lafon, Pages, Passouant, Labauge, Minvielle, and Cadilhac, 1956; Lereboullet, Pluvinage, and Amstutz, 1956; Postel and Cossa, 1956).

Neurological changes which temporarily affect the CNS, but apparently do not always result in permanent

TABLE 1

ESTIMATES OF THE TOTAL NUMBER OF ALCOHOLICS AND OF THE RATE OF ALCOHOLISM IN CANADA AND PROVINCES, 1967

	Total Alcoholics(1)	Total population 20 Years & Over(2)	Total Alcoholics per 100,000*	Percentage of Alcoholics*
Canada	288,003	11,903,100	2,420	2.4
British Columbia	34,505	1,193,100	2,892	2.9
Quebec	89,352	3,360,500	2,659	2.7
Ontario	113,730	4,296,100	2,647	2.6
Manitoba	13,222	570,800	2,316	2.3
Alberta	14,032	842,400	1,666	1.7
New Brunswick	5,331	333,300	1,599	1.6
Prince Edward Island	960	60,400	1,589	1.6
Saskatchewan	8,168	549,800	1,485	1.5
Nova Scotia	5,609	430,200	1,304	1.3
Yukon	107	8,300	1,289	1.3
Newfoundland	2,986	244,200	1,223	1.2
North West Territories	171	14,000	1,221	1.2

*Population 20 years and older.

Sources:

(1) Research Division, Alcoholism Commission of Saskatchewan.

(2) Annual Reports on Vital Statistics, 1967, Dominion Bureau of Statistics; Ottawa.

organic lesions have been attributed (Ferrer, Santibáñec, Castro, Krauskopf, and Heliette, 1970) to epileptic seizures, alcoholic hullucinosis, and oneiroid episodes. Various chronic anatomical-clinical syndromes have been observed. Among these have been alcoholic polyneuritis, myopathy, Wernicke's syndrome, Korsakoff's psychosis, Marchiafava-Bignami's axial degeneration of the corpus collosum, alcoholic epilepsy, Marie-Foix's cerebral cortical degeneration, Morell's laminar cortical sclerosis, Adams and Lapresle's central pons myelinosis, and spinal syndromes (Adams, Victor, and Elliott, 1959; Bacher, Chanoit, Rouquette, and Verdeaux, 1960; Ekbom, Hed, Kirstein, and Astrom, 1964; Hecaen and Ajuriaguerra, 1956; Hed, Lundmark, Fahlgren, and Orell, 1962; Hibbs, Black, Ferraus, Weilbaecher, and Burch, 1965; Schuller, 1961; Wieser, 1965).

Several reports have described a cortical cerebellar atrophy occurring among chronic alcoholics (e.g., Lhermitte, 1934; Romano, Michael, and Merritt, 1940; Skillicorn, 1955). Clinical observations conducted on 50 alcoholic patients by Victor, Adams, and Mancall (1959) confirmed a clinical-pathological entity predominately characterized by an ataxia of gait and stance, as well as individual movements of the legs. Eleven cases were autopsied in the same study, and a parallelism was drawn between the clinical observations and histological specimens. Lesions were found in the anterior and superior aspects of the medial vermis. The specific areas most consistently lesioned were the central lobule and the anterior folia of the anterior lobe. The Purkinje cells were lesioned more than any other type of cell. This finding is particularily meaningful in light of the finding that this area is associated with postural tonus, equilibrium, and locomotion of the entire body (Chambers and Sprague, 1951, 1955a and b; Eccles, Ito, and Szentagothai, 1967; Sprague and Chambers, 1954; Vinken and Bruyn, 1969).

The restricted form of cerebellar lesioning described by Victor et al. (1959) is a neurological complication which has proved to be evasive to clinical diagnosis. Cerebellar damage is often extensive before it is detected, because the cerebellum is known to be a highly compensatory organ (Goldstein, 1938). Hence, structural cerebellar abnormalities often go undetected during routine clinical examinations (Vinken and Bruyn, 1969). Fortunately, structural abnormalities can be detected in the NEG radiographs of alcoholics who do not present clinical symptoms of cerebellar dysfunction (Castro, 1970). However, the NEG is limited in that it requires highly trained technicians, and the measurement through ventricular enlargement only reveals gross structural differences.

Sensory abnormalities have been observed in patients with cerebellar lesions (Halpern, 1949), and combined cerebellar-labyrinthine injury (Halpern, 1951). Halpern has called the alterations in sensory functioning the syndrome of sensorimotor induction. This syndrome is of special interest to neurologists and psychologists because Halpern has shown that the symptoms characterizing the syndrome are not necessarily related to the particular anatomical lesions, but are simply the manifestations of functional changes. Deviations in the visual perception of verticality and horizontality were observed in all of Halpern's patients having disturbances in postural, and tactile spheres. However, the visual modality was organically unimpaired.

Witken (1965) has argued that perception is a stable and enduring individual characteristic resistent to change. In the same article he stated that "Alcoholics have been found to present a consistent picture of marked field dependence." The field dependent (FD) relies heavily on the perceptual field or environmental frame of reference.

Witken's perceptual tests of field dependency have been widely used in research because they are purported to objectively measure the reliance an individual has on the perceptual field. Of special interest to psychologists are the relationships Witken has established between the dimensions of field dependence-field independence and personality variables. Through the use of clinical interviews, autobiographies, and projective techniques Witken, Dyk, Fatterson, Goodenough, and Karp (1962) have characterized the field dependent individual as coping passively in his general relationships with his environment including his interactions with other people. Hence, the field dependent has been found to require environmental support, passively accept authority, fear his own impulses, and lack assertiveness in unstructured situations. Field independent individuals have been characterized as actively coping with their environment. They reveal the high level of self-esteem and control over their emotional processes which is lacking in the field dependent person.

How is Witken's conception of the field dependent connected to the alcoholic personality? Over the past 30 years there has been considerable controversy over what has been claimed as an alcoholic personality. It should be kept in mind that alcoholism mirrors the complexity of human psychopathology as it interacts with many personality, social, racial, cultural, economic, and geographic factors. However, the behavior of alcoholics has often been characterized in the psychodynamic literature (e.g., Knight, 1937, 1938) as being extremely passive-dependent. The psychodynamic interpretation of the alcoholic having severe identity problems with little struggle for maintenance of identity (i.e., inadequately developed controls, maternal over-identification) is consistent with Witken's description of the field dependent perceptual orientation.

There are similarities in the personality variables Witken ascribes to the field dependent and the psychoanalytic analysis of the alcoholic. The dynamic theorists argue that there is support for the notion of early maternal identification and sexual ambivalence among most alcoholics. An oral character disorder develops into masculine problems of identity and inhibitions of aggressive impulses later revealing themselves as pronounced in the sexual-social interactions of the individual. Feelings of inferiority are often the result of the weak ego structure. Guilt and shame enter into the syndrome. The alcoholic personality is unable to assert himself, and hence the neurotic symptoms of turning in on the self--the sadomasochistic narcissism characteristic of infantile regression. Tahka (1966) in his extensive analysis of familial relationships of alcoholics emphasizes the effects of this parental influence. Hence, the psychodynamic theorists see the ingestion of alcohol as partly a result of the yearning for passive gratification originating in a maternal superego. The intoxifying effects of alcohol relieve the aggressive impulses seeking expression, encourages self-confidence, and finally becomes a substitute for object relationships which never had a chance to develop.

However, the controversy over the pervasive use of Freudian terminology such as orality as explaining the alcoholic's excessive drinking (i.e., passive yearning for maternal gratification) had led some theorists (Sutherland, Schroeder, and Tordella; Syme, 1957) to question the usefulness and validity of an "alcoholic personality type." In 1959 Witken, Karp, and Goodenough extended their concept of field dependence to alcoholics. They confirmed their prediction that alcoholics were field dependent. In subsequent studies conducted at Witken's lab it was found that the ingestion of alcohol (Karp, Witken, and Goodenough, 1965a), cessation of drinking behavior (Karp, Witken, and Goodenough, 1965b) or length of drinking behavior (Karp and Konstadt, 1965) did not alter field performance. These studies suggested that alcoholic individuals are field dependent prior to becoming alcoholics. This led the Witken researchers to explain field dependency among alcoholics in terms of predispositional personality variables. Hence, Witken et al. (1959) have stated that "It must be stressed that field-dependent perceptual performance reflects a general personality constellation rather than the alcoholic symptom per se."

There have been no longitudinal studies published which have confirmed the assertion that individuals are field dependent prior to becoming alcoholics. Several investigators (e.g., Goldstein and Chotlos, 1965) are critical of this "predispositional hypothesis" and favor a "consequential hypothesis." That is, it is argued that alcoholic field dependency is related to an organic dysfunction of the central nervous system not to personality dynamics. Hence, Goldstein and Chotlos (1966) have reported that alcoholics significantly improve on rod and frame performance following an 8-10 week abstinence period. Studies have also failed to confirm the Witken argument that field dependency among alcoholics generalizes to other aspects of personality (Goldstein and Chotlos, 1965; Goldstein, Neurringer, Reiff, and Shelly, 1968).

In light of the above evidence stressing the importance of the cerebellum in sensorimotor-perceptual functioning, and the noted prevalence (e.g., Victor et al., 1959; Allsop and Turner, 1966) of cerebellar lesioning among chronic alcoholics, it is hypothesized that there should be a relationship between the performance of alcoholics on the Witken rod and frame test of field dependency and tests of postural functioning.

Cerebellar Degeneration Associated with Chronic Alcoholism

Several early neurological reports have noted the close association between chronic alcoholism and a restricted form of cerebellar dysfunction (Courville and Friedman, 1940; Guillain, Bertrand, and Guillain, 1939; de Haene, 1937; Lhermitte, 1935; Parker and Kernohan, 1933, 1935; Romano et al., 1940; Santha, 1948; Stender and Luthy, 1931; Thomas, 1905; Zulch, 1948, 1952). The cerebellar dysfunction noted by these authors is characterized by an instability of stance and ataxic gait. The lesioning tends to be restricted to the anterior and superior aspects of the cerebellar vermis with predominant involvement of the Purkinje cells.

Although heredity (e.g., Holmes, 1907) and malnutrition cannot be ruled out as contributing etiopathogenic factors, recent investigators using pneumoencephalographic and advanced histological techniques with chronic alcoholics have suggested that alcohol is a predominant causative agent in the pathogenesis of cerebellar dysfunction (Allsop and Turner, 1966; Ames, 1961; Chodoff, Auth, and Toupin, 1956; Decker, Wells, McDowell, 1959; Skillicorn, 1955).

It is significant to note that Purkinje cell lesioning has been produced by alcoholic intoxication in animals (Lhermitte, 1935; Lhermitte, de Ajuriaguerra, and Garnier, 1938). Alcoholic cortical cerebellar degeneration with predominant involvement of the Purkinje cells has been clearly defined and confirmed (i.e., histologically) as a clinical-pathological entity by Victor, Adams, and Mancall (1958, 1959). In these two investigations the authors examined 85 chronic alcoholics with cerebellar ataxia and presented neuropathological evidence in 11 subjects. A description of a cerebellar syndrome resulting primarily from the excessive ingestion of alcohol can be summarized from the neurological, pathological, and histological observations provided from the above literature.

Neurological

In alcoholic cerebellar degeneration the ataxia is characteristically more prominent in the legs and body than in the upper extremities. The gait is hesitant, broad-based, and reeling, and the step movements are irregular. Nystagmus and speech disturbances are rare. Ocular movements are relatively little involved (Victor et al., 1959).

Romano et al. (1940) observed body sway while standing (i.e., a Romberg symptom) with eyes open or closed. That lesioning of the anterior vermis produces difficulties in standing has been shown by Chambers and Sprague (1955a). Decker et al. (1959) found that in two cases of alcoholic cerebellar degeneration the patients failed to perform rapidly alternating movements in the legs. A consistent neurological finding reported in the literature is a marked asynergia and dysmetria in the heel-knee-shin test. Victor et al. (1959) reported that the patient's postural instability becomes much more apparent when he is subjected to special neurological tests such as tandem walking. These authors (Victor et al., 1959) indicated that "heel-to-toe walking was virtually impossible for these patients, even for those with the mildest form of the disease."

The functions involved in walking include equilibrium, proprioception, and vision. The area which seems to be most predominantly lesioned, the superior vermis, receives projections from the vestibular nuclei, proprioceptive input via the spinocerebellar tracts, and fibers from the visual system via cortico-pontine fibers (Ruch, Patton, Woodbury, and Towe, 1961). Hence, the neuropathological involvement of the vermis probably accounts for the clinical symptomatology (e.g., ataxia) of the lower limbs.

Considering the high frequency of alcoholism the cases of alcoholic cerebellar degeneration reported in the literature are rare. The neocerebellum has been found to be slightly lesioned in most cases. The relative non-involvement of this area may account for some of the difficulty encountered during formal neurological testing of the cerebellar faculty (Allsop and Turner, 1966). However, the precise pathogenesis of the cerebellar degeneration is still controversial.

Pathological

Pathological examinations have consistently reported that in cases of alcoholic cerebellar degeneration there is a symmetrical atrophy of the cerebellum, particularly involving the anterior and superior aspects of the vermis and adjacent lateral and flocculonodular lobes. The severity of lesions is in an anterior-posterior direction. The cerebellar lesioning tends to be anatomically constant and restricted to these areas. Associated changes have been noted in the inferior olivary nuclei in the medulla. The fastigial, globose, emboliform, and vestibular nuclei are less consistently involved.

Histological

There appears to be a sequence to the histological changes. The granular cell layer appears to be initially affected followed by Purkinje cell degeneration and astroglial proliferation. The Purkinje cells display greater degenerative changes than other cerebellar tissue and may be entirely absent in the most affected lobules. Although the cerebellar lesions vary in their severity and duration, they are usually accompanied with astrocytic reactions and are often characterized by acute swelling with tigrolysis of the Purkinje elements. The retrograde degeneration of the inferior olivary nuclei follows the pathway of cerebellar cortical lesioning described by Holmes and Stewart (1908).

The above has been a neurological, pathological, and histological description of the cerebellar syndrome. Some observations on the effects of toxic agents on the cerebellum may be worth noting. For example it is possible that cerebellar dysfunction is due to the more direct effects of toxic agents such as notedin anoxia and hyperthermia (Freeman and Dunnoff, 1944; Krainer, 1949; Malamud, Haymaker, and Custer, 1946). It is worthy to note that alcohol consumption (300 mg/100 ml. of blood) reduces the oxygen consumption (anoxia) in the human brain by about 30% (Battey, Heyman, and Patterson, 1953). Cerebellar lesioning has also been invoked by lead poisoning and DDT (Ferraro and Hernandez, 1932; Freifeld, 1932; Haymaker, Gingler, and Ferguson, 1946; de Villaverde, 1927). Granule and Golgi II cell loss has been evoked by methyl mercury compounds (Hunter and Russell, 1954) and thiophene (Upners, 1939). Nutrition, gastric activity, and liver function, all sources of organic complications highly associated with chronic alcoholism have not been found to be etiopathogenic to cerebellar dysfunction (Ferrer et al., 1970; Victor et al., 1959).

It has been noted that after an intoxicating dose of ethanol alcohol the concentration of gamma-aminobutyric acid (GABA) in the brain decreases (Ferrer and Arnold; 1961). Israel (1969) suggested that alterations in GABA metabolism may effect changes in synaptic transmission. Recently, Gordon (1967) found that ethanol alcohol administered in intoxicating doses (in rats) reduced GABA content by 10% in the cerebral hemispheres, but drastically lowered the GABA content in the cerebellum by 60%. Gordon's highest concentration of blood-alcohol and GABA decrease was noted 3 hrs. after administration. It is interesting to note that this temporal relationship corresponds somewhat to the symptoms (i.e., disequilibrium) of intoxication in man.

It is probable, therefore, that cerebellar dysfunction is very prevalent among individuals who consume alcohol in excess, but the gradual insidious lesion formation has only been capable of detection in the more advanced stages. Parameters on the amount and rate of alcohol con-consumption, its effects on GABA and cerebellar lesioning await further research.

Field Dependency Among Alcoholic Populations

In the above section the relationship of cerebellar degeneration to alcoholism has been considered. What follows is a brief review of the literature of field dependency among alcoholics. Early work by Witken, Lewis, Hertzman, Machover, Meissner, and Wapner (1954) introduced indices which measure the dependency of the individual on the perceptual field. The indices are based on three perceptual tests and are indicative of an individual's position on a continuum of perceptual differentiation.

1) The embedded figures test (EFT) consists of a series of 24 complex designs. A simple figure is embedded in a complex design. The dependent variable is the time taken by a subject to locate the simple figure. Field dependency is characterized by higher (time) scores. Jackson (1959) has developed a short form of the EFT (12 items) which correlates highly (.96 - .99) with the original long form.

2) The body adjustment test (BAT) requires a subject titled in a chair to make judgments of body verticality while within a specially constructed room which remains independently tilted. Scores are based on 6 trials. Larger scores represent greater deviation from verticality and are labeled field dependent.

3) In the rod and frame test (RFT) the subject sits 7 feet in front of an illuminated rod and frame in a

dark room. In a series of 24 trials the rod and frame are preset in different tilted positions (± 28°). On 16 of the 24 trials the subject is also placed in a tilted position (± 28°). The subject adjusts the rod to a position of verticality while in one of the three static positions: upright, left and right tilt. Thus, the only available sensory cues the subject can relie on are the erroneous (non-vertical) position of the frame and his own assessment of body position. This limitation apparently causes a discrepancy in judgment and is referred to as "perceptual conflict" (Witken et al., 1954). Under these conditions accurate judgment is dependent upon an intact sense of equilibrium and visual perception. Field dependency is characterized by judgments having large deviations (approx. 8° or more) from verticality.

Witken et al. (1954, 1962) report that there is considerable evidence of self-consistency in performance on these tests. The "perceptual index" reported in studies using this battery represents the combined standardized scores on all three of the tests.

Witken's differentiation hypothesis states that those individuals characterized by field dependency have a mode of perception which is global, non-articulated, and undifferentiated. That is, they tend to relie heavily on the perceptual field or environmental frame of reference. On the RFT they relie heavily on the tilted frame while making judgments of true verticality. The field independent individual, however, is characterized by a mode of perception which is body-oriented, articulate, and differentiated.

In the following review of the literature of field dependency among alcoholic groups, 15 out of the total 19 reported were derived from either Witken's lab in New York City or Goldstein's lab in Topeka Kansas. Table 2 lists all the presently known studies completed on field dependency among alcoholic groups, the location where the study was conducted, and the perceptual test used in each one. A description of the alcoholic groups which have been employed in studies of field dependency is mentioned in Tables 1-4 in the Appendix. It should be noted that some reports have not provided sufficient information to make the tables complete.

In an early study (Witken et al., 1954) of 77 hospitalized psychiatric patients Witken noticed that 14 subjects (Ss) who were diagnosed as alcoholics had "considerably higher" index scores than the nonalcoholic patients on the above field dependency test battery. In a follow-up study Witken et al. (1959), who used the same battery, found that alcoholics scored significantly higher in field dependency than college men, a normal group matched for age, education, and ethno-religious background, and another group of psychiatric patients.

Similarily, Bailey, Hustmyer, and Kristofferson (1959) found that a group of hospitalized alcoholics were

TABLE 2

LOCATION, TESTS, AND SCORING METHODS USED IN STUDIES OF FIELD DEPENDENCY AMONG ALCOHOLIC POPULATIONS

Study	Location[a]	Test Used[b] BAT	RFT	EFT	Scoring Method[c]
Witken et al. (1954)	NYC	1	1	1	MIS
Bailey et al. (1959)	NYC	1	1	1	MIS
Witken et al. (1959)	NYC	1	1	1	MIS
Bailey et al. (1961)	NYC	0	1	0	MSS
Karp et al. (1963)	NYC	1	1	1	MIS
Goldstein & Chotlos (1965)	T	0	1	0	DMSE
Karp et al. (1965a)	NYC	1	1	1	AV
Karp & Konstadt (1965)	NYC	1	1	1	MIS
Karp et al. (1965b)	NYC	1	1	(1)	MSE,MIS
Goldstein & Chotlos (1966)	T	0	1	0	DMSED
McCarthy (1967)	T	0	1	0	-
Reilly & Sugarman (1967)	NJ	0	0	(1)	MSE
Goldstein et al. (1968)	T	0	(1)	0	DMSE
Jacobson (1968)	WV	0	(1)	0	DMSE
Klappersack (1968)	T	0	1	1	DMSE
Burdick (1969)	S	0	0	(1)	MSE
Jacobson et al. (1970)	C	0	(1)	0	MSE
Karp et al. (1970)	NYC	0	0	(1)	MSS
Goldstein & Shelly (1971)	T	0	(1)	0	DMSE

[a]C = Chicago's Alcoholic Treatment Center, Chicago, Illinois; NYC = State University of New York Alcohol Clinic, Brooklyn, New York; NJ = New Jersey Neuropsychiatric Institute; S = Shodel Hospital, Seattle, Washington; T = Topeka Veterans' Administration Hospital, Topeka, Kansas; WV = Eastern State Hospital, Williamsburg, Virginia.

[b]1 = Used; 0 = Not Used; (1) = Used in short form (i.e., RFT used in upright position only and only 12 figures used in the EFT).

[c]AV = analysis of variance (scoring details not given); DMSE = double mean sum of errors (a group mean based on each

TABLE 2 (Continued)

S's mean error); DMSED = double mean sum of error differences (a group mean based on each S's mean error differences--i.e., postscores minus prescores); MDSE = median sum of errors (a group median based on each S's sum of errors); MIS = mean index scores (a group mean based on the standardization of test battery scores); MSE = mean sum of errors (a group mean based on each S's sum of errors); MSS = mean standardization of scores (a group mean based on the standardization of a particular test in the battery).

field dependent. In a follow-up study Bailey et al. (1961) found that alcoholics from Alcoholics Anonymous (AA) and another group of hospitalized alcoholics scored significantly higher in field dependency than a control group composed of old and young Ss. A comparison of diffuse BD Ss, with and without a history of excessive drinking showed that the BD groups had a significantly greater degree of field dependency than controls. Only the RFT was used in the foregoing experiments. It was Bailey's study which first suggested that field dependency could be a consequence of organic BD. It should be noticed, however, that no diagnosis of BD was reported in the alcoholic group except for those Ss having a "chronic brain syndrome with psychotic reaction associated with alcohol."

Karp, Poster, and Goodman (1963) using the test battery, found a group of alcoholic women significantly more field dependent than a control group. This is the only study reported in the literature which has investigated field dependency among alcoholic females.

Goldstein and Chotlos (1965) found alcoholics slower than controls on timed tests involving figure tracing, speed of speech, and other psychomotor responses. The RFT scores of the alcoholics were significantly higher than those of the control Ss. On most of the measures (e.g., Delayed Auditory Feedback, Trail Making Test) the alcoholics were much more variable than the controls.

In 1965 a series of three experiments (Karp and

Konstadt, 1965; Karp, et al., 1965a, 1965b) were conducted to test the stability of alcoholic field dependency. Karp et al. (1965a) concluded that field dependency could not be attributed to the acute effects of intoxication or to cessation of drinking (1965b). In addition Karp and Konstadt (1965) suggested that field dependency could not be attributed to duration of drinking history. In all three experiments the test battery was employed. Hence, Karp et al. (1965b) stated:

> This evidence of stability of field dependence over various phases of the alcoholismic cycle makes less likely the hypothesis that field dependence is a consequence of alcoholism and to that extent makes the alternative hypothesis of predisposition more plausible (p. 584).

However, using just the RFT Goldstein and Chotlos (1966) found significantly greater field independent performance among an alcoholic group following a period of 8-10 weeks of psychiatric treatment (and abstinence). They stated that "these results tend to cast doubt on the stability hypothesis."

McCarthy (1967) has investigated the relationship of rod and frame performance and railwalking (Heath, 1942) among alcoholics. In the railwalking test the S is required to walk on rails with progressively narrower dimensions. McCarthy found that hospitalized alcoholics perform inferior to non-alcoholics, but with training and sobriety their performance equals that of controls.

Reilly and Sugarman (1967) tested 96 alcoholics on

Schroder and Streufert's Sentence Completion Test (Schroder and Streufert, 1962), and distinguished between four different levels of increasing order of abstractness. The investigators referred to the three levels of functioning as System I, II, III, and IV. Only two Ss were included in System III. Of the remaining 91 Ss who were also tested on the EFT, 62 Ss were included in System I and 29 Ss were classified under System II. As predicted the System I group was significantly more field dependent than the System II group.

A factor analytic study was conducted by Goldstein et al. (1968) with the RFT and a variety of measures (e.g., Edwards Personal Preference Schedule, Guilford-Martin Inventory of Factors) of psychological and social dependency. However, it was found that the RFT had only a neglible degree of communality with the other measures. The hypothesis that field dependency generalizes to other dimensions of personality-related measures of dependency was refuted.

Jacobson (1968) reported that after a period of sensory deprivation a group of chronic alcoholics improved in rod and frame performance. Experimental Ss spend one hour lying on a bed in a dark, sound-reduced room. The Ss who were confined to the room significantly improved (25%) while control Ss showed a nonsignificant improvement (5%). These results are similar to the results reported earlier by Jacobson (1966). All the subjects in this experiment were male college students.

Subjects confined to perceptual isolation showed a significantly greater increase (28%), while controls showed a nonsignificant increase (5%). Jacobson (1968) explained the increments on the basis of increased awareness of bodily sensations and concluded that:

> The stability hypothesis of Witken et al. (1962) is questionable, and perceptual dependence, as defined by RFT performance, is amenable to experimental manipulation in a variety of populations and under differing types and degrees of sensory restriction (p. 549).

It should be mentioned that other studies (Astrup, 1967; Klepper, 1969; Wolf, 1965) have shown that increases in body sensitivity may result from sensory deprivation. Astrup (1967) has reported significant improvement on the RFT in Ss exposed to the restricted perceptual environment of South African gold mines. The difference in the period between pre-testing and post-testing which was 2.5 hours resulted in a highly significant ($p < .005$) reduction of error in rod and frame performance. Similarly Wolf (1965) and Klepper (1969) have significantly increased rod and frame performance by body-attention procedures, (i.e., by rapidly whirling the Ss in a revolving chair for 20 seconds).

Using visual, postural, and visual organizational tests, Klappersack (1968) attempted to test whether different postural and visual tasks (e.g., railwalking, rod test, EFT) differentially determine field performance in alcoholics as compared to non-alcoholics. Klappersack further divided the alcoholic and non-alcoholic groups into field dependent and field independent groups on the basis of rod and frame performance. The series of test results revealed that:

> . . . alcoholics and controls had similar sources of field dependence. Alcoholics and controls were thus either field dependent or field independent for similar reasons. The chief sources of difficulty for the field dependent groups occurred in the visual organizational tests. On the postural tests, all groups did equally well. The performance of the brain damaged group was uniformly inferior on all tests (p. 2203-b).

Klappersack concluded that:

> The results are interpreted as consistently failing to support that aspect of the consequential theory dealing with equilibratory functioning (p. 2203-b).

Klappersack further suggested that:

> . . . a predispositional theory is inadequate to cover the wide range of performance by alcoholics in the various tests. The Witken theory of psychological differentiation seems to be most consistent with the interpretation of the RFT as being a measure of cognitive functioning or an aspect of intellectual capacity (p. 2203-b).

Burdick (1969) using the EFT with a group of alcoholics at Shadel Hospital compared his resuls with those of Karp et al. (1965b) and Reilly and Sugarman (1967). Contrary to the findings of the later writers, Burdick observed that his group was significantly more field independent. It should be noted, however, that the Shadel Hospital population was characterized by a higher socio-economic level, the average income of patients in 1967 was $17,000.

In an attempt to replicate the findings of Goldstein and Chotlos (1966), Jacobson, Pisani, and Berenbaum (1970) administered the RFT at 7-14 and 33 days of hospitalization to a group of alcoholics. No significant differences between the two testing periods were observed. Although they report their data is contrary to that of Goldstein's, differences in procedure may account for the inconsistency of results. The Jacobson interim testing period is only approximately 2-3 weeks while the Goldstein interim period is approximately 7-9 weeks. If duration of abstinence is related to RFT improvement as Goldstein suggests, then Jacobson's shorter obstinence period might explain his negative results. Furthermore, Goldstein found significant improvement scores in all three body positions whereas Jacobson did not use any one of the three standard body positions. It is unknown as to why Jacobson had his Ss stand throughout the testing period, especially if his intent was solely on replication, as reported.

Using the EFT Karp, Kissen and Hustmyer (1970) found that alcoholics selected for insight psychotherapy were significantly more field independent than non-selectees. It was also observed that early dropouts were significantly more field dependent than patients who remained in therapy. Finally, in a recent factor analytic study (Goldstein and Shelly, 1971) involving the RFT it was found that alcoholics had normal language and memory functions, but impaired psychomotor dexterity and speed.

As the above review indicates, most of the investigators who have researched field dependency among alcoholic groups have used the RFT. These studies have generally supported the earlier finding of Witken et al. (1959) who reported that alcoholics tend to be characterized by a field dependent perceptual orientation. However, there is still doubt as to whether the field dependency predisposes the onset of alcoholism or is a consequence of the organic effects of alcohol on the CNS.

Statement of the Problem and Rationale

Previous investigations (Bailey et al., 1961; Goldstein & Chotlos, 1965; Klappersack, 1968) have considered the relationship of brain damage to rod and frame performance among alcoholics, but have not attempted to assess the degree or localization of damage. For example, Bailey et al. (1961) reported their neurological diagnosis in vague, generalized terms such as "brain-damaged alcoholic patients" and "diffuse brain damage, but without a history of excessive drinking". Similarly, Klappersack (1968) who noted that a BD group was uniformly inferior on all the tests used in his study, stated briefly that the BD Ss were selected "on the basis of neurological evidence of cranial pathology and were comparable to the other groups in age and intelligence". No other neurological details were reported in these two foregoing studies. Also, Goldstein and Chatlos (1965) did not include a BD group, but on the basis of the alcoholic group's inferior performance on the timed tasks they concluded that "some of the findings could be attributed to dysfunction of lower centres, particularly the brain-stem-cerebellor-vestibular systems."

The purpose of this study is to examine cerebellar dysfunction among alcoholics. In order to validate the cerebellar involvement of the cerebellum on the tests included in this study a group of patients diagnosed as having lesions restricted to the cerebellum will be included. The anterior cerebellum has been shown to be associated with postural tonus, locomotion and body equilibrium. It is therefore hypothesized that:

1) The alcoholic group will differ from the control group on each of three batteries of sensorimotor tests involving posture, locomotion, and body equilibrium in a direction similar to that of the cerebellar group.

Halpern (1949, 1951) has observed that cerebellar lesioning is associated with visual deviations of verticality and horizontality. It is therefore hypothesized that:

2) (a) The cerebellar group will be characterized by greater error than the control group on tests involving visual judgments of verticality.

(b) The alcoholic group will differ from the control group on the visual tests in a direction similar to that of the cerebellar group.

Four levels of cerebellar functioning will therefore be investigated: posture, visual judgments of verticality, locomotion, and body equilibrium. The rationale behind the use of the tests included in this study follows:

Postural. A kinesthetic judgment involves the discrimination of 'position and movement of body parts. Active body-limb positioning is based on feedback from muscle-spindles, tendon receptors, and/or joint receptors and may be investigated by having a blindfolded subject duplicate the position of one limb by its partner (Deutsch and Deutsch, 1966).

The muscle-tendon receptors signal the relative state of tension of individual muscles and provide information as to the position of the limbs in relationship to the body and the environment. Gamma fibers which supply the intrafusal fibers of the muscle spindles facilitate voluntary contraction thereby contributing to the stability of muscular control (Deutsch and Deutsch, 1966). However, gamma excitation is dependent upon the presence of the anterior lobe of the cerebellum (Granit, 1955). Anterior lobe lesioning effected through the chronic ingestion of alcohol may therefore effect deviations in muscular tone and posture, because of alterations in gamma firing and the consequent changes in muscle spindle sensitivity.

Halpern (1949, 1951) has observed that patients with cerebellar lesions tend to perceptually deviate from true verticality and horizontality in a direction consistent with the side of the lesion. While blindfolded patients with lesions in the right cerebellar hemisphere held a dowel to the right of true verticality. The same ipsilateral relationship was observed with patients having lesions in the left cerebellar hemisphere. The dowel test requires a subject to compare the position of one arm to the other on the basis of an imaginary vertical axis mediated by the tactile stimulation of the hands holding the dowel.

Visual judgments of verticality. Halpern (1949, 1951) has also noticed the same ipsilateral cerebellar relationship in the visual modality. His patients showed a deviation in the coordination of verticality and horizontality when seeing with the eye corresponding to the side of the affected equilibrium. For instance, when perceiving with the right eye, a true vertical line drawn on a blackboard was seen by a patient having a lesion on the right cerebellar hemisphere to be inclined to the left (Halpern, 1951). Some patients correct their visual deviations when asked to use both eyes. However, cases have been reported where the visual deviations have been observed independently of whether the subject was looking with the right eye, left eye, or both eyes (Halpern, 1949). Likewise, the side and degree of deviation is consistent for any one subject, and the deviation also can be detected in other sensory modalities (e.g., tactile localization, one-sided deviation in acoustic perception).

A task requiring subjects to make judgments of verticality by adjusting an illuminated rod to a vertical position while seated in a completely dark room is included in this study to confirm the prediction that cerebellar lesioning causes deviations in visual verticality.

It has been reported (Brodal and Grant, 1962) that the cerebellar vermis distribute fibers to the vestibular nuclei over two pathways. A direct pathway is made up of axons from Purkinje cells which terminate in the vestibular nuclei. The other pathway is indirect and is made up of fibers from the vermis to the fastigial nucleus which connect with fibers to the vestibular nuclei.

An interruption in both cerebellar-vestibular pathways would occur in cases of alcoholic cerebellar degeneration because lesioning is prominent in the anterior vermis, and the Purkinje cells are the cells most consistently reported as lesioned. One can only speculate on the functional role attributed to the cerebellar-vestibular connections at the lateral vestibular nucleus of Deiters. Carpenter (1959) observed that fastigial lesioning produced disturbances of equilibrium with occasional staggering and sometimes falling to the side of the lesion.

To investigate the possibility that anterior cerebellar lesioning causes larger error in judgments of verticality while in a tilted position it is necessary to compare the difference in error between judgments made in an upright position and tilted body positions in the two groups. It is therefore further hypothesized that on the visual tests:

(c) The difference between the error made in body-upright positions and the body-tilted positions during visual testing of verticality will be greater among the alcoholics and cerebellar patients.

Locomotion and body equilibrium. The studies (e.g., Victor et al., 1958, 1959) on alcoholic cerebellar degeneration have consistently reported that patients show a marked disturbance of gait with mild disturbances of the upper extremities. Vinken and Bruyn (1969) have stated that the gait disturbances characterizing the syndrome of the anterior lobe is "chiefly one of an exaggeration of postural reflexes.

That the function of the anterior lobe is of prime importance to the stretch response and posture has been shown by Matthews (1959). The spastic rigid gait which occurs in cerebellar ataxia is probably due to an alpha motorneuron facilitated release; the tonic inhibitory influence exerted by the anterior lobe on alpha motorneurons being interrupted by lesioning of the vermis.

Cerebellar ataxia among alcoholics has been described as a clinical-pathological entity (Victor et al., 1959), but the number of cases reported have been extremely rare. This could partially be a result of a failure to detect the intervening degrees of cellular loss, and a failure to attribute ataxia to the effects of alcoholism. Chodoff et al. (1956) searched the records in a hospital in Washington, D. C. for all cases who had been diagnosed as having cerebellar sclerosis, olivopontocerebellar atrophy or parenchymatous cortical cerebellar atrophy during a five to eight year period. Of 18 cases reported alcohol was attributed as the only demonstrable etiological factor in 16. The other two cases were attributed to heat stroke and dilantin and/or alcohol. The authors concluded that:

> . . . cerebellar degeneration of this type is quite possible more common than has been thought. It may be that a not inconsiderable number of these cases have been masquerading under such diagnoses as peripheral neuropathy, multiple sclerosis, and cerebral arteriosclerosis (p. 380).

Incoordination of lower limb musculature can be attributed to the toxic effect of alcohol on the superior and anterior aspects of the cerebellar vermis. This area receives projections from the vestibular nuclei, proprioceptors via the spinocerebellar tracts, and some corticopontine fibres from the visual, somatosensory, and auditory system (Ruch et al., 1961).

The servo-mechanisms involved in standing and walking include vestibular, proprioceptive, and visual functioning. Progressive degrees of lesioning in this cerebellar area should make it more difficult for a subject to walk on a test involving the sensitive coordination of the legs such as the Heath rails (Heath, 1942). Postural equilibrium and ataxia has been measured by a quantitative ataxia test battery using the Heath rails (Graybiel and Fregly, 1965). His method includes the rail test for assessing locomotor aspects of ataxia and a static "floor test" (Fregly and Graybiel, 1968) for assessing postural equilibrium. Normative data has been published (Graybiel and Fregly, 1965; Fregly and Graybiel, 1968) using both the rail and floor batteries.

Fregly, Bergstedt and Graybiel, (1967) have reported significant performance decrements on all the tests in subjects who were given controlled dosages of alcohol. They concluded that "ataxia test findings related fairly well to the blood alcohol determination along the time axis of the experiment."

CHAPTER 2

METHOD

Three groups of subjects (Ss) were tested on the RFT and a series of tests involving sensorimotor functioning. All Ss were required to complete the testing in one session lasting about two hours.

Subjects

Alcoholics Anonymous (AA). Fifteen male Ss, 37-60 years old were used. The Ss had received 4-12 years of education, and were obtained anonymously through the cooperation of the Alcoholism Foundation of Manitoba (AFM). Most of the alcoholics entering Nassau House, the AFM's half-way house, are self-declared alcoholics with chronic drinking problems. Conditions considered as a basis for exclusion from the study were intoxication or tranquilizing drugs within the last 24 hours, alcoholic hallucinosis, DT's (delirium tremens), and overt psychosis.

Control (C). Fifteen male Ss, 33-57 years old were used. The Ss had received 5-13 years of education, and had no histories of drinking problems.

Cerebellar Brain Damage (CBD). This group consisted of three patients presently admitted to a Winnipeg General

Hospital for cerebellar brain damage. They were diagnosed by Dr. M. Newman (neurologist) as having structural lesions confined to the cerebellum (e.g., neoplasms). None of the patients had a history of a drinking problem. Briefly the diagnoses which are mentioned in the records (personal communication, Manitoba Rehabilitation Hospital Discharge Summary #16665, personal file #23955) by Dr. Newman are as follows.

The first patient was a fourteen year old female admitted to the Winnipeg General Hospital for an operation on a neoplasm located on the right cerebellar hemisphere. There was a predominent ataxia of the right extremities. At the time of discharge she was able to walk without any assistance (e.g., walker). However, her gait was often characterized by a tendency to walk to the right. Because the cerebellar involvement has effected the coordination of her right hand, the patient has learned to write with her left hand.

The second patient was a twenty-eight year old female admitted to the Manitoba Rehabilitation Hospital for a severe cerebellar ataxia. Upon admission she was diagnosed as having gross ataxic dysarthria and nystagmus. There was a generalized weakness, impaired speech, and very poor balance. Her condition improved slowly but steadily upon a treatment regimen involving a program of trunk and limb exercises. An initial intention tremor and trunk ataxia disappeared and there was a continued improvement in muscle strength. At the time of testing she was able to walk with a walker or the assistance of another person.

The third patient was a twenty-four year old male admitted to the Manitoba Rehabilitation Hospital after recovering from injuries incurred from a car accident. There were neurological symptoms which implied a cerebellar disorder. The patient was characterized by an inco-coordination of both arms and both legs and an inability to hold the trunk upright while walking or standing. Upon testing he was unable to stand without assistance, his balance was poor, his speech comprehensible but slurred and arrhythmic.

A greater number of patients would have been more desirable but at the time of conducting the experiment only three patients were available. It was also not possible to investigate a massed action control group.

Apparatus

Postural tests. A black mask made of cloth was used to blind the Ss. The mask covered both the eyes and the nose. During all the postural testing, the Ss were placed in front of a grid of horizontal and vertical tapemeasures. This grid is illustrated in Figures 1-4. Each S was administered the four tests of statokinetic positioning within a 9.5 x 11 x 8 ft. room painted white. As illustrated in Figures 1 and 2 the first two tests included the use of a wooden cylindrical dowel. The dowel was painted black and was 47 x .75 in. and weighed 3.17 oz. A strip of white adhesive

FIGURE 1

Subject attempting to position the dowel in a vertical position while blindfolded (DT/V). On this trial he is holding the dowel slightly inclined to the right. Note the grid of tape-measures in back of the subject which can be used for measuring the degree of dowel deviation from true verticality or horizontality.

FIGURE 2

Same subject as in Figure 1 attempting to position the dowel in a horizontal position while blindfolded (DT/H). On this trial he is holding the dowel slightly inclined to the right.

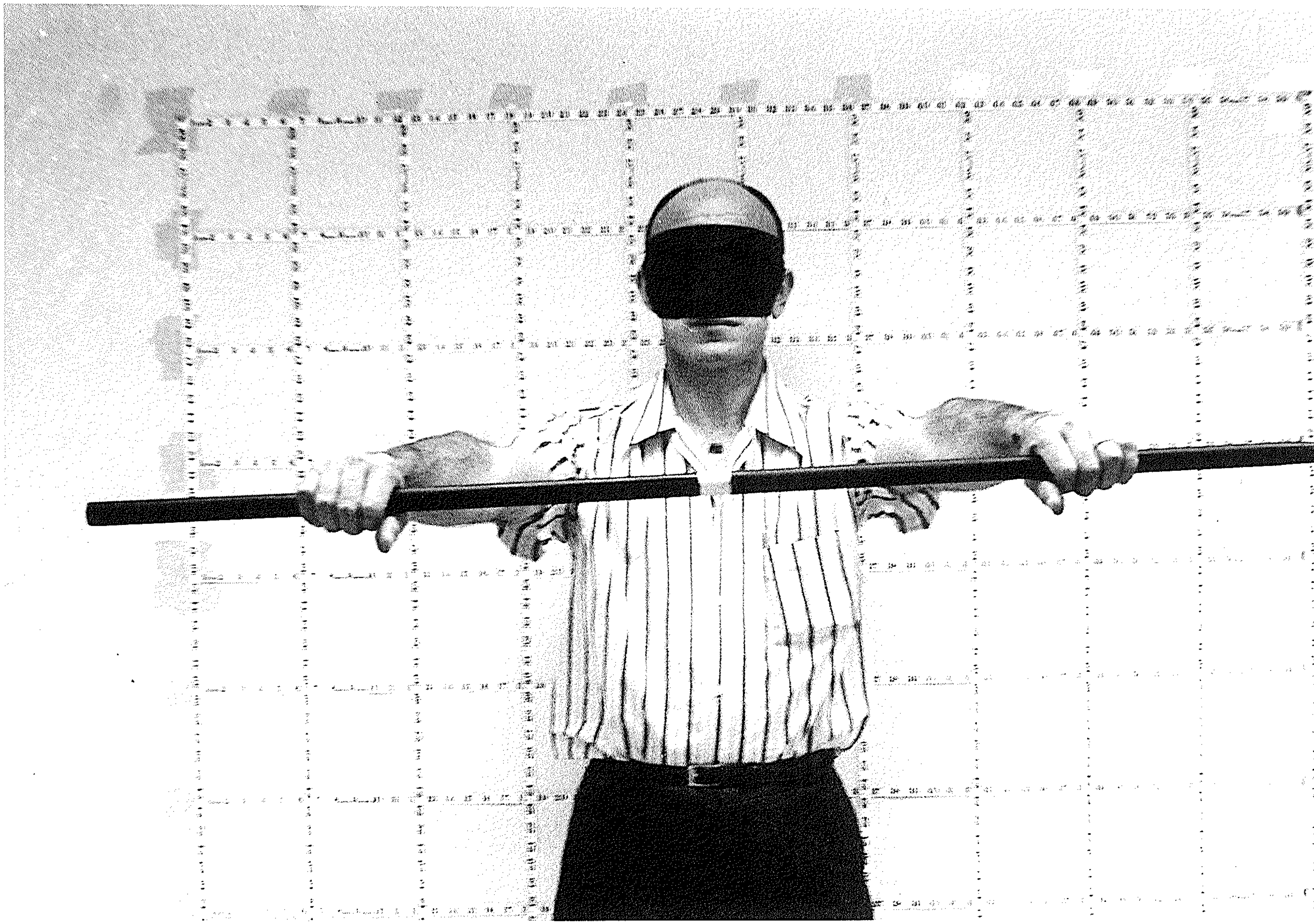
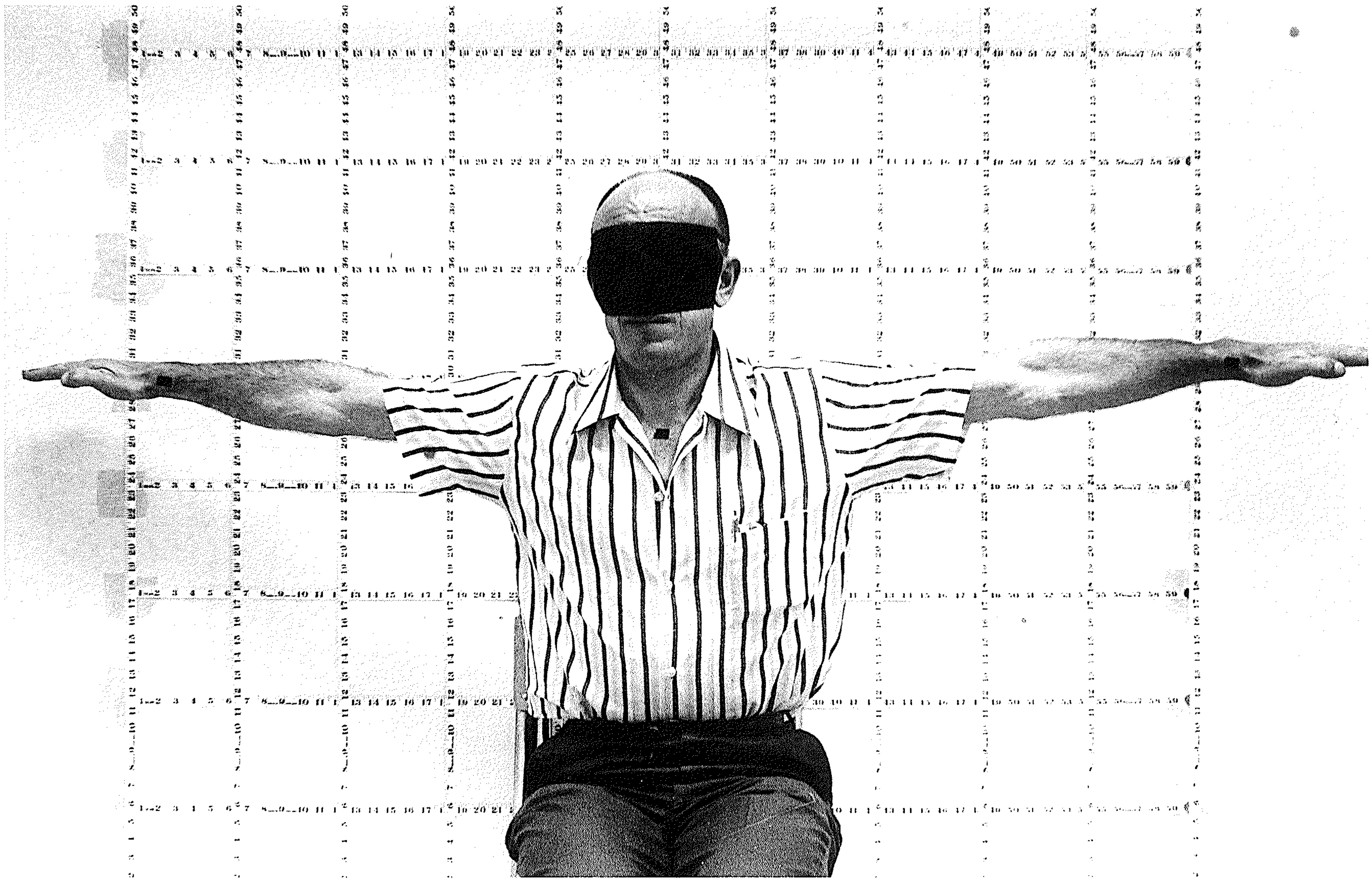


FIGURE 3

Same subject as in Figures 1 and 2 attempting to hold his arms outstretched in a frontal parallel position he judges to be horizontal while blindfolded. On this trial the arm deviation line, the straight line connecting the fingertip points, is slightly inclined to the right.

FIGURE 4

Same subject as in Figures 1-3 attempting to hold his arms outstretched in a horizontal-lateral position while blindfolded. On this trial the arm deviation line, the straight line connecting the wrist points is slightly inclined to the right. Note that Figures 1-4 have shown that the tendency to deviate to the right was consistent over the four tests for this subject.



tape 1 in. wide was fixated around the midpoint of the dowel. Stripes of black electrician's tape approximately .5 in. long was placed on each S's wrist, the tip of the middle fingers, and at the neck. These strips of tape were used to facilitate the measurement of the different postural positions. After photographing the S's in front of the grid, the strips appeared as points representing coordinates on a Cartesian graph.

A Kowa (Model, F 1.9/50 mm.) 35 mm camera was used to take the photographs of the S's during the actual testing. A very sensitive film (Tri-X 135 Pan) was used in place of flash bulbs to eliminate the possibility of visual cues.

Rod and frame test. The S's were tested in a 16.5 x 11 x 8 ft. room painted black. Two sheets dyed black covered the floor space in front of a chair where the S sat for testing. All metal objects (e.g., light switches) were masked with black tape or black paper. These steps were taken to reduce the reflection of light sources (e.g., the illumination of the rod and frame). Preliminary investigation showed that it was necessary to take these precautions in order to eliminate vague cues of horizontality and verticality. A constant temperature of 68° F. was maintained in this room for all Ss.

At all times the experimenter (E) sat in a partially enclosed control booth (2.5 x 4 x 6.67 ft.) directly behind the S. At no time could the E or the S see each other. The

Ss were placed into a specially designed chair for the visual tests. As illustrated in Figure 5, the chair was very similar to that described by Witken et al. (1962). The chair has built-in adjustments for clamping the S in an erect sitting position. Foam-rubber padding was glued to the head and shoulder braces for purposes of personal comfort to the S. Besides the upright position illustrated in Figure 5, the chair can also be tilted into the two other standard positions (28° left and 28° right) used in the RFT. The left-tilt position is illustrated in Figure 6. The position of the chair was controlled by an electric motor connected to a series of reduction gears and was operated via a microswitch-relay system by the E. The rate of tilt was 1 degree/sec.

The chair was placed 7 ft. directly in front of a commercial rod and frame device (Polymetric, Model V-1260 M-2) which is illustrated in Figure 6. The intensity of the illumination of the rod and frame was held constant for all Ss. A three-way switch (left-middle-right) controlling the movement of the rod (2.86°/sec.) was placed at the front of the arm rest to be used by the Ss during the trials. After a trial the illumination of the rod and frame was turned off by a control switch operated by E. This prevented the S from perceiving E's adjustment of the rod and frame for the next trial. A separate light switch independently controlling the illumination (on or off) of the rod and frame was also operated by E. The tilt of the rod and frame

FIGURE 5

A frontal view of the tilting chair in the upright position. As illustrated the chair has built-in adjustments for bracing the subject at the head, shoulders, hips, knees, and feet. Note the three-way control switch at the front of the right arm rest. This switch is used by the subject to control the position of the rod.

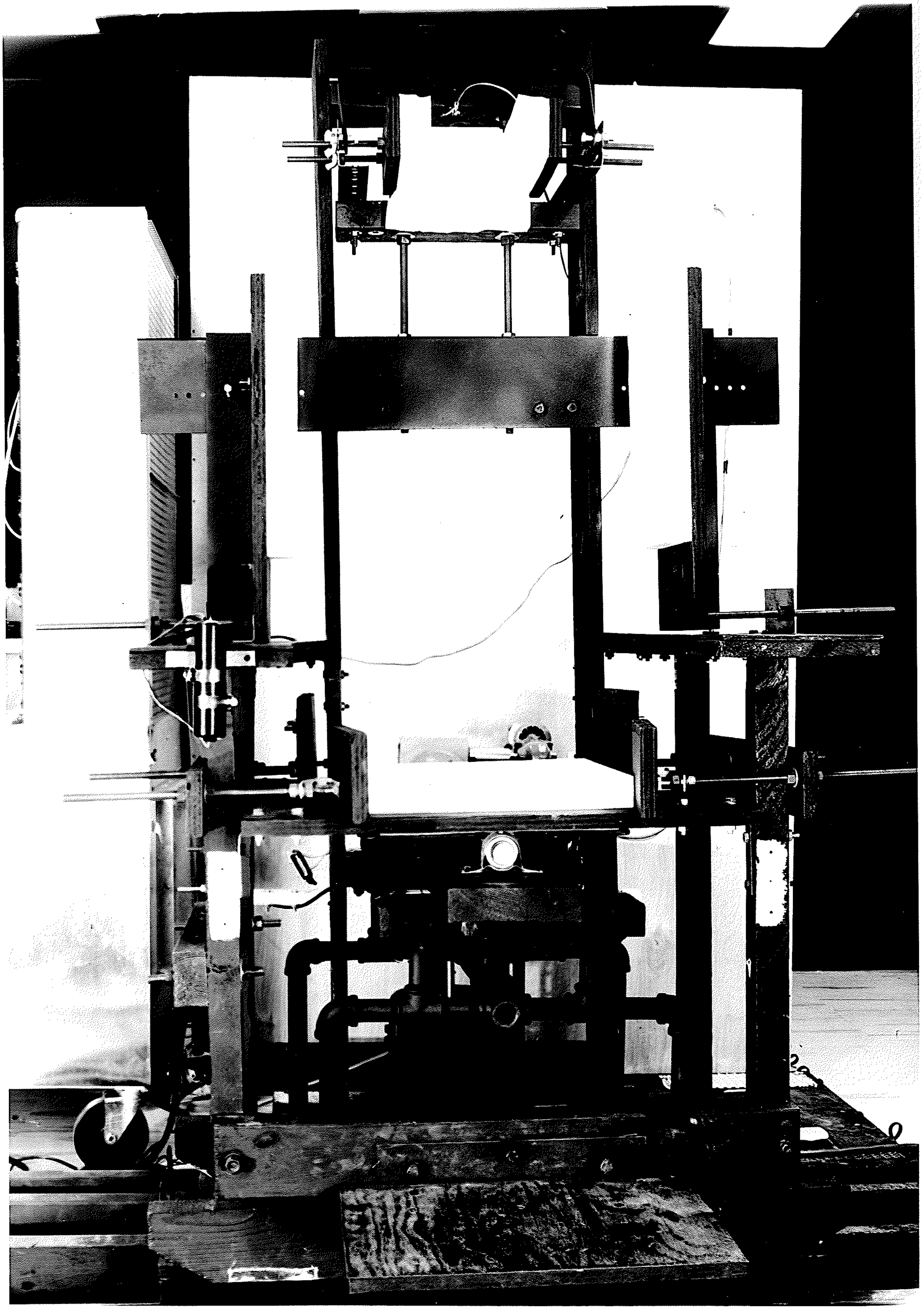
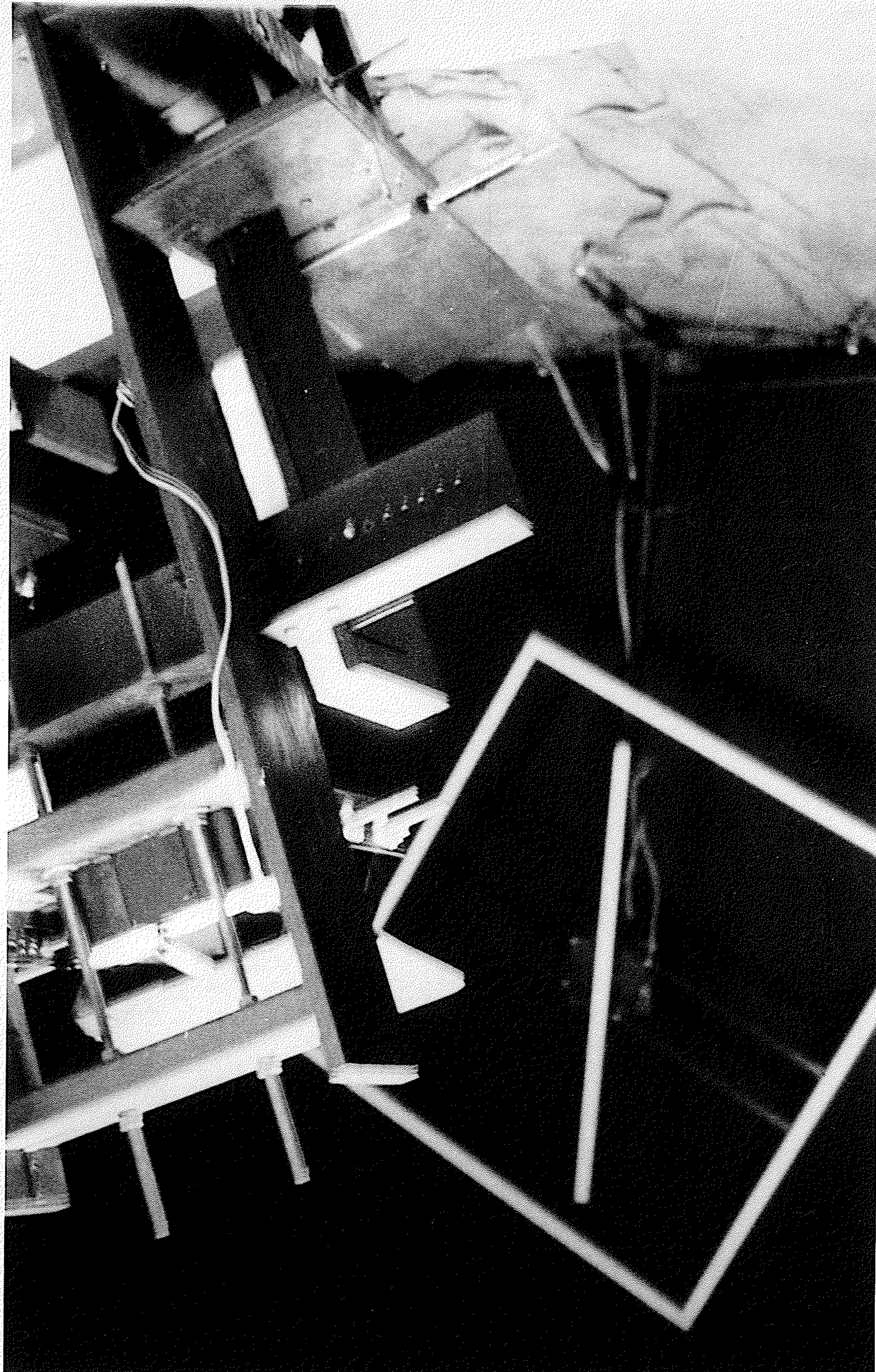


FIGURE 6

A frontal view of the rod and frame apparatus taken from behind the tilting chair in the left-tilt position.



was also controlled by an electric motor and was operated by switches in the E's control booth.

Two potentiometer's mounted on an instrument panel in the control booth continuously indicated the angle of the rod and frame. The potentiometers were used to help adjust the rod and frame to the appropriate trial positions and for recording the S's error. A S's degree of error for any particular trial was recorded precisely in the control booth where E sat.

Locomotion and body equilibrium tests. The six rails used for testing locomotion and equilibrium are illustrated in Figure 7. The rails were of metal construction with a sandblasted surface. Each one of the rails was superimposed on a wooden base and secured by bolts which also permitted leveling on uneven floors. The length, width, and height (above the base) dimensions were respectively as follows: Rail 1: 9.0 ft. x 5 in. x 3.5 in.; Rail 2: 8.0 ft. x 3 in. x 3.0 in.; Rail 3: 8.5 ft. x 2.5 in. x 4.0 in.; Rail 4: 7.67 ft. x 2 in. x 2.63 in.; Rail 5: 7.67 ft. x 1.5 in. x 4.0 in.; Rail 6: 9.0 ft. x .875 in. x 3.75 in. All Ss were required to wear laced shoes with even heels.

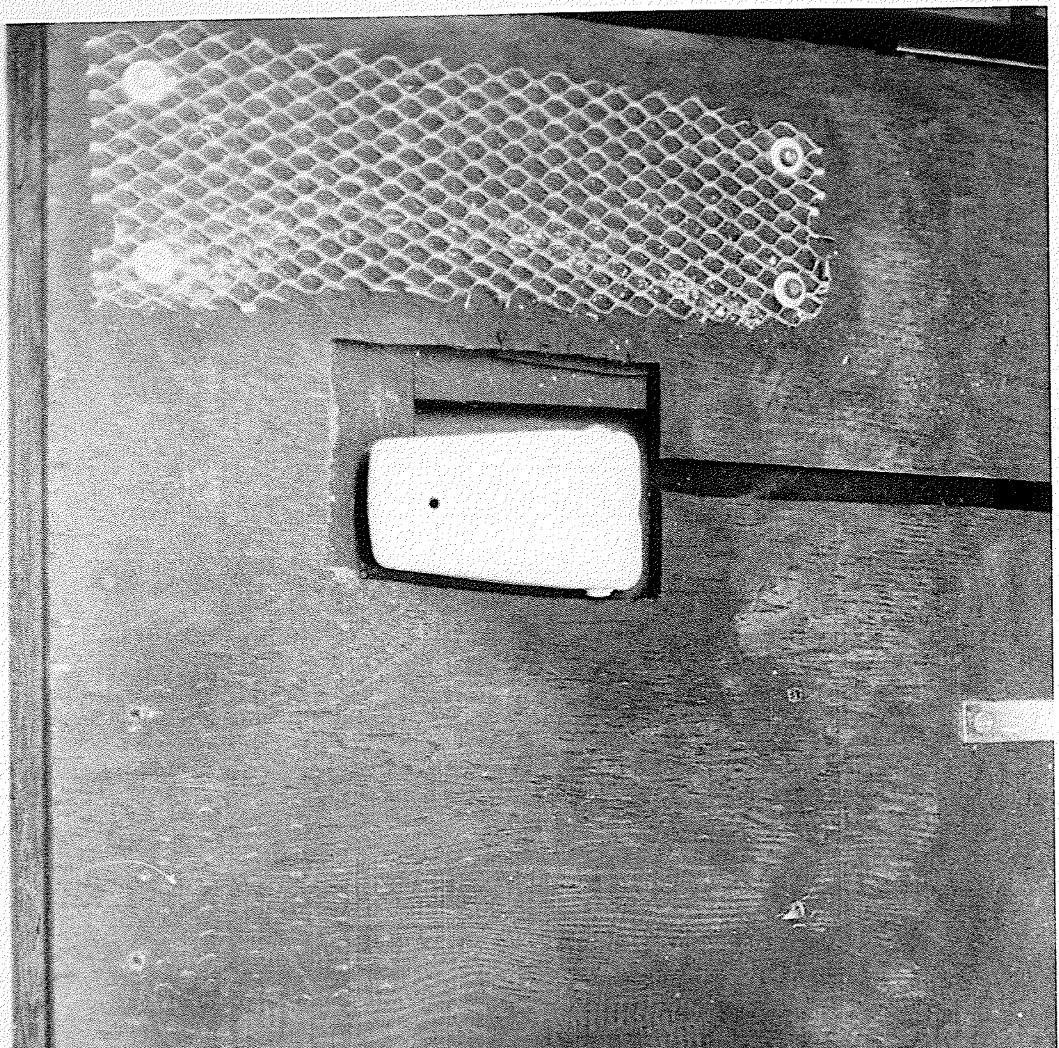
Each S was administered a test of lower extremity motility on the device illustrated in Figure 8. The length between the middle of the foot pedals is 10 in. The two spring-loaded foot pedals are each 2.5 x 3 x 4 in. and are mounted .75 in. above the surface of the wooden base. They

FIGURE 7

The six sandblasted rails used to test locomotion and equilibrium.

FIGURE 8

The two spring-loaded foot pedals used to test lower extremity motility.



are both independently connected through rheostats to 2 channels on a 6-channel Grass (Model-B) polygraph. Hence, a continuous polygraphic "spike" recording appears simultaneously upon the depression of each respective pedal.

Procedure

All Ss were first asked to fill out an information sheet. The questions included in the information sheet represented items related to the personal background of the S (e.g., age, years of education). Subjects were then administered a series of four test batteries involving body orientation in the sequential order listed in Table 3.

The test procedure is summarized as follows:

1) Subjects were brought into an experimental room where they filled out the information sheet and then were asked to perform four tests of statokinetic positioning of the arms while blindfolded.

2) The experimenter led the S blindfolded into a second experimental room which was painted black in order to reduce perceptual cues. The S was braced into a specially designed tilting chair in front of a rod surrounded by a square frame which could be illuminated in the dark. These instruments are similar to the standard apparatus described by Witken et al. (1954). Two tests were administered in this situation:

a. A total of six trials were administered in the rod test. The S's task was to adjust the tilted rod to

TABLE 3

SEQUENCE OF TEST ADMINISTRATION

Sequence of Testing	I Statokinetic Postural	II Visual	III Locomotor Ataxia	IV Statokinetic Equilibratory
	Test Battery			
1	DT/V	RD/L	LT/L	S/O
2	DT/H	RD/R	LT/R	S/C
3	AT/F	RD/U	LT/B	SR
4	AT/L	RFT/L	W/F	SOLEC/L
5		RFT/R	W/B	SOLEC/R
6		RFT/U		

AT/F = Arm Test Frontal; AT/L = Arm Test Lateral; DT/H = Dowel Test-Horizontal; DT/V = Dowel Test-Vertical; LT/B = Leg Test-Both Legs; LT/L = Let Test-Left; LT/R = Leg Test-Right; RD/L = Rod Test-Left; RD/R = Rod Test-Right; RD/U = Rod Test-Upright; RFT/L = Rod and Frame Test-Left; RFT/R = Rod and Frame Test-Right; RFT/U = Rod and Frame Test-Upright; S/C = Stand with Eyes Closed Test; S/O = Stand with Eyes Open Test; SR = Sharpened Romberg; SOLEC/L = Stand One Leg (Left) Eyes Closed; SOLEC/R = Stand One Leg (Right) Eyes Closed; W/F = Walking Heel-to-Toe Test Forward; W/B = Walking Heel-to-Toe Test Backward.

a vertical position while only the rod was illuminated. On four of the trials the S was tilted 28° to the left and right. On the remaining two trials the S was in an upright position. All judgments of verticality were made when the S was in a static position.

b. A total of 24 trials were administered in the rod and frame test. The Ss task was to adjust the tilted rod to a vertical position while both the rod and frame were illuminated. On 16 of the trials the S was tilted 28° to the left and right. On the remaining 8 light trials the S was in an upright position. All judgments of verticality were made when the S was in a static position.

3) Subjects were removed from the tilting chair in front of two foot pedals which measure lower extremity motility. Subjects were required to make rapidly alternating movements with their legs. Each leg was examined separately, and then both legs were examined simultaneously.

4) Subjects were led into another room in which a series of six rails of progressively narrower dimensions located. This test required the Ss to stand and walk heel-to-toe forwards and backwards on the rails.

5) Subjects were led into a final experimental room where they were given three clinical tests used for assessing ataxia.

1) Statokinetic Postural Test Battery (SPTB). The SPTB includes four tests which resemble those described by

Halpern (1949, 1951). Halpern used a close facsimile of the tests to assess the effects of cerebellar brain damage on posture. Deviations in body-limb posture were assessed by observing the statokinetic positioning of the limbs while Ss held their eyes closed. In each of the postural tests included in this study Ss were blindfolded, and postural positions were recorded by photographing the S while performing various statokinetic tasks. In each of the tests two trials were administered.

Each S was shown the four photographs illustrating the SPTB (Figures 1-4). The Ss were instructed to replicate the positions in exactly the same manner as illustrated by the S in the picture. To insure that the S understood the correct positions, the experimenter asked the S to assume each position with his eyes open. Any positioning errors were corrected by the experimenter.

The horizontal and vertical lines behind each S illustrated in Figures 1-4 were used as a true graphical frame of reference for measuring postural deviation. A piece of black masking tape was placed in the middle of each S's neck, at the wrists, and on the tip of the middle finger of each hand. These pieces of black tape show up as points on the graph and were used for measuring after the photographs were developed.

a. Dowel Test-Vertical (DT/V). The S was given a dowel 47 inches long and .75 inches in diameter while in a standing position. While holding the dowel in a horizontal position, E placed each hand of the S one ft. from the midpoint of the rod. He was then instructed to hold it still in a vertical position in front of his body with arms outstretched. The photograph was taken 10 seconds after the S reported that the dowel was in the vertical position. After the photograph was taken the S was told to relax his arms and the second trial was repeated the same way after a 15-second rest period.

The DT/V was measured by first drawing a line parallel to the vertical reference lines through the midpoint of the dowel. Another line was drawn which coincided with the dowel. The degree of dowel deviation was defined by the angle of the intersecting straight lines. The DT/V is illustrated in Figure 1.

b. Dowel Test-Horizontal (DT/H). This test is the same as the DT/V except that the S was instructed to place the rod in a horizontal position.

The DT/H was measured by first drawing a line parallel to the horizontal reference lines through the midpoint of the dowel. Another line was drawn which coincided with the dowel. The degree of deviation was defined by the angle of the two intersecting straight lines. The DT/H is illustrated in Figure 2.

c. Arm Test Frontal (AT/F). The S was seated in a chair facing the camera. Upon E's request the S raised his arms outstretched in a frontal-parallel position he judged to be horizontal. The photograph was taken 10 seconds after the S reported that he had his hands in the proper position. After the photograph was taken the S is told to relax his arms and the second trial was repeated in the same way after a 15-second rest period.

The AT/F was measured by first drawing a straight line connecting the finger tip points. This line is called the arm deviation line. The degree of arm deviation is represented by the angle defined by the intersection of a horizontal reference line with the arm deviation line. The AT/F is illustrated in Figure 3.

d. Arm Test-Lateral (AT/L). This test is the same as the AT/F except that the S was instructed to raise his arms into a lateral position. The scoring procedure is the same as in the AT/F except that the arm deviation line is defined by the straight line connecting the two wrist points. The AT/L is illustrated in Figure 4.

2) Visual Test Battery (VTB). The VTB included two tests each having three subtests. The rod test (RD) is a visual-statokinetic postural test and the rod and frame test (RFT) is a visual-organizational-statokinetic postural test.

a. Rod Test (RD). After being led into the experimental room still blindfolded from the SPTB, the S was guided into the tilting chair illustrated in Figure 5. The S was seated into the middle of the chair which was in the upright position. The S was told that it was necessary that he be braced into this position to eliminate the misalignment of his body. The head, shoulders, hips, knees, and feet were braced into position by tightening all the body braces.

After it was insured that the S understood the task the head mask was lowered in front of the S's eyes, the lights turned off, and the S's blindfold removed. After approximately one minute the E raised the face mask and began the testing.

The S was given six trials in which the body was sequentially tilted to the left for two trials (RD/L), tilted to the right for two trials (RD/R) and upright for two trials (RD/U). The position of the rod was alternated 28° to the left and right of true vertical. Deviations from the vertical are expressed as being "to the left" when the top of the rod is inclined to the S's left, and "to the right" when the top is inclined to the S's right.

b. Rod and Frame Test (RFT). As mentioned above the task on the RFT requires the S to make visual judgments of verticality while the rod is surrounded by the frame. As in the RD the illumination is turned on and off at the start and end of each trial.

The S is given a total of 24 trials in which the body is sequentially tilted to the left for eight trials (RFT/L), tilted to the right for eight trials (RFT/R) and upright for two trials (RFT/U). The position of the rod is alternated 28° to the S's left and right. In Series I (trials 1, 2, 5, 6, 11, 12, 15, and 16) the body and frame are tilted to the same side. In Series II (trials 3, 4, 7, 8, 9, 10, 13, and 14) the body and frame are tilted to opposite sides. In Series III (trials 17-24) the body is erect and the frame tilted. The procedure is identical to the one described by Witken et al. (1954).

3) Leg ataxia test battery (LATB). The LATB includes the following subtests which measure leg coordination. There are five tests in this battery:

a. Leg test-left (LT/L). This test requires the S to make rapidly alternating movements with the left leg while sitting in front of the instrument illustrated in Figure 8. The S was instructed to tap each foot pedal as rapidly as he can for 15 seconds starting with the left pedal.

The LT/L is measured by counting the millimeters between each left leg spike on the polygraphic record. The mean number of seconds between left-right-left movements represents the average reaction time for alternate left leg movements on this test. The variability represents the extent of incoordination in the left leg.

b. Leg test-right (LT/R). This test is the same as the LT/L except that the S performs the leg movements with the right leg and starts with the right pedal. The scoring procedure is the same as in the LT/L except that the mean and variability represent the movement data for the right leg.

c. Leg test-both legs (LT/B). This test is similar to the other two leg tests except that the S performs the leg movements with both legs. The S is instructed to tap the left foot pedal with the left leg and the right foot pedal with the right leg as rapidly as he can for 15 seconds starting with the right pedal.

The LT/B is measured by counting the millimeters between the alternating spikes of the two legs on the polygraphic record. The mean number of seconds between the left and right movements represent the average reaction time for alternate leg movements on this test. The variability represents the extent of incoordination between the two legs.

d. Walking heel-to-toe test forward (W/F). The procedure used in testing Ss on the W/F was identical to that of Graybiel and Fregly (1965). The W/F requires the S to walk heel-to-toe with shoes on along a series of six rails of progressively narrower dimensions. During the testing on all the rails the body must be erect, arms folded against the chest, feet in heel-to-toe position, and tandemly aligned. The higher scores on two out of three trials constitutes the scoring for each particular rail. After the final two steps each succeeding step is scored as one (step). The maximum number of steps per trial is five. Hence, the maximum score per trial is five, the maximum rail score is 10, and the maximum test score equals 60.

e. Walking heel-to-toe test backward (W/B). This test is the same as the W/F except that the S walks backward. Both the W/F and W/B can be illustrated by observing the S in Figure 9.

4) Statokinetic equilibratory test battery (SETB). In the SETB the same six rails used in the W/F and W/B tests, and the floor are used for measuring statokinetic equilibrium. The procedure used in testing Ss on the tests in the SETB is identical to that of Fregly and Graybiel (1968). Each of the tests requires the S to maintain static body equilibrium while in various body positions. There are five tests in the battery:

a. Stand with eyes open test (S/O). The S/O requires the S to stand heel-to-toe with shoes on and eyes open on the series of six rails of progressively narrower dimensions. During the testing on the rails the body must be erect, arms folded against the chest, feet in heel-to-toe position and tandemly aligned.

FIGURE 9

A subject attempting to walk forward on the rail which is 2.5 inches wide. This subject is demonstrating the correct posture for the test (W/F). His body is erect, his arms are folded at the chest, and his feet are tandemly aligned as he walks heel-to-toe down the rail.

The S/O is a timed test. The timing of each trial begins as soon as the correct balanced position on the rail is assumed. A trial is the period of time the *S* can stand in the above body position without violating his position or when 60 seconds has expired. The higher scores on two out of three trials constitutes the scoring for each particular rail. Hence, the maximum rail score equals 120, and the maximum test score equals 720.

b. Stand with eyes closed test (S/C). This test is the same as the S/O except that it requires *S* to keep his eyes closed. The timing of each trial begins as soon as the correct balanced position on the rail is assumed and the *S* closes his eyes. A trial is the period of time the *S* can stand in the above body position without violating his position, opening his eyes, or when 60 seconds has expired. This test and the S/O can also be illustrated by observing the *S* in Figure 9.

c. Sharpened Romberg (SR). In the SR test the *S* stands on the floor with his feet in heel-to-toe position and tandemly aligned. The body must be erect with the arms folded against the chest and the eyes closed.

The SR is a timed test. The timing for each trial begins as soon as the correct balanced position on the floor is assumed and the *S* closes his eyes. Four trials are administered. A trial is the period of time the *S* can stand in the above body position without violating his position, opening his eyes, or when 60 seconds has expired. The scores for each of the four trials are summed. Hence, the maximum trial score equals 60, and the maximum test score equals 240.

d. Stand one leg (left) eyes closed (SOLEC/L). In the SOLEC/L the *S* stands on the floor with his left leg with his eyes closed. During the testing of the left leg the body must be erect, and the arms folded against the chest.

The SOLEC/L is a timed test. The timing of each trial begins as soon as the correct balanced position on the floor is assumed and the *S* closes his eyes. Five trials are administered. A trial is the period of time the *S* can stand in the above position without violating his position, opening his eyes, or when 30 seconds has expired. The score for each of the five trials are summed. Hence, the maximum trial score equals 30, and the maximum test score equals 150.

e. Stand one leg (right) eyes closed (SOLEC/R). This test is the same as the SOLEC/L test except that the *S* stands with his right leg.

CHAPTER 3

RESULTS

The main analysis of the data was in terms of the difference in performance between alcoholic, control, and brain damaged groups. Since each group of subjects was observed under more than one treatment condition (i.e., postural and visual tests) the results were evaluated by a multifactor analysis of variance with repeated measures. The analysis of variance was followed by an application of the Scheffé test for the multiple comparison between means. A secondary analysis of the data includes a series of correlations between each test battery and the conditions of the RFT. The analysis of variance revealed the following group effects:

1) The three groups did not differ under any of the conditions of the Visual Test Battery ($F = 2.258$, $df = 2/30$, $p < .20$) or the Statokinetic Postural Test Battery ($F = .037$, $df = 2/30$, $p < .05$). The means of the visual tests are illustrated in Figure 10.

2) Group effects were noted under the conditions (LT/L, LT/R, LT/B) of the leg test ($F = 27.182$, $df = 2/30$, $p < .001$). The Scheffé test ($df = 2/30$, $p < .01$) indicated that the cerebellar group differed from the alcoholic and

Group means of the two visual tests (RD and RFT) each under the three conditions of body tilt: subjects tilted left, right, or upright.

control groups on each of these conditions. There was no differences found between alcoholic and control groups. Group effects were noted under the conditions (W/F and W/B) of the rail walking test ($F = 15.682$, $df = 2/30$, $p < .001$). On both the W/F and the W/B conditions the Scheffé test ($df = 2/30$, $p < .01$) indicated that the control group walked significantly more steps on the rails than the brain damaged group. The alcoholic group did not differ from the control group or the brain damaged group. However, as illustrated in Figure 11, the mean level of performance for the alcoholics differed in a direction similar to the brain damaged group. Both the leg test and the rail walking tests define the locomotor Ataxia Test Battery.

3) Group effects were noted under the conditions (S/O and S/C) of standing on the rails ($F = 24.219$, $df = 2/30$, $p < .001$). There was a highly significant interaction ($F = 22.515$, $df = 1/30$, $p < .001$) on the S/O-S/C conditions. Subsequent simple effects analyses of variance revealed that there was a group difference on both the S/O ($F = 38.89$, $df = 2/30$, $p < .001$) and the S/C ($F = 7.52$, $df = 2/30$, $p < .001$) conditions. The Scheffé test ($df = 2/30$, $p < .01$) indicated that on both of these tests the control group differed from the brain damaged group, but the alcoholic group did not differ from either the control or brain damaged groups (Figure 12). The mean level of performance of the alcoholics again differed in a direction similar to the brain damaged group. Group effects were also found with

Group means of a rail test under two conditions: subjects walking forward (W/F) or backward (W/B).

Group means of a rail test under two conditions: subjects standing with eyes opened (S/O) or closed (S/C).

the Sharpened Romberg test ($F = 8.25$, $df = 2/30$, $p < .005$) and the conditions (SOLEC/L and SOLEC/R) of the standing-on-one-leg test ($F = 5.650$, $df = 2/30$, $p < .01$). It is interesting to note that on these tests the Scheffé test indicated ($df = 2/30$, $p < .01$) that the controls also differed (stood longer) from the brain damaged group, but that the alcoholics did not differ from the control group or the brain damaged group. Consistent with the previous findings is the observation that the alcoholics tend to differ in a direction similar to the cerebellar group. The SOLEC exemplifies this relationship as illustrated in Figure 13.

A major prediction (1) made in Chapter 2 (p. 27) was not confirmed. The statistical analysis stated above did not support the hypothesis that alcoholic and control groups would differ on each of three batteries of sensorimotor tests of posture, locomotion and body equilibrium. Predictions (2a) and 2b) were confirmed. The cerebellar brain damaged group was characterized by higher error ($\overline{X} = 17.127$) than the control group ($\overline{X} = 9.596$) on the tests involving visual judgments of verticality. The alcoholic group also differed ($\overline{X} = 16.274$) from the control group in a direction similar to that of the cerebellar group on the visual tests.

Additional findings were the following.

The difference between the performance of all subjects on the RD and RFT (having the greatest error) was significant

Group means of an equilibratory test under two conditions: subjects standing with the left leg only (SOLEC/L) or right leg only (SOLEC/R).

(df 2/30, $p < .01$). The Scheffé test (df = 2/30, $p < .01$) further indicated that there was a difference between the combined (RD and RFT) means on the body-tilt-left conditions and the body-upright conditions. Although the body-tilt-left conditions and the upright conditions did not differ the direction was in agreement with the general finding (Teuber and Mishkin, 1954; Witken et al., 1962) that the tilted positions are associated with greater perceptual error.

There was some support for the prediction (2c) that the difference between the error made in the body-upright positions and the body-tilted positions would be greater among the cerebellar patients ($\overline{X} = 11.062$) than the controls ($\overline{X} = 5.673$).

It was noted above that none of the four tests of the Statokinetic Postural Battery differentiated between the three groups. The only difference found in the analysis of this battery was a test effect ($F = 19.571$, df = 3/90, $p < .001$). The Scheffé test indicated that the means of DT/V, DT/H, and AT/F each differed from the mean of the AT/L.

<u>Correlations</u>. The various correlations between the different conditions of the RFT and each test battery are included in Tables 4-15. The different measures are listed in accordance with the major test abbreviations. Tables 4-7 are reported for all subjects (N = 33), Tables 8-11 are

TABLE 4

CORRELATIONS FOR ALL SUBJECTS ON ALL MEASURES OF THE RFT AND RD

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
RD/L	.61**	.68**	.27	.68**	.61**
RD/R	.51**	.49**	.01	.54**	.41*
RD/U	.35*	.64**	.47**	.56**	.56**
RD/T	.60**	.57**	.10	.61**	.51**
RD	.59**	.71**	.31	.70**	.63**

*$p < .05$
**$p < .01$

TABLE 5

CORRELATIONS FOR ALL SUBJECTS ON ALL MEASURES OF THE RFT AND TESTS OF THE SPTB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
DT/V	.05	.10	.19	.13	.12
DT/H	.18	.13	-.10	.20	.10
AT/F	.28	.21	-.08	.25	.16
AT/L	.27	.29	.31	.23	.32
SPTB	.33	.31	.03	.35*	.26

*p < .05
**p < .01

TABLE 6

CORRELATIONS FOR ALL SUBJECTS ON ALL MEASURES OF THE RFT AND TESTS OF THE LATB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
LT/L	.13	.09	.31	.09	.19
LT/R	.18	.09	.28	.11	.20
LT/B	.08	.07	.30	.05	.16
W/F	-.44*	-.61**	-.62**	-.57**	-.64**
W/B	-.46**	-.71**	-.68**	-.65**	-.71**

*p < .05
**p < .01

TABLE 7

CORRELATIONS FOR ALL SUBJECTS ON ALL MEASURES OF THE RFT AND TESTS OF THE SETB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
S/O	-.40**	-.56**	-.39*	-.53**	-.53**
S/C	-.52**	-.69**	-.54**	-.66**	-.67**
S/R	-.40*	-.57**	-.50**	-.53**	-.57**
SOLEC/L	-.47**	-.54**	-.51**	-.56**	-.58**
SOLEC	-.48**	-.61**	-.53**	-.59**	-.62**

*p < .05
**p < .01

TABLE 8

CORRELATIONS FOR ALCOHOLICS ON ALL MEASURES OF THE RFT AND RD

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
RD/L	.44	.66**	.45	.61*	.58*
RD/R	.19	.35	.11	.36	.25
RD/U	.52*	.72**	.47	.67**	.64**
RD/T	.37	.57*	.31	.55*	.47
RD	.48	.68**	.41	.65*	.60*

*p < .05
**p < .01

TABLE 9

CORRELATIONS FOR ALCOHOLICS ON ALL MEASURES
OF THE RFT AND TESTS OF THE SPTB

	RFT/L	RFT/R	RFT/U	RFT/R	RFT
DT/V	.10	.29	.48	.29	.33
DT/H	-.04	.20	.28	.19	.18
AT/F	.10	.24	-.03	.22	.13
AT/L	.38	.19	.21	.19	.27
SPTB	.23	.44	.35	.42	.39

*$p < .05$
**$p < .01$

TABLE 10

CORRELATIONS FOR ALCOHOLICS ON ALL MEASURES OF THE RFT AND TESTS OF THE LATB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
LT/L	.33	.42	.48	.38	.45
LT/R	.41	.18	.42	.21	.34
LT/B	.40	.09	.26	.18	.24
W/F	-.61*	-.75**	-.84**	-.75**	-.81**
W/B	-.51	-.11	-.52*	-.35	-.46

*$p < .05$
**$p < .01$

TABLE 11

CORRELATIONS FOR ALCOHOLICS ON ALL MEASURES OF THE RFT AND TESTS OF THE SETB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
S/O	-.35	-.66**	-.40	-.60*	-.54*
S/C	-.47	-.69**	-.53*	-.65**	-.63*
SR	-.48	-.57*	-.49	-.53*	-.56*
SOLEC/L	-.44	-.46	-.52*	-.49	-.52*
SOLEC/R	-.46	-.56*	-.55*	-.55*	-.58*

*$p < .05$
**$p < .01$

TABLE 12

CORRELATIONS FOR CONTROLS ON ALL MEASURES OF THE RFT AND RD

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
RD/L	.81**	.69*	.24	.77*	.73*
RD/R	.64*	.56*	-.14	.61*	.50
RD/U	.25	.50	.09	.39	.36
RD/T	.77**	.50	-.01	.64**	.57*
RD	.68**	.60*	-.01	.66**	.58*

*p < .05
**p < .01

TABLE 13

CORRELATIONS FOR CONTROLS ON ALL MEASURES OF THE RFT AND TESTS OF THE SPTB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
DT/V	-.01	-.16	-.54*	-.06	-.21
DT/H	.27	.25	.08	.33	.26
AT/R	.50	.25	-.13	.35	.30
AT/L	-.06	.22	.30	.01	.15
SPTB	.42	.20	-.39	.32	.18

*p < .05
**p < .01

TABLE 14

CORRELATIONS FOR CONTROLS ON ALL MEASURES
OF THE RFT AND TESTS OF THE LATB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
LT/L	.05	-.07	.48	-.10	.10
LT/R	-.11	-.17	.30	-.24	-.05
LT/B	-.12	-.12	.10	-.17	-.08
W/F	.17	.10	.13	.13	.11
W/B	-.02	-.39	-.39	-.21	-.29

*$p < .05$
**$p < .01$

TABLE 15

CORRELATIONS FOR CONTROLS ON ALL MEASURES OF THE RFT AND TESTS OF THE SETB

	RFT/L	RFT/R	RFT/U	RFT/T	RFT
S/O	-.26	-.47	-.39	-.44	-.44
S/C	-.41	-.62*	-.30	-.57*	-.54*
SR	-.01	-.33	-.29	-.27	-.23
SOLEC/L	-.35	-.44	-.23	-.48	-.42
SOLEC/R	-.31	-.51	-.13	-.48	-.40

*p < .05
**p < .01

reported for the alcoholic group (N = 15), and Tables 12-15 for the control group (N = 15).

The most consistent correlations which reached significance occurred among the tests of the Statokinetic Equilibratory Test Battery. The equilibratory tests formed a very stable cluster as high correlations were noted for all subjects on every test in the battery. Another finding is that the RD correlates with the RFT regardless of the subject breakdown. The rail walking tests were found to yield high correlations with the RFT conditions especially among the group of alcoholics. The only test battery which failed to yield a significant cluster was the Statokinetic Postural Test Battery. The leg tests (LT/L, LT/R, and LT/B) similarly failed to yield significant correlations.

CHAPTER 4

DISCUSSION

The findings of this study can be summarized in terms of the rod and frame test and the three batteries of postural tests.

1) The results of the rod and frame test scores among alcoholics did not confirm previous findings (e.g., Witken et al., 1962) of greater field dependence among alcoholics. However, the failure to reach significance was largely due to the high rate of variability noted among the three groups. The mean perceptual error for each group confirmed the prediction that the cerebellar brain damaged subjects would be characterized by the highest degree of perceptual error. The alcoholics performed in a direction similar to the cerebellar group in contrast to the control group. Reference to the test data revealed that neither the alcoholics or the controls formed homogeneous groups on the basis of a continuum of perceptual error. The results of this study are consistent with the findings of Goldstein and Chotlos (1965) and McCarthy (1967) who have noted a similar "heterogeneity effect" in perceptual error among alcoholics.

This "heterogeneous effect is an important point which deserves more attention. A close examination of the data revealed that on most of the conditions investigated in this study the alcoholics were found to be characterized by higher levels of variability than the control group. An inspection of Figures 10-13 which illustrates the comparison of means between groups fails to reflect the dispersion of scores. Such comparisons do not reflect the high level of differentiation within the alcoholic group. A brief discussion of the RFT will exemplify this point.

The range of scores for the alcoholic group is 7.00°-41.75° whereas in the control group the range is only 4.67°-22.71°. The subjects of this study can be placed into three levels. The first level reflects the lowest perceptual error and can be represented by the range of 4°-14°. The second level, 17°-33° represents a higher range of error, and the third level of 39° and higher can be thought of as representing extreme error. It is interesting to note that while most of the controls (N = 10) score in the first level there are six alcoholics who performed in this range. Hence, one finds that there are alcoholics who perform at levels comparable to controls. In general the RFT data reveals that alcoholics tend to gravitate towards the end of the scale representing poorer performance. In the second level there are five controls and seven alcoholics. There were no control subjects found in the third level.

The two alcoholics who scored at this level represent subjects whose performance is extremely deviant.

This brief inspection of the RFT results exemplifies the fact that the alcoholics in this study spanned a wide range of performance. The wide dispersion noted in the RFT scores was also found among alcoholics on the other tests of this study. Some alcoholics outperformed some of the control subjects. Based on Witken's (1962) cut off point of 8° error on the RFT there are five control subjects who can be "classified" as field independent. There was one alcoholic who reached this level of perceptual performance, thereby surpassing the ten other controls. On the other hand one can take note of the extremely deviant scores of the two alcoholics in the third level (39.13° and 41.75°). It should be noted that these two scores even surpass the degree of frame tilt (28°).

One important finding of this study that the alcoholics were characterized by a wider range of perceptual-postural ability than the control subjects. A close inspection of the data (see Tables 20-23 in the Appendix) revealed that a comparison by only mean performance obscures the more important finding of high within group variability. Hence, the general findings are in agreement with those of Goldstein and Chotlos (1965) and McCarthy (1967) who observed a "heterogeneous effect" on the performance of alcoholics.

The rod test can be thought of as a test of posture because it does not include the influence of the surrounding frame. The finding that the rod test presents less of a perceptual problem to subjects is consistent with Klappersack's study (1968). However, all the correlations between the rod test and the rod and frame test in this study were higher than those Klappersack reported. His correlation (36, $p < .05$) failed to reach significance for the alcoholic group. Furthermore, the results of this study revealed that there are significant relationships between the two tests on each one of the body positions.

2) It is difficult to offer an explanation as to why the four tests of statokinetic positioning failed to differentiate between the groups. The arms-frontal test was characterized by the most error. It significantly differed from the other three tests of statokinetic positioning, but like the other tests failed to differentiate between the groups. In light of the fact that Halpern (1949, 1951) noted arm deviations among his cerebellar patients it was perplexing to note that the cerebellar group in this study failed to differ from the other two groups. One would almost suspect from the data of this study that the tests were not sensitive to dysfunction at the cerebellar level.

It may have been possible that the nature of the cerebellar lesions in this study differed from those reported by Halpern (1949, 1951). In these two studies Halpern observed that the patients who were diagnosed as having one-sided (hemispheric) lesions were characterized as having consistent ipsilateral deficits on each one of his tests. None of the cerebellar patients in this study demonstrated this phenomenon. This clinical sign might have been suspected of the cerebellar patient who was diagnosed as having a right-sided hemispheric lesion. However, she was observed to deviate on both sides (left and right). If subsequent research validates the conjecture that the arm deviations only occur in conjunction with particular localized areas of cerebellar dysfunction the tests would be of special interest to clinical neurologists who welcome tests which are sensitive to restricted areas of degeneration. It is uncertain as to whether or not there were any methodological differences which might account for the negative results of this test.

3) The cerebellar patients were found to be characterized by impaired lower extremity motility on each of the three leg tests. There failed to be a significant difference between the alcoholic and control groups although on each of the three tests there was a consistent tendency for the alcoholics to perform the rapidly alternating movements slower. Two of the alcoholic subjects performed at a level near the cerebellar patients suggesting a possible organic deficit. This conclusion was reached in light of further evidence which revealed that the same two alcoholics were not able to perform the tests of body equilibrium or

walk on the rails. The leg tests did not correlate at an acceptable level with measures of the RFT, but it is significant to note that each of the leg tests correlated ($p < .01$) with the test requiring subjects to walk forward on the rails (W/F). Each leg test also correlated ($p < .05$) with the test requiring subjects to walk backwards on the rails. The two rail walking tests proved to be highly indicative of RFT performance for all subjects.

The rail walking tests (W/F and W/B) differentiated among the groups in the direction predicted. Klappersack failed to reach an acceptable degree of correlation with the RFT using a similar rail walking test. It is possible that methodological differences could account for the inconsistency of results. Klappersack only used three rails and one of them was only 1 in. wide. Our data revealed that only a few alcoholic subjects were able to complete Rail 5 which is 1.5 in. wide. None of the alcoholics in this study were able to perform on Rail 6 which is .875 in. wide. It is questionable as to whether or not Klappersack's testing procedure was in accordance with the standardized procedure outlined by Graybiel and Fregly (1965). Klappersack scored according to the length walked on the rails instead of the number of steps. Secondly, he did not state whether he required his subjects to walk erect in a heel-to-toe fashion with the feet tandemly aligned, arms folded at the chest, and body erect. This point deserves special attention because if Graybiel's conditions had not been rigidly controlled in this study the alcoholics would have increased their performance on the rails. This methodological error complicated by the fact that only three rails were used, one of which could have been lacking in "discriminative power" could have resulted in a failure of his test to differeniate among subjects effectively; consequently one would suspect a "homogeneity effect" in his correlations with the RFT.

4) All the tests in the statokinetic battery were found to yield data which were consistent with the contention that alcoholics (e.g., Goldstein and Chotlos, 1965) can be placed along a continuum of organic deterioration. On the equilibratory tests the alcoholics approached the level of performance which was comparable to the impaired performance of the brain damaged group. The results for all the subjects on the tests in this battery reached a highly significant ($p < .01$) degree of correlation with the RFT. This cluster of correlations suggests that the equilibratory tests which all have in common the capacity for differentiating subjects on the ability to maintain balance all appear to be highly supportive instruments for confirming the viewpoint that postural components of equilibrium are related to rod and frame performance.

The results of this study suggest that alcoholics can be regarded as individuals who suffer idiosyncratic levels of postural dysfunction. On the basis of the results observed it would be misleading to classify alcoholics as a homogeneous group characterized by a field dependent perceptual orientation. Alcoholics on the other hand can be placed along an intact-deteriorated dimension of postural equilibrium. An evaluation of this dimension has revealed "equilibratory clusters" which correlate highly with the rod and frame test. Although the alcoholics tended to score in a direction similar to the brain damaged group on the equilibratory tests it is too premature to conclusively attribute the differences observed to a cerebellar dysfunction. By comparing the level of performance of the alcoholics with that of the brain damaged patients and control subjects the results of this study can only indirectly support the contention that disequilibrium among alcoholics is due to a cerebellar impairment.

A discussion of the over-all status of the construct of field dependency has been circumvented. The empirical data of this study has shown a high relationship between tests of posture and field dependency. It should be emphasized however that the relationships observed cannot refute or confirm the theoretical position held by Witken. That is, it is possible that in alcoholic field dependency a kind of "perceptual conflict" occurs and hence the "externally oriented" alcoholic is prone to rely heavily on the erroneous position of the frame as an external referent when in a situation devoid of other environmental cues.

Brief interviews held with the alcoholics after testing suggested that a perceptual reliance on the frame may have occurred among some alcoholics which may have influenced their decision making during the adjustment of the rod to a vertical position. One alcoholic subject reported "I didn't know where I was but the frame looked straight up and down so I put it in line with it". In fact it is interesting to note that this response bias seemed to be especially true of the cerebellar patients. Assuming that it is this reliance which accounts for the perceptual error as Witken has argued (and this study would casually support this viewpoint) further research is needed before one can cogently accept the premiss that predispositional personality variables account for the "external orientation" a subject brings with him into the testing situation.

CHAPTER 5

SUMMARY

The primary focus of this study was to examine the relationship between rod and frame performance and posture among alcoholics. An alternative to Witken's "predispositional hypothesis" was presented. The "consequential hypothesis" was interpreted as suggesting that field dependency among alcoholics reflects an organic dysfunction of postural mechanisms. Hence, the study was undertaken to explore the long-range hypothesis that the extreme error of judgment in verticality on the Witken task noted among alcoholics (e.g., Goldstein and Chotlos, 1965) could be due to the physiological effects of alcohol on the central nervous system. It was pointed out that structural lesions in the cerebellar vermis have been observed among alcoholics and that this area is known to be associated with postural functioning. It is this relationship which provided the basic rationale to the study.

Postural mechanisms are associated with the Witken perceptual task because the judgment of verticality made under the experimental conditions necessitates an assessment of one's postural relationship to gravity. Hence, it was hypothesized that postural differences would account for the perceptual differences among alcoholics. In order to determine whether postural abilities relate to rod and frame performance three areas of postural functioning were investigated: statokinetic positioning, locomotion, and equilibrium. A group of cerebellar patients was included to validate the contention that cerebellar dysfunction would result in impaired performance on the tests included in the study.

The results indicated that:

1) The brain-damaged group of subjects who were diagnosed as having cerebellar lesions were inferior to the other two groups on the RFT and all the tests of posture. The alcoholics tended to perform in a direction similar to the cerebellar patients especially on the tests of statokinetic equilibrium.

2) Contrary to previous findings alcoholics were not found to be significantly more field dependent than controls. However, there was a tendency for all groups to perform as predicted on the RFT. The RD was found to correlate highly with the RFT among all subjects.

3) Clusters of high correlations confirmed the major premiss of the study. This premiss focused on the significance of postural components as sources of determinents in field performance among alcoholics.

On the basis of this study it was concluded that alcoholics do not form a homogeneous perceptual group and that Witken's "predispositional hypothesis" may be in need of qualification.

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APPENDIX

TABLE 16

STUDIES OF FIELD DEPENDENCY IN ALCOHOLICS
AS MEASURED BY WITKEN'S PERCEPTUAL BATTERY

Study		Group	N	Age	Mean Age	Battery Score
Witken et al. (1959)	I	HA	20	20-40	30.1	+ .86
		CM	51	-	-	.00
	II	OP	30	26-55	40.7	+1.25
		C	30	-	-	+ .11
	III	HA-OP	20	20-33	27.5	+ .80
		PP	20	21-36	26.6	+ .11
Karp et al. (1963)		AW	24	20-51	38.6	+1.29
		C	24	20-52	38.6	+0.17
Karp & Konstadt (1965)		AY	20	22-32	27.40	+ .85
		AO	20	42-55	47.80	+1.65
		CY	20	21-32	27.45	- .06
		CO	20	42-56	48.10	+ .67
Karp et al. (1965b)		AA-CA	20	31-55	42.7	+ .67
		AA-CD	20	29-52	47.5	+ .94
		HA-CA	20	35-61	43.8	+1.43
		HA-CD	20	32-57	42.8	+1.67

AO = Alcoholics, Older; AW = Alcoholic Women; AY = Alcoholics Younger; C = Control; CA = Continually Abstinent; CD = Currently Drinking; CM = College Men; CO = Controls, Older; CY = Controls, Younger; HA = Hospitalized Alcoholics; OP = Outpatients; PP = Psychiatric Patients.

TABLE 17

STUDIES OF FIELD DEPENDENCY IN ALCOHOLICS AS MEASURED BY WITKEN'S BODY ADJUSTMENT TEST

Study	Group	N	Age	Mean Age	BAT Score
Karp et al. (1963)	AW	24	20-51	38.6	+2.42
	C	24	20-52	38.6	+ .60
Karp et al. (1965b)	AA-CA	20	31-55	42.7	48.30
	AA-CD	20	29-52	47.5	47.50
	HA-CA	20	35-61	43.8	70.45
	HA-CD	20	32-57	42.8	77.55

AA = Alcoholics Anonymous; AW = Alcoholic Women; C = Control; CA = Continually Abstinent; CD = Currently Drinking; HA = Hospitalized Alcoholics.

TABLE 18

STUDIES OF FIELD DEPENDENCY IN ALCOHOLICS AS MEASURED BY WITKEN'S ROD AND FRAME TEST

Study		Group	N	Age	Mean Age	RFT	RFT-U	RFT-R	RFT-L
Bailey et al. (1961)	I	BA	15	36-66	50	+2.43	-	-	-
		AA	15	31-70	49	+1.44	-	-	-
		CO	15	32-54	41	- .05	-	-	-
		CY	15	19-28	23	+ .04	-	-	-
	II	BO	13	19-65	52	+3.20	-	-	-
		SA	14	26-51	39	+1.69	-	-	-
		PS	15	20-64	38	+ .57	-	-	-
Karp et al. (1963)		AW	24	20-51	38.6	+ .68	-	-	-
		C	24	20-52	38.6	- .19	-	-	-
Goldstein & Chotlos (1965)		HA	50	-	44.76	-	16.18	23.09	24.42
					(6.00)	-	(11.98)	(12.38)	(13.15)
		C	50	-	41.84	-	7.36	13.70	15.81
					(6.96)	-	(4.96)	(10.15)	(11.35)
Karp et al. (1965b)		AA-CA	20	31-55	42.7	111.48	-	-	-
		AA-CO	20	29-52	47.5	112.85	-	-	-
		HA-CA	20	35-61	43.8	110.70	-	-	-
		HA-CO	20	32-57	42.8	149.75	-	-	-
Klappersack		FO(HA)	-	-	44.00	18.37	-	-	-
						(4.89)	-	-	-
		FO(C)	-	-	44.32	16.93	-	-	-
						(5.07)	-	-	-

TABLE 18 (Continued)

Study	Group	N	Age	Mean Age	RFT	RFT-U	RFT-R	RFT-L
	FI(HA)	-	-	40.75	5.23	-	-	-
					(1.94)	-	-	-
	FI(C)	-	-	34.70	5.81	-	-	-
					(1.80)	-	-	-
	BD	-	-	-	17.59	-	-	-
					(10.48)	-	-	-
Goldstein & Chotlos (1966)	HA-PR HA-PT	62	29-57	43.8	-	-3.34	-3.93	-5.60
Goldstein & Chotlos (1968)	HA	30	-	-	11.7	-	-	-
					(9.1)	-	-	-
Jacobson (1968)	E-PR	30	-	-	154	-	-	-
	E-PT				115	-	-	-
	C-PR				179	-	-	-
	C-PT				169	-	-	-
Jacobson et al. (1970)	HA-PR	37	-	41.9	66.45	-	-	-
	HA-PT				64.53	-	-	-
Goldstein & Shelly (1971)	HA	50	-	45.26	8.94	-	-	-
				(7.48)	(7.51)	-	-	-

TABLE 18 (Continued)

Note:

RFT-U-R-L represent the three body positions; standard deviations are indicated by parentheses.

AA== Alcoholics Anonymous; AW = Alcoholic Women; BA = Brain-damaged Alcoholics; BD = Brain-damaged; C = Control; CA = Continuously Abstinent; CD = Currently Drinking; CO = Controls, Older; CY = Controls, Younger; E = Experimental; FD = Field Dependent; FI = Field Independent; HA = Hospitalized Alcoholics; PR = Pretest; PS = Paranoid Schizophrenics; PT = Posttest; SA = Sociopathic Personality disturbance with alcoholism.

TABLE 19

STUDIES OF FIELD DEPENDENCY IN ALCOHOLICS AS MEASURED BY WITKEN'S EMBEDDED FIGURES TEST

Study	Group	N	Age	Mean Age	EFT Score	Standard Deviation
Karp et al. (1963)	AW	24	20-51	38.6	+2.42	-
	C	24	20-52	38.6	+ .60	-
Karp et al. (1965a)	A-WC	24	27-57	40.8	130	-
	A-DC	24	27-57	40.8	106	-
Karp et al. (1965b)	AA-CA	20	31-55	42.7	1146.0	-
	AA-CD	20	29-52	47.5	1535.1	-
	HA-CA	20	35-61	43.8	1887.9	-
	HA-CD	20	32-57	42.8	1760.7	-
Reilly & Sugarman (1967)	S_I	62	25-63	43(Md)	1231	513
	S_{II}	29			957	452
Klappersack (1968)	FD-HA	-	-	44.00	55.17	21.55
	FD(C)	-	-	44.32	54.92	33.34
	FI-HA	-	-	40.75	29.53	16.45
	FI(C)	-	-	34.70	17.54	16.47
	BD	-	-	-	88.05	31.92

TABLE 19 (continued)

Study	Group	N	Age	Mean Age	EFT Score	Standard Deviation
Burdick (1969)	SH-HA	21	38-60	49.2	1024.6	426.5
Karp et al. (1970)	HA-S	18	-	-	+ .70	1.47
	HA-NS	18	-	-	+2.31	2.03

A-WC = Alcoholics, Wet Condition; A-DC = Alcoholics, Dry Condition; AA = Alcoholics Anonymous; AW = Alcoholic Women; BD = Brain Damage; C = Controls; CA = Continually Abstinent; CD = Currently Drinking; FD = Field Dependent; FI = Field Independent; HA = Hospitalized Alcoholics; N = Nonselectee; S = Selectee; S_I = Systems I; S_{II} = Systems II; SH = Shadel Hospital.

TABLE 20

MEANS AND STANDARD DEVIATIONS FOR THE LATB

Test	Alcoholics	Controls
LT/L	21.87 (3.55)	19.92 (4.80)
LT/R	19.74 (2.82)	17.93 (3.58)
LT/B	10.50 (2.34)	9.45 (2.62)
W/F	30.47 (18.79)	44.73 (9.28)
W/B	18.07 (17.40)	37.20 (11.28)

TABLE 21

MEANS AND STANDARD DEVIATIONS FOR THE SPTB

Test	Alcoholics	Controls
DT/V	5.68 (3.65)	5.28 (3.80)
DT/H	4.70 (2.70)	6.72 (4.48)
AT/F	9.15 (6.05)	9.90 (5.44)
AT/L	2.92 (2.90)	1.55 (1.11)

TABLE 22

MEANS AND STANDARD DEVIATIONS FOR THE VTB

Test	Alcoholics	Controls
RD/L	11.33 (7.87)	7.69 (5.50)
RD/R	12.67 (7.32)	9.03 (5.50)
RD/U	9.13 (12.61)	4.30 (3.59)
RFT/L	20.58 (8.89)	14.46 (8.14)
RFT/R	25.65 (15.61)	14.77 (8.66)
RFT/U	18.28 (11.87)	7.33 (4.44)

TABLE 23

MEANS AND STANDARD DEVIATIONS FOR THE SETB

Test	Alcoholics	Controls
S/O	402.73 (153.88)	518.80 (50.81)
S/C	96.47 (108.10)	228.07 (110.99)
SR	106.53 (92.42)	179.73 (71.41)
SOLEC/L	28.73 (43.55)	66.80 (40.75)
SOLEC/R	22.73 (38.47)	78.73 (43.92)