SELECTIVE MEMORY IMPAIRMENT AFTER ELECTRO-CONVULSIVE THERAPY

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PREFACE

This study was first conceived in the early autumn of 1963. Preliminary reading, which formed the frame of reference for the introductory sections and structuring of the experimental design was done between the autumn of 1963 and the spring of 1964. The first clinical phase was performed between the summer of 1964 and the spring of 1965; the second clinical phase from the summer of 1965 to the spring of 1966. Statistical analysis of the data and further interpretative reading was done between 1966 and early 1969. The text is designed to describe historically the formulation and modification of ideas while still conforming to traditional methods of medical scientific presentation. Although much of the material included in the results is irrelevant to the original hypotheses it is included as a matter of interest.

I would like to thank my colleagues who were closely concerned with this study in consultation and discussion, mainly: Myron G. Sandifer, M. D., Associate Dean of the School of Medicine, the University of Kentucky, for psychiatric consultation; Gilbert Gottlieb, Ph.D., Research Scientist, N. C. Department of Mental Health for psychological consultation; Lacoe B. Alltop, M.S.P.H., Biostatistician, N. C. Department of Mental Health and Carl M. Cochrane, Ph.D., Professor of Psychology, the Bowman Gray School of Medicine, Winston-Salem, N. C. for statistical consultations. To Gordon Carson, B.S., and Douglas Deaton, B.A., I express my

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I have a deep gratitude to the State of North Carolina for the provision of my own appointment and most of the above mentioned services and facilities.

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I. DEFINITION OF THE PROBLEM

"Chaos of thought and passion, all confused."

Alexander Pope: An Essay on Man

Since 1960 we have been involved continuously in research projects involving the clinical, therapeutic and psychological implications of convulsive therapy (1-4). While studying post-ictal verbal memory impairment in these latter projects (3, 4), we were impressed by the number of patients who made statements in the nature of obvious wish fulfillments while still in a post-ictal state of clouded consciousness.

One patient in particular, while still disoriented in all spheres, stated that she was in Duke Hospital (Durham, N. C.). With further clearing of consciousness she perseverated with this statement. This persistence as regards to her whereabouts continued even when she showed complete orientational clarity in other spheres and later appeared to be in the nature of a voluntary confabulation. She later acknowledged her true surroundings, namely Dorothea Dix Hospital (Raleigh, N. C.) and spontaneously volunteered that the continuous assertion that she was in Duke Hospital was in the nature of a wish fulfillment: Duke Hospital being a private facility of considerable prestige value, whereas Dorothea Dix Hospital is a North Carolina State

administered institution.

This appeared to be an extraordinary sequency of events where a false orientational statement in the nature of a wish fulfillment began in the depth of post-ictal confusion as an organic perserveration, then persisted into a state of clear consciousness where it at first appeared to have the essential psychologic qualities of an hysterical dissociation, then later to have the quality of a voluntary confabulation.[1]

Stimulated by these and other similar observations, it was decided to construct a controlled experiment to measure the influence of emotional factors in determining qualitatively and quantitatively the material recalled in the post-ictal confusional state.

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[1] Penfield and Jasper (pp, 452-469, 5) quote many examples of converse phenomena occurring in temporal lobe lesions where an experiential memory becomes the phenomenological expression of a temporal lobe seizure.

II. CONVULSIVE THERAPY: PANACEA AND ENIGMA

A. THERAPEUTIC MODE OF ACTION OF CONVULSIVE THERAPY

Macbeth:

> *Canst thou not minister to a mind diseas'd*
> *Pluck from the memory a rooted sorrow,*
> *Raze out the written troubles of the brain,*
> *Cleanse the stuff'd bosom of that perilous stuff*
> *Which weighs upon the heart.*

Shakespeare: Macbeth V:iii

Since the introduction of convulsive therapy by Meduna (1) shock treatment has remained an enduring and successful method of treatment of mental illness. The earlier pharmaceutical convulsive therapy (1-4) has been almost entirely replaced by electrical convulsive therapy since Cerletti's classic induction of a grand mal convulsion by electric stimulation (5, 6).[2]

Although originally conceived as a specific therapy for schizophrenia (1), clinical studies in the later 1930s and 1940s described shock treatment as being efficacious in many mental

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[2] During the past few years there has been a renewed interest in the pharmaceutical production of convulsions with the use of hexafluorodiethyl ether (Indoklon) a drug which has the paradoxical properties of both being an anesthetic and an epileptogenic substance. Although this substance has been intensively studied by several groups of investigators (7-9), there appears to be no diminution of the popularity of electrically stimulated convulsions.

conditions of diverse etiology (10-15)[3] with a peculiar specificity in the treatment of depression (22-27). The empirical definition of the therapeutic efficacy of convulsive therapy was accompanied in the literature, perennially, by postulates and controversy regarding its therapeutic mode of action.

The wealth of literature on the therapeutic mode of action of E.C.T. prompted Gordon, 1948, (29) to summarize the literature in this subject. His paper catalogues, uncritically and without bibliography, no less than fifty theories on this subject. Since that time further theories, often more ingenious than credible, have been published in the scientific literature. The present review of the literature is directed at attempting to organize the main themes on this subject into a meaningful pattern.

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[3] In reviewing the literature, the author found that convulsive therapy had been recommended as palliative or curative in a vast spectrum of physical and mental symptoms and syndromes (16). Examples of the diverse therapeutic recommendations for convulsive therapy are: refractory neurodermatitis (17); the Morgagni-Morel Syndrome (18); pain gastroduodenal ulcer (19); anesthesia in transorbital lobotomy (20) and trigeminal neuralgia (21).

1. SOMATOGENIC THEORIES

The rationale for the introduction of convulsive therapy by Meduna as a specific therapy for schizophrenia[4] was the assumption that epilepsy and schizophrenia were mutually exclusive biochemically (1). Subsequently, many diverse organic theories have been advanced to explain the therapeutic activity of convulsive therapy.

a. Theories relating to readjustment of specific physiologic or biochemical functioning:

In the literature the following have been explicitly or implicitly associated with the therapeutic mode of action of convulsive therapy: General dissolution in cortical functioning with relegation of higher functions to sub-cortical structures (35); depression of cerebral metabolism (36); generalized cerebral excitation (37); reduced reactivity of the cerebral cortex (38);

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[4] In 1928 Notkin (30) reviewed the literature referring to the coincidence of epilepsy and the functional psychoses. This paper appears to have reflected the current opinion at that time regarding the mutual exclusiveness of epilepsy and schizophrenia. Meduna, citing another reference (31), followed this principle in initiating convulsive therapy as a specific remedy for schizophrenia. Meduna (1) described this theoretical concept: "Certain biochemical antagonism exists between the convulsive state and the schizophrenic process. Therefore, if we produce convulsive reactions in the schizophrenic patients, this ought to alter the chemical milieu of the patient in a way that resists the development of the schizophrenic process." Subsequent literature has contradicted the mutual exclusiveness of epilepsy and schizophrenia (32, 33). This subject is further complicated by diagnostic difficulties as the epileptic may present clinically with predominantly schizophrenic symptomatology. Slater, et al, 1963 (34) present well documented evidence to suggest that epileptics presenting with schizophrenic-like symptoms are basically epileptic psychoses and are not schizophrenic from the etiological standpoint.

cortical neuronal damage (39-41), sometimes with the implication that diseased nerve cells associated with the mental illness are more susceptible to destruction than healthy cells (42); diminution of reactivity of the reticular activating system (43); loss of frontal lobe inhibition (44); generalized cerebral facilitation (37); changes in patterns of E.E.G. activity (45, 46); cerebral vaso-dilatation (47); depletion of brain glycogen (48); cerebral anoxia (49-51); stimulation of the vital centers in the medulla (52); stimulation of the acidophil cells of the anterior hypophysis (53); increased neuronal cell permeability (54); increased followed by decrease in vagal activity (55); increase in blood pyruvic acid (56); alteration in serum calcium levels (57); increased intra-cellular fluids (58); enzymatic changes in cerebral nucleic acid metabolism (59); increase in plasma alpha-amino acid nitrogen (60) normalization of thyroid function (61, 62).

b. Theories relating to the readjustment of autonomic nervous system functioning:

An early concept regarding the organic pathogenesis of schizophrenia was that there was a fundamental pathology of the regulatory mechanisms of the autonomic nervous system. The pathogenic sequence of events in a case of schizophrenia were described as: (a) hyperexcitability of the autonomic regulatory mechanisms, (b) loss of competence in the regulatory mechanisms and (c) complete failure of these mechanisms (63). Increased appetite, weight gain, disappearance of constipation, remission of insomnia and menstrual

dysrhythmias, seen clinically, during and following a course of convulsive therapy, led to the postulate that the therapeutic activity of convulsive therapy was intimately associated with functional changes in the autonomic nervous system (63-65). Readjustment of autonomic nervous sustem activity was interpreted as resulting from modification of function of hypothalamic centers. Gellhorn, 1938 and 1948, (66, 67) and Himwich, 1937 and 1942, (49, 50) interpreted the changes in autonomic nervous system reactivity as a result of a massive sympathetic nervous system mobilization against the stress of cerebral anoxia, whereas other authors felt that direct electrical stimulation of the hypothalamic centers by the fit provoking electrical stimulus was the important mediating mechanism (68-70). This theoretical concept received further experimental substantiation in endogenous depressions with the studies of Funkenstein, 1948 and 1949, who found alterations in parasympathetic-sympathetic balance before and after a course of electroconvulsive therapy (71-73).

c. The general adaptation syndrome:

In 1950, Selye's exposition of the general adaptation syndrome (74) led to the application of this theory to the therapeutic mode of action of E.C.T. It was theorized that the specific stress of the convulsion initiated the nonspecific physiological adaptational response resulting in improved behavioral patterns (75). Considerable experimental data, both in clinical and animal studies, were amassed to show that, in fact, there was a marked response of

the hypothalamic adrenocortical axis to the stress of convulsion therapy (66-70). Royce and Rosvold, 1953 (70), found that repeated application of the electrical stimulus during the tonic convulsive contraction greatly enhanced the adrenocortical response in mice. From this finding they postulated that direct stimulation of the hypothalamus by the electrical impulse was a major factor in the adrenocortical response to the specific stress of electric convulsive therapy.

d. Convulsive therapy as a homeostatic adaptive mechanism:

A regularly occurring concept is that therapeutic improvement in convulsive therapy is positively associated with the induction of a grand mal convulsion. The administration of sub-convulsive doses of epileptogenic drugs or electrical stimulation is reported as having a disappointing therapeutic effect (80-83) with the possibility of making the patient refractory to later grand mal convulsive therapy (84).

The concept of epilepsy having a useful biological function is generally anathematized by neurologists although such theories have been advanced to explain the origin and meaning of epilepsy both phylogenically and ontogenically.[5] Roth, 1952, (87) elaborated on the concept earlier postulated by Cerletti, 1954, (88)

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[5] Temple Fay, 1942 (85) suggested that convulsive movements are characteristic of the amphibian level of motor development and possibly served a useful adaptive function at the evolutionary stage of emergence of life from the sea. Depletion of water, salts, oxygen or electrolytes would initiate a convulsive movement which would "flip" the organism back into the sea. Wilson, 1965 (86) speculated on a possible ontogenic adaptive function of convulsive activity as a protective mechanism for the foetus in utero.

that the therapeutic modus operandi of convulsive therapy was a homeostatic adaptive mechanism. Roth's hypothesis (87) postulated that convulsive therapy acted as an adaptive mechanism allowing the central nervous system to readjust physiologically to a more efficient pattern of biological functioning thus tending to normalize any deviant thought, emotional or behavioral patterns. Roth gave substance to this theory in providing experimental data with pertinent theoretical considerations.

Fink, et al, 1957 and 1958 (89, 90) later advanced a theory compatible with Roth's theory of the adaptational value of convulsive therapy. They advanced the theory that specific organic changes occurred in the central nervous system after convulsive therapy as measured by abnormal EEG tracings. This physiological disturbance with the psychological corollaries of disturbed mentation and perception allows the patient to make a more satisfactory adaptation to the environment.

2. PSYCHOLOGICAL THEORIES

Psychological theories relating to the therapeutic mode of action of convulsive therapy are mainly variations of several themes.

a. The "need of punishment".

This theory related mainly to depressed patients suffering from ideas of guilt. It is theorized that the convulsive therapy acts as a "punishment" administered by the symbolic father figure (the psychiatrist) (91-93). This theory is plausible in being concordant with the concept of depressive

guilt's being rooted in infancy (p. 105, 94).

b. "Death and rebirth."

The unconsciousness and ensuing coma produced by the convulsion is symbolic of death, while the gradual post-ictal re-orientation to the environment is symbolic of rebirth. In this way the patient is able to conquer death wishes and fears and then start life afresh (95, 96). The concept of "rebirth" has been further elaborated by some authors who describe the patient as passing through the ontogenic phases of development both physiologically (97) and psychologically (98, 99) in the post-convulsive confusional state.

c. "Fear" of treatment.

The "fear" of treatment was an early and enduring theory of the therapeutic modus operandi of convulsive therapy. Various explanations were forthcoming regarding the genesis and therapeutic activity of fear in convulsive therapy. McCowan, 1940 (100) likens shock treatment to the "surprise bath or swinging bed"; many authors stress the primitive nature of the fear with a resulting maximal physiological defense response for self-preservation (101-104) whereas others have more exotic psychological explanations; e.g., the fear of treatment activates "castration anxiety" (105). Practical attempts to examine the role of fear as a therapeutic mechanism have generally shown no positive association between the intensity of fear of treatment and the therapeutic outcome (106-109) whereas one study produced converse results; namely, the therapeutic outcome was negatively

associated with the intensity of the fear of treatment (110).

d. Liberation of libidinal energy.

The extreme physical exertion associated with the convulsion led to theories that this dynamic release of energy was associated with therapeutic improvement. Rationalization led to two main hypotheses, namely: (i) the unloading of extreme amounts of energy resulted in destructive drives being directed outwards instead of inwards (104); (ii) the convulsion represented an artificial discharge of disturbing libidinal tensions with a resulting restitution of ego organization (105).

e. Theories relating to patient-therapist relationship.

Some authors have advocated that convulsive therapy facilitates the psychotherapeutic process by improving the patient's affective tone and fostering cooperation between patient and therapist (111) whereas others have stressed that enhancement of transference and countertransference occurs during convulsive therapy with a resulting beneficial therapeutic effect (112).

3. COMBINED SOMATOGENIC AND PSYCHOLOGICAL THEORIES

Association of confusion with therapeutic response: A regularly occurring concept is that the therapeutic outcome of convulsive therapy is positively associated with the degree of confusion and memory impairment induced by the treatment. Proponents of this theory have two major postulates: (a) recent pathological thought, emotional and behavioral patterns are more easily obliterated by the physiological storm of convulsive therapy with the patient's regressing to earlier premorbid

healthy patterns (84, 113, 114). This theory is compatible with the theory of "consolidation of memory traces" which requires the elapse of a certain time interval after learning for memory impressions to be retained. This concept has considerable verification from animal experimental data (115-117); (b) The post-convulsive amnesia is emotionally selective with the selective forgetting of concepts with emotional connotations of anxiety, guilt or ego threat (84, 118, 119). However, in well-controlled clinical studies investigators have been unable to find any positive association between the intensity of confusion and the degree of therapeutic improvement (120-122).

4. CRITIQUE OF THE THEORIES OF THE THERAPEUTIC MODE OF ACTION OF CONVULSIVE THERAPY:

This appraisal of the literature would appear to be a reasonable sample of the imposing number of studies and theories on the therapeutic mode of action of convulsive therapy.

Three major areas of criticism seem justified:

a. The organic theories.

The organic theorists in general substantiate their postulates with data defined by scientific experimentation often entailing exquisite regard to techniques and methodology. However, any illustration of changing physiological function is immediately interpreted as being positively associated with therapeutic outcome, whereas the therapeutic outcome and changing physiological function might be dependent variables with no cause

and effect relationship. Few of the studies were structured to define corollaries between physiological and behavioral changes.

b. Psychological theories.

In general the psychological theorists err in the opposite direction. With a few exceptions; for example, the controlled studies of Crumpton, 1963, (107), Gallinek, 1956, (108) and Fisher, 1953, (110), an almost universal fault is the inference of a general conclusion from a particular example. These inferences, aptly, are generally concordant with a predetermined psychological orientation and show little regard for the facts; e.g., in one paper the concept of the selective forgetting of unpleasant memories is invoked simultaneously with the contradictory postulate that the post-ictal period provides an ideal moment to obtain catharsis (93). This latter contradiction shows a felicitous disregard of logic which is not unusual in those who subscribe to a conceptual orientation with the inherent epistomological paradoxes of the psychoanalytic theory.

c. The third major criticism is directed at the orientational dichotomy of the investigators in general. The organicists show complete disregard of the psychological aspects of the therapy and vice versa with the psychologically oriented. The major exception to this is the work of Fink, et al (89, 90) who produced experimental data to integrate psychological, psychodynamic and organic changes following convulsive therapy.

B. EMOTIONS, MEMORY, AND CONVULSIVE THERAPY

And we forget because we must,
and not because we will.

Arnold: Absence

There is general agreement in the literature that convulsive therapy causes variable disturbance in memory and learning functions. At one end of the spectrum are reports on individual cases where convulsive therapy has resulted in severe permanent organic memory defects (123-126)[6], whereas, at the other end of the spectrum many controlled studies have shown little or no detectable impairment in memory and intellectual functioning two or three weeks following the completion of standard courses of electroconvulsive therapy (128-137). The concordant findings in the latter studies, from diverse geographical areas and using different psychological measuring instruments, would appear to give reliability to these findings.[7] In the technical administration of electroconvulsive therapy many variables have been positively associated with the intensity of post-convulsive memory impairment: size of electrodes

[6] Bourne, 1955 (126) described a case of severe permanent intellectual impairment in a patient following a course of electro-convulsive therapy, which is interpreted as brain damage resulting from cerebral anoxia. In reviewing the literature Penfield (pp. 550, 551, 127) subscribes to the view that, in general, intellectual deterioration in epilepsy is minimal.

[7] These investigations included the use of many different psychological instruments: the Wechsler Memory Scale, Babcock Test, Shipley Hartford Scale, Wechsler Bellevue Scale, Hunt Minnesota Scale for Organic Impairment, Alpha Group Test; tests for speed of ideation and visual motor ability, Bender-Gestalt drawing test, serial sevens, noun naming and color naming.

(138); site of electrode placement (139-144); type of electrical wave (145-147); intensity of electrical stimulus (148); frequency and number of treatments (149-151).

Although many well controlled studies have been directed at measuring the effects of electro-convulsive therapy on mentation, few studies have sought to elucidate the influence of emotional factors in influencing post-ictal memory impairment. In the clinical situation the author has been impressed frequently by the complaints of post-convulsive memory impairment which are grossly disproportionate to any memory impairment elecitable by clinical or systematic memory testing. In our experience, many of these cases are complaining of a loss of a congruous emotional attachment to an intellectualized memory. This phenomenon would appear to be similar to post-convulsive depersonalization (152) or feelings of loss of familiarity (153, 154) described in the literature as psychopathological complications of convulsive therapy.

Although the concept of the selective forgetting of unpleasant experiences is generally recognized as a possible therapeutic mode of action of convulsive therapy, little attention has been given to experimental investigation of this concept. It would appear that this theory germinated by the extension of the psychoanalytic concepts of "active forgetting" into the sphere of post-convulsive memory impairment. In 1950 Holland (155) described the selective forgetting of memory impressions after convulsive therapy as having "the earmarks of a repressing force". He differentiated between the immediate post-convulsive "organic"

memory impairment and the more prolonged "emotional" lapses in memory. The former, a passive process, resulted in random obliviousness, whereas, the latter was an active process of forgetting associated with specific psychological forces. He concluded that the dynamic mechanism of repression was more pronounced after convulsive therapy in that unpleasant associational processes determined the material to be forgotten. The highly selected and almost negligible data quoted by the author gives little factual substance to the theory.

A well controlled study by Janis, 1950 (119) gave some factual substance to the concept of post-convulsive selective forgetting of unpleasant experiences. Detailed histories of emotionally loaded experiences were elicited in a group of depressed patients before the initiation of convulsive therapy. Three weeks following the course of treatment histories were again elicited from this group of patients. A decrement in memory for unpleasantly loaded previous life experiences was described, whereas, the pleasant life experiences were not affected. A control group of patients who did not receive convulsive therapy did not show this selective memory decrement. The unpleasant emotional experiences which showed a significant decrement were those associated with: guilt, anxiety, shame, feeling of inferiority and anger. Carter[8], 1953

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[8]We found an abstract of Carter's work in the American Psychologist (156) but we were unable to find the unabridged publication.

(156) replicated the previous experiment with the identical findings.

In summary, it would appear that considerable literature exists pertaining to technical and mechanistic studies of post-convulsive memory impairment; however, although selective memory impairment has been propounded as a therapeutic modus operandi of convulsive therapy we could find only two documented studies of careful investigation of this problem (119, 156). These studies were directed at measuring selective memory impairment several weeks after a course of therapy. Although Holland's study (155) gives little factual data to substantiate his theory we consider it reasonable to conceive that different principles of recall may apply to the immediate post-convulsive confusional state than apply to period of several weeks after completion of a course of therapy. We found no reference in the literature to systematic investigation of the effect of emotional factors in influencing immediate post-convulsive recall.

Our original observations (page 1) led us to believe that even in the most intense post-convulsive confusion emotional factors might be influencing orientation and recall. The apparent dearth of studies in this area led us to believe that a controlled investigation of this apparent "no-man's-land" would be a worth-while and fruitful project.

III. ORGANIC VERSUS FUNCTIONAL AMNESIAS: THE PERENNIAL DICHOTOMY

"'When I use a word', Humpty Dumpty said in a rather scornful tone, 'it means just what I chose it to mean, - neither more nor less.'"

Lewis Carroll: Through the Looking Glass

When theories regarding the therapeutic mode of action of convulsive therapy were discussed it was indicated that few experiments, directed at elucidating this problem, attempted to define interaction between organic and psychological factors. This division continued the classificatory dichotomy, perpetuated in medical texts and probably in medical teaching. This point may be illustrated by several quotations from psychiatric and neurological texts referring to amnesias. Noyes and Kolb, 1963 (p. 88, 1) state, "Amnesia may be produced either, by organic or psychogenic factors"; Pearson, 1963 (p. 64, 2) states, "There are organic amnesias such as may occur in head trauma, but more striking are the functional amnesias in which remembrance of the happenings during a certain time period are blotted out." This division of amnesias into an etiological dichotomy is merely an extension of the rules applying to the etiology of psychopathology in general. Brosin, 1959 (p. 118, 3) describes the clinical features of the post-concussional state as a well-defined syndrome characterized by: "headaches, dizziness, apathy, dullness, inability to concentrate, easy fatiguability, decreased tolerance to noise, light, alcohol and exertion and insomnia..." It is implicit in his description that there is a direct cause and effect relationship between the head injury and the production of the syndrome. He

later goes on to state that if symptoms persist after a period of six weeks that there is a "strong likelihood of psychoneurosis." The cut off point of six weeks appears to be based on an extensive study of cases of head injury by Ruesch and Bowman, 1945 (4). In our opinion it is irrational to advocate that an "organic syndrome" suddenly becomes a "psychoneurosis" after a defined period of time especially when head injury has already been invoked as a condition sine qua non for the origin of the syndrome.

In promoting this dichotomy the texts define some basic diagnostic principles. The generally accepted features of the organic amnesias appear to be: (a) the revelation of structural damage or physiological dysfunction of the central nervous system (p. 977, 5; p. 89, 1; p. 160, 6); and (b) destruction of the memory trace by the organic process rendering the amnesia irreversible (p. 64, 2; p. 977, 3). The essential diagnostic features of functional amnesias are: (a) they occur in previously "neurotic" personalities (p. 160, 6; 7); (b) they are of sudden dramatic onset often associated with emotional shock (8-11) and (c) they are generally associated with secondary gain (p. 99, 12; p. 403, 13; p. 337, 14). The pragmatic advantages of this dichotomy are obvious in the clinical, diagnostic, and therapeutic situation, and in the law courts where the amount of financial compensation for injury may vary according to the presence or absence of an organic diagnosis.

This organic vs functional classification, although

expedient, cannot be substantiated by facts according to detailed studies in the medical literature. Examination of the basic criteria, outlined above, for the dichotomy, is quite revealing.

(a) The concept of positive neurological signs being essential for organcity of symptoms:

Strauss and Savitsky, 1934 (15), after describing the detailed multidisciplinary approach to cases of head injury state in their conclusions: "Negative results in neurological examination and a normal mental status are no final criterion of the presence, absence or degree of damage to the brain resulting from head trauma." Mulder, 1959 (p. 1151, 16) in referring to frontal lobe tumors, states, "Brain tumors arising in the frontal lobe, however, are more likely to give rise to progressive mental symptoms without associated neurological signs..."

(b) The irreversibility of the amnesias in organic brain syndromes.

The recovery of apparently lost memory impressions methodologically is an "open-ended" situation to which an absolute term like "irreversible" may not be applied, i.e., the investigator is never sure that a memory *cannot* be recalled. In our previous experiments in post-convulsive orientation and recall (17, 18) the "open-ended" nature of the recall of verbal memories became a matter of some importance, as post-convulsive questioning was discontinued after an arbitrary period of one hour, obviously there was no guarantee that memories, apparently

irrevocably lost, might not be remembered in two hours, two days, or two years. It has been shown that apparently "irreversible" memories after brain trauma can be recalled in the therapeutic situation (19) or with special techniques such as hypnosis (19,20).

(c) Association of sudden onset with functional amnesias:

Amnesias associated with temporal lobe epilepsy are often of dramatic and sudden onset. Spurling, 1950 (p. 7, 21) states, "A psychomotor convulsion which is not usually recognized as such, is characterized by periods of abnormal behavior with amnesia. For example, the patient may, without explanation, leave a social gathering, wander aimlessly for an hour or more, and come to himself in new surroundings without recollection of how he arrived or what has occurred in the interval. Psychomotor attacks may assume a great variety of patterns. On clinical grounds they are difficult to distinguish from functional states."

Attention has been drawn to this classificatory dichotomy, to show an orientational trend in diagnostic categorization. It must be pointed out, giving due recognition to the advantages of a clear cut diagnostic system, that this division obscures the biological and psychological facts. As has been already discussed some of the salient descriptive features of either condition may occur in the other. In reviewing our clinical diagnostic experience in this field it is our experience that in general psychiatric practice there is a considerable adherence to this dichotomy and that to a large extent the ultimate diagnostic decision,

regarding the individual patient, depends on the orientation of the observer.

Although many authors have given due cognizance to the possibility of multiple etiological factors' existing in amnesias most observations and studies have been undertaken post facto with no measured pre-morbid data for comparative purposes. This lack of reliable pre-morbid data has resulted in a failure to assess the relative importance of different variables such as mechanistic, intellective or emotional factors in defining post-traumatic amnestic syndromes and has resulted in a hodge podge of theoretical interpretations of memory pathology.

IV. BIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF MEMORY AND ITS PATHOLOGY

"Women and elephants never forget...."

Munro: Reginald

A. BIOLOGICAL ASPECTS OF MEMORY.

(1). It has been maintained that memory is a fundamental property of living matter; the acquisition, retention and reproduction of physiological and behavioral patterns being an essential feature of organismic adaptation (p. 338, 1; p. 27, 2). There is however a basic difference in complexity between "memory" functioning in the unicellular organism's feeding and avoidance responses (p. 19, 3), as compared to the intricate associative learning seen in higher central nervous system functioning. Lashley, 1934 (p. 456-596, 4) has belabored the point of making too concrete an interpretation of the analogy between chemical learning at a cellular level and the complex behavioral learning in the central nervous system. Gerard, 1967 (p. 26, 5) also warns against the narrow definition of memory as "the modification of behavior by experience" by facetiously citing many examples of natural phenomena occurring in inanimate matter which would satisfy this definition of memory.

(2). The relationship of memory to neuroanatomical structures:

A large number of neuroanatomical structures have been implicated in memory functioning. Just as the acquisition and

reproduction of behavioral patterns appear to be a universal property of living organisms in the process of adaptation, so this generalization can be applied to nervous system functioning in general. Learning would appear to be a common property of all nervous system functioning irrespective of the level of phylogenetic development, e.g. experimental studies have shown that fixation of learned experiences occurs in the rat spinal cord (6). As one ascends the central nervous system phylogenically the "memorialization" function becomes more complex as regards anatomical, physiological and behavioral variables.

Many structures in the phylogenically higher centers of the central nervous system have been implicated as essential media for intact verbal memory function. Hoenig, Anderson, Kenna and Blunden, 1962 (7) reviewed this subject comprehensively. A recapitulation of some of their observations, shows that neuropathology associated with amnestic disorders, may occur in many areas of the neocortex, paleocortex, and mid-brain. (a) Marked impairment of memory for recent events have been noted in pathological lesions in the limbic system especially the mammillary bodies (8), the hippocampus (9-11), the fornices (12), and the anterior thalamic nuclei (13). It is interesting to note that these structures are essentially the same as those of the visceral brain as conceptualized by Papez, 1958 (14). (b) The former silent areas of the neocortex have been implicated in memory functioning, e.g. electrical stimulation of the

postero-lateral areas of the temporal and parietal cortices results in the visual and auditory hallucinatory activation of previous experiences (p. 103, 15; 16, 17).

(3) The psychophysiology of memory:

Most psychophysiological theories depend on the fundamental postulate that in memorialization there is reactivation of a previously stored sensory impression variously known as: a trace (p. 645-659, 18); an engram (19); a neural pattern (20); a specific representational system (21). Most modern theories also incorporate the concept of the existence of motor memory in the fact that motor response patterns are pre-set through pervious learning (22-24). There is, however, no universal theoretical agreement regarding the physiological mechanisms required for storage and activation of these traces. Different opinion may be seen in contrasting the classical Pavlonian concepts of the cerebral localization of conditioned reflexes (25) with the views of Lashley who considers that behavioral plasticity must be served by a diffuse flexible neural organization (26). Another theoretical variation is seen in comparing the "trace theory" with Bartlett's theory of schemata (27). The former envisages that a simple stimulus-response activation of a previous sensory impression occurs during memorialization, whereas the latter conceptualizes a complex classification and neural organization of individual sensory impressions into schemata; the structuring of schemata being directed by the individuals attitudes, interests,

motives and emotions.

In recent years experimental studies have thrown considerable light on the possible physico-chemical media responsible for the registration, retention and eventual recall of sensory impressions. It is postulated that sensory impressions are received and transmitted as an electrical impulse which in turn is converted to a chemical molecular structure, RNA, for storage at a cellular level. This stored molecule will respond to a similar modality of incoming electrical activity, resulting in the activation of the original memory impression (28, 29).

B. FUNCTIONAL DISORDERS OF MEMORY

Consideration of functional disorders of memory particularly amnesias, reveals the existence of a second classificatory dichotomy. Following Freud (30), most psychoanalytic texts have carefully differentiated between these two entities: (a) psychogenic amnesia is defined as having an unconscious motivation, whereas feigned amnesia (malingering) has conscious motivation (31, 32). Although this "unconscious" versus "conscious" motivational classification appears to be generally accepted in psychiatric and psychoanalytic texts, there does not appear to be universal acceptance of this dichotomy in neurological works. Walshe, 1955 (p. 337, 33) states, "Amnesias, fugues and double personality are among the rarer manifestations of hysteria. It may be doubted whether some of the apparent fugues in which the subject disappears from home and is found days later wandering, unkempt,

unfed, and exhausted, in a remote part of the country are *genuine*. The subject commonly has *an excellent and obvious reason* for flight..." It would appear implicit in his description that Walshe, by stressing the secondary gain and using the word "genuine", doubts the possible existence of unconscious motivation of such attacks. Other neurologists give lip-service to this dichotomy with apparently no conviction regarding its validity e.g. Smith, 1967, (34), after defining the difference between hysterical signs and malingering, proceeds to use the words "hysteria" and "malingering" as being synonymous. However, psychiatry, in its all-embracing comprehensiveness has gradually incorporated the concept that malingering itself is a nosological entity (p. 191, 35) often implying that this condition is more serious than other types of mental illness (36).

Hedonistic motivation, whether conscious or unconscious in origin, is a fundamental theme of theories dealing with the pathology of memory. Freud, 1963, an early proponent of this type theory, propounded the concept of primary and secondary gain. The original Freudian concept envisaged primary gain as being motivated by unconscious psychological forces whereas secondary gain was directed at achieving some material benefit from the symptoms (p. 383-385, 37).

Modern authors, by liberal interpretation, have considerably modified the implications of this classical concept without disturbing the notion that memory pathology has an essential

hedonistic function in adaptation. Menninger, 1964 (p. 178, 38) states, "...dissociative loss of consciousness *is actually* a device for the control of agression, and not merely as is sometimes assumed, a self-anesthetizing device in states of fear." Wechsler, 1944 (p. 7, 39), referring to loss of memory, states, "A little inquiry immediately reveals the emptiness of the complaint. Such patients suffer from want of attention (they are too self-centered) therefore they do not remember." Bromburg, 1948 (p. 99, 40) states, "Amnesias serve the inner purpose of denial of unpleasant reality." Many authors subscribe to the view that amnesias are directed at eradicating from consciousness specific stressful episodes which might arouse overwhelming anxiety (41-43). These examples illustrate the general theme that memory has a functional plasticity aiding individual adaptation to both endogenous and exogenous stressful situations.

A cogent criticism of most functional theories of memory pathology is the complete disregard, that these theorists, have for memory apparatus is considered as a perfect functional machine capable of "photographic" registration and reproduction of all sensory impressions, the only factor disturbing the mechanistic efficiency being the emotional one under consideration.

Recapitulation: It would appear that there is considerable clinical and experimental evidence to define an anatomico-physiological basis for memory. The narrow classification of amnesias into organic and functional disorders has led to a non-comprehensive approach in theoretical concepts of memory pathology. A

major difficulty in bridging the gaps between different theoretical viewpoints has been the post facto nature of most studies on memory pathology.

V. EMOTIONS AND MEMORY

"I've a grand memory for forgetting, David." (Alan Breck)

R. L. Stevenson: Kidnapped

It has long been postulated in western philosophy that emotional factors have a profound influence on perceptions, mentation and memory. However, the classical psycho-analytic concept of memory functioning has probably had the greatest influence on modern psychiatric and psychological thought. In "The Psychopathology of Everyday Life" (1), Freud, 1953, propounded the concept of psychic determinism which has endured as a central theme in psycho-analytic epistomology. In postulating that the forgetting of places, names, foreign words, etc., were not chance phenomena but fulfilled a dynamic function in the integration of the instinctive, affective and intellectual functions of the personality, he elevated the whole process of memory from its hitherto passive role to that of an active one. Implicit in the principle of "active forgetting" is the principle of "active remembering." Unfortunately, in this classical work, Freud, 1953, (1) advanced, sometimes implicitly, sometimes explicitly, two different theses on memory: (a) that there is a tendency to forget the disagreeable; (b) that there is a tendency to forget that which will awaken pain. These two postulates are not the same. The first thesis postulates that there is conscious qualitative discrimination between agreeable and disagreeable material as regards retention and recall. The second thesis refers to the concept of repression which ascribes

an unconscious motivation to forgetting; a name is forgotten as there is a danger of its activating (by association of ideas), unconscious material, previously repressed because of their consciously painful nature.

In subsequent years the psychoanalytic literature produced an abundance of literature verifying the original Freudian Theories on memory functioning. Besides self-perpetuation in the psychoanalytic literature the germination and maturation of this theory, stimulated investigators in the fields of general psychiatry and general psychology to test the thesis experimentally. Failure to appreciate the difference in the two concepts described above led to considerable confusion in the subsequent literature, especially the literature in general psychology.

Many experiments which were obviously constructed to test a possible differential ability to retain and recall pleasant and unpleasant material masqueraded as attempts to prove or disprove the mechanism of repression. In the introduction to his erudite review of the literature on this subject even Gilbert, 1938, (2) confuses these two concepts.

Pertinent to our study we reviewed the literature on studies referring to differential ability to recall pleasant and unpleasant material in: (a) non-psychiatric populations; (b) psychiatric populations; (c) subjects with organic disease of the central nervous system.

A. EXPERIMENTAL STUDIES IN RETENTION AND RECALL OF EMOTIONALLY LOADED VERBAL MATERIAL IN NON-PSYCHIATRIC POPULATION

Experiments investigating emotional influences affecting verbal memory can, by and large, be classified into two major categories: (a) studies which employed classical methods of memory experimentation using as verbal material pleasant, unpleasant and indifferent words; (b) studies which used the method of recall of pleasant and unpleasant life experiences.

a. Experiments on words with emotional connotations.

Studies in this field were a direct extension of classical memory experiments. Classical techniques such as using the methods of paired associates, quantitative recall or facilitation of relearning of nonsense syllables, were applied to lists of words with Pleasant (P), Unpleasant (U), and Indifferent (I) emotional connotations. As indicated by Meltzer, 1930, the earlier experiments in this field were generally marred by faulty methodology (3). Subsequent experiments showed marked improvements in experimental techniques. One of the major areas of criticism was the method of selection of words appropriate to the three categories of P, U, and I. In the earlier experiments words were arbitrarily assigned to an apparently appropriate category (4, 5); however, later experiments used the study populations, by judgmental ratings to pre-select and assign words to specific P, U, and I lists (6-8). Another area of methodological improvement,

in these type experiments, related to adequate statistical treatment of the data, e.g. many of the earlier experiments had inadequate sample sizes to draw statistically reliable conclusions.

In spite of all the methodological criticisms advanced by Meltzer, 1930 (5) and Gilbert, 1938 (2), experimental results showed a remarkable consistency in confirming the concept that pleasant words were more easily recalled than either unpleasant or indifferent words (4-14). Again a general consensus exists that there is a greater facilitation of memory for unpleasant than for indifferent words (5-8).

The following criticisms appear pertinent in evaluating the usefulness of this method in testing the concept of a hedonistic tendency in memory: (a) Even when the subject population selected and assigned the verbal material to a particular emotional list, there is always ambiguity as to whether this selective process represented an intellectual judgment or the underlying feeling attached to the particular word. Young, 1937 (15) considered that there was a critical difference in these two concepts.[9] (b) All the studies except one quoted had sample population of

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[9] Young (15) concluded from an experimental study that there was little relationship between the meaning of unpleasantness and pleasantness and a consciously felt experience of pleasantness and unpleasantness. He expressed this concept, "There are, of course, cerebrally aroused feeling of pleasantness and of unpleasantness. Everyone knows that feeling of pleasantness and of unpleasantness can be established by recalling past experiences and imagining possible situations. The report of felt pleasantness which is associatively aroused is one thing, but the mere listing of words with pleasant and unpleasant meanings is something different."

either school or college students. It would appear fallacious to infer general conclusions on memory functioning from experimental populations which reputedly consist of subjects of above average intelligence and of more intense psychological sophistication than the average person. (c) These experiments were conducted in the controlled circumstances of laboratory-type experimentation and are far removed from the complexities of everyday life situations. Meltzer, 1930 (3) aptly defines these artificial circumstances as "Insufficiently life-like". (d) Gestalt psychology (16) has stressed the importance of meaningfulness in the retention and recall of verbal material and resulting criticism has been directed at classical word-list techniques of measuring memory functioning on this account. If meaningfulness be an important variable in the assessment of mechanistic factors in memory functioning, this same criticism may be directed at this method of assessing emotional influences on the recall of word-list material.

b. Experimental studies in measuring recall of life experiences with pleasant, unpleasant or indifferent affective tones:

The essential feature of these experimental studies was the establishment of a base-line of pleasant (P), unpleasant (U), and indifferent (I) life experiences; either by recording a recent history of life events judgmentally rated as P, U, or I or by the subjects keeping a detailed diary of life events recorded

immediately giving a coincidental rating of P, U, or I associated affective tone. After a lapse of time the subjects were asked to recall the original base-line material. These data were then analyzed with regard to differential quantitative recall of P, U, and I material.

Studies using this type method of assessing emotional factors influencing remembering resulted in a general consensus that pleasant memories were more easily recalled than unpleasant memories (9, 10, 16-21); one exception was Wohlgemuth, 1923 (23) who reported converse results.

The obvious advantages of the life experience method of assessing emotional factors, influencing memory as compared to the PUI word list method are: (a) the test material is directly relevant to the individual subject; and (b) the total technique appears to be more pertinent to true life situations than the insipid word list method.

Fundamental disadvantages of this method are: It is doubtful if genuinely relevant emotional life experiences will be communicated to the experimenter due both to willful and unwitting suppression by the subject and to difficulties in verbal symbolization of affective states[10], in reminiscing about life experiences the subject is prone to emotional influences of the moment which may or may not distort the genuine affective tone experienced at the time of the occurrence. A caricature of the latter criticism is seen in the pathological emotional state of severe depression where all life experiences in retrospect are inextricably associated with grossly unpleasant feeling tone.

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[10]Whitehorn, 1939, (p. 263, 24) describes the fundamental difficulties in the communication of feeling and the difficulties an observer has in assessing the affective tone in others. "For a good many years I have been interested in listening to patient's accounts of their emotions. At one time I naively supposed that I might learn thereby just how the patient was feeling, perhaps be able to label 'the emotions' he or she is really experiencing. I still listen with great interest to patient's statements along these lines, but not with the expectation of discovering what 'emotions' he or she is really experiencing - rather with the hope of understanding in some measure the conventionalized scheme of symbols by which the patient tries to represent himself to himself and to others. Not only are the words conventional symbols; the motor parts of patterns of behavior and corresponding verbalizations are used with the deliberate intention of deceiving others, but this is not the phenomenon of which I now speak. I refer to the degree of conventionality in the patterning of behavior by which one reacts overtly in an emotional experience."

B. EXPERIMENTAL STUDIES ON DIFFERENTIAL RECALL OF EMOTIONALLY TONED MATERIALS IN PSYCHIATRIC POPULATIONS

Sharp, 1938, (25) followed the earlier works of Birnbaum, 1912, (26) and Waldberg, 1921, (27) in using psychiatric populations as experimental subjects. The rationale for the choice of this subject population were: (a) the more vivid emotional life of psychiatric patients would accentuate differences in the area of emotional factors influencing recall; (b) Freud's early conclusions were drawn from psychiatric populations although these theories were later expanded to include memory functioning in general (1).

Sharp's experiment (25) used the techniques of the quantitative recall and the saving in relearning of word lists of P, U, and I emotional tone. The subject populations were three groups of non-psychiatric subjects and three groups of 'psychoneurotics'. Conclusions drawn from the study were that an initial "repression" of both unpleasant and pleasant material occurred followed by an enhancement of memory for the pleasant material. No significant differences were found between the "psychoneurotic" group and the non-psychiatric control group; the defined principles of memory applying to both these populations.

C. MEMORY TESTING IN ORGANIC REACTION TYPES

Betlheim and Hartmann, 1924, (28) investigated the memory reproduction of short stories of a crude sexual nature in patients suffering from Korsakow's psychosis. Their assumption

was that confabulations in this condition were not entirely the random productions of a physiologically disturbed central nervous system but that emotional as well as organic factors influenced the context of recalled material. They specifically stated that the mental mechanisms of "repression, displacement, and condensation" found in "normal" psychological functioning would have their counterpart in organic brain disease. Their major conclusion was that disagreeable concepts of a crude sexual nature were distorted and reproduced in a symbolic form which was acceptable to the subject.

Schilder, 1951, (29) following a method similar to Betlheim and Hartmann, 1951, (28) studied thought disorder in patients suffering from general paresis. After presentation of a short story the paretic patients were asked to reproduce this material. The short story was of a sadistic nature describing the death of a sea captain who fell overboard and was mutilated by a shark.[11] From his observations, Schilder drew several conclusions regarding both mechanistic and emotional factors influencing memory reproductions in paretic thought disorder. Several principles were

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[11] Schilder's shark story is translated by Rapaport, 1951, (28) as "the son of the minister Herbig, of Holzengel near Greussen, was swallowed by a shark. He was first officer of a Hamburg merchantman, and was washed overboard by a squall. Since rescue proved impossible, the unfortunate young man was caught, in front of the eyes of his terrified shipmates, by a shark which followed the steamer. He was dragged to the bottom of the ocean, leaving behind him a dark streak of blood."

described governing the emotional influences affecting recall (a) scenes of intense emotional significance were weakened and generalized; (b) distortion of concepts, occurred as a result of the emotional influences of wish-fulfillment; and (c) unpleasant ideas were represented by concepts of diametrically opposite emotional significance.

VI. FORMULATION OF THE EXPERIMENTAL HYPOTHESES

And Jehovah prepared a great fish to swallow up Jonah; and Jonah was in the belly of the fish for three days and three nights.

Jonah 1:17

Our original observation regarding the possibility of emotional factors influencing recall in the post-convulsive confusional state led us into several areas of literature review: (a) theories on the therapeutic mode of action of convulsive therapy; and studies pertaining to memory impairment after convulsive therapy; (b) current theories and orientation regarding the differential influence of "organic" and "functional" factors in determining disturbances of memory in cases of acute disruption of central nervous system functioning; (c) studies aimed at measuring emotional factors influencing memory in clear consciousness and in patients with organic disease of the central nervous system. This review presented a bewildering complexity of theories pertaining to memory functioning in general and disclosed a multitude of technical experimental difficulties on investigating this subject which appeared to us all but insurmountable even to the most intrepid investigator. However, several factors were decisive in our continuing with the experiment; (a) convulsive therapy is almost unique in providing a subject population which moves from clear consciousness to mental confusion under the therapist's control; (b) to our knowledge no controlled experiment has been directed at measuring emotional factors affecting recall

in the immediate post-convulsive confusional state; (c) the rapid decrease in popularity of convulsive therapy, at least in the United States, lends a degree of urgency to any experimentation in this field.

It was decided to investigate this problem by measuring quantitatively and qualitatively the retention and recall of emotionally toned stories. One group of patients would be presented with an unpleasant story to recall after convulsive therapy, whereas another group of patients would be presented with a pleasant story. The previously discussed difficulties in allowing the subject population to assign test material to a particular emotionally toned category appeared insurmountable. On this account, as we were interested mainly in the concept of the selective forgetting of unpleasant material, it was decided to select a story sufficiently disagreeable to meet any general criteria of unpleasantness and arbitrarily designate it "the unpleasant story".

Schilder's shark story (1) was chosen as the unpleasant story. The German names and place names in Rapaport's translation (1) were modified to suit local circumstances, but the grammatical structure and syntax were maintained. The unpleasant experimental story read:

"The son of Preacher Tate of Belmont, near Charlotte, N. C., was swallowed by a shark. He was first officer on a Wilmington fishing vessel. He was washed overboard by a big wave. Since rescue was impossible the unfortunate young man was caught, in

front of the eyes of his terrified shipmates, by a shark which followed the steamer. He was dragged to the bottom of the ocean, leaving behind him a dark stream of blood."

Many advantages were inherent in the use of this story. Its use, by the eminent physician Paul Schilder, 1951 (1), who spent much of his professional life evaluating problems of a similar nature of our experimental concept (1, 3, 4) is a recommendation in itself. In his studies on thought disorder in general paretics, Schilder defined "base-line" concepts regarding the method in which patients with organic disease of the central nervous system distorted this particular story on recall (1).

Any reader who has any doubt regarding the unpleasant nature of a shark attack is referred to the dreadful descriptions and pictorial illustrations of shark mutilations in: Shark (5); Shark Attack (6); and Dangerous Marine Animals (7). The terror inspired by the shark attack motif has been exploited in the fictional works of Hemingway, 1961, (8) and Fleming, 1964 and 1965, (9, 10). Although our subject population was obviously not expected to have sophisticated knowledge of shark bite pathology it was considered that the shark attack legend was a relatively familiar topic in a population drawn from the catchment area of the North Carolina coastal plain. The warm waters of the Gulf Stream wash the coast of the Carolinas as far North as Cape Hatteras. Each summer an almost total population migration occurs to vacation at the beaches of North and South Carolina and to enjoy the water sports of the Atlantic surf.

It would not be without some factual justification that a swimmer in this area should have a "subconscious" fear of sharks as suggested by Coppleson, 1958, (6) as the coastal waters from Charleston, South Carolina, to Morehead City, North Carolina have been subject to the tragic periodic visits of marauding sharks (6).[12]

Finally, before leaving the shark fear theme, may we quote Ommaney, 1963, (11):

"They (the sharks) are among the most primitive of any living vertebrates - for 350 million years they have pursued a lonely course down the tumultuous road of evolution, meeting the problems of changing conditions by changing themselves scarcely at all. Because of this, as much as for the fearsome reputation which some sharks have as killers, they inspire in man a kind of atavistic horror, and unconscious memory, perhaps of distant ages when the sea held creatures even more terrible than they. In any case, to become aware of the shark approaching from dim waters just beyond the range of vision, or of a manta ray flapping like some prehistoric monster across the ocean floor, is to experience a nightmare sense of peering down some dreadful corridor into an abysmal past."

Some obvious disadvantages were apparent in utilizing the shark story in this particular context. It was considered that specific emotional factors peculiar to this story, especially in relation to convulsive therapy, might nullify drawing general conclusions from any positive findings. The first area of criticism referred to the primitive nature of the shark attack fear amply illustrated by the quotation by Ommaney, 1963, (11). Jung, 1953, (12) makes particular reference to the specific archetype in mythology of the hero's being swallowed by a monster. As stated

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[12] The North Carolina Museum of Natural History, Raleigh, N. C., has an imposing number of exhibits of different types of sharks caught in the inlet and off the North Carolina coast.

in Section II (p. 10) many authors have stressed the primitive nature of the fear associated with convulsive therapy (13-16). Thus, this primitive type story might fall on fertile ground for forgetting and spuriously give positive results inapplicable to unpleasant emotional memories in general.

The two Freudian theories on forgetting (17), namely: (a) that there is a tendency to forget the disagreeable; and (b) that there is a tendency to forget that which will arouse pain; also posed a difficulty. Our main interest was to test the first concept; namely, that after convulsive treatment there is a tendency to forget the disagreeable. However,the shark story appeared to be loaded the potentials for testing the second concept. The oral erotic and oral sadistic phases in emotional development (18) and the castration complex (19) are well known sources of inhibition in infantile development according to the psychoanalytic theory. The oral sadistic implications of the shark story are obvious. Dismemberment and mutilation of the body in a shark attack might easily become symbolic of castration. This dilemma was insoluble as a similar type criticism could be directed at any emotionally loaded material.

For comparative purposes a control story with a different emotional tone to the shark story was fabricated. It was composed to resemble the unpleasant story as regards the general text; syntax; and number of concepts; namely: "The son of Preacher Tate of Belmont near Charlotte, N. C., caught a tuna fish. He was a

charter passenger on a Wilmington fishing vessel and brought the fish on board despite big waves. Since help was impossible, the fortunate young man, alone, landed the tuna fish, which had followed the steamer, in front of the eyes of his admiring shipmates. The fish was dragged to the bottom of the boat leaving behind it a pool of sea-water." On account of the difficulties outlined previously regarding the validity of assigning a story to a particular category of pleasant, unpleasant or indifferent, it was decided to arbitrarily call this the pleasant story. This story might readily be categorized as pleasant, indifferent or even by a piscophobe as unpleasant. However, as the aim in using a control story was to obtain recall data to compare with the shark story data it was considered that if this story were less unpleasant than the shark story it would suffice our purpose. We were satisfied that this story was less unpleasant than the shark story.

The experimental hypotheses:

It was predicted that there would be both quantitative and qualitative differences in post-convulsive recall of pleasant and unpleasant verbal memories learned before application of treatment; namely: (a) significantly more concepts of the pleasant story would be recalled than of the unpleasant story and (b) these differences would apply specifically to the four most unpleasant concepts in the unpleasant story when compared to the equivalent concepts in the pleasant story. The four most unpleasant concepts

of the shark story were arbitrarily defined as: "was swallowed by a shark"; "was caught by a shark"; "he was dragged to the bottom of the ocean"; and "leaving behind him a dark stream of blood".

VII. STRUCTURING THE EXPERIMENTAL METHOD

By different methods different men excel;

Charles Churchill: Epistle to William Hogarth

A. GENERAL PROCEDURE

In order to facilitate the interpretation of the results it was determined to build in certain controls into the experimental method. It was decided that studies would be conducted on each subject on two occasions; namely, at the first and second treatments of a series. If the patient were tested with the pleasant story at the first treatment of a series then the unpleasant story would be presented at the second treatment and vice versa if the unpleasant story were used at treatment one. This would allow the individual subject to act as her own control. In order to allow for meaningful interpretation of any positive findings in the test group of patients it was decided to use a control group of subjects who underwent exactly the same procedures as the test group apart from omission of the electroconvulsive therapy. Patients would be randomly assigned as to which story was presented first.

The experiment was planned to maintain constant or to control within defined limits as many as possible of the relevant extraneous variables.

B. PRESENTATION OF STORIES AND RECALL TESTS

In order to obtain standard presentation of the verbal material to be learned, three repetitions of the story were to be

presented to the subjects by tape recording,[13] with the test instructions incorporated in the recording.

After an interval of twenty minutes from presentation of the material before application of the electric shock treatment the first recall was to be performed. This would give a baseline of recalled material before application of the treatment. Ten minutes after this first recall the electric shock treatment would be applied i.e., thirty minutes after the presentation of the verbal material. Two further recalls would be undertaken at thirty minutes and sixty minutes after the application of the electrical stimulus. All recalled material would be recorded by tape recorder.

The temporal sequence of these events were to some extent arbitrarily defined but not entirely without rationale.

The consolidation theory of memory postulates that a permanent memory trace of an experience is not completely formed immediately after an experience but remains in a state of fragility for a variable period of time after learning (4, p. 192, 5). Animal experimentation on the effect of electro-convulsive shock on pretreatment learning, has been a considerable factual basis to this concept (6). Assuming the consolidation theory of memory

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[13] Important factors to be held constant are the intensity of the sound and the rate of presentation of the stories. Studies in digit span learning have shown the rate of presentation of the stimuli to be a highly important variable (1-3).

trace fixation to be true, an adequate time period had to elapse between the learning of verbal material and the application of the electric shock stimulus in this experiment or the learned material might be irrevocably lost in the "physiological storm" of the convulsion (7). In previous experiments Gottlieb and Wilson, 1965 (8) and Wilson and Gottlieb, 1967 (9) reported the accurate post-convulsive recall of verbal memories which had been learned twenty minutes before treatment. As the present verbal material was of a more complex nature than the four digit span and short sayings used in our previous experiments (8, 9), a longer period between the learning of the material and application of the stimulus was defined; namely, thirty minutes.[14]

In assessing recall of verbal memories during the period of post-ictal confusion an important variable appeared to be the duration of time which elapses between the stimulus application and the administration of the recall tests. Many studies have defined a predictable pattern of post-ictal recovery of physiological and intellectual functioning (11-13). In our previous studies on unilateral electric shock treatment (8, 9) we reported a constancy in the sequence of recovery as regards the various spheres of orientation and recall of verbal memories which showed little sequential variation with either the site of application

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[14] There is experimental evidence to suggest that consolidation time varies according to the complexity of the material to be learned. More complex material requiring a longer period for consolidation (10).

of electrodes or the treatment number in a series.

The two predetermined post-ictal times for applying recall tests were; namely: (a) 30 minutes after the application of the convulsive stimulus, and (b) 60 minutes after application of shock were chosen using data from our previous studies (8, 9). At the thirty-minute interval it was anticipated that there would still be marked clouding of sensorium and that the verbal material recalled at this time would be under less scrutiny from the higher centers than material obtained later. At the sixty-minute time interval it was foreseen that the recall test would be applied to the patient in a state of relatively clear consciousness. These latter data would be commensurate with the maximum possible recall in the immediate post-convulsive period. In our previous studies (8, 9) recent memories (digit span and sayings) were recalled within 60 minutes after treatment, in all cases, at the first and second treatments in a series.

C. THERAPEUTIC TECHNIQUE

Many variables have been defined in the literature as being important in determining the intensity of post-ictal confusion with electroconvulsive therapy.

1. The intensity of the electrical stimulus:

In a well controlled experiment, Ottosson, 1960, (14) found a positive association between the intensity of the electrical stimulus and the degree of post-convulsive confusion. His study compared the relative importance of the intensity of the

electrical stimulus with the duration of the induced abnormal electrical activity in defining the degree of post-convulsive disturbance of intellectual and memory functioning. The intensity of the electrical stimulus was found to be the more important variable.

2. Type of electrical wave used as the stimulus:

In the late forties several studies were directed at measuring the different degrees of post-convulsive confusion associated with the type-wave of the electrical stimulus. There was general agreement that the technique of Brief Stimulus Therapy, using a square wave stimulus, caused less post-convulsive confusion than the conventional sine wave stimulus method (15-17). Bayles, et al, 1950, (15) advocated the use of Brief Stimulus Therapy for the following reasons: there was a reduction in the potential or probable amount of brain damage; there was a reduction in the severity of EEG changes; and there was a reduction in the severity of the post-shock confusional state.

3. Site of electrode placement:

Several studies have reported a decrease in post-convulsive confusion and memory impairment with unilateral electrical stimulation of the non-dominant cerebral hemisphere (18-21). In interpreting the results of a study on unilateral convulsive therapy Wilson and Gottlieb, 1967, (9) suggested the theoretical possibility of varying degrees of post-convulsive confusion resulting from different bilateral electrode placement depending on

whether the frontal lobes or temporal lobes were primarily affected by the direct electrical stimulus. One would predict less post-convulsive memory impairment with bilateral frontal electrode placement, than with bilateral temporo-parietal electrode placements as the frontal lobes have been implicated mainly in predictive intelligence (22, 23), whereas, the temporo-parietal lobes are more intimately associated with memory functioning (24-26).

4. Number of treatments in a series:

It is a well known clinical fact that post-convulsive confusion becomes progressively more severe with the sequential convulsive therapies. Clinical and electroencephalographic studies have confirmed this clinical observation (27-30). In our previous studies (8, 9) no significant differences were found in the post-ictal times of orientation and recall of recent verbal memories between the first and second treatment of a series.

As a result of the above observations, the following experimental procedures were defined: (a) a stimulus of standard intensity would be used throughout the experiment; namely, a current of 130V for 0.6 seconds administered by a Medcraft machine with glissando technique: (b) the center of the circular electrodes would be placed 1 1/2 inches above the zygoma on a perpendicular line drawn at the right angles to the midpoint of a line joining the lateral angle of the orbit and the external auditory meatus.

D. DEFINITION OF THE SUBJECT POPULATION

The abundance of literature referring to the influence of technical factors in determining the intensity of post-convulsive confusion is complemented by a dearth of literature concerning the differential effects of various constitutional variables. It was contemplated that the most important constitutional factors affecting both the learning of verbal material and its subsequent post-convulsive recall would be: (a) age; (b) intelligence; and (c) diagnostic category.

Criteria for patient selection:

1. Sex: As the investigator was employed in research and service clinical duties on a female admission ward at Dorothea Dix Hospital it was decided to select a female subject population through expediency.

2. Age: Certain investigators have reported a progressive decline in both intelligence (31) and verbal learning capacity (33) with advancing years, but, it would appear that there is a greater negative association between performance abilities than verbal abilities and age (p. 139, 33, 34). In our previous studies (8, 9) we found age to have a non-significant negative correlation with the speed of post-ictal reorientation and recall of recent verbal memories. Using the data and conclusions from the above studies it was decided to have an upper age limit of 55 years. Exclusion of the older age group would eliminate the population with excessive "age determined" decrement in learning

capacity and also eliminate subjects with early senescent or cerebral arteriosclerotic disease of the central nervous system. It was considered that patients with organic disease of the central nervous system would confound the results both as regards verbal learning ability and post-convulsive verbal memory recall.[15]

3. Intelligence: Although studies have shown only a moderate positive relationship between intelligence and learning ability (p. 315, 36) and factor analytic studies have tended to negate any general learning capacity (37, 38), nevertheless, it was considered that intelligence might be an important variable in both the retention and recall of the test stories and become an important parameter in the interpretation of the results. Again in our previous studies (8, 9), intelligence was found to have a non-significant positive correlation with the speed of post-convulsive orientation and verbal memory recall. However, in the present experiment the verbal material to be learned before treatment was of a more complex nature than the digit spans and short saying used in the previous studies. It was considered that intelligence might become an influential factor in determining the quantity and quality of post-ictal recall. For this reason it was planned to use the Verbal Scale of the Wechsler Adult Intelligence Scale (39) as a device to measure the

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[15] In an analogous situation it has been reported that after head injury there is a greater likelihood of permanent organic impairment in patients previously suffering from cerebral arteriosclerosis (35).

functional intelligence of the subject but not to use the defined intelligence quotient as a criterion for patient selection.

The latter decision was made for two reasons: (a) Formal intelligence testing is notoriously unreliable in measuring the inherent intellectual capacity of mental patients (40-44)[16]. (b) It was anticipated that many patients would perform satisfactorily in the intelligence test interview situation under the supervision of the tester, yet they might be incapable of cooperating in the experimental tests on account of disorders in volition and concentration secondary to their mental illness.[17] It was decided to fabricate a learning capacity test as a screening procedure to exclude unsuitable subjects. In order to measure the patient's functional intellectual capacity in the same general sphere as the experimental tests it was decided to make up a short story for retention and recall. Three

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[16] Studies in the intelligence testing of psychotic groups of patients generally show a wider scatter in sub-test scores. Another source of variability is the changing mental condition of the individual patient as regards cooperation and motivation (40-44).

[17] It was foreseen that a large proportion of the study population would fall into the diagnostic categories of schizophrenia and depression. Defect in the ability to maintain attention and concentration is an habitual feature of schizophrenic illness (p. 68-70, 45; 46) and is also commonly associated with retardation in depressive illness (p. 258, 47; p. 18, 48). The volitional disorders anticipated which would affect motivation were mainly: schizophrenic negativism (p. 442-445, 49; p. 233-234, 50; p. 368, 51) and lack of initiative in retarded depressions (p. 68, 52; p. 425, 53).

presentations of the following sentence were to be given to the subject: "A man from Richmond, Virginia, visited his relatives in Rocky Mount, North Carolina". After intervals of thirty and sixty minutes the patient would be asked to recall this sentence. It was arbitrarily defined that a minimal recall of at least five of the seven concepts at both recall times would be essential for inclusion in the study.[18]

4. Diagnostic category:

As the context of the unpleasant test story was loaded with sadomasochistic concepts it was considered that psychopathologic complexes specific to a particular diagnostic group might affect the retention and recall of the test material. Theoretically oral sadistic complexes have been implicated as specific etiologic factors in both depression (54) and schizophrenia (55, 56). As the aim of the study was to define interaction between psychological and organic factors, different mental mechanisms between diagnostic categories might be a variable of considerable importance and complicate the interpretation of the data. It was deliberated that the ideal situation would be to select a population with similar diagnosis and homogenous psychopathology.

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[18] The test sentence was scored: 1 A man 2 from 3 Richmond, Virginia 4 visited his relatives 5 in 6 Rocky Mount, 7 North Carolina.

However, if strict diagnostic and psychopathologic standards were defined as selective criteria there would obviously be a proportional reduction in suitable candidates. This would coincide with a local situation where there has been a continuous decrease during recent years, in the proportion of patients to whom electroconvulsive therapy has been administered.[19] As a result of these factors a lengthy and indeterminate time would elapse in building up a study population. Some consolation was obtained for relinquishing diagnostic selective criteria in the fact that local studies in diagnostic agreement among psychiatrists show diagnosis to be an unreliable measure (65).

For reasons previously discussed organic diagnoses were to be excluded and the severer mental defective patients would be excluded by the preliminary memory test.

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[19] A memorandum from the office of the Physician Superintendent of Dorothea Dix Hospital, Raleigh, N. C. showed a 66% reduction per capita in the administration of E.C.T. over the seven-year period from 1956-63. The principal reason for this was the increased use of phenothiazine and antidepressant medication in schizophrenia and depression respectively. A monumental literature describes the therapeutic efficacy of these drugs. As a result of local interest in and clinical investigation of the psychopharmaceuticals (57-64) there is probably a higher proportion of patients in the N. C. State Hospital System treated by drug therapy than in other geographical areas. It was considered that any local study of E.C.T. must depend on a biased subject population as E.C.T. is generally recommended only after therapeutic failure on psychopharmaceuticals.

VIII. THE EXPERIMENTAL METHOD (PHASE I)

"It is a good divine that follows his own instructions: I can easier teach twenty what were good to be done, than be one of the twenty to follow mine own teaching."

Shakespeare: The Merchant of Venice

A. SITE

The study was conducted on Ward 301, a female admission ward, Dorothea Dix Hospital, Raleigh, N. C.

B. PATIENT POPULATION

1. Test group:

Fifty female patients who were consecutive referrals for electroconvulsive therapy were studied on the project. To be assigned to the study they fulfilled the following selective criteria: (a) Aged 55 years or less; (b) diagnosis; organic diagnoses were excluded; and (c) they successfully completed the screening recall tests.

The screening recall test: This was a test of recall of recently presented verbal material. The following technique was used in the recall test. "Now I want you to listen carefully to this story as I will ask you to repeat it again later: 'A man from Richmond, Virginia, visited his relatives in Rocky Mount, North Carolina'". Three repetitions of the story were given. The second repetition was introduced: "Listen carefully, I am going to tell you the story again, 'A man from Richmond...'" The third repetition was introduced: "I will tell you the story

one more time, 'A man from Richmond...'" The subject was asked to recall this material at intervals of thirty minutes and sixty minutes. A score of five points from the possible seven was necessary to qualify for the experimental project. (For scoring see previous description, p. 56).

2. Control group:

For each patient assigned to the test group one subject was allotted to the control group. The control group subjects were selected randomly from the ward population who had not received convulsive therapy. They had to fulfill similar selective criteria to the test group regarding (a) age, (b) diagnoses, and (c) ability to pass screening recall test.

C. MEMORY TESTING PROCEDURES

1. Test group:

a. Assignment of patients: Selected subjects were randomly assigned, by a prearranged random table, to Group C or Group D. Group C was tested with the pleasant story at Treatment No. 1 of a series and with the unpleasant story at Treatment No. 2 of a series. Vice versa Group D was presented with the unpleasant story at Treatment No. 1 of a series and the pleasant story at Treatment No. 2.

b. Presentation of verbal material: The verbal material was prerecorded on a Wollensak tape-recorder at Volume 7. It was presented to the patients at Volume 2. The

recordings were made by Dr. Myron G. Sandifer.[20] Three repetitions of the story were given. Instructions were incorporated on the recording.

The pleasant story: First repetition - "This is not a true story, it has been made up to test your memory. Now listen carefully as you will be asked to repeat it again later. 'The son of Preacher Tate, of Belmont, near Charlotte, N. C. caught a tuna fish. He was a charter passenger on a Wilmington fishing vessel, and brought the fish on board despite big waves. Since help was impossible, the fortunate young man alone, landed, in front of the eyes of his admiring shipmates, the tuna fish, which had followed the steamer. The fish was dragged to the bottom of the boat, leaving behind it a pool of sea water.'"

Second repetition - "Listen carefully, I will tell you the story again, 'The son of Preacher Tate...'"

Third repetition - "Listen carefully. I will tell you the story one more time, 'The son of Preacher Tate...'"

The unpleasant story was: "The son of Preacher Tate of Belmont near Charlotte, N. C. was swallowed by a shark. He was first officer of a Wilmington fishing vessel and was washed overboard by a big wave. Since rescue proved impossible, the unfortunate young man was caught, in front of the eyes of his terrified shipmates, by a shark which followed the steamer. He

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[20] Formerly Director of Research, N. C. Dept. of Mental Health. Now Professor of Psychiatry, University of Kentucky, Lexington, Ky.

was dragged to the bottom of the ocean, leaving behind him a dark streak of blood." Three repetitions of this story were presented to the subject with the same instructions as for the pleasant story incorporated on the recording.

c. Recall procedure: Presentation of the verbal material was timed by stopwatch. Immediately after the third repetition of the story was complete the stopwatch was activated. Twenty minutes later a first recall was done. Ten minutes after the first recall the electroconvulsive therapy was applied. Thirty minutes after application of the electrical stimulus a second recall was undertaken. The third recall was exactly sixty minutes after the application of the electrical stimulus.

All recalls were done by a standard procedure, namely: The tester stated to the subject, "Some time ago you were told a story on this tape recorder. I want you to tell me what you remember of that story." In the event of a lack of response two further repetitions of this statement were made. When the subject had completed the recall a further statement was made, namely, "Do you remember any more?" This latter statement was repeated twice more. All the subjects responses were recorded on the tape recorder.

2. Control Group:

All the above procedures were undertaken in the control group except for the omission of the electroconvulsive therapy.

D. ELECTROCONVULSIVE THERAPY TECHNIQUE

All patients were premedicated with 1/100 gr. of atropine. Thirty-five seconds before application of electrical stimulus a muscle relaxant Anectine (succinyl choline) 15 mg. was administered intravenously. The electrical stimulus was 130 V x 0.6 sec. administered by a Medcraft machine using glissando technique. The center of the circular electrodes were placed one and one-half inches above the zygoma on a perpendicular line drawn from the midpoint of the line joining the lateral angle of the orbit with the external auditory meatus. Oxygen was administered by artificial respiration after the convulsion until the return of natural breathing.

E. TREATMENT OF DATA

The recorded responses were transcribed verbatim for data analysis.

FLOW CHART

Population Selection

Assignment of patient to electroconvulsive therapy → Selection of control patient

Selective criteria

a. Age
b. Diagnosis
c. Recall test

WAIS Verbal Scale

Random Assignment

Selective criteria

a. No convulsive therapy
b. Age
c. Diagnosis
d. Recall test

WAIS Verbal Scale

Random Assignment

Memory Testing

	C	D	A	B
0 min	P Story	U Story	P Story	U Story
20 min	1st Recall	1st Recall	1st Recall	1st Recall
30 min	ECT	ECT	-	-
60 min	2nd Recall	2nd Recall	2nd Recall	2nd Recall
90 min	3rd Recall	3rd Recall	3rd Recall	3rd Recall
	↓	↓	↓	↓
0 min	U Story	P Story	U Story	P Story
20 min	1st Recall	1st Recall	1st Recall	1st Recall
30 min	ECT	ECT	-	-
60 min	2nd Recall	2nd Recall	2nd Recall	2nd Recall
90 min	3rd Recall	3rd Recall	3rd Recall	3rd Recall

IX. RESULTS (PHASE I)

"You have only to take in what you please and leave out what you please; to select your own conditions of time and place; to multiply and divide at discretion; calculation is nothing but cookery"

Lord Brougham, 1849

A. Definitions

In order to clarify the description of the interaction of variables the following words will be used only with the specific meanings defined.

Administration refers to the total experimental process of presentation of a story and recording of the recalled material.

Order refers to the order of story administration, e.g. it is implicit in "pleasant story first administration" that this group of patients will have the unpleasant story presented on second administration.

Unpleasant story refers to the modified Schilder Shark Story (1).

Pleasant story refers to the fabricated fishing story.

Recall number refers to the material recalled at various intervals after the presentation of the story. Recall 1 refers to material recalled 20 minutes after story presentation. Recall 2 refers to material recalled 60 minutes after

story presentation. Recall 3 refers to recalled material 90 minutes after presentation of the story.

Control group refers to the patients who were studied without the application of electroshock treatment.

Test group refers to the patients who were studied with the application of electroshock treatment.

Item refers to an individual concept expressed in the stories.

B. Population Characteristics

Table 1 shows the characteristics of the population of 100 patients regarding: age, intelligence and diagnosis.

Table 1.

Population Characteristics
(Age, Intelligence and Diagnosis)

		Age		Intelligence		Diagnosis		
	N	M	SD	M	SD	Dep.	Schiz.	Other
Group A	25	40.6	10.23	99.52	16.29	13	9	3
Group B	25	37.2	8.19	99.40	12.47	10	10	5
Group C	25	39.9	10.35	94.00	11.94	11	12	2
Group D	25	43.7	8.64	94.20	9.37	10	13	2

Group A Control group - pleasant story first administration
Group B Control group - unpleasant story first administration
Group C Test group - pleasant story first administration
Group D Test group - unpleasant story first administration

(1) Age: The mean age of the study population (Mean 40.34 S.D. 9.76) is significantly lower than the mean age (53.1 years) of all female admissions to Dorothea Dix Hospital during this period of time ($p < .005$) (2). This is understandable as the selective criteria for inclusion in the study defined an upper age limit of 55 years.

Figure 1 shows the distribution of the population by age.

In Table 1 there are no significant differences between the age means of groups A, C and D; however, the mean age of Group B is significantly less than that of Group D (two-tailed t-test; $t = 2.729$, 48 df, $p < .01$). As the random procedure outlined in the experimental method was followed in control patient selection it is difficult to explain this significantly low mean. A contributing factor to this phenomenon is the presence of five patients, in this group, with "other" diagnoses: these five patients had personality disorder diagnoses and belonged to a younger age group.

(2) Intelligence: The mean intelligence of the total study population, as measured by the W.A.I.S. Verbal Scale (3) was 96.8 (S.D. 12.79). Figure 2 shows the distribution of this population graphically.

Figure 2 shows the population to be normally distributed as regards intelligence with the lower tail of the distribution cut off. Patients with an I.Q. less than seventy were eliminated from the experiment by failing the memory test which was a

Figure 1.

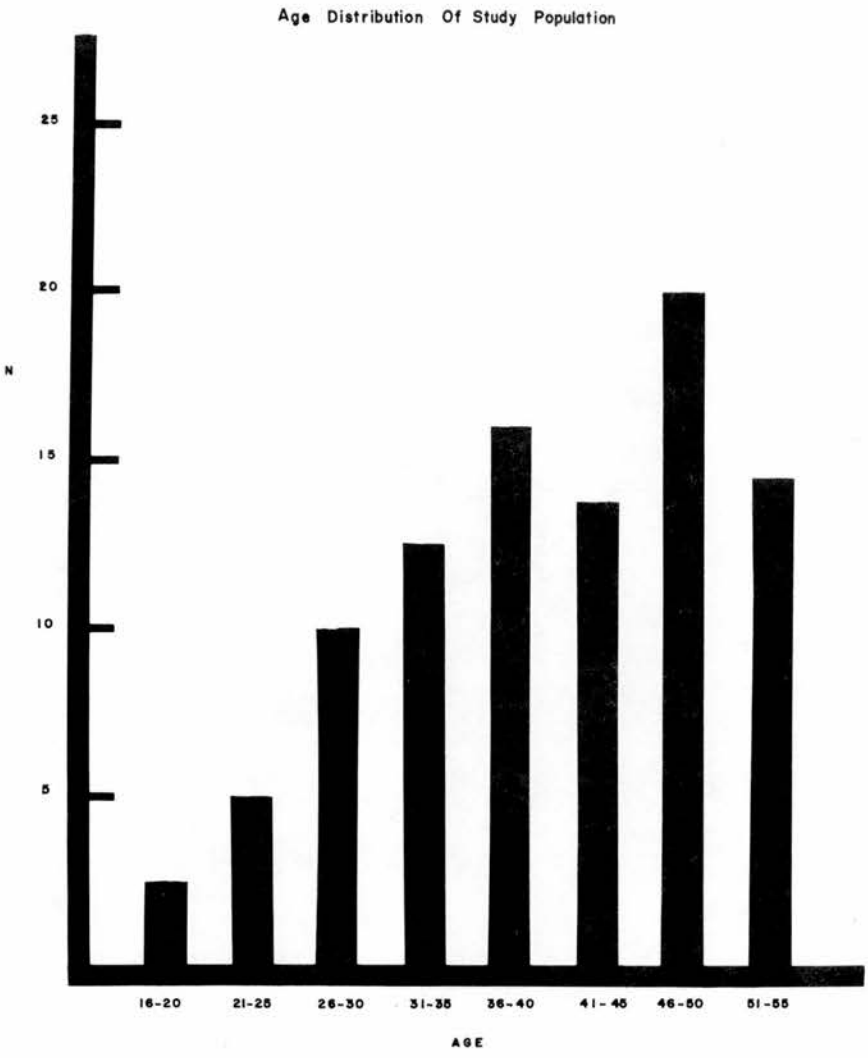
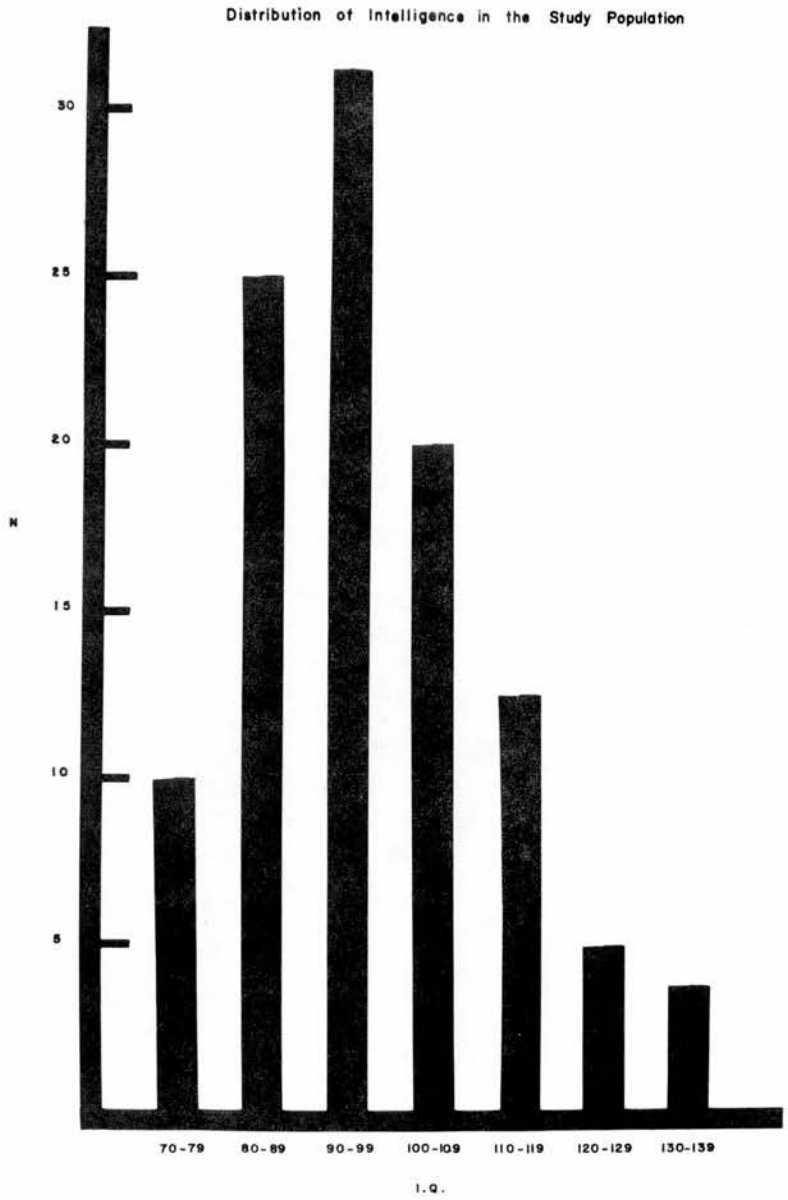

Age Distribution Of Study Population
25
20
N
15
10
5
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
AGE

Figure 2.


Distribution of Intelligence in the Study Population
30
25
20
N
15
10
5
70-79
80-89
90-99
100-109
110-119
120-129
130-139
I.Q.

selective criterion for inclusion. In all, eleven patients failed the memory test; seven patients as a result of an intellectual deficit and four patients as a result of lack of cooperation.

Table 1 shows the I.Q. means with standard deviations for the four subgroups of patients. It can be seen that there is a remarkable similarity between means of the two control groups (99.52 and 99.40); similarly in the two test groups there is close approximation between means (94.08 and 94.20). The difference between the mean of Group B (99.40) is significantly different from the mean of Group D (94.20) at the 95% level.

The remarkable similarity of means within the control groups and within the test groups as compared to the difference between the control group and test group would appear to indicate differences in sampling between the control and test populations. As indicated previously, the test population was selected from consecutive referrals for electroconvulsive treatment by the resident physicians, whereas the control population was selected randomly from the residual patients on the ward. Several factors probably contributed to the difference between the two groups: (a) the psychiatric residents were probably using dull intelligence as a selective criterion in recommending electroconvulsive therapy, thus leaving a residual population of higher intelligence from which the control group was sampled; (b) the control group had a larger proportion

of personality disorders who generally scored higher on the intelligence scale.

(3) Diagnosis: Table 1 also shows the diagnostic distribution in the subgroups of patients. Although the control groups show a larger proportion of "other" diagnoses, the differences are not significant by the Chi square test. Patients with schizophrenic and depressive diagnoses form the bulk of the populations, both test and control.

C. Analysis of Concept Recall Data

(1) Reliability of Scoring.

The number of concepts remembered were scored quantitatively by two raters, Raters A and B. Rater A was the investigator. Rater B was a senior undergraduate student majoring in English at North Carolina State University. The material was scored independently and with no collaboration between raters. Immediately after recording the recalled material, Rater A scored the number of recalled concepts on data sheets. Rater B scored the recalled material quantitatively from the verbatim transcriptions. Rater B was uninformed regarding the nature of the experiment. Both raters conformed to the basic rule that the material was to be scored according to the number of concepts recorded rather than according to verbal accuracy, e.g., if "the son of Preacher Tate" were remembered as "a doctor's son" this would score one point.

Inter-rater reliability:

The Coefficient of Correlation (product moment) between raters in all recalls both test and control groups, was 0.833 ($N = 600$, $p = < 0.005$).

Table 2 shows the inter-rater Coefficients of Correlation with the data broken down by recall number and whether control or test group.

Table 2.

Coefficients of Correlation
(product moment)

Rater A vs Rater B

		Control Group		Test Group	
	N	r	p	r	p
Recall 1	100	0.912	<0.005	0.882	<0.005
Recall 2	100	0.825	<0.005	0.953	<0.005
Recall 3	100	0.905	<0.005	0.902	<0.005

Regarding the experimental hypothesis a crucial area of scoring reliability lay in the post-convulsive recall of material, so inter-rater Coefficients of Correlation were computed for the second and third recalls after treatment in both the pleasant story groups and the unpleasant story groups. These coefficients of correlation are shown in Table 3.

Tables 2 and 3 showed significantly high agreement between the raters and so gave confidence in further analysis of the quantified data.

Table 3.

Coefficients of Correlation
(Product Moment)

Rater A vs Rater B

	Pleasant Story Test			Unpleasant Story Test		
	N	r	p	N	r	p
Recall 2	50	0.945	0.005	50	0.958	0.005
Recall 3	50	0.898	0.005	50	0.905	0.005

In the subsequent analysis only the scores of Rater A were used.

(2) Analysis of Total Quantitative Recall of Concepts.

Table 4 shows the number of concepts remembered by individual subjects in the control groups. The data are broken down by pleasant story vs. unpleasant story; first administration vs. second administration and by recall number.

Table 4.

No. of Concepts Remembered by Each Patient

	Control Group A Pleasant Story (1st Admin.)				Control Group B Unpleasant Story (1st Admin.)		
Pat. No.	Recall no. 1	2	3	No. Pat.	Recall No. 1	2	3
1	6	6	6	26	5	7	7
2	9	11	12	27	13	13	13
3	8	8	8	28	4	3	5
4	5	5	6	29	12	11	11
5	12	11	11	30	5	5	5
6	7	8	6	31	9	9	9
7	6	9	9	32	5	5	5
8	4	5	5	33	9	10	11
9	7	9	7	34	9	9	9
10	7	8	8	35	6	6	6
11	8	10	9	36	6	6	6
12	10	8	6	37	10	9	9
13	10	11	11	38	8	7	7
14	7	7	7	39	11	10	13
15	12	12	12	40	11	11	13
16	4	7	6	41	3	3	3
17	4	4	5	42	7	8	9
18	13	13	13	43	8	8	9
19	7	8	8	44	6	5	6
20	4	4	4	45	7	7	8
21	9	12	11	46	7	7	6
22	7	6	7	47	12	11	10
23	8	7	8	48	8	7	8
24	11	13	13	49	12	12	12
25	6	7	5	50	12	12	12
Means	7.64	8.36	8.12		8.20	8.04	8.36

Table 4.
(continued)

No. of Concepts Remembered by Each Patient

	Control Group A Unpleasant Story (2nd Admin.)				Control Group B Pleasant Story (2nd Admin.)		
Pat. No.	Recall No. 1	2	3	Pat. No.	Recall No. 1	2	3
1	6	7	6	26	7	8	8
2	8	9	9	27	13	13	12
3	5	6	6	28	5	5	5
4	5	5	5	29	10	11	10
5	10	11	12	30	8	8	8
6	10	8	9	31	10	7	11
7	7	7	7	32	5	5	5
8	3	3	3	33	9	12	12
9	7	7	9	34	11	11	12
10	6	6	6	35	5	6	7
11	7	8	7	36	5	4	6
12	7	8	8	37	11	13	13
13	10	11	12	38	11	10	11
14	4	4	5	39	12	11	10
15	5	7	8	40	13	13	13
16	3	3	3	41	3	3	3
17	5	5	5	42	7	9	8
18	11	11	10	43	11	11	11
19	8	7	7	44	8	8	8
20	4	3	3	45	9	9	9
21	10	10	10	46	5	5	5
22	6	6	6	47	12	12	11
23	6	8	7	48	12	7	7
24	8	10	11	49	12	12	12
25	7	7	7	50	13	13	13
Means	6.72	7.08	7.24		9.08	9.04	9.20

Analyses of variance were the statistical methods used for analysis of these data. Duncan's Multiple Range Test (4) was used to define significant differences between groups of means.

Table 5 shows the analysis of variance table for the preceding data.

Table 5.

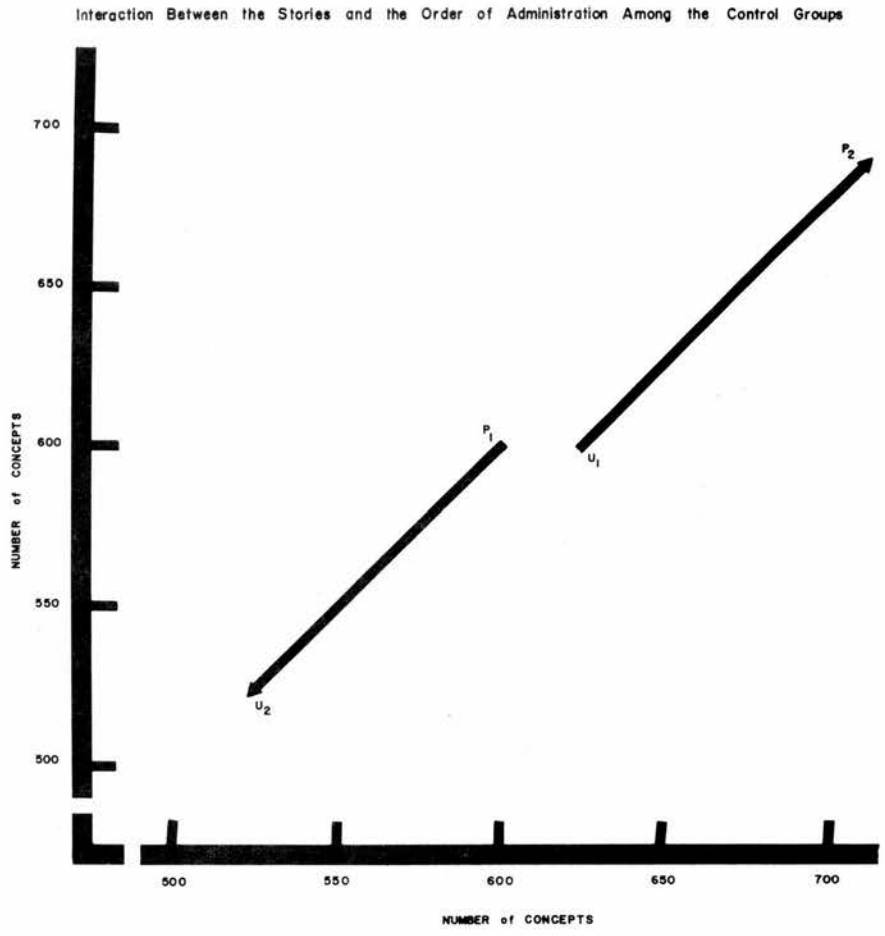
Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	69	69.0	9.16**
Recalls 1 vs 2 vs 3 (R)	2	7	3.5	
1st Admin. vs 2nd Admin. [Order (O)]	1	1	1.0	
Interaction				
S X R	2	1	0.5	
S X O	1	90	90.0	11.95**
R X O	2	1	0.5	
S X R X O	2	3	1.5	
Residual	288	2170	7.5	

Significance ** $p < .01$

The analysis of variance shows that there were significant differences in two areas of the data on Table 4: (a) significantly more concepts of the pleasant story were remembered than of the unpleasant story in the overall results; and (b) interaction

Figure 3a.


Interaction Between the Stories and the Order of Administration Among the Control Groups
700
650
600
550
500
NUMBER of CONCEPTS
P2
P1
U1
U2
500
550
600
650
700
NUMBER of CONCEPTS

occurred between the pleasant or unpleasant nature of the story and the order of administration as shown in Figure 3a.

If the pleasant story were administered first a decrement occurred in the number of concepts remembered of the unpleasant story administered second. Vice versa, if the unpleasant story were told first, an increment occurred in the number of concepts remembered of the pleasant story administered second.

There was a tendency in the control groups for these data to show the phenomenon of reminiscence as there was a general trend towards an increase in the number of concepts remembered with sequential recalls. This trend, however, did not attain a level of statistical reliability.

Table 6 shows the equivalent data for the test groups.

Table 6.

No. of Concepts Remembered by Each Patient

	Test Group C Pleasant Story (1st Admin.)				Test Group D Unpleasant Story (1st Admin.)		
Pat. No.	Recall No. 1	2	3	Pat. No.	Recall No. 1	2	3
51	10	9	9	76	3	1	1
52	6	1	5	77	3	2	3
53	10	0	1	78	10	0	0
54	6	0	2	79	5	1	2
55	9	8	6	80	7	7	7
56	4	0	1	81	5	0	3
57	7	3	7	82	5	2	1
58	11	3	3	83	11	3	2
59	9	6	9	84	7	0	0
60	8	2	3	85	7	0	0
61	10	5	9	86	6	0	7
62	7	3	4	87	2	0	1
63	5	1	2	88	5	0	0
64	9	7	8	89	6	3	5
65	10	7	8	90	5	0	3
66	4	0	3	91	9	0	2
67	10	6	8	92	7	3	4
68	7	1	7	93	4	0	0
69	3	0	0	94	9	0	8
70	7	2	3	95	8	0	0
71	3	0	0	96	2	0	2
72	7	3	5	97	5	0	3
73	7	0	5	98	4	0	2
74	10	7	7	99	5	5	5
75	6	2	3	100	12	1	9
Means	7.40	3.04	4.72		6.08	1.12	2.80
Code Letter	a	b	c		g	h	i

Table 6.
(continued)

No. of Concepts Remembered by Each Patient

Test Group C Unpleasant Story (2nd Admin.)				Test Group D Pleasant Story (2nd Admin.)			
Pat. No.	Recall No. 1	2	3	Pat. No.	Recall No. 1	2	3
51	11	10	11	76	5	1	1
52	7	5	2	77	6	5	5
53	9	0	0	78	10	0	4
54	4	0	0	79	7	3	3
55	8	1	4	80	8	8	9
56	5	0	0	81	9	4	6
57	6	5	6	82	3	2	1
58	8	0	2	83	8	2	3
59	10	0	0	84	8	0	1
60	8	0	5	85	6	1	3
61	10	0	6	86	8	0	6
62	7	2	5	87	1	0	1
63	6	1	2	88	7	3	7
64	6	0	0	89	5	3	3
65	11	9	10	90	4	4	4
66	3	0	0	91	8	2	6
67	8	8	8	92	3	0	3
68	7	0	5	93	5	0	1
69	4	0	0	94	11	0	8
70	6	0	2	95	8	2	4
71	5	0	0	96	3	2	2
72	4	0	2	97	6	2	6
73	3	0	1	98	6	1	5
74	10	4	7	99	7	5	5
75	6	2	3	100	6	0	1
Means	6.88	1.88	3.24		6.32	2.00	3.92
Code Letter	j	k	l		d	e	f

Table 7 shows the analysis of variance table for the above data.

Table 7.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	61	61.0	8.91**
Recalls 1 vs 2 vs 3 (R)	2	1116	508.0	74.20**
1st Admin. vs 2nd Admin. [Order (O)]	1	2	2.0	
Interaction				
S X R	2	11	5.5	
S X O	1	50	50.0	7.30**
R X O	2	1	0.5	
S X R X O	2	1	0.5	
Residual	288	1973	6.8	

Significance ** $p < .01$

The analysis of variance table (Table 7) shows three areas where significant differences occur.

a. Highly significant differences occur between recall numbers. Recall 1 was performed before application of electro-convulsive therapy, whereas Recalls 2 and 3 were performed 30 minutes and 60 minutes after the application of the therapy.

This shows that the decrement in the number of recalled concepts after treatment as compared to the pre-convulsive recall is highly significant. In the control group no such decrement occurs from Recall 1 through 3, so the observed decrement is a result of post-convulsive amnesia rather than a "normal" forgetting process.

b. Significantly more concepts of the pleasant story were remembered than the unpleasant story in the overall results. This is similar to the control group.

c. Another area of agreement between the control and test groups is the interaction resulting from the order of telling of the pleasant and unpleasant stories. This interaction is shown in Figure 3b.

If the pleasant story were told first, there was a decrement in the number of recalled concepts of the unpleasant story administered second; whereas, if the unpleasant story were administered first, there was an increment in the number of recalled concepts in the pleasant story.

d. Table 8 shows all the test group means arrayed to show significant differences between groups of means. The code letters are those defined in Table 6.

Figure 3b.

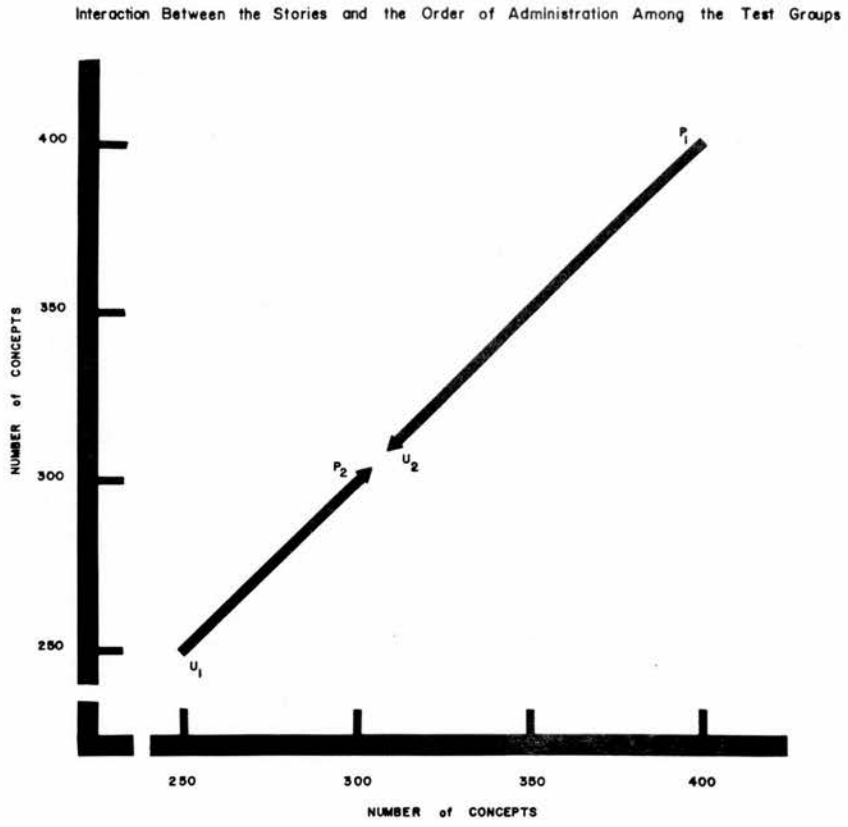

Interaction Between the Stories and the Order of Administration Among the Test Groups
NUMBER of CONCEPTS
400
350
300
250
P1
P2
U2
U1
250
300
350
400
NUMBER of CONCEPTS

Table 8.

Arraying of Means to Show Significant Differences between Groups of Means by Duncan's Multiple Range Test

Means (Code Letters)	hke	ibl	fc	gdj	a

Table 8 shows the means of the test groups arrayed in ascending order from left to right, i.e. the lowest mean is h and the highest is a. Each group is significantly different from other groups. The first group (h, k, e) show that the means of the second recalls (i.e., 30 minutes after treatment) group together except for the mean of the second recall of the pleasant story on first administration. This latter mean is grouped with the means of the third recalls (i, b, l) of the unpleasant story, whether the unpleasant story be told at the first or second administration. The third recalls of the pleasant story (f, c) group together, and are significantly greater than any other of the post-convulsive recalls.

Recapitulation: These results confirmed the first experimental hypothesis, namely, more concepts of the P story were recalled than of the U story in the post-convulsive confusional state. A salient feature to substantiate this is the fact that in the test group, the subject population to whom the P story was administered first, recalled as many concepts of the P story

30 minutes after treatment as were recalled of the U story 60 minutes after treatment whether the U story was administered first or second.

The following conclusions were applicable to both the control and test groups: (a) In the overall results significantly more concepts of the P story were remembered than of the U story; and (b) when the P story was presented first, there was a proactive inhibition of the learning of the unpleasant material presented later. Vice versa when the U story was presented first proactive facilitation of the P story occurred.

(3) Quantitative Recall of Concepts: Emotional vs Indifferent

This part of the analysis deals with the differential quantitative recall of the various items qualitatively predefined as emotionally loaded or indifferent items.

Table 9.

Indifferent Items

Pleasant Story	Unpleasant Story
1. The son of Preacher Tate	1. The son of Preacher Tate
2. of Belmont near Charlotte, N. C.	2. of Belmont near Charlotte, N. C.
3. he was a chartered passenger	3. he was first officer
4. on a Wilmington fishing vessel	4. on a Wilmington fishing vessel

Emotional Items

Pleasant Story	Unpleasant Story
1. caught a tuna fish	1. was swallowed by a shark
2. landed a tuna fish	2. was caught by a shark
3. was dragged to the bottom of the boat	3. was dragged to the bottom of the ocean
4. leaving behind it a pool of sea water	4. leaving behind him a dark streak of blood

Table 9 shows an enumeration of the items as coded in the following data analysis.

Table 10 shows tabulation of the item data divided into emotional and indifferent items in the control groups. The data are tabulated by recall number and whether first or second administration. Each entry shows the sum of each item recalled by each group of patients, i. e. the maximum score in each recall is 25 as there were twenty-five patients in each group.

Table 10.

Control Group A

	Pleasant Story (1st Admin.)						Unpleasant Story (2nd Admin.)					
	Indifferent Items			Emotional Items			Indifferent Items			Emotional Items		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3
1	25	25	25	19	21	18	24	25	25	22	21	21
2	25	25	25	9	11	11	22	22	22	12	15	15
3	16	18	18	11	15	14	11	11	13	9	11	14
4	22	22	23	21	20	22	20	19	17	9	10	9
Sum	88	90	91	60	67	65	77	77	77	52	57	59
Means	22	22.5	22.8	15.0	16.8	16.3	19.3	19.3	19.3	13.0	14.3	14.8

Table 10.
(continued)

Control Group B

	Unpleasant Story (1st Admin.)						Pleasant Story (2nd Admin.)					
	Indifferent Items			Emotional Items			Indifferent Items			Emotional Items		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3
1	25	25	25	18	16	17	25	25	25	23	23	24
2	21	21	21	11	14	13	23	25	24	16	17	14
3	16	15	15	19	18	20	16	15	15	20	20	19
4	18	19	18	23	23	22	20	18	18	22	21	21
Sum	80	80	79	71	71	72	84	83	82	81	81	78
Means	20.0	20.0	19.8	17.8	17.8	18.0	21.0	20.8	20.5	20.3	20.3	19.5

Table 11.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	100.1	100.1	4.74*
Recalls 1 vs 2 vs 3 (R)	2	2.9	1.45	
1st Admin. vs 2nd Admin. [Order (O)]	1	7.1	7.1	
Indifferent Items vs Emotional Items (E)	1	315.4	315.4	14.93*
Interaction				
S X R	2	0.8	0.4	
S X O	1	70.0	70.0	3.31*
S X E	1	0.1	0.1	
R X O	2	0.6	0.3	
R X E	2	2.3	1.15	
O X E	1	9.3	9.3	
S X R X O	2	6.8	3.4	
S X R X E	2	1.4	0.7	
S X O X E	1	117.0	117.0	5.5**
R X O X E	2	0.2	0.1	
S X R X O X E	2	1.4	0.7	
Error	72	1521.5	21.3	

Significance * $p < 0.05$

** $p < 0.01$

Table 11 shows the analysis of variance table for the data in Table 10. The analysis of variance shows significant differences occur in several areas of these data, namely:

(a) Significantly more of the "indifferent" items were remembered than of the "emotional" items.

(b) Significantly more of the items of the pleasant story were remembered than of the unpleasant story irrespective of the emotionality of the items.

(c) Significant differences occur in the number of items of the pleasant story remembered compared to those of the unpleasant story, depending on the order of administration. If the pleasant story were administered first, a decrement occurred in the number of items of the unpleasant story administered second.

(d) There was significant interaction between the order of telling the stories and the "emotionality" of the items. The previously described interaction between pleasant and unpleasant stories and order of administration affected both the "indifferent" and "emotional" items but not equally.

Conclusions: There is no evidence from this analysis that there was selective forgetting of unpleasant emotional items as compared to pleasant emotional items, except when the order of pleasant and unpleasant story administration is taken into account. The previously noted pro-active facilitation of P material by previously administered U material and vice versa the pro-active

inhibition of U material remembered by previously administered P material applies more to the emotional items than the indifferent items. There is no evidence in this overall analysis that the most U material was selectively forgotten unless the order of story telling is taken into account.

Table 12.

Test Group C

	Pleasant Story (1st Admin.)						Unpleasant Story (2nd Admin.)					
	Indifferent Items			Emotional Items			Indifferent Items			Emotional Items		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3
1	24	12	17	20	11	14	24	8	11	22	6	12
2	22	9	14	6	3	4	22	5	9	10	2	7
3	12	2	6	11	4	9	10	5	5	12	3	5
4	17	8	14	21	7	11	19	7	8	13	1	5
Sum	75	31	51	58	25	38	75	25	33	57	12	29
Means	18.8	7.8	12.8	14.5	6.3	9.5	18.8	6.3	8.3	14.3	3.0	7.3

Table 12.
(continued)

Test Group D

	Unpleasant Story (1st Admin.)						Pleasant Story (2nd Admin.)					
	Indifferent Items			Emotional Items			Indifferent Items			Emotional Items		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3	Recall No. 1	2	3
1	21	6	9	17	5	11	24	12	18	19	10	15
2	19	6	11	5	0	0	22	11	16	10	3	5
3	9	1	3	9	1	5	5	0	1	14	2	4
4	22	4	11	19	2	10	20	7	14	16	2	7
Sum	71	17	34	50	8	26	71	30	49	59	17	31
Means	17.8	4.3	8.5	12.5	2.0	6.5	17.8	7.5	12.3	14.8	4.3	7.8

Table 12 shows the tabulation of the item data divided into emotional and indifferent items in the test groups. The data are tabulated by emotional vs indifferent items; recall number; and whether first or second administration.

Table 13.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	100.0	100.0	4.07*
Recalls 1 vs 2 vs 3 (R)	2	1976.1	988.05	40.23**
1st Admin. vs 2nd Admin. [Order (O)]	1	0.2	0.2	
Indifferent Items vs Emotional Items (E)	1	240.7	240.7	9.80**
Interaction				
S X R	2	24.7	12.35	
S X O	1	22.1	22.1	
S X E	1	0.4	0.4	
R X O	2	3.6	1.9	
O X E	1	0.1	0.1	
S X R X O	2	1.6	0.8	
S X R X E	2	14.3	7.15	
S X O X E	1	1.0	1.0	
R X O X E	2	5.7	2.85	
S X R X O X E	2	1.9	0.95	
Error	72	1768	24.56	

Significance * $p < .05$

** $p < .01$

Table 13 shows the analysis of variance table of the data on Table 12. Significant differences occur in several areas.

(a) There were significant differences between recall numbers, as a result of post-convulsive impairment in memory.

(b) In the overall picture significantly more of the indifferent items were remembered than of the emotional items.

(c) Significantly more of the items of the pleasant story were remembered than of the unpleasant story.

Conclusions: There is no evidence to confirm our second hypothesis; namely that there would be selective forgetting of the most disagreeable items of the unpleasant story in the post-convulsive recalls. On examining the raw data it would appear that there is a trend for pro-active inhibition of the most unpleasant items on second administration, as occurred in the control group. This, however, did not reach any level of statistical reliability.

In both the control and test groups the analysis of these limited selected data conformed with the analysis of the total data in the fact that more items of the pleasant story were remembered than of the unpleasant story. By and large more indifferent items were remembered than emotional items. Regarding the pro-active inhibition of unpleasant material by previously presented pleasant material, evidence was obtained from the control group that this pro-active inhibition referred particularly

to inhibition of the most disagreeable items. A similar trend occurred in the test group but this did not reach the level of statistical reliability. There was no evidence to suggest in the overall picture that there was selective forgetting of the most disagreeable items.

(4) Analysis of Quantitative Recall of Concepts by Diagnosis: Schizophrenia vs Depression

Table 14 shows the quantitative remembrance of concepts broken down by diagnosis (Depression vs Schizophrenia).

Table 14.

Quantitative Remembrance of Concepts by Diagnosis

Control Group

	P Story						U Story					
	Recall No. 1		2		3		1		2		3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Depressive	6.85	2.3	6.90	2.5	6.72	2.2	6.25	2.3	6.41	2.4	6.43	2.6
Schizophrenic	5.72	1.3	5.64	1.6	5.87	1.1	5.50	3.2	5.60	3.6	5.71	2.9

Test Group

	P Story						U Story					
	Recall No. 1		2		3		1		2		3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Depressive	6.21	2.2	4.13	2.4	5.77	1.3	7.21	1.4	.35	.79	1.76	1.7
Schizophrenic	5.33	1.3	2.57	1.9	4.87	2.4	5.82	1.8	.17	.14	2.01	2.3

Table 14 shows that the depressive patients had greater quantitative remembrance of concepts in all recalls of both stories in both the control and test groups except for the third recall of the unpleasant story in the test groups. None of these differences reached the level of statistical reliability.

D. Concept Distortion

Oh, 'twas in the broad Atlantic.
'Mid the equinoctial gales,
That a young fellow fell overboard
Among the sharks and whales.
And down he went like a streak of light.
So quickly down went he.
Until he came to a mer-ma-id
At the bottom of the deep blue sea.

Oxford Song Book:

Oh! Twas in the broad Atlantic

In his study of memory in general paretics using the shark story, one of Schilder's major conclusions was that patients tended "to distort disagreeable concepts on recall to render them more pleasant" (1). It was decided to analyze our data according to this thesis. The following predictions were made: (a) in the overall recalled material there would be a tendency to distort the concepts of the stories to render them more pleasant. (b) this hedonistic distortion would be most marked in the unpleasant story especially in the post-convulsive recalls.

(1) Data Reliability

The data were scored independently and with no collaboration by two raters, Rater C and Rater D. Rater C was a senior undergraduate student of English at North Carolina State University. Rater D was a junior undergraduate student of biology at North Carolina State University. The material was scored from the verbatim transcripts of the recorded data with neither rater's knowing the aims and structure of the experiment. Rater C scored the data first. He was instructed to identify individual concepts and score each according to whether the concept had been rendered more pleasant, more unpleasant or had been left unchanged. Each concept scored was identified numerically. With similar preliminary instructions, Rater D scored the enumerated concepts without knowing the direction of change if any of Rater C.

Table 15 is the contingency table showing the inter-rater reliability in scoring the emotional distortion of items.

Table 15.

Contingency Table Showing Inter-rater Reliability in the Scoring of Emotional Distortion of Items

		Rater C			
		More P	No Change	More U	TOTAL
Rater D	More P	271	271	15	557
	No Change	40	2,704	32	2,776
	More U	14	184	48	246
	TOTAL	325	3,159	95	3,579

X^2 Chi^2 = 1565.64

r = .467

$p < .005$

The inter-rater correlation of attributes [r = .467 ($p < .005$)] shows a highly significant degree of agreement between raters C and D in classifying the items according to the direction of emotional distortion.

Table 15 shows that in the overall results there is a marked stability in the recall of items with both raters agreeing that the preponderance of items showed "no change". However, if distortion of concepts occurred, the direction was preponderantly in the direction of being rendered more pleasant. Rater D classified

420 items as showing emotional distortion with a ratio of greater than 3:1 that the concepts were distorted in the direction of being rendered more pleasant. Rater D classified 803 items as showing emotional distortion with a ratio of greater than 2:1 that this distortion was in the direction of rendering them more pleasant.

(2) Direction of Concept Distortion

In the following analyses only the scores of Rater C were used. Each subject was placed in either one of two categories: The first category consisted of subjects who distorted a preponderant number of items in the direction of rendering them more pleasant; the second category was composed of subjects who showed a preponderance of items which showed no change or were distorted in the direction of rendering them more disagreeable.

Tables 16 (a), (b) and (c) show a comparison between the control groups and test groups in the direction of emotional distortion of the pleasant story.

Table 16.

Control Groups vs Test Groups

(Subjects classified by direction of emotional distortion of items: More P vs No Change and More U.)

First Recall

(a).

	More P	NO Change More U	TOTAL
Control Groups	28	22	50
Test Groups	22	27	49
TOTAL	50	49	99

$Chi^2 = .816$

Not Significant ($p < .05$)

Second Recall

(b).

	More P	No Change More U	TOTAL
Control Groups	33	17	50
Test Groups	12	24	36
TOTAL	45	41	86

$X^2 = 7.692$

Significant ($p < .01$)

Table 16.
(continued)

Control Groups vs Test Groups

Third Recall

(c).

	More P	No Change More U	TOTAL
Control Groups	31	19	50
Test Groups	18	29	47
TOTAL	49	48	97

$X^2 = 4.538$

Significant ($p < .05$)

Tables 16 (a), (b) and (c) show that there was a greater tendency for the control group subjects to distort the pleasant story in a hedonistic direction than did the test groups. These differences between the control and test groups reached the level of statistical reliability in the second and third recalls (the post-convulsive recalls in the test groups).

Table 17.

Unpleasant Story
Control Groups vs Test Groups

(Subjects classified by direction of emotional distortion of items: More P vs No Change and More U.)

(a). First Recall

	More P	No Change More U	TOTAL
Control Groups	27	23	50
Test Groups	24	25	49
TOTAL	51	48	99

$X^2 = 0.087$

Not Significant ($p > .05$)

(b). Second Recall

	More P	No Change More U	TOTAL
Control Groups	26	24	50
Test Groups	3	20	23
TOTAL	29	44	73

$X^2 = 8.424$

Significant ($p < .01$)

Table 17.
(continued)

Unpleasant Story
Control Groups vs Test Groups

Third Recall

(c).

	More P	No Change More U	TOTAL
Control Groups	26	24	50
Test Groups	13	29	42
TOTAL	39	53	92

$X^2 = 3.323$

Not Significant ($p > .05$)

Tables 17 (a), (b) and (c) show that there was a greater tendency for the control groups subjects to distort the unpleasant story than did the test groups. These differences were most marked in the second and third recalls reaching a high level of statistical reliability in the second recalls.

Conclusions: Neither of our predictions materialized; in fact, converse results were obtained. There was a constant trend for more subjects to show hedonistic distortion of the pleasant story than of the unpleasant story, although this did not reach the level of statistical reliability. Converse to our expectations the control groups in clear consciousness showed more

hedonistic distortion of both pleasant and unpleasant stories than did the test groups in the post-convulsive recalls. The latter finding reached the level of statistical reliability in three of four analyses.

E. Concept Distortion by Individual Patients

Although no evidence was found in the statistical analysis that there was a greater tendency for hedonistic distortion of unpleasant material than pleasant material, examination of the verbatim transcripts tended to show qualitative differences in the distortion between pleasant and unpleasant stories and between control and test groups. Crude distortions of items such as the recall of diametrically opposite concepts from the original story occurred mainly in the recall of the unpleasant story by the test group. The control group by and large were more subtle in their distortion. A quantitative analysis to demonstrate this point was impossible and it was considered that this thesis could be adequately illustrated by exemplification.

Subject 51 (Test group - Pleasant story first administration). Concepts recalled of the unpleasant story administered second.

Recall 1: "Preacher Tate's son of near Belmont. I mean Belmont, near Charlotte, was caught by a shark. He was first officer of a shipping vessel in Wilmington, N. C. Before help could be signaled - before he could signal for help, the big shark caught him before the terrified eyes of his own shipmates

and threw him to the floor of the big vessel, and where he had been, just left a long, dark stream of blood."

Recall 2: "Preacher Tate's son of near Belmont, near Charlotte, N. C. was caught by a shark, and before the eyes of his shipmates - before anyone could be told, he was caught before the eyes of his shipmates and thrown to the bottom of the vessel. He was first officer of the vessel in Wilmington, N. C.; first officer of a shipping vessel of Wilmington, N. C. and before it could be told of his troubles, the shark had thrown him to the floor of the vessel before the very eyes of his shipmates."

Recall 3: "Preacher Tate's son of near Belmont, Charlotte, N. C., was caught by a shark. He was first officer of a shipping vessel of Wilmington, N. C. and before help could be gotten for him, the large shark dragged him to his - down on the floor of the vessel, big vessel, before the eyes of the terrified shipmates and just left a long streak of blood."

These recalls by subject 51 show two phenomena described by Schilder (1): (a) the recall of diametrically opposite concepts to the correct ones in order to make the outcome of the story more agreeable, namely: the shark landed in the ship instead of the preacher's son in the sea. Also, the shark was responsible for the "long streak of blood"; and (b) there is condensation of ideas, the concept of landing the tuna fish as narrated in the first story is carried into the second story to implement the agreeable outcome of the story.

Subject 54: (Test group - Pleasant story first administration). Recalls of the unpleasant story administered second.

Recall 1: "Well, the son of Preacher Tate, I believe his name was. A shark caught him or something that's swimming in the water, and he was from Charlotte, N. C., and the shark swallowed him, and he couldn't get away, and that's about all I remember."

Recall 2: Nothing.

Recall 3: "Seemed to me that something swallowed something or other in the water, a fish or an oyster. I don't know what it was a fish or something or other. Nothing except that he swallowed something. It was a shark, I believe."

In the first recall subject 54 tended to deny the shark by qualifying it with "or something swimming in the water". In the third recall, the story is made agreeable by the substitution of diametrically opposite concepts; the concept of the man being swallowed by the shark was changed to the man swallowing the shark.

Subject 62: (Test group - Pleasant story first administration). Recall of unpleasant story second administration.

Recall 1: "Well, this young man was the son of a preacher named Preacher Tate and he was swallowed by a shark, and I understood it that he was an officer in the ship there at Wilmington, N. C. and he was rescued by a shark, and he was rescued in front of his terrified shipmates, but they lived near, Belmont, Charlotte, N. C."

Recall 2: "Well, there was a young man from Belmont, N. C., that was visiting in Charlotte, N. C., and he was rescued at Wilmington, N. C. He was swallowed by a shark."

Recall 3: "Well, it was the son of a Preacher Tate at Belmont, near Charlotte, N. C. He was swallowed by a shark, and he was rescued by his friends when he was caught by a shark at Wilmington, N. C."

Subject 62 in all recalls brings the story to an agreeable conclusion by stating that the preacher's son was ultimately rescued from his plight.

As stated previously, this gross type of hedonistic conceptual distortion was unique to the unpleasant story in the test group.

Subject 17: (Control group - Pleasant story first administration). Recalls of unpleasant story second administration.

Recall 1: "The son of Preacher Tate from Belmont, near Charlotte, N. C., was swallowed by a whale. He was first officer. He was lost out to sea."

Recall 2: "The son of Preacher Tate from Belmont, near Charlotte, N. C., was swallowed by a whale. And something he was carried out to sea, wasn't it? He was first officer."

Recall 3: "The son of Preacher Tate of Belmont, near Charlotte, N. C., was swallowed by a whale. He was carried out to sea. He was first officer of a Wilmington fishing vessel."

Although there is a degree of finality about being "carried out to sea", nevertheless, subject 17 suppressed the gory details of the mutilation.

Subject 28: (Control group - Unpleasant story first administration). Recalls of unpleasant story first administration.

Recall 1: "There was a preacher that had a son, and he went fishing - I can't remember. He had a son and went fishing, and he got dumped overboard, and he couldn't be rescued and it left a trail of blood."

Recall 2: "There was a preacher and he had a son named Tate from Wilmington, N. C., and he went fishing, and he fell and that's not right, and he left a blood trail behind him."

Recall 3: "Well, there was a preacher, and he had a son named Tate, and he was - liked to go fishing. He was from Wilmington, N. C., and he fell overboard. There was no rescue squad there, and it left a trail of blood behind him."

Subject 28 shows suppression of all the violent elements except the "trail of blood". There is also suppression of the word "shark".

Conclusions: The most crude distortions occurred in the unpleasant story, especially the test groups, where, on occasion,

diametrically opposite concepts were used to distort the emotional significance of the story. In the control groups more subtle methods were used to mellow the emotional significance, such as the suppression of the word "shark" and suppression of the details of the gory mutilation.

(2) Paranoid Distortion in an Individual Patient

Only one patient showed overt paranoid distortion of the stories as a result of a current mental condition.

Subject 65: (Test group - Pleasant story first administration). Recalls of unpleasant story administered second.

Recall 1: "Well, the story had two or three angles to it as far as I'm concerned. About the greatest inconsistency it had was the fact that a minister's son who lived outside of Charlotte, I believe it was Belmont - I'm not sure of the town, went fishing on a charter vessel off Wilmington. And it said that much of it, and then again he was on a steamer - the story was very inconsistent. The story was told three times, and each time it told a different angle; so I didn't know whether to elaborate on the - whether to tell you each story or what. I thought at first they said a fishing boat off Wilmington, and he apparently fell into the water and was swallowed by a shark. And in front of all his fellow mates on the boat, and the last they saw was a stream of blood following the shark. And they - another one said something about it was a steamer, and then the other one said something about it was a vessel. A little deviation. Well, in each one of them he was followed by a stream of blood. The same idea, but it seems as though to me the vessels were different in each one of them. Now I could be wrong on that. It said he was cruising one time. That's all."

The suspiciousness, thinking past the point, paranoid projection and obsessive hair-splitting illustrated by subject 59 in Recall 1 implies a different motivation for completion of the task than in the average subject. There is an obvious difference

between the misinterpretation of the material by the above patient who was looking for some sinister motive in the test situation as compared to the more passive memory distortions of the average patient.

(3) Sharks vs Whales

A common word misrepresentation in the reproduction of the unpleasant story was the substitution of the word "whale" for the word "shark". This inaccuracy was relatively common in both the control and test groups irrespective of whether the unpleasant or pleasant story was administered first.

Table 18 shows the frequency distribution of patients who used the word "whale" in the various recalls.

Table 18.

	Control Group			Test Group		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Unpleasant story first	4	3	4	6	1	3
Unpleasant story second	6	5	4	6	2	5

Table 18 shows that the substitution of "whale" for "shark" was distributed relatively evenly throughout the various groups of patients.

A few patients compromised by using both names.

Subject 91 (Test group - Unpleasant story first administration). Unpleasant story first administration:

Recall 1: "The son of Parson Patterson, the captain of a ship, he was eaten by a shark after he was knocked overboard by a huge whale. Since rescue was impossible, the shark that was following the vessel closely grabbed the young captain, carried him to the bottom of the sea while his shipmates watched in horror and left a trail of dark blood behind him."

Another subject showed even more ingenuity by fabricating a neologism to consummate the compromise.

Subject 80 (Test group - Unpleasant story first administration). Unpleasant story first administration:

Recall 1: "A young man from Charlotte, West Virginia was swallowed by a whale - by a whark - while his terrified shipmates looked on. He was carried to the bottom of the sea. Later he was took shore off the Wilmington coast, leaving a dark stream of blood."

The relatively common occurrence of the substitution of "whale" for "shark" was interpreted as probably resulting from the biblical story of Jonah's being swallowed by the whale, as biblical stories are a common preoccupation of the fundamentalist religious groups of North Carolina. The more benign nature of the whale as compared to the malevolence of the shark in its relationships with man might denote that the substitution of "whale" for "shark" was another method of weakening the emotional significance of the story. However, it is considered that the former explanation was more likely.

The hero being swallowed by a monster is conceived of by Jung as being an archetypal memory of the collective unconscious (5). In the characteristic myth the hero, after being swallowed, takes active steps of retribution to destroy the monster. Our results gave little substance to this theory. Most of the recalls, as in the original material, placed the hero in a passive role; a phlegmatic victim of turbulent circumstances. Only one subject ascribed to the hero an active role of destroying the shark.

Subject 54 (Test group - Pleasant story first administration). Unpleasant story second administration.

Recall 1: "A young man from Richmond, Virginia, Preacher Tate's son, went all by himself out on a boat fishing after a shark. He found a shark and he didn't know what to do with it, and so he - the young man had to take it by himself and got it and left a pool of - not water but blood but something like that with him. Was he from Richmond, Virginia?"

F. Constancy of Verbal Memories within Patients

Examination of the verbatim transcripts tended to show that between patients there was a considerable variability of language used to express concepts. However, the individual patient appeared to show a consistency in language usage from one recall to another. Interestingly this appeared to apply to both the control groups and the test groups.

It was decided to test the prediction that a rater could match accurately the first and third recalls of individual patients. To test this hypothesis, the material was divided into four groups: A. Pleasant story (control group);

B. Unpleasant story (control group); C. Pleasant story (test group); and D. Unpleasant story (test group). Recall 1 and 3 of ten subjects in each group were used. Subjects were chosen randomly from the control groups. On account of the post-convulsive decrement in memory in the test groups the ten subjects who remembered the largest number of concepts at Recall 3 were used. In each group the verbatim transcript material from Recall 1 were listed numerically. The third recalls from the same subjects were listed alphabetically in random order. The rater, a junior undergraduate student in Economics at North Carolina State University was asked to match the numbered statements with the letter statements.

In all groups, control and test, pleasant story and unpleasant story, he was able to match the statements with absolute accuracy (p.00000027 for 100% success in each group; p $1/3.6^{24}$ for 100% success in 4 groups). Appendix A contains the material of this analysis.

This consistency in verbal recall is not surprising in the control groups; however, in the test groups it illustrates that disruption of the central nervous system functioning did not result in a more accurate recall of the original material presented but there was a consistent reversion to the pre-convulsive learned material whether it were accurate or inaccurate. A practical analogy might be drawn, namely, that administration of convulsive therapy to a paranoid patient with perceptual

distortions will only result in a reversion to pre-convulsive paranoid ideation rather than to realistic environmental interpretation.

2. Mechanistic Factors Influencing Recall

A. Age and Intelligence

(1) Age

Table 19 shows the coefficients of correlation (Product moment) between age and quantitative item recall by individual patients in various subgroups.

Table 19 shows that there are no significant coefficients of correlation between age and the quantitative recall of concepts either in the control groups or test groups. There would appear to be a greater tendency for a negative relationship between age and quantitative recall in the control groups than in the test groups; however, the correlations are all small and at times negligible. The inference is that age alone was a negligible factor in determining the quantity of recalled material.

(2) Intelligence

Tables 20 (a) and (b) show the coefficients of correlation (Product moment) between the Verbal Intelligence Quotients of the WAIS (3) and the quantitative recall of items in the various subgroups of patients.

Section IX (Phase I).

Table 19.

Coefficients of Correlation
Age vs Quantitative Recall of Items

Control Groups

	P (1st Admin.)			U (2nd Admin.)			U (1st Admin.)			P (2nd Admin.)		
	Recall No.			Recall No.			Recall No.			Recall No.		
	1	2	3	1	2	3	1	2	3	1	2	3
Age	-.199	-.188	-.175	-.156	-.148	-.158	.071	-.002	-.068	-.007	-.014	-.054

Test Groups

	P (1st Admin.)			U (2nd Admin.)			U (1st Admin.)			P (2nd Admin.)		
	Recall No.			Recall No.			Recall No.			Recall No.		
	1	2	3	1	2	3	1	2	3	1	2	3
Age	.149	.079	.119	.094	.003	.188	-.247	-.121	.097	.169	-.142	.186

Section IX (Phase I).

Table 20.

Coefficients of Correlation
Verbal I.Q. (WAIS vs Quantitative Recall of Concepts)

Control Groups

	P (1st Admin.)			U (2nd Admin.)			U (1st Admin.)			P (2nd Admin.)		
	Recall No.			Recall No.			Recall No.			Recall No.		
	1	2	3	1	2	3	1	2	3	1	2	3
Verbal I.Q.	.519**	.602**	.612**	.651**	.656**	.641**	.451*	.440*	.465*	.515**	.470**	.527**

Test Groups

	P (1st Admin.)			U (2nd Admin.)			U (1st Admin.)			P (2nd Admin.)		
	Recall No.			Recall No.			Recall No.			Recall No.		
	1	2	3	1	2	3	1	2	3	1	2	3
Verbal I.Q.	.291	.370*	.249	.305	.229	.290	.315	-.079	-.089	.139	-.124	.034

* $p < .05$

** $p < .01$

Table 20 (a) shows that there is a significantly high positive relationship between intelligence and quantity of material remembered at all recalls in the control populations. This finding is compatible with results in other experimentation (6, 7). It is of interest to note that the coefficients of correlation between verbal I.Q. and the three recalls of the unpleasant story (first administration) are significant only at the .05 level of probability, whereas, all other coefficients of correlation in the control groups are significant at the .01 level of confidence. It may be that the unpleasant nature of the material accounts for the lower positive association in this group.

Table 20 (b) shows only a moderate positive association between intelligence and quantity of material remembered at the first recalls (pre-treatment). None of these correlations reach the level of statistical reliability. This drop in positive association is probably associated with the pre-E.S.T. stress situation. Studies have generally reported significantly poorer learning responses occur in individuals under stress[19] (12) and there is a wider range of scatter in verbal learning in these groups (13). Our findings did not confirm the latter results as there was no difference in Variance Ratio between our control groups and test groups in the first recalls.

In the test group of patients to which the pleasant story was administered first, positive coefficients of correlation

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[19] Controversial results have been reported regarding the intensity of stress caused by the administration of E.S.T. Shagass, 1962 (8) makes the statement "in one of our studies we predicted that the 'stress' associated with electroconvulsive therapy (ECT) would provoke more disturbing emotion than when the patient knew he was not to receive a treatment. In fact, several patients became more disturbed in the nontreatment test."

Although the technique of the shock administration would have no bearing on the degree of stress at treatment number one, it certainly would at the second treatment if true differences occur between the stressfulness of different type convulsive techniques. The method used in this study; namely, the administration of a muscle relaxant without previous anesthesia has been described by Sargant and Slater, 1963 (9) in the following terms, "Scoline administration must always be preceded by unconsciousness produced by pentothal, as the feeling of progressive paralysis which would otherwise be felt is terrifying." However, studies by Huggins, Sandifer and Pearson, 1964 (10) and Rose, 1959 (11), have shown only mild patient preference for the use of a general anesthetic before administration of the muscle relaxant.

occur between intelligence and the post-convulsive recalls. In general this finding is similar to those reported in our previous studies, (14, 15). In the other test group to which the unpleasant story was administered first, almost neglible but generally negative coefficients of correlation occur between verbal intelligence and post-convulsive recalls. The loss of positive association in these areas is presumably related to the unpleasant nature of the first story administered.

Conclusions: In this analysis age was found to be a negligible factor in influencing material remembered at any of the recalls in either the control or test groups of subjects. Intelligence had a significantly high positive association with all recalls in the control groups. There was also a trend to positive association between intelligence and quantitative recall in the test groups except in the post-convulsive recalls of the group to which the unpleasant story was administered first. In this group the post-convulsive coefficient of correlation were negligible and generally negative.

B. Age, Intelligence and General Remembering Ability

The following analysis is directed at determining interaction between age, intelligence and remembering ability.

(1) Control Group: Pleasant Story First Administration

Table 21 shows the coefficients of correlation (Product moment) between age, intelligence and number of concepts remembered at each recall by individual subjects. These data

apply to the control group to which the pleasant story was administered first.

Table 21.

Correlation Matrix

Intercorrelation Coefficients of Age with Intelligence with Number of Concepts Remembered at Each Recall

Control Group - Pleasant Story First

		Pleasant Story			Unpleasant Story		
		Recall No.			Recall No.		
	I.Q.	1	2	3	1	2	3
Age	-.199	-.199	-.188	-.175	-.156	-.148	-.158
I.Q.		.519**	.602**	.612**	.651**	.656**	.641**
P. Story Recall # 1			.862**	.820**	.647**	.799**	.804**
P. Story Recall # 2				.899**	.675**	.785**	.803**
P. Story Recall # 3					.593**	.746**	.758**
U. Story Recall # 1						.885**	.845**
U. Story Recall # 2							.909**

Significance ** $p < .01$

Table 21 shows a general nonsignificant association between age and intelligence, and between age and quantitative remembering in all recalls. A significantly high positive association occurs between intelligence and quantity remembered at all recalls. Significantly high positive relationships occur amongst

all recalls irrespective of story material with a tendency towards higher positive coefficients of correlation to occur amongst recalls within stories than between stories.

The correlational data in Table 21 was factored by the centroid method (16). Table 22 shows the centroid factor matrix of two factors. Factors I and II underwent a counterclockwise orthogonal rotation to minimize positive loadings on the pleasant story recalls and maximize negative loadings on the variables of the unpleasant story recalls.

Table 22.

Control Group - Pleasant Story First Administration

Centroid Factor Matrix

Variable	Factor I	Factor II
Age	-.200	.130
Intelligence	.665	-.308
Recall 1 P. Story	.914	.037
Recall 2 P. Story	.947	.049
Recall 3 P. Story	.925	.084
Recall 1 U. Story	.724	-.589
Recall 2 U. Story	.841	-.454
Recall 3 U. Story	.860	-.382

Factor I is obviously a measure of general learning ability with high positive loadings on all recall variables. This general learning ability is positively associated with intelligence and negatively associated with age. Factor II demonstrates the difficulty of changing the story material from pleasant to unpleasant. It probably represents the pro-active inhibition of the learning and recall of unpleasant material by previously learned pleasant material. The negative loading on intelligence would indicate that this particular difficulty is more marked in subjects of lower intelligence.

(2) Control Group: Unpleasant Story First Administration

Table 23 shows that age had a nonsignificant association with all other variables. A significantly high positive association occurred between intelligence and quantitative remembrance of concepts at all recalls in both stories. Intercorrelation coefficients amongst recalls tend to be extremely high with a tendency to be higher amongst recalls within a story than between stories.

The correlational data in Table 23 was factored by the centroid method (16). Table 24 shows the centroid factor matrix after rotation. Factor I is an unrotated factor. Factors II and III were rotated in a counterclockwise direction with orthogonal axes.

Table 23.

Correlation Matrix

Intercorrelation Coefficients of Age with Intelligence with Number of Concepts Remembered at Each Recall

Control Group - Unpleasant Story First

		Unpleasant Story			Pleasant Story		
		Recall No.			Recall No.		
	I.Q.	1	2	3	1	2	3
Age	.141	.071	-.002	-.068	-.007	-.014	-.054
I.Q.		.451*	.440*	.465*	.515**	.470*	.527**
U. Story Recall # 1			.928**	.888**	.848**	.814**	.792**
U. Story Recall # 2				.924**	.822**	.823**	.807**
U. Story Recall # 3					.824**	.857**	.817**
P. Story Recall # 1						.897**	.905**
P. Story Recall # 2							.903**

Significance * $p < .05$

** $p < .01$

Table 24.

Control Group - Unpleasant Story First Administration

Centroid Factor Matrix

Variable	Factor I	Factor II	Factor III
Age	.034	.350	.038
Intelligence	.576	.382	.054
Recall 1 U. Story	.931	-.185	.215
Recall 2 U. Story	.923	-.264	.143
Recall 3 U. Story	.917	-.248	.007
Recall 1 P. Story	.929	.003	-.202
Recall 2 P. Story	.920	-.058	-.209
Recall 3 P. Story	.912	.020	-.304

Factor I again represents a general learning ability factor positively associated with intelligence. Factor II would appear to represent a difficulty in mastering the unpleasant story by the older more intelligent subject. Factor III is a bipolar factor showing the difficulty in changing text of the material from unpleasant to pleasant story. Age and intelligence would appear to have little bearing on this difficulty.

(3) Test Group: Pleasant Story First Administration

Table 25.

Correlation Matrix

Intercorrelation Coefficients of Age with Intelligence with Number of Concepts Remembered at Each Recall

Test Group - Pleasant Story First

		Pleasant Story			Unpleasant Story		
		Recall No.			Recall No.		
	I.Q.	1	2	3	1	2	3
Age	.285	.149	.079	.119	.094	.003	.188
I.Q.		.291	.370*	.249	.305	.229	.290
P. Story Recall # 1			.699**	.651**	-.087	.008	-.203
P. Story Recall # 2				.772**	-.237	.246	-.098
P. Story Recall # 3					-.339	.020	-.247
U. Story Recall # 1						.141	.577**
U. Story Recall # 2							.486**

Significance * $p < .05$

** $p < .01$

Table 25 shows that in general there is a nonsignificant positive association between age and intelligence and age and all recalls. Intelligence has a positive relationship with all recalls but only once reaches the level of statistical reliability. There are in general, significant positive associations between recalls within stories but negative relationships between stories.

The correlational data in Table 25 was factored by the centroid method (16).

Table 26.

Test Group - Pleasant Story First Administration

Centroid Factor Matrix

	Factor		
Variable	I	II	III
Age	.314	-.101	.230
Intelligence	.625	-.153	.161
Recall 1 P. Story	.577	.575	-.246
Recall 2 P. Story	.681	.590	.224
Recall 3 P. Story	.522	.681	.069
Recall 1 U. Story	.270	-.614	.248
Recall 2 U. Story	.423	-.262	.445
Recall 3 U. Story	.411	-.709	.219

Table 26 shows the centroid factor matrix. The three factors are unrotated.

Factor I reflects a general learning and recall ability positively associated with intelligence. The loadings are considerably lower in this factor than the corresponding data for the control group (Table 23). These lower loadings are obviously due to the application of shock treatment. Nevertheless, it

does illustrate that the quantity of post-convulsive recall is related to the general verbal learning ability of the individual subject. Factor II is a bipolar factor reflecting the result of changing the text of the story from pleasant to unpleasant material. The negative loadings of age and intelligence indicate that the younger, less intelligent subjects found this change of material most difficult. This factor corresponds to Factor II in the quivalent control group (Table 22); however, the factor loadings are much higher in this analysis. This latter observation would appear to denote that the application of shock treatment accentuated the difficulties experienced by the control group in switching from pleasant to unpleasant material. Factor III shows some degree of correspondence with the control group equivalent. It would appear to denote that the older, more intelligent patient learned by repetition of the technique irrespective of the application of shock treatment.

(4) Test Group: Unpleasant Story First Administration

Table 27.

Correlation Matrix

Intercorrelation Coefficients of Age and Intelligence with Number of Concepts Remembered at Each Recall

Test Group - Unpleasant Story First

		Unpleasant Story			Pleasant Story		
		Recall No.			Recall No.		
	I.Q.	1	2	3	1	2	3
Age	.211	-.247	-.121	.097	.169	-.142	.186
I.Q.		.315	-.079	-.089	.139	-.124	.034
U. Story Recall # 1			.097	.308	-.017	-.267	-.253
U. Story Recall # 2				.397*	.240	.213	.122
U. Story Recall # 3					-.041	.021	.032
P. Story Recall # 1						.508**	.646**
P. Story Recall # 2							.781**

Significance * $p < .05$

** $p < .01$

Table 27 shows a negative association between intelligence and post-convulsive recalls. There are generally positive, at times significantly high, correlations between recalls within stories but a negative relationship among recalls between stories.

Table 28.

Centroid Factor Matrix

	Factor		
Variance	I	II	III
Age	.139	.264	.304
Intelligence	-.159	.266	.528
Recall 1 U. Story	-.298	.290	-.469
Recall 2 U. Story	.390	-.466	.203
Recall 3 U. Story	.202	-.556	.348
Recall 1 P. Story	.604	.279	.324
Recall 2 P. Story	.753	.170	-.228
Recall 3 P. Story	.843	.357	.123

Table 28 shows three unrotated factors extracted by the centroid method from the correlational data in Table 27 (16).

There would appear to be essential differences in this factor matrix from previous ones. Both Factor I and Factor III appear to represent a general learning ability. It is interesting to note that both factors have negative loadings on the first recall of the unpleasant story. Presumably this is associated with the emotionally unpleasant nature of the story presented in the pre-convulsive period. Factor III has a high positive loading on intelligence and a high negative loading on the first

recall of the unpleasant story. Presumably this is associated with the emotionally unpleasant nature of the story presented in the pre-convulsive period. Factor III has a high positive loading on intelligence and a high negative loading on the first recall of the unpleasant story. This might indicate that the more intelligent patients had relatively greater difficulty than the less intelligent in maintaining their learning performance in this stressful situation. Factor II has positive loadings on all variables except the post-convulsive recalls of the unpleasant story. This factor is apparently an excellent representation of the original experimental hypothesis namely: that there would be a decrement in the quantative recall of the unpleasant story in the post-convulsive period.

Conclusions: The first three factor analytic studies show remarkably similar factor loading patterns. One factor in each representing a general learning ability factor positively associated with intelligence. The loadings in the control groups are in general much higher than in the test group. These analysis also have bipolar factors which represent the learning difficulties experienced when the texts of the stories are changed. The bipolar loadings were more extreme when the text of the material was changed from pleasant to unpleasant material than vice versa. The fourth factor analysis shows a different pattern having two factors which appear to represent a general learning ability but in both these factors there are negative loadings

on the first recall (pre-convulsive) of the unpleasant story and probably represents a disruption of the rank order of subjects as regards recall ability as a result of a combination of unpleasant emotional material presented in the stressful pre-convulsive period. Factor II in this analysis represents the difficulty in recalling unpleasant material in the post-convulsive period.

C. Serial Order of Items

The following analysis deals with the influence of the serial order of presentation of items on learning and recall.

Table 29 defines the enumeration of different items.

Table 29.

Enumeration of Items of Pleasant Story

Item No.	
1.	The son of Preacher Tate
2.	from Belmont, near Charlotte, N. C.
3.	caught a tuna fish
4.	he was a chartered passenger
5.	on a Wilmington fishing vessel
6.	he brought it on board despite big waves
7.	since help was impossible
8.	the fortunate young man
9.	which followed the steamer
10.	landed the tuna fish
11.	in front of the eyes
12.	of his admiring shipmates
13.	it was dragged to the bottom of the boat
14.	leaving behind it a pool of sea water.

Table 29.
(continued)

Enumeration of Items of the Unpleasant Story

Item No.	
1.	The son of Preacher Tate
2.	of Belmont near Charlotte, N. C.
3.	was swallowed by a shark
4.	he was first officer
5.	on a Wilmington fishing vessel
6.	he was washed overboard by a big wave
7.	since rescue was impossible
8.	the unfortunate young man
9.	which followed the steamer
10.	was caught by a shark
11.	in front of the eyes
12.	of his terrified shipmates
13.	he was dragged to the bottom of the ocean
14.	leaving behind him a dark streak of blood.

Table 30 shows the number of subjects in the control group who remembered each individual item. Both the pleasant story administrations, first and second, are summed together as are the unpleasant stories. As each story was told to 50 subjects the maximum score for each item is fifty.

Table 30.

Control Group

Item No.	Pleasant Story Recall No. 1	2	3	Sum	Unpleasant Story Recall No. 1	2	3	Sum
1	50	50	50	150	49	50	50	149
2	48	50	49	147	43	43	43	129
3	42	44	42	128	40	37	38	115
4	32	33	33	98	27	26	23	76
5	42	40	41	123	38	38	35	111
6	18	23	23	64	29	28	29	86
7	27	25	26	78	21	19	23	63
8	1	1	1	3	0	0	0	0
9	25	28	25	78	23	27	28	78
10	19	27	28	74	17	14	17	48
11	22	28	22	72	17	20	18	55
12	13	15	16	44	9	12	13	34
13	31	35	33	99	28	29	34	91
14	43	41	43	127	32	33	31	96

Table 31 shows the analysis of variance tables for these data.

Table 31.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	120	128	12.08**
Recall 1 vs 2 vs 3 (R)	2	12	6	
Between Items (1)	13	6862	527	49.72**
(I) S X R	2	5	2.5	
R X I	26	46	1.2	
S X I	13	184	14.2	1.33
S X I X R	26	39	1.5	
Error	84	893	10.6	

Significant ** $p < .01$

Table 31 confirms the previous findings that significantly more of the pleasant concepts were recalled than unpleasant ones. There are highly significant differences between the quantity of different items recalled.

Table 32 shows the Spearman Rank Coefficients of Correlation (17) between the number of individual items recalled and the serial rank order of the item in the presentation of the stories.

Table 32.

Spearman Rank Coefficients of Correlation

No. of Items Recalled vs Serial Order of Presentation

	Control Group					
	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Coeff. of Correl.	.474*	.457*	.467*	.599*	.517*	.560*

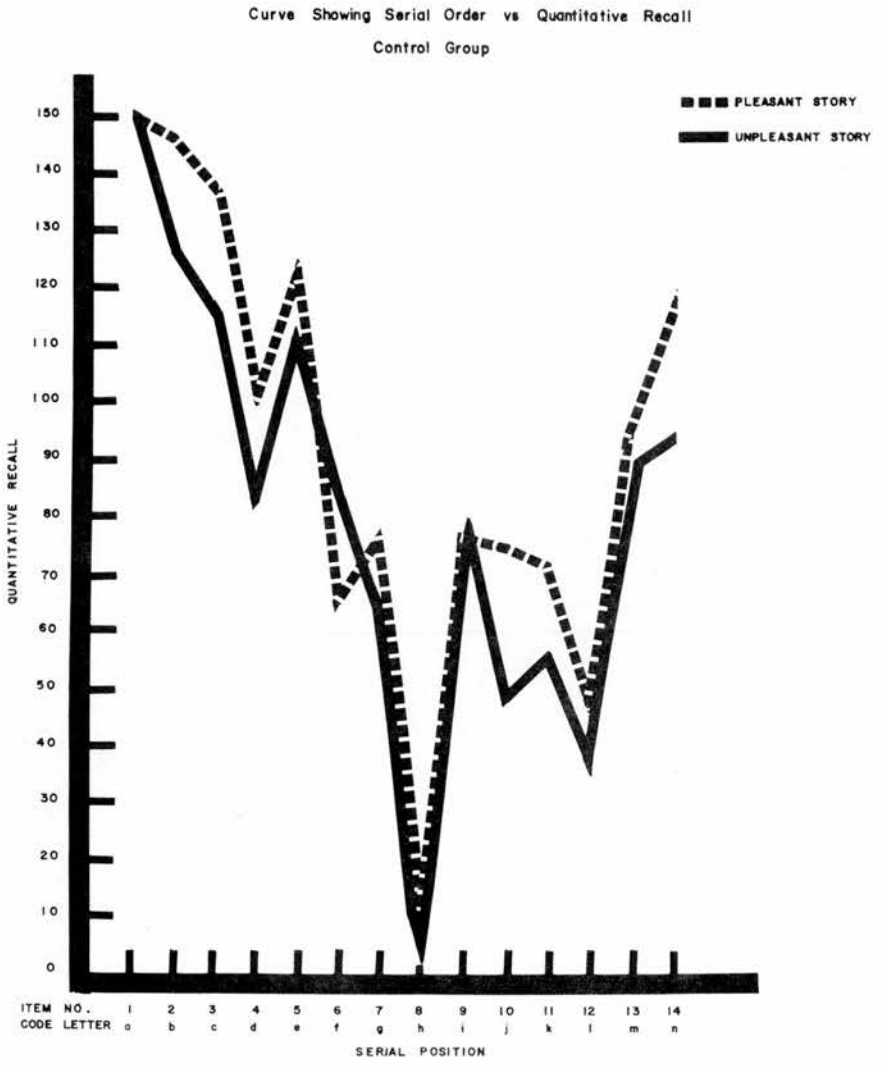
Significant * $p < .05$

It can be seen that these are significant positive correlations between the serial order of presentation of individual items and the quantity of recall of these items.

Figure 4 shows the serial position versus quantitative recall curve of individual items of both the pleasant and unpleasant stories in the control groups. The scores of all recalls of both administrations of each story are summed.

Figure 4 shows the importance of serial position of the concepts as regards quantity of recall. It can be seen that there was greatest quantitative recall of the early concepts in the story the subsequent statements showing a progressive decrement, then there is an increase in remembrance of the number of concepts presented at the end of the story. A remarkably similar

Figure 4.


Curve Showing Serial Order vs Quantitative Recall
Control Group
PLEASANT STORY
UNPLEASANT STORY
QUANTITATIVE RECALL
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ITEM NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14
CODE LETTER a b c d e f g h i j k l m n
SERIAL POSITION

pattern is shown with both the pleasant and unpleasant stories. The almost complete lack of recall of concept 8 ("the fortunate young man" - P story; the "unfortunate young man" - U story) is probably due both to their serial position and also to their being obscure statements.

Table 33 shows the arraying and grouping of means by Duncan's Multiple Range Test (3) of the data on Figure 4.

Table 33.

Control Group

Arraying and Grouping of Means by Duncan's Multiple Range Test

Code Letter	a	b	c	e	n	m	d	i	f	g	k	j	l	h
	———													
		———												
			———											
				———										
					———									
						———								
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								———						
									———					
										———				
											———			
												———		
													———	
														———

Significance $p < .05$

Table 33 shows that many of the differences in quantitative recall of the data on Figure 4 are significant at the 95% level of confidence.

Conclusions: This analysis of the control group data shows the serial position of the individual item to be of extreme importance as regards quantitative recall. (a) The correlational

analysis, Table 32 shows that there was a positive association between the rank order of serial presentation and quantity of recall. (b) Figure 4 shows that these data followed the principle of "Primacy and Recency" i.e., the first concepts and the last concepts were better remembered than the intermediate items. Both these principles have been already reported in word-list tests (18 - 20) and the memorialization of texts (21) in non-psychiatric populations.

Table 34 shows the number of subjects in the test group who remembered each individual item. Both the pleasant story administrations, first and second are summed together as are the unpleasant stories. As each story was told to 50 subjects the maximum score for each item is fifty.

Table 34.

Test Group

Item No.	Pleasant Story Recall No. 1	2	3	Sum	Unpleasant Story Recall No. 1	2	3	Sum
1	48	24	35	107	45	14	20	79
2	44	20	30	94	41	11	20	72
3	39	21	29	89	39	11	23	73
4	17	2	7	26	19	6	8	33
5	37	15	28	80	41	11	19	71
6	23	11	18	52	20	2	6	28
7	18	2	7	27	18	3	9	30
8	0	0	0	0	0	0	0	0
9	16	6	9	31	15	2	7	24
10	16	4	9	29	13	4	6	23
11	18	5	11	34	17	4	8	29
12	5	1	2	8	3	0	0	3
13	25	6	13	44	21	4	10	35
14	37	9	18	64	32	3	15	50

Table 35 shows the analysis of variance table for the above data.

Table 35.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story (S)	1	109	109	18.17**
Recalls 1 vs 2 vs 3 (R)	2	1993	9965	166.08**
Between Items (I)	13	3703	284	47.33**
Interaction				
S X R	2	19	9.5	
R X I	26	533	20.5	3.42*
S X I	13	113	8.7	
S X R X I	26	56.5	2.17	
Error	84	500.5	6.0	

** Significant at $p < .01$

* Significant at $p < .05$

Table 35 confirms the previous findings that significantly more of the pleasant concepts were recalled than unpleasant ones; and there were significant differences on quantitative remembering between recalls. It also shows that there are highly significant differences between the quantity of individual items recalled.

Significant interaction also occurs between the individual items and recall number.

Figure 5 illustrates this interaction graphically.

Table 36 shows the Spearman Rank Coefficients of Correlation (17) between quantity of individual items recalled and the serial order of item presentation in the stories.

Table 36.

Spearman Rank Coefficients of Correlation
Quantity of Individual Items Recalled vs
Serial Order of Presentation

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Coeffic. of Correl.	.493*	.521*	.500*	.551*	.643*	.495*

Significant * $p < .05$

Table 36 shows significantly high positive coefficients of correlation in all recalls between the serial order of concept presentation and quantitative recall. These findings are similar to those of the control group. The post-convulsive recalls maintain the positive relationship between serial order and quantitative recall.

Figure 5 illustrates the serial position versus quantitative recall curve of individual items of both the pleasant and unpleasant stories in the test group of patients. The scores of all recalls of both administrations of each story are summed.

Figure 5.

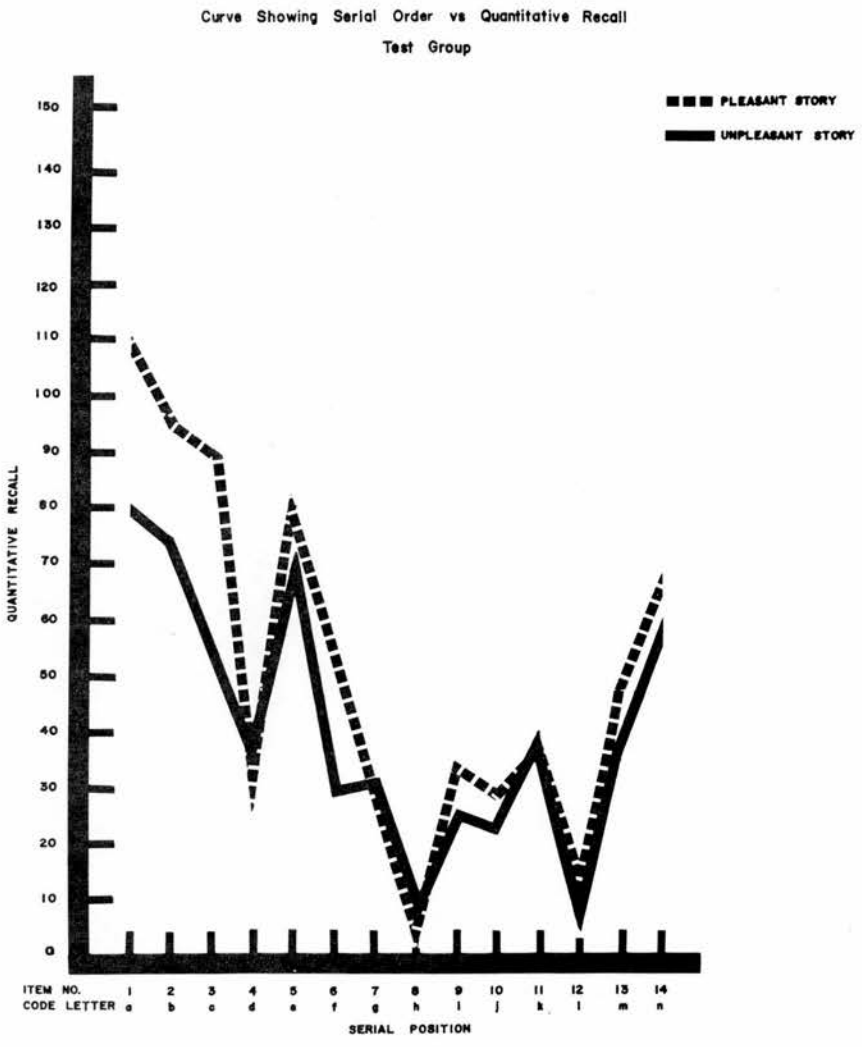
Curve Showing Serial Order vs Quantitative Recall
Test Group
PLEASANT STORY
UNPLEASANT STORY
QUANTITATIVE RECALL
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ITEM NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14
CODE LETTER a b c d e f g h i j k l m n
SERIAL POSITION

Figure 5 shows that in the test group of patients a similar phenomenon occurs as in the control group. There is greater quantitative recall of the items occupying the extremes of the serial positions. Both the pleasant and unpleasant stories show this phenomenon of primacy and regency. As in the control group concept 8 (the "fortunate young man" - P story; the "unfortunate young man" - U story) show a complete lack of recall.

Table 37 shows the arraying and grouping of means by Duncan's Multiple Range Test of the data on Figure 5.

Table 37.

Code Letter	a	b	c	e	n	f	m	k	d	g	i	j	h	l
Significance ($p < .05$)														

Table 37 shows that the means of different items group themselves into six discrete groups without any overlapping as was found in the control group. The first four groups (a b c e n f m) by and large represent the items at the extremes of the serial order. The fifth group (k d g i j) by and large represents the intermediate items. The sixth group (h i) represents the items least recalled probably due to a combination of serial position and obscurity. It can also be seen that the first items (a b c e) are all significantly higher than the last item (n).

Conclusions: As in the control groups this data analysis shows the serial position of the individual item to be of extreme importance as regards quantitative recall both in the pre- and post-convulsive recalls. (a) The correlational analysis Table 36 shows there is a positive association between the serial rank order of the item and the quantity of recall. This applies to both the pre-convulsive and post-convulsive recalls. (b) The phenomenon of "primacy" and "recency" is also shown. Arranging and grouping of the means (Duncan's Multiple Range Test) shows more discrete groupings than the control group. This would tend to show that in the treatment group the serial position of the item is of even greater importance than in the control group.

X. SUMMARY OF CONCLUSIONS - SHARK STORY vs FISHING STORY (PHASE I)

"Life is the art of drawing sufficient conclusions from insufficient premises."

Samuel Butler: Note Books, Life

In this study many interesting results were found pertaining to "emotional" and "mechanistic" factors influencing the recall of these stories.

A. Emotional Factors

(1) The first experimental hypothesis was substantiated namely a greater number of concepts of the pleasant story were remembered in the post-convulsive recalls than of the unpleasant story. In the overall picture in both the control groups and test groups more pleasant material was recalled than unpleasant material. It would appear that the application of electroconvulsive treatment accentuated the "memory laws" defined in the control group.

(2) No factual evidence was obtained to support the second hypothesis, in general, the converse appeared to be more applicable. Variation between quantitative recall of pleasant story and of unpleasant story depended more on fluctuation of the quantitative recall of the indifferent items than the predefined emotional items, i.e. the most disagreeable items of the unpleasant story were as well remembered as their pleasant story

equivalents. This principle was applicable to both the control and test groups.

(3) In the overall pictures both the control and test groups showed remarkably similar patterns. Significantly more pleasant concepts than unpleasant concepts were remembered in both groups. There was interaction between the emotional nature of the stories and the order of telling. Administering the pleasant story first caused pro-active inhibition of the learning of the unpleasant story administered later; whereas, vice versa, administration of the unpleasant story first caused pro-active facilitation of the pleasant story administered second.

(4) There was a general tendency to distort the recalled concepts to render than more pleasant. When the subjects were classified according to the presence or absence of a preponderance of hedonistic distortion of concepts the following results were obtained: (a) a greater number of subjects showed hedonistic distortion of the pleasant story than of the unpleasant story; (b) a greater number of subjects in the control group showed predominantly hedonistic distortion than did those in the test group.

By exemplification it was shown that the conceptual distortions were more extreme and crude in the test groups than in the control groups as regards weakening of the disagreeable emotional significance of the unpleasant story.

B. Mechanistic Factors

(1) Age: Age alone, has no significant bearing on quantitative recall of concepts.

(2) Intelligence: Intelligence had a significant positive association with all recalls in both stories in the control groups. In the test groups there were nonsignificant positive coefficients of correlation between intelligence and quantitative recall in the pretreatment recalls. In the post-convulsive recalls the coefficients of correlation between intelligence and quantitative recall were negligible.

(3) A correlational analysis of the quantity of concepts remembered between recalls within patient groups showed the following results.

a. Control groups: There was a general learning factor positively associated with intelligence: When the text of the story was changed there was a shuffling of the rank order of subjects as regards quantity of recall. There was a greater change in rank order when the text of the story was changed from pleasant to unpleasant than vice versa.

b. In the test groups a similar general learning ability factor was extracted. Again there was a shuffling in rank order when the text of the story was changed. The quantity of post-convulsive recalled material was positively associated with the quantity of recall before application of the treatment.

(4) The serial order of presentation of items was of considerable importance. In both the control and test groups at all recalls, two phenomena were shown: (a) There was a significant positive relationship between serial order of the item and quantity of recall; and (b) the phenomenon of "primacy" and "recency" occurred, i.e. there was greater quantitative recall of the items at the extremes of the text than of the intermediate items.

XI. DISCUSSION SHARK STORY vs FISHING STORY (PHASE I)

"I knew a wise man that had it for a by-word, when he saw men hasten to a conclusion, 'Stay a little, that we may make an end the sooner.'"

Francis Bacon - Of dispatch

This phase of the study showed that there was a selective memory impairment for the unpleasant story in the post-convulsive state. However, this impairment did not depend on the selective forgetting of the most disagreeable items of the shark story, as the greatest fluctuation in item scores occurred in what had been previously classified as indifferent items.

At this stage, on account of the specific primitive sadistic nature of the shark story, we were not convinced that general conclusions could be drawn from these results regarding the selective forgetting of disagreeable material in general. The rationale for these doubts have already been considered in Section V and may be summarized: (a) the shark story was loaded with the potential of activating anxiety associated with oral sadistic and castration complexes (2, 3); (b) the primitive nature of the fear associated with convulsive therapy, stressed by previous authors (4, 5), might provide fertile ground for forgetting of this particular story; (c) the Jungian hero-myth archetype of the hero's being swallowed by a monster (6) might provide spuriously positive results in selective forgetting peculiar to this particular story.

By speculation we might advocate that evidence was obtained from this study to counteract concepts (a) and (c). The absence of a difference in quantitative recall of the unpleasant story amongst diagnostic groups would tend by implication to diminish the etiological significance of oral sadistic complexes in depressive illness and schizophrenia as has been reported (p. 11, 7, 8). If oral sadistic complexes were of sufficient importance to cause mental illness one would expect differences in quantitative recall between the depressive-schizophrenic groups and the "other" diagnostic groups.

In the total three hundred possible recalls of the shark story only one subject in one recall described the "hero" as taking active steps to retribution in destroying the monster. This would appear to be overwhelming evidence against the hero-myth archetype of Jung (6).

Although these rationalizations were invoked they did not alter the fundamental situation that a general conclusion about emotional influences on post-convulsive memory functioning was being drawn from emotional material far removed from the anxieties, stresses of every day life. For this reason it was decided to embark on a second phase of the study using a different test story.

XII. FORMULATION OF SECOND EXPERIMENTAL HYPOTHESIS

"Man propounds negotiations, man accepts the compromise. Very rarely will he squarely push the logic of a fact to the ultimate conclusion in unmitigated act."

Rudyard Kipling: The Female of the Species

It was decided to replicate the previous experiment using different stories to test similar predictions. A story of an unpleasant sexual nature was fabricated to resemble Schilder's shark story (1) as closely as possible in the number of concepts, grammatical structure and syntax: This story, arbitrarily called the unpleasant story, read: "The daughter of a preacher from a small town near Chicago, Illinois was the victim of rape. She was a high school student. While out walking, she was attacked by a man. Since help was impossible the unfortunate young lady was caught, in front of the horrified eyes of some distant picnickers, by the rapist who had been following her. She was dragged behind some bushes all the time screaming for help."[20]

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[20] In the interceding time since the first phase of the study, it was drawn to our attention that legal action was pending against a psychologist by an individual who identified himself with the text of some psychological test material. On the advice of the Research Committee at Dorothea Dix Hospital it was decided to remove from the story personal names, and place names from N. C.

In our opinion there was little doubt that this story would be classified, judgmentally as unpleasant. The felony of rape is regarded as a particularly heinous crime in North Carolina and is a capital offence[21] (2). Nevertheless, a survey of the literature on the news stands of two respectable local drugstores showed a high proportion of books and magazines whose titles and cover illustrations were of a sexual or sexual sadistic nature. It appeared that there was a considerable local demand for this type literature.

In contrast to the unpleasant story, a romantic type story was fabricated as the control story; namely: "The daughter of a preacher from a small town near Chicago, Illinois, was picked as homecoming queen. She was a high school student. After being chosen queen she was crowned by her boyfriend. Alone in her glory, the fortunate young lady was escorted, in front of the eyes of admiring spectators, by her maids of honor who were following her. She was presented some flowers while crying with joy." This story was arbitrarily called the pleasant story.

The same difficulties arose regarding the true emotional significance of these stories as were discussed in the formulation of the previous experimental hypothesis. Again as we were

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[21] Article 7, Section 14 - 21 of the general statutes of N. C. reads, "Every person who is convicted of ravishing or carnally knowing any female of the age of 12 years or more by force and against her will, or who is convicted of unlawfully and carnally knowing and abusing any female child under the age of twelve years, shall suffer death."

interested in the selective forgetting of unpleasant material our main concern was that the "rape story" was more unpleasant than the "romantic" story. We were satisfied at least at a judgmental level that this was so.

Experimental hypotheses: Our experimental hypotheses were similar to these in Phase I. It was predicted that there would be both quantitative and qualitative differences in the post-convulsive recall of pleasant and unpleasant verbal memories learned before application of convulsive treatment; namely: (a) Significantly more concepts of the pleasant story would be recalled than of the unpleasant story, and (b) these differences would apply specifically to the four most unpleasant concepts in the unpleasant story when compared with the equivalent concepts in the pleasant story. The four most unpleasant concepts of the rape story were arbitrarily defined as: "was the victim of rape"; "she was attacked by a man"; "she was dragged behind some bushes"; and "all the time screaming for help."

XIII. THE EXPERIMENTAL METHOD (PHASE II)

"He who resolves never to ransack any mind but his own;...will be obliged to imitate himself, and to repeat what he has before often repeated."

Sir Joshua Reynolds: Discourse to students of the Royal Academy, 1770

Similar pre-experimental considerations were applicable to this phase of the experiment as outlined in Section VII - structuring the experimental method.

A. Site

This phase of the study was conducted on Ward 201, an admission ward in Dorothea Dix Hospital, Raleigh, N. C. In the time intervening since the previous experiment the organizational framework of N. C. State Hospital System was reorganized and converted to the "Unit System" whereby Dorothea Dix Hospital was subdivided into five administrative units, each unit serving a specific geographical catchment area. Each unit was integrated regarding sex and race. Ward 201 was the admission ward for Unit 5 which received patients from five counties in the industrial Piedmont section of the state.

B. Patient Population

It was decided to include both male and female patients in the study population.

Test Group: Fifty consecutive referrals who fulfilled the following selective criteria were studied on the project:

(a) age: 55 years or less; (b) diagnosis: only patients with a formal diagnosis of depression or schizophrenia were included in this phase of the study. (c) They successfully completed the screening recall test.

The screening recall test: This was a test of recall of recently presented verbal material. The following technique was used in the screening recall test. "Now I want you to listen carefully to this story as I will ask you to repeat it again later: 'A lady from Richmond, Virginia, visited her relatives in Rocky Mount, N. C.'" Three repetitions of the story were presented. The second repetition was introduced: "Listen carefully, I am going to tell you the story again, 'A lady from Richmond...'" The third repetition was introduced: "I will tell you the story one more time, 'A lady from Richmond...'" The subject was asked to recall this material after intervals of thirty minutes and sixty minutes. A score of five points from the possible seven was necessary to qualify for the experimental project.

Control Group: Coincidentally, with the assignment of a patient to the test group a subject who had not received E.S.T. was selected randomly from the ward population and placed in the control group. The control population had to fulfill similar selective criteria to the test group regarding: (a) age; (b) diagnosis; and (c) ability to pass the screening recall test.

C. Memory Testing Procedures

(1) Test Group:

a. Assignment of Patients: Selected subjects were randomly assigned, by a prearranged random table to Group C or Group D. It was decided to administer the recall test only at the first treatment in a series so that each group of patients was told only one story. Group C was told the pleasant story and Group D was told the unpleasant story.

b. Presentation of Verbal Material: The verbal material was prerecorded on the Wollensak tape recorder at Volume 7. It was presented to the patients at Volume 2. The recording was Dr. Myron G. Sandifer[22]. Three repetitions of the story were given. Instructions were incorporated on the recording.

The pleasant story: First repetition, "This is not a true story, it has been made up to test your memory. Now listen carefully as you will be asked to repeat it again later. 'The daughter of a preacher from a small town near Chicago, Illinois, was picked as homecoming queen. She was a high school student who, after being chosen queen, was crowned by her boyfriend. Alone in her glory the fortunate young lady was escorted, in front of the eyes of admiring spectators by her maids of honor who were following her. She was presented with some flowers

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[22]Formerly Director of Research, N. C. Department of Mental Health. Now Professor of Psychiatry, University of Kentucky, Lexington, Kentucky.

while crying with joy.'"

Second repetition, "Listen carefully, I will tell you the story again: 'The daughter of a preacher...'"

Third repetition, "Listen carefully, I will tell you the story one more time: 'The daughter of a preacher...'"

The unpleasant story: "The daughter of a preacher from a small town near Chicago, Illinois, was the victim of rape. She was a high school student, who, while out walking, was attacked by a man. Since help was impossible the unfortunate young lady was caught, in front of the horrified eyes of some distant picnickers, by a man who had been following her. She was dragged behind some bushes all the time screaming for help." Three repetitions of this story were presented to the subject with the same instructions incorporated on the recording as for the pleasant story.

c. Recall Procedure: Immediately after presentation of the third repetition, a stopwatch was activated. Twenty minutes later, a first recall was done. Ten minutes after the first recall, the electroconvulsive therapy was applied. Thirty minutes after application of the electrical stimulus a second recall was undertaken. The third recall was exactly sixty minutes after the application of the electrical stimulus.

All recalls were done by a standard procedure, namely: The tester said to the subject, "Some time ago you were told a story on this tape recorder. I want you to tell me what you remember

of that story." In the event of lack of response, two more repetitions of the statement were made. When the subject had completed the recall, a further statement was made, namely: "Do you remember any more?" This latter statement was repeated twice more. All the subjects' responses were recorded by tape recorded.

(2) Control Group: All of the above procedures were undertaken in the control group except for the omission of the electroconvulsive therapy.

D. Electroconvulsive Therapy Technique

All patients were premedicated with 1/100 gr. of atropine. Thirty-five seconds before application of the electrical stimulus a muscle relaxant Anectine (succinyl choline) 15 mg. was administered by a Medcraft machine using glissando technique. The center of the circular electrodes were placed 1 1/2 inches above the zygoma on a perpendicular line drawn from the midpoint of the line joining the lateral angle of the orbit with the external auditory meatus. Oxygen was administered by artificial respiration after the convulsion until the return of natural breathing.

E. Data Collection

The recorded responses were transcribed verbatim for data analysis.

F. Experimental Differences Phase I vs Phase II

(1) Different geographical catchment area for the subject population.

(2) Both sexes were studied in the second phase.

(3) A depressive or schizophrenia diagnosis was a criterion of selection for the study.

(4) Different stories were used as test material.

(5) Each subgroup of subjects were told only one story.

FLOW CHART

Patient Selection

Assignment of patient to electroconvulsive therapy	Selection of control patient
Selective criteria	Selective criteria
a. Age	a. Age
b. Diagnosis	b. Diagnosis
c. Recall test	c. Recall test
WAIS Verbal Scale	WAIS Verbal Scale
Random Assignment	Random Assignment

Memory Testing

	C	D	A	B
0 min	P Story	U Story	P Story	U Story
20 min	1st Recall	1st Recall	1st Recall	1st Recall
30 min	ECT	ECT	-	-
60 min	2nd Recall	2nd Recall	2nd Recall	2nd Recall
90 min	3rd Recall	3rd Recall	3rd Recall	3rd Recall

XIV. RESULTS (PHASE II)

"What would life be without arithmetic..."

Rev. Sydney Smith: To Miss

A. Definitions

In describing the results in Phase II of the experiment exactly the same terminology is used as defined on page 64.

B. Population Characteristics

Table 47 shows the study population of 100 patients broken down by age; intelligence; and diagnosis.

Table 47.

Population Characteristics

(Age, Intelligence, and Diagnosis)

		Age		Intelligence		Diagnosis		
	N	M	SD	M	SD	Dep.	Schiz.	Other
Group A	25	38.5	9.37	92.2	15.08	16	9	
Group B	25	37.1	10.10	89.2	11.8	17	8	
Group C	25	36.7	10.25	90.4	13.91	17	8	
Group D	25	37.7	11.83	90.1	13.05	12	13	

Group A Control Group - Pleasant Story
Group B Control Group - Unpleasant Story
Group C Test Group - Pleasant Story
Group D Test Group - Unpleasant Story

(1) Age

Figure 6 shows the distribution of the study population by age.

Figure 6 shows a difference in frequency distribution by age from the population in Phase I of the study. The previous population showed a definite positive skewing with increasing frequency in the older age groups. This population shows increased frequency in the 26 - 40 years age range. This tends to lower the mean age of the total population (Mean = 37.2; S.D. = 10.31) but this drop in mean age is not statistically significant. There are no significant differences in age between the different groups in Table 47.

(2) Intelligence

The mean intelligence of the study population is 90.5 (S.D. 13.62) as measured by the W.A.I.S. Verbal Scale (1). There are no significant differences between the means of the different groups in Table 47. The mean intelligence of this population is significantly lower than the mean intelligence of the population in Phase I (Mean 96.8; S.D. 12.79) ($T = 3.398$; 198 df; $p < .001$). The reason for the drop in mean intelligence between the two populations is obscure. This may be related to different catchment areas: racial differences, or different criteria of selection of patients for E.C.T. as different resident psychiatrists were responsible for treatment recommendation in this phase of the study.

Figure 7 shows a relatively normal distribution of intelligence with the greatest frequency of I.Q.'s falling between 80 and 89. The lower tail of the distribution has been cut off as

Figure 6.

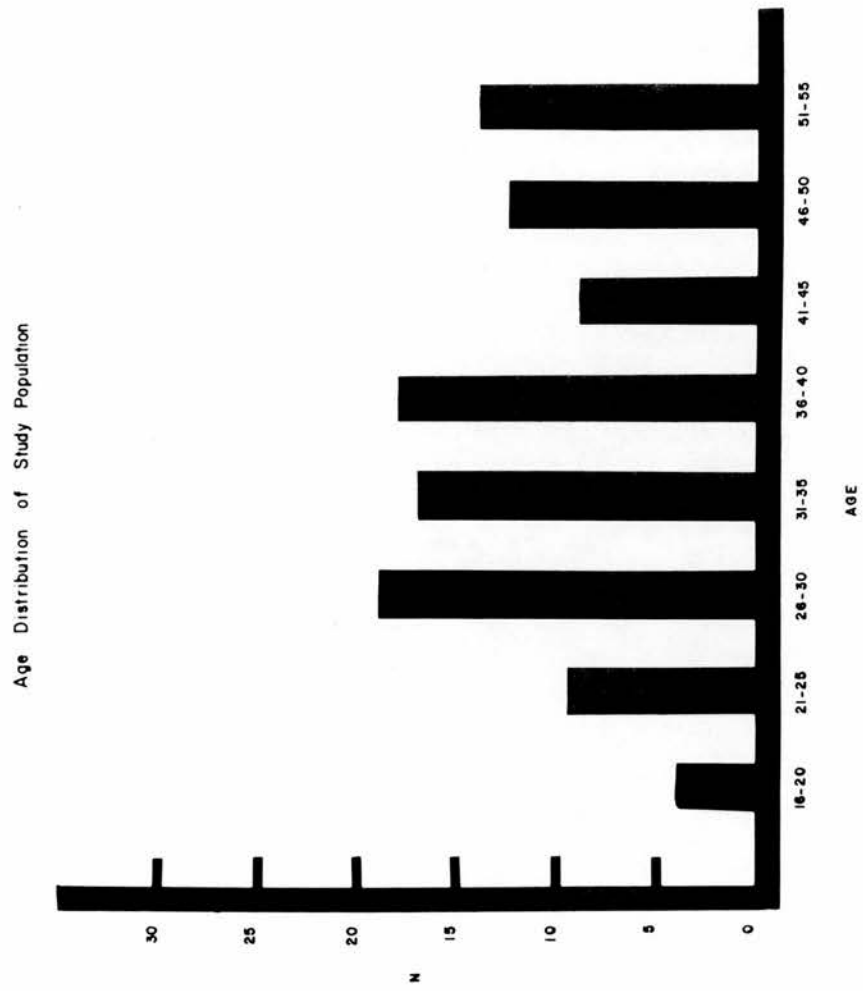
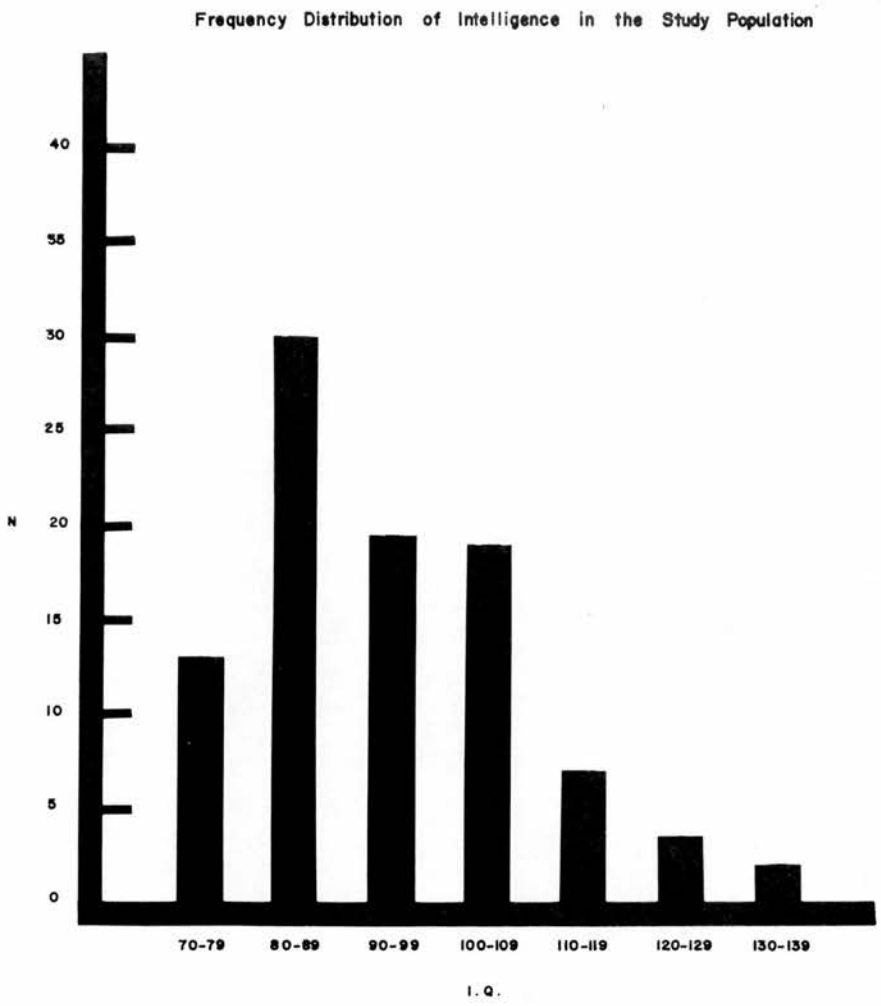

Age Distribution of Study Population
N
30
25
20
15
10
5
0
18-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
AGE

Figure 7.


Frequency Distribution of Intelligence in the Study Population
N
40
35
30
25
20
15
10
5
0
70-79
80-89
90-99
100-109
110-119
120-129
130-139
I.Q.

a result of exclusion of these patients by failing the screening recall test.

(3) Diagnosis

Table 47 shows the diagnostic frequency distribution in the subgroups of patients. Groups A, B, C show remarkably similar patterns with a greater incidence of depressive diagnoses than schizophrenic diagnoses. Group D, however, shows an inverse pattern with a higher incidence of schizophrenics than depressions. This difference is not significant by the Chi square test at the .05 level of confidence.

C. Analysis of Concept Recall Data

(1) Reliability of Scoring

The number of concepts recalled were scored by two raters, Raters A and B. Rater A was the investigator. Rater B was a graduate student in English at the University of Minnesota. The material was scored independently with no collaboration between raters. Immediately after recording the recalled material, Rater A scored the number of recalled concepts on data sheets. Rater B scored the material quantitatively from the verbatim transcriptions. Rater B was uninformed regarding the nature of the experiment. The only preliminary instruction given to Rater B was that the material was to be scored according to the number of concepts recorded rather than according to verbal accuracy.

The inter-rater coefficient of correlation (Product moment) between raters in all recalls both test and control groups was .935 ($N = 300$, $p = < .0005$).

Table 48 shows the inter-rater coefficients of correlation with the data broken down by recall number and whether control or test group.

Table 48.

Coefficients of Correlation
(Product Moment)

Rater A vs Rater B

	Control Group			Test Group	
	N	r	P	r	P
Recall 1	50	.895	< .005	.927	< .005
Recall 2	50	.942	< .005	.896	< .005
Recall 3	50	.913	< .005	.958	< .005

The critical area of scoring reliability as regards the experimental hypotheses lay in the post-convulsive remembering of material, so, inter-rater coefficients of correlation was computed for the second and third recalls (post-convulsive recalls) for both the pleasant and unpleasant stories. These coefficients of correlations are shown in Table 49.

Table 49.

Coefficients of Correlation
(Product Moment)

Rater A vs Rater B

		Pleasant Story Test		Unpleasant Story Test	
	N	r	P	r	P
Recall 2	25	.921	< .005	.931	< .005
Recall 3	25	.953	< .005	.901	< .005

Tables 48 and 49 show highly significant inter-rater agreement in the quantitative scoring of concepts and give confidence in further data analyses. In subsequent analyses only data of Rater A are used.

Table 50 shows the number of concepts remembered by individual subjects in both the control and test groups. The data are broken down by pleasant story vs unpleasant story, and by recall numbers.

Table 50.

No. of Concepts Remembered by Individual Patients

	Control Group A Pleasant Story				Control Group B Unpleasant Story		
Pat. No.	1	2	3	Pat. No.	1	2	3
1	9	8	9	26	8	8	8
2	6	6	6	27	4	6	7
3	4	5	5	28	6	5	8
4	3	6	6	29	7	4	5
5	9	8	9	30	4	5	3
6	6	6	6	31	8	9	10
7	9	10	9	32	12	9	9
8	6	6	7	33	8	8	8
9	6	6	6	34	6	7	7
10	8	8	8	35	9	9	9
11	8	8	7	36	3	4	3
12	6	5	5	37	3	4	4
13	6	5	6	38	8	8	8
14	6	6	6	39	3	4	4
15	12	12	12	40	10	11	11
16	9	9	9	41	10	8	7
17	4	4	4	42	5	6	5
18	5	4	4	43	7	7	7
19	5	4	4	44	8	8	7
20	12	11	10	45	2	2	3
21	1	1	1	46	4	3	3
22	3	4	4	47	8	8	8
23	6	6	6	48	6	8	8
24	9	10	10	49	8	8	8
25	8	10	11	50	7	8	7
Mean	6.68	6.72	6.80		6.56	6.68	6.68
Code Letter	a	b	c		d	e	f

Table 50.
(continued)

No. of Concepts Remembered by Individual Patients

Test Group C Pleasant Story				Test Group D Unpleasant Story			
Pat. No.	Recall No. 1	2	3	Pat. No.	Recall No. 1	2	3
51	9	0	2	76	5	2	2
52	6	0	0	77	6	5	5
53	8	1	5	78	6	6	6
54	2	0	0	79	0	0	0
55	5	1	4	80	9	0	6
56	4	0	1	81	9	6	9
57	3	0	0	82	7	1	6
58	4	0	0	83	5	0	4
59	9	0	0	84	6	0	0
60	6	0	5	85	7	6	7
61	5	1	5	86	8	5	5
62	2	0	0	87	6	2	3
63	6	0	1	88	6	5	6
64	4	4	4	89	7	0	3
65	5	0	4	90	7	3	6
66	7	3	3	91	6	1	3
67	10	0	0	92	4	0	2
68	10	0	0	93	7	2	4
69	5	5	5	94	8	4	7
70	7	0	0	95	10	7	6
71	5	1	1	96	3	0	2
72	8	0	0	97	8	2	3
73	5	0	0	98	7	3	3
74	8	0	0	99	5	0	2
75	8	0	0	100	8	0	2
Mean	6.04	.64	1.60		6.40	2.40	4.08
Code Letter	g	h	i		j	k	l

Table 51.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratios
Control vs Test Groups (C)	1	748.8	745.8	138.11
Pleasant Story vs Unpleasant Story (S)	1	38.6	38.6	7.15
Recalls 1 vs 2 vs 3 (R)	2	279.2	139.6	25.85
Interaction				
C X S	1	49.8	49.8	9.22**
C X R	2	308.9	104.5	19.35**
S X R	2	15.2	7.6	1.40
C X S X R	2	13.9	7.0	1.30
Residual	228	1544.4	5.4	

** $p < .01$

* $p < .05$

Table 51 shows the analysis of variance table for the data on Table 50. This analysis shows that significant differences occurred in several areas; namely:

(a) More concepts were remembered by the control group than the test group, related to the post-convulsive impairment in verbal memory.

(b) In the overall picture more unpleasant concepts were remembered than pleasant ones.

(c) More concepts were recalled at the first recall than in recalls 2 and 3. Interaction between recall number and test vs control shows these recall number differences are related to post-convulsive verbal memory impairment.

(d) More pleasant story concepts were remembered than unpleasant story concepts by the control group, but vice versa occurred in the test group where more of the unpleasant concepts were remembered.

Figure 8 (a) is a graphic illustration of interaction between C and R. Figure 8 (b) illustrates graphically interaction between C and S.

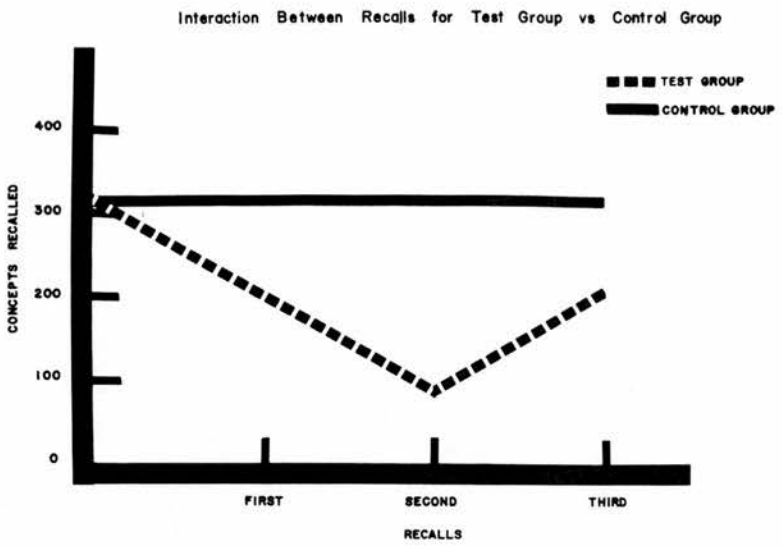
Table 52.

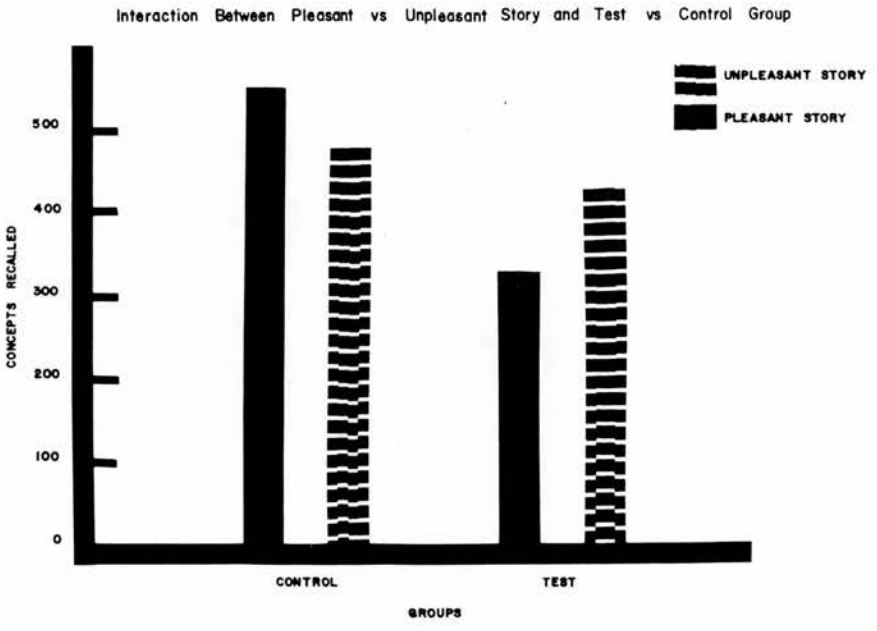
Arraying of Means to Show Significant Differences between Groups of Means by Duncan's Range Test

Means (code letters)	h	i	k	l	a	b	c	d	e	f	g	j

Table 52 shows the means in Table 50 arranged into significantly different groups by Duncan's Multiple Range Test (2). It can be seen that no significant differences occurred between any of the control group means or the pre-convulsive recall means in the test group (a b c d e f g j). However, all the post-convulsive recall means were significantly different from each other (h, i, k and l). The post-convulsive recalls of the unpleasant material (k, l) were significantly higher than the means of the post-convulsive recalls of the pleasant story (h, i).

Figure 8.
(a and b)





Conclusions: From this analysis of the data, the following conclusions can be drawn: (a) The first experimental hypothesis was not substantiated by these data; in fact, the converse was true, as the post-convulsive quantitative recall of unpleasant material was significantly greater than that of the pleasant material. (b) In the first phase of the study, post-convulsive memory accentuated tendencies found in the control group; however, in this phase of the study the converse was true.

(3) Second Experimental Hypothesis

This analysis deals with the differential quantitative recall of the various items qualitatively predefined as emotional or indifferent items.

Table 53.

Indifferent Items

	Pleasant Story		Unpleasant Story
(1)	The daughter of a preacher	(1)	The daughter of a preacher
(2)	From a small town near Chicago, Ill.	(2)	From a small town near Chicago, Ill.
(3)	She was a high school student	(3)	She was a high school student
(4)	After being chosen queen	(4)	Who while out walking

Emotional Items

(1)	Picked as homecoming queen	(1)	Was the victim of rape
(2)	Was crowned by her boyfriend	(2)	Was attacked by a man
(3)	She was presented some flowers	(3)	She was dragged behind some bushes
(4)	While crying with joy	(4)	All the time screaming for help

Table 53 shows the enumeration of items as coded in the following data analysis.

Table 54 shows the tabulation of data divided into emotional and indifferent items. Each entry shows the sum of each item recalled by each group of patients, i.e. the maximum score in each item is 25 as there were twenty-five patients in each group.

Table 54.

Indifferent Items

Control Groups						
	Pleasant Story			Unpleasant Story		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3
1	23	22	23	22	23	23
2	19	20	18	18	18	18
3	9	9	9	10	9	11
4	14	15	16	21	22	22
	65	66	66	71	72	74
Means	16.15	16.50	16.50	17.75	18.00	18.50

Test Groups						
	Pleasant Story			Unpleasant Story		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3
1	25	7	11	23	14	23
2	18	3	6	20	12	16
3	11	1	3	11	2	2
4	10	2	3	12	4	7
	64	13	23	66	32	48
Means	16.00	3.25	5.75	16.50	8.00	12.00

Table 54.
(continued)

Emotional Items

Control Groups						
	Pleasant Story			Unpleasant Story		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3
1	17	17	17	19	20	20
2	14	12	14	21	22	22
3	18	19	19	15	17	19
4	12	14	14	10	11	9
	61	62	64	65	70	70
Means	15.25	15.50	16.00	16.25	17.50	17.50

Test Groups						
	Pleasant Story			Unpleasant Story		
Item No.	Recall No. 1	2	3	Recall No. 1	2	3
1	20	1	5	15	7	12
2	21	1	3	6	4	5
3	13	1	4	19	6	9
4	7	0	1	19	1	7
	61	3	13	59	18	33
Means	15.25	0.75	3.25	14.75	14.50	8.25

Table 55 shows the analysis of variance table of the data in Table 54.

Table 55.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Test Groups vs Control Groups (C)	1	1449	1449	61.66**
Pleasant Story vs Unpleasant Story (S)	1	142	142	6.04*
Emotional vs Indifferent Items (E)	1	68	68	2.89
Recall 1 vs 2 vs 3 (R)	2	507	253.5	10.79**
Interaction				
C X S	1	18	18	
C X E	1	15	15	
C X R	2	626	313	13.32**
S X E	1	3	3	
S X R	2	41	20.5	
E X R	2	2	1	
C X S X E	1	1	1	
C X S X R	2	28	14	
C X E X R	2	7	3.5	
S X E X R	2	1	0.5	
C X S X E X R	2	1	0.5	
Error	72	1692	23.5	

Significant * $p < .05$

Significant ** $p < .01$

The analysis of variance of these data gives the following significant results:

(a) More of the unpleasant material was remembered than of the pleasant material.

(b) The control group remembered more than the test group (a result of the post-convulsive memory impairment in the test group).

(c) There were differences amongst recall numbers (again as a result of post-convulsive memory impairment in the test group).

Thus the original hypothesis was not substantiated that there would be selective forgetting of the predefined most unpleasant items. Examination of the data in Table 54 shows a tendency for a greater post-convulsive remembrance of the emotionally unpleasant items than of the equivalent items in the pleasant story; however, this was not statistically reliable.

(4) The Influence of Sex

As the stories in this phase of the study were of a sexual nature it was considered that the sex of the subjects might be a factor in producing differences in quantitative recall.

Table 56 shows the total data broken down by sex.

Table 56.

Quantitative Remembrance of Concepts by Sex

	Control Group											
	Pleasant Story Recall No.						Unpleasant Story Recall No.					
	1		2		3		1		2		3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Males (N11)	6.80	2.5	6.80	2.7	6.80	2.8	6.20	3.2	5.90	2.5	6.10	2.2
Females (N14)	6.60	2.9	6.66	2.7	6.80	2.5	6.80	2.1	7.20	2.0	7.26	2.3
Significance	N.S.		N.S.		N.S.		N.S.		N.S.		N.S.	

	Test Group											
	Pleasant Story Recall No.						Unpleasant Story Recall No.					
	1		2		3		1		2		3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Males (N11)	5.45	2.4	0.55	1.2	1.75	2.8	6.82	.98	2.91	2.4	4.82	1.9
Females (N14)	6.50	2.2	0.71	1.5	1.43	1.8	6.07	2.6	2.00	2.4	3.50	2.4
Significance	N.S.		N.S.		N.S.		N.S.		N.S.		N.S.	

Table 56 shows that there was a trend for the female subjects to remember more of the unpleasant story at all recalls in the control group; whereas, the converse occurred in the test group where the male population remembered more than the female subjects at all recalls. These differences, however, did not reach the level of statistical reliability.

(5) The Influence of Diagnosis

Table 57 shows the quantitative remembrance of concepts broken down by diagnostic groups (Schizophrenia vs Depression).

Table 57 shows that the depressive patients had greater quantitative remembrance of concepts in all recalls of both stories in both control and test groups. These differences reach the level of statistical reliability in many of the recalls, especially in the unpleasant story in the test group. The depressive subjects were of higher intelligence than the schizophrenic subjects but this difference was only of statistical significance in one subgroup, the pleasant story test group, (Depressives: WAIS Verbal I.Q. Mean - 94.3, S.D. = 11.8. Schizophrenics: WAIS Verbal I.Q. Mean = 82.5, S.D. = 9.8, $p < .05$). This difference in intellectual functioning level between the diagnostic groups was probably factor in accounting for learning differences. In all groups, the mean age of the depressive subjects was higher than the schizophrenic subjects. This factor would tend to give the schizophrenic population an

Table 57.

Quantitative Remembrance of Concepts by Diagnosis

Control Group

	Pleasant Story						Unpleasant Story					
	Recall No. 1		Recall No. 2		Recall No. 3		Recall No. 1		Recall No. 2		Recall No. 3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Dep.	7.62	2.3	7.69	2.5	7.54	2.4	6.50	2.3	6.81	2.1	6.62	2.4
Schiz.	4.83	1.3	5.50	.84	5.67	1.0	5.25	3.2	5.75	3.3	6.25	3.3
Significance	$p < .02$		N.S.		N.S.		N.S.		N.S.		N.S.	

Test Group

	Pleasant Story						Unpleasant Story					
	Recall No. 1		Recall No. 2		Recall No. 3		Recall No. 1		Recall No. 2		Recall No. 3	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Dep.	6.76	2.2	.35	.79	1.06	1.6	8.00	1.4	4.43	2.4	6.57	1.3
Schiz.	4.33	1.3	.17	.04	2.00	2.4	5.43	1.8	1.57	1.9	3.07	2.0
Significance	$p < .05$		N.S.		N.S.		$p < .01$		$p < .01$		$p < .001$	

age defined advantage in learning. However, in reviewing the data, it would appear that the schizophrenic subjects had a particular inability to learn and recall this type story material. In Phase I there were no significant diagnostic differences in quantitative recall of either the shark or the fishing story.

D. Concept Distortion

As in the first phase of the study, it was decided to analyze the data according to the emotional direction of distortion of concepts on recall. The following predictions were made before data analysis: (a) In the overall recalled material there would be a tendency to distort the concepts of the stories to render them more pleasant; and (b) this hedonistic distortion would be most marked in the unpleasant story especially on the post-convulsive recalls.

(1) Data Reliability

The data were scored independently and with no collaboration by two raters, Rater C and Rater D. Rater C was a senior undergraduate student in psychology at North Carolina State University. Rater D was a junior undergraduate student in biology at North Carolina State University. The material was scored from the verbatim transcripts of the recorded data with neither rater's knowing the aim and structure of the experiment. Rater C scored the data first. He was instructed to identify individual concepts and score each according to whether the concept had been rendered more pleasant, more unpleasant or had been left

unchanged. Each concept scored was identified numerically. With similar preliminary instructions Rater D scored the enumerated concepts.

Table 58 is the contingency table showing the inter-rater reliability in scoring the emotional distortion of the items.

The inter-rater coefficient of attributes of r = .661 shows a highly significant degree of agreement between Rater C and Rater D in classifying the items according to the direction of emotional distortion.

Table 58 shows that as in the first phase there is a marked stability in the recall of items with the preponderance of items showing "no change". However, if distortion of concepts did occur both raters agreed that the direction could be preponderantly in the direction of rendering the concepts more unpleasant.

(2) Pleasant Story vs Unpleasant Story
(Direction of concept distortion)

In the following analyses the scores of Rater C were used. Each patient was placed in either one of two categories. The first category was composed of subjects who distorted a preponderant number of items in the direction of rendering them more pleasant; the second category was composed of subjects who showed a preponderance of items which showed no change or were distorted in the direction of rendering them more disagreeable.

Table 58.

Contingency Table Showing Inter-rater Reliability in the Scoring of Emotional Distortion of the Items

		Rater C			
		More P	No Change	More U	TOTAL
Rater D -	More P	73	7	10	90
	No Change	45	1102	55	1202
	More U	0	26	123	149
	TOTAL	118	1135	188	1441

$X^2 = 1257.76$

$r = .661$

$p < .005$

The hypogeometric distribution was used to compute the probabilities in tables 59 through 62.

Table 59 (a), (b) and (c) show the distribution of patients in the control groups classified according to the above method. The data are broken down to compare the pleasant story with the unpleasant story by recall number.

Table 59.

Control Groups
Pleasant Story vs Unpleasant Story

(Subjects classified by preponderance of item distortion)
More P vs More U or No Change

(a). First Recall

	More P	No Change More U	TOTAL
Pleasant Story	2	23	25
Unpleasant Story	11	14	25
TOTAL	13	37	50

Significant $p < .0075$

(b). Second Recall

	More P	No Change More U	TOTAL
Pleasant Story	3	22	25
Unpleasant Story	11	14	25
TOTAL	14	36	50

Significant $p < .0128$

(c). Third Recall

	More P	No Change More U	TOTAL
Pleasant Story	3	22	25
Unpleasant Story	10	15	25
TOTAL	13	37	50

Significant $p < .0253$

Tables 59 (a), (b) and (c) show that in the control groups there was a greater tendency to distort the unpleasant story hedonistically than the pleasant story in all of the three recalls.

Tables 60 (a) and (b) show the equivalent data for the test groups.

Table 60.

Test Groups
Pleasant Story vs Unpleasant Story

(Subjects classified by preponderance of direction of concept distortion)

More P vs More U and No Change

(a). First Recall

	More P	No Change More U	TOTAL
Pleasant Story	8	17	25
Unpleasant Story	8	16	24
TOTAL	16	33	49

Not Significant $p < .4887$

(b). Second, Third Recalls Combined (Post-convulsive recalls)

	More P	No Change More U	TOTAL
Pleasant Story	0	16	16
Unpleasant Story	5	33	38
TOTAL	5	49	54

Not Significant $p < .1558$

In Table 60 (b) the data from both the second and third recalls (post-convulsive) were collapsed into one table. Table 60 (a) and (b) shows that there was no significant differences between the pleasant and unpleasant story as regards hedonistic distortion of concepts either in the pre-convulsive or post-convulsive recalls in the test groups.

(3). Control Groups vs Test Groups
(Direction of concept distortion)

Tables 61 (a) and (b) show a comparison between the control groups and test groups in emotional distortion of the pleasant story. The second and third recalls are collapsed into one table. As in the previous analyses the data is classified according to the number of patients who showed a preponderance of distortion in the direction of rendering the items more pleasant versus these subjects who showed "no change" or distortion preponderantly in the direction of rendering the items more unpleasant.

Table 61.

Pleasant Story
Control Group vs Test Group

(Subjects classified according to preponderance of item distortion)

More P vs No Change and More U

(a). First Recall

	More P	No Change More U	TOTAL
Control Group	2	23	25
Test Group	8	17	25
TOTAL	10	40	50

Significant $p < .037$

(b). Second and Third Recalls

	More P	No Change More U	TOTAL
Control Group	5	44	49
Test Group	0	17	17
TOTAL	5	61	66

Not Significant $p < .21$

Table 61 (a) shows that the test group showed significantly greater positive distortion of the pleasant story at the first recall. There are no significant differences at the second and third recalls between test and control group; however, the trend is for the control group to show more hedonistic distortion of the pleasant story.

Tables 62 (a) and (b) show the equivalent data for the unpleasant story as shown in the previous tables for the pleasant story.

Table 62.

Unpleasant Story
Control Group vs Test Group

Distortion: (More Pleasant vs No Change and More Unpleasant)

(a). First Recall

	More P	No Change More U'	TOTAL
Control Group	8	16	24
Test Group	11	14	25
TOTAL	19	30	49

$X^2 = .586$
Not Significant

(b). Second and Third Recalls

	More P	No Change More U	TOTAL
Control Group	21	29	50
Test Group	5	31	36
TOTAL	26	60	86

$X^2 = 7.84$

$p < .01$

Table 62 (a) shows that in the first recall of the unpleasant story the control group showed a greater tendency towards hedonistic distortion of the unpleasant stories. Nevertheless, in the

second and third recalls (post-convulsive recall for the test group) the control group shows a significantly greater hedonistic distortion.

Conclusions: The above analyses did not confirm our hypotheses. (a) Contrary to our prediction, the distortion of concepts tended in general to be in the direction of rendering them more unpleasant. (b) In comparing the pleasant story with the unpleasant story as regards hedonistic distortion of concepts, differences occurred in the control groups where there was greater hedonistic distortion of the unpleasant story than the pleasant one. At all recalls these differences were statistically reliable.

E. Concept Distortion by Individual Patients

Examination of the verbatim transcripts of the unpleasant material showed several methods were used to weaken the emotional significance of the story. In contrast to the shark story where the method of remembering diametrically opposite concepts was commonly used, in this story, it was rarely used. This was probably a result of this text not lending itself to this type distortion. However, the following subject did show this phenomenon.

Subject 77: (Test group - Unpleasant story).

Recall 1: "A young girl of a preacher was attacked by a rapist that lived in a small town in Chicago, Illinois. Some picnickers - the rapist was caught by some picnickers on the out-stretches of town. She was dragged behind some bushes. I believe that is all I remember."

Recall 2: "A girl was raped. It was in Chicago, Illinois. She was the daughter of a preacher. Picnickers on the outside, wait a minute. She was, got it all confused. I'm trying to think. About this rapist that was attacked, that is all I remember."

Recall 2 shows the phenomenon of patient remembering a diametrically opposite concept where the rapist became the victim of the attack.

Variations of the test instructions which were incorporated on the tape recording of the story were frequently remembered by the test group which was told the unpleasant story, namely: "This is not a true story but has been made up to test your memory." It was considered that this was a method of weakening the story from a real life situation to a fictional one. Exemplification of this is shown below.

Subject 83: (Test group - Unpleasant story.)

Recall 1: "A lady from, a young lady from Chicago, Illinois, was crying and screaming and was raped and was pulled in some bushes and was raped and the story is not true and it is just a story to remember."

Subject 99: (Test group - Unpleasant story).

Recall 1: "Should I try to remember everything. I remember that someone said that it was only a story and I take his word for it that it is just a story and it is not true.

In the story there was, as the story goes, not being true, is probably fictional or something like that. There was a young girl in the story and she was, she lived somewhere on the outskirts of Chicago and she had been in high school and she was raped. And the rapist who was seen, I suppose, in the park where she was and he was because someone saw him, I believe someone saw him doing this and her being a victim of rape. Is it due to some distraction, I did not get to hear all of it, but major details, I mean the major happenings in the story which is just a story was things that I just said."

Subject 82: (Test group - Unpleasant story).

Recall 1: "I think it was a little girl in a little town close to Georgia. And a bunch of boys raped her and she was walking down the street and a bunch of people, picnickers, pulled her behind a bush and she didn't scream for help. You said, 'that wasn't a true story.'"

The above examples illustrate a denial of the reality of the unpleasant story.

It was noted in Phase I of the study that the memory "mechanisms" were more crude in the post-convulsive recalls than in the equivalent control group recalls. This principle appeared to apply also to this phase of the study. The phrase "a girl (female) was raped" was not a statement in the recorded material. This phrase was used only three times by the control population in the third recall of the unpleasant story, whereas, it was used by ten subjects in the test group in the third recall of this story (statistically reliable $X^2 = 5.099$, 1 df, $p < .05$). The following examples will serve to illustrate the subtle amelioration of the disagreeable nature of the unpleasant story by the control group as compared to the crude statements of the situation by the test group.

Subject 80: (Test group - Unpleasant story).

Recall 3: "A girl from Chicago took a walk one day. She was a high school graduate and she was attacked by a rapist in front of a horrified group of people and drug behind the bushes and raped. That is all I can remember. No I can't think of anything more, my mind went blank."

Subject 86: (Test group - Unpleasant story).

Recall 3: "A woman went to Chicago and she was walking through the park and some boys raped her. Yes, she was hollering and she couldn't get help."

Subject 83: (Test group - Unpleasant story).

Recall 3: "A young lady from Chicago, Illinois, was raped and she was pulled over in the bushes and was raped and that is about all I know."

Subject 90: (Test group - Unpleasant story).

Recall 3: "A young girl was walking along in a small town near Chicago, Illinois. She was drug behind the bushes and raped. That is all I can remember."

Subject 94: (Test group - Unpleasant story).

Recall 3: "I remember more about it now. It is about a girl from Chicago, and this guy, anyway he raped her and she was - he raped her in front of some picnickers, you know, and she was screaming and people couldn't come help her. That is about all I remember about it. She was raped anyway in hearing of other people, picnickers, that is about all I know about it."

Subject 34: (Control group - Unpleasant story).

Recall 3: "A young girl, the daughter of a preacher in a small town near Chicago, Illinois was the victim of a rapist and before the horrified eyes of picnic onlookers the crime was committed."

Subject 37: (Control group - Unpleasant story).

Recall 3: "I remember something about a preacher's daughter; and then something about Chicago; something about Illinois; something about playground, picnic ground or something; something about rape; something about dragging a girl behind a bush."

Subject 38: (Control group - Unpleasant story).

Recall 3: "There was a preacher who lived in a small town near Chicago, Illinois, and his daughter was out walking one day and was attacked by a man. She was screaming and hollering, she had seen some picnickers at a distance; evidently help was not available and she was attacked and dragged in behind some bushes."

Subject 48: (Control group - Unpleasant story).

Recall 3: "The daughter of a preacher who was a high school student was out walking one day. She was attacked by a man and drug behind some bushes in front of the eyes of thousands, all the while hollering and screaming."

Subject 49: (Control group - Unpleasant story).

Recall 3: "The daughter of a small town preacher from Chicago, Illinois, was out walking one afternoon and attacked by a rapist. In front of some horrified picnickers, she was dragged behind some bushes and attacked, screaming."

The above examples have been selected to show the contrast between the expression of the verbal memories of the unpleasant story by the post-convulsive subjects with the control group equivalents. The crude use of the expression "was raped" (twice by Subject 83; three times by Subject 94) by the post-convulsive group is in contrast to the, at times deliberate, avoidance of this expression by the control group subjects.

(2) Paranoid Distortion in an Individual Patient

As in Phase I only one patient showed frank paranoid distortion of the material as a result of her current mental condition.

Subject 93: (Test group - Unpleasant story).

Recall 1: "It was compared with one that happened in Chapel Hill, isn't it? Did this happen in Chapel Hill three months ago and you just made it Chicago, Illinois.

Once there was a lady from Chicago, Illinois, a farmer's daughter, who had gone to school to get an education. While she was walking through the arboretum of the campus she was suddenly attacked by a colored person who attacked and cut her throat and then she gave in to him and she said 'Help! Help! Oh, please help!' Not a soul - just stood around and gaped at what was going on. He muttered something and she was still screaming."

Recall 3: "This girl from Richmond, Virginia, was walking through the park one day when all of a sudden she came to a clump of bushes, all of a sudden without even seeing anything, this man jumped out, this colored man, grabbed her by the throat and said, 'I'll kill you anyway,' and he put the razor to her neck and she said 'Help! Help! Somebody please help!' and he killed her right there in front of everybody and that is the end of the story and it happened in Chapel Hill. Me, my sons from Chapel Hill went to the place and the boys didn't know what in the world was going on. They showed us exactly where she died and exactly where she fell and everything."

The above story referred to a true event in which a girl student had been murdered in the arboretum in Chapel Hill several months previously. The above narrative shows paranoid thought disorder: over-inclusive thinking, condensation of ideas and thought disconnection. It is interesting to note that the resemblance between the post-convulsive recall (Recall 3) and the pre-convulsive recall (Recall 1). This is another illustration of reversion to the distorted material that had been previously learned rather than to the factual material of the story.

2. MECHANISTIC FACTORS INFLUENCING RECALL

A. Age and Intelligence

(1) Age

Table 63 shows the coefficients of correlation (Product moment) between age and quantitative item recall by individual patients in various subgroups.

Table 63.

Coefficients of Correlation
Age vs Quantitative Recall of Items

Control Groups

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Age	-.331	-.406*	-.347*	.098	.150	.030

* Significant $p < .05$

Test Groups

	Pleasant Story			Pleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Age	.067	.276	.136	.218	.140	.182

The only significant relationships between age and quantitative recall are seen in recalls 2 and 3 of the pleasant story in the control group where there are significant negative coefficients of correlation. This negative association between age and learning ability is in accordance with general learning theory (3, 4). In these particular recalls the tendency is probably accentuated by the romantic nature of the pleasant story which gave it more "learning appeal" to the younger subjects. Apart from these

significant negative associations the general trend is towards nonsignificant positive associations between age and quantitative recall. This trend is probably a result interaction between age, intelligence and diagnostic category and will be dealt with later.

(2) Intelligence

Table 64 shows the coefficients of correlation (Product moment) between the verbal intelligence quotients of the W.A.I.S. (2) and the quantitative recall of items in the sub-groups of subjects.

Table 64.

Coefficients of Correlation

Verbal I.Q. (WAIS) vs Quantitative Remembrance of Concepts

Control Groups

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Verbal I.Q.	.469*	.502**	.682**	.812**	.849**	.798**

Significant * $p < .05$

** $p < .01$

Test Groups

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Verbal I.Q.	.532**	.098	-.207	.162	.309	.180

Significant ** $p < .01$

Table 64 shows that there were significantly high positive associations between intelligence and quantitative remembrance of concepts at all recalls in both the control groups. In the test groups there is a significantly high coefficient of correlation between verbal intelligence and the first recall (preconvulsive) of the pleasant story; however, in the unpleasant story, test group, although there is also a positive association at the first recall it does not reach the level of statistical reliability.

Conclusions: This study showed age alone to be a negligible factor in defining quantitative remembrance of concepts except in the control group pleasant story where significant negative coefficients of correlation occurred at all recalls. Intelligence had a significant positive relationship with quantitative remembrance of concepts at all recalls in the control groups.

B. Age, Intelligence, Diagnosis and General Remembering Ability

(1) Control Group - Pleasant Story

Table 65 shows the coefficients of correlation (Product moment) between age, intelligence, diagnosis and quantitative remembrance of concepts at the three recalls of the pleasant story in the control group.

Table 65.

Correlation Matrix

Intercorrelation Coefficients between Age, Intelligence, Diagnosis and Quantitative Remembrance Concepts at All Recalls

Control Group - Pleasant Story

			Pleasant Story Recall No.		
	I.Q.	Diag.	1	2	3
Age	-.003	.101	-.331	-.406*	-.347
I.Q.		.215	.469*	.502**	.682**
Diagnosis			.553**	.415*	.410*
Recall 1				.919**	.917**
Recall 2					.970**

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

Table 65 shows marked positive association amongst recalls and between intelligence and quantitative remembrance of concepts. Age is generally negatively associated with intelligence and quantitative remembrance.

Table 66 shows the centroid factor matrix (5) of two factors extracted from the correlational data in Table 65. Factors I and II were derived after counterclockwise rotation of orthogonal axes (6).

Table 66.

Control Group - Pleasant Story

Centroid Factor Matrix

Variable	Factor I	Factor II
Age	-.070	.616
I.Q.	.313	-.632
Diagnosis	.295	-.431
Recall 1 - Pleasant Story	.868	-.410
Recall 2 - Pleasant Story	.933	-.380
Recall 3 - Pleasant Story	.811	-.587

Factor I is a general learning factor positively associated with a high intelligence and a depressive diagnosis. Factor II denotes the impaired learning capacity of this material by the less intelligent schizophrenic patient.

(2) Control Group - Unpleasant Story

Table 67 shows the coefficients of correlation (Product moment) between age, intelligence, diagnosis and quantitative remembrance of concepts at the three recalls of the unpleasant story in the control group.

Table 67.

Correlation Matrix

Intercorrelation Coefficients between Age, Intelligence, Diagnosis and Quantitative Remembrance of Concepts at All Recalls

Control Group - Unpleasant Story

			Unpleasant Story Recall No.		
	I.Q.	Diag.	1	2	3
Age	.171	.251	.098	.150	.030
I.Q.		.188	.812*	.849*	.798**
Diagnosis			.161	.230	.282
Recall 1				.919*	.816**
Recall 2					.887**

Significance $p < .01$

Table 67 shows significantly high positive association amongst quantitative remembrance of concepts at all recalls. This quantitative recall is positively associated with intelligence.

Table 68 shows the centroid factor matrix (5) of two factors extracted from the correlational data in Table 67. Factors I and II were derived after counterclockwise rotation of orthogonal axes (5).

Table 68.

Control Group - Unpleasant Story

Centroid Factor Matrix

Variable	Factor I	Factor II
Age	-.046	-.474
I.Q.	.827	-.150
Diagnosis	.050	-.523
Recall 1 - Unpleasant Story	.903	-.265
Recall 2 - Unpleasant Story	.907	-.356
Recall 3 - Unpleasant Story	.878	-.290

Factor I is a general learning factor, the learning ability being positively associated with the intelligence. Factor II illustrates the learning difficulty in the unpleasant story of the younger, less intelligent schizophrenic patients.

Table 69 shows the coefficients of correlation (Product moment) between age, intelligence, diagnosis and quantitative remembrance of concepts at all recalls of the pleasant story, test group.

Table 69.

Correlation Matrix

Intercorrelation Coefficients between Age, Intelligence, Diagnosis and Quantitative Remembrance of Concepts at all Recalls

Pleasant Story - Test Group

			Pleasant Story Recall No.		
	I.Q.	Diag.	1	2	3
Age	.074	-.129	.067	.276	.136
I.Q.		-.139	.532**	.098	-.207
Diagnosis			-.223	.466*	.588**
Recall 1				.088	-.066
Recall 2					.782**

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

Table 69 shows significantly high positive associations between intelligence and quantitative remembrance at the pre-convulsive recall. Significantly high coefficients of correlation occurred between diagnosis and post-convulsive recalls.

Table 70 shows the centroid factor matrix (5) of three factors extracted from correlational data in Table 69. Factor I is an unrotated factor. Factors II and III were obtained by clockwise rotation of orthogonal axes (5).

Table 70.

Pleasant Story - Test Group

Centroid Factor Matrix

Variable	Factor I	Factor II	Factor III
Age	.245	.209	.409
I.Q.	.312	.566	-.359
Diagnosis	.403	-.425	.394
Recall 1 - Pleasant Story	.326	.573	-.240
Recall 2 - Pleasant Story	.872	-.206	-.151
Recall 3 - Pleasant Story	.705	-.600	-.021

Factor I shows a general learning and recall ability with a positive relationship between a depressive diagnosis, higher intelligence and the ability to remember concepts especially in the post-convulsive recalls. Factor II shows that the more intelligent schizophrenic patient remembered well in the pre-convulsive recall but was unable to remember the pleasant story concepts after application of treatment. Factor III shows the older, less intelligent patient with a depressive diagnosis had difficulty remembering at all recalls.

Table 71 shows the coefficients of correlation (Product moment) between age, intelligence, diagnosis and quantitative

remembrance of concepts at all recalls of the unpleasant story, test group.

Table 71.

Correlation Matrix

Intercorrelation Coefficients between Age, Intelligence, Diagnosis and Quantitative Remembrance of Concepts at All Recalls

			Unpleasant Story Recall No.		
	I.Q.	Diag.	1	2	3
Age	-.003	-.229	-.057	.218	.140
I.Q.		.167	.162	.309	.180
Diagnosis			.694**	.623**	.679**
Recall 1				.597**	.940**
Recall 2					.984**

Significance ** $p < .01$

Table 71 shows significantly high positive association diagnosis and quantitative remembrance at all recalls and also amongst quantitative remembrance at different recalls.

Table 72 shows the centroid factor matrix (6) with two factors extracted from the correlational data in Table 71. Factors I and II were obtained by counterclockwise rotation of orthogonal axes (5).

Table 72.

Unpleasant Story - Test Group

Centroid Factor Matrix

Variable	Factor I	Factor II
Age	.114	.387
I.Q.	.307	.157
Diag.	.640	-.453
Recall 1 - Unpleasant Story	.802	-.525
Recall 2 - Unpleasant Story	.988	.240
Recall 3 - Unpleasant Story	.982	-.216

Factor I is again a general learning ability factor highly loaded on the post-convulsive recalls. Although intelligence has a positive association with all recall, diagnosis was a more important variable in defining remembering ability at all recalls. Factor II shows the inability to recall this material by the schizophrenic group of patients. This inability is more marked in the pre-convulsive recall.

Conclusions: This correlational study, as in Phase I, shows that there was a general learning ability factor common to both the control groups and test groups. By and large this general learning ability was positively associated with degree of

intelligence and a depressive diagnosis. The diagnosis of schizophrenia was consistently associated with a poor learning ability in both the pleasant and unpleasant stories. This poor performance of the schizophrenic subjects might be explained: (a) by a nonspecific learning deficiency (6, 7); or (b) by the generally lower intelligence of this group as compared to the depressive subjects. However, Phase I showed no differences in learning capacity between the diagnostic subgroups. This correlational study generally showed diagnosis to be a variable of greater importance than intelligence in inhibiting learning.

C. Serial Order of Items

The following analysis deals with the influence of the serial order of items on learning and recall.

Table 73 defines the enumeration of different items.

Table 73.

Enumeration of Items of Pleasant Story

Item No.	
1.	The daughter of a preacher
2.	from a small town near Chicago, Illinois
3.	was picked as homecoming queen
4.	she was a high school student
5.	after being chosen queen
6.	who was crowned by her boyfriend
7.	alone in her glory
8.	the fortunate young lady
9.	was escorted by her maids of honor
10.	in front of the eyes of
11.	admiring spectators
12.	who were following her
13.	she was presented some flowers
14.	while crying with joy.

Table 73.
(continued)

Enumeration of Items of Unpleasant Story

Item No.	
1.	The daughter of a preacher
2.	from a small town near Chicago, Illinois
3.	was the victim of rape
4.	she was a high school student
5.	while out walking
6.	who was attacked by a man
7.	since help was impossible
8.	the unfortunate young lady
9.	was caught by a rapist
10.	in front of the horrified eyes
11.	of some distant picnicker's
12.	who had been following her
13.	she was dragged behind some bushes
14.	all the time screaming for help.

Table 74 shows the number of subjects in the control group who remembered each individual item. As each story was told to 25 subjects the maximum score for each item is twenty-five.

Table 74.

Control Group

	Pleasant Story				Unpleasant Story			
	Recall No.				Recall No.			
Item No.	1	2	3	Sum	1	2	3	Sum
1	22	23	23	69	23	22	23	68
2	18	18	18	54	19	20	18	57
3	19	20	20	59	17	17	17	51
4	10	9	11	30	9	9	9	27
5	8	5	5	18	14	15	16	45
6	21	22	22	65	14	12	14	40
7	12	10	10	32	5	4	3	12
8	0	0	1	1	1	0	0	1
9	12	14	14	40	7	6	6	19
10	7	6	4	17	9	10	11	30
11	7	8	8	23	13	15	16	44
12	6	6	6	18	5	5	3	13
13	15	17	17	49	18	19	19	56
14	10	11	9	30	12	14	14	40

Table 74.
(continued)

Test Group

	Pleasant Story				Unpleasant Story			
	Recall No.				Recall No.			
Item No.	1	2	3	Sum	1	2	3	Sum
1	25	7	11	43	23	14	23	60
2	18	3	6	27	10	12	16	48
3	20	1	5	26	15	7	12	34
4	11	1	3	15	11	2	2	15
5	10	2	3	15	12	4	7	23
6	21	1	3	25	6	4	5	15
7	5	0	0	5	4	1	4	9
8	0	0	0	0	0	0	0	0
9	9	0	2	11	9	4	5	18
10	3	0	0	3	9	1	3	13
11	6	0	0	6	14	4	8	26
12	3	0	1	4	4	1	1	6
13	13	1	4	18	19	6	9	34
14	7	0	1	8	19	1	7	27

Table 75.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story	1	0.1	0.1	
Recall 1 vs 2 vs 3	2	0.4	0.2	
Item 1 vs 2 vs 3	13	2955.5	227.35	27.26**
Error	67	559.0	8.34	
Significance * p < .01	83			

Table 75 shows the analysis of variance table for the group data in Table 73. It shows that there were significant differences between the number of times each different item was remembered.

Table 76.

Analysis of Variance Table

Source of Variation	df	S.S.	M.S.	F-ratio
Pleasant Story vs Unpleasant Story	1	177.2	177.2	16.7*
Recall 1 vs 2 vs 3	2	1093.4	546.7	51.6*
Item 1 vs 2 vs 3	13	1626.0	125.1	11.8*
Error	67	710.7	10.6	
	83			

Table 76 shows the analysis of variance table for the test group data in Table 74. It shows that there were significant differences between stories (already known); significant differences between recalls (result of post-convulsive amnesia); and significant differences between the number of times each individual item was remembered.

Table 77 shows the Spearman Rank Coefficients of Correlation (S) between the number of times each item was remembered and the serial rank order of the item in the presentation of the stories.

Table 77.

Spearman Rank Coefficients of Correlation

No. of Times Each Item was Remembered
vs
Serial Order of Presentation

Control Group

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Coeff. of Correl.	.549*	.405	.508*	.444	.216	.332

Test Group

	Pleasant Story			Unpleasant Story		
	Recall No.			Recall No.		
	1	2	3	1	2	3
Coeff. of Correl.	.608*	.761*	.623*	.253	.565*	.359

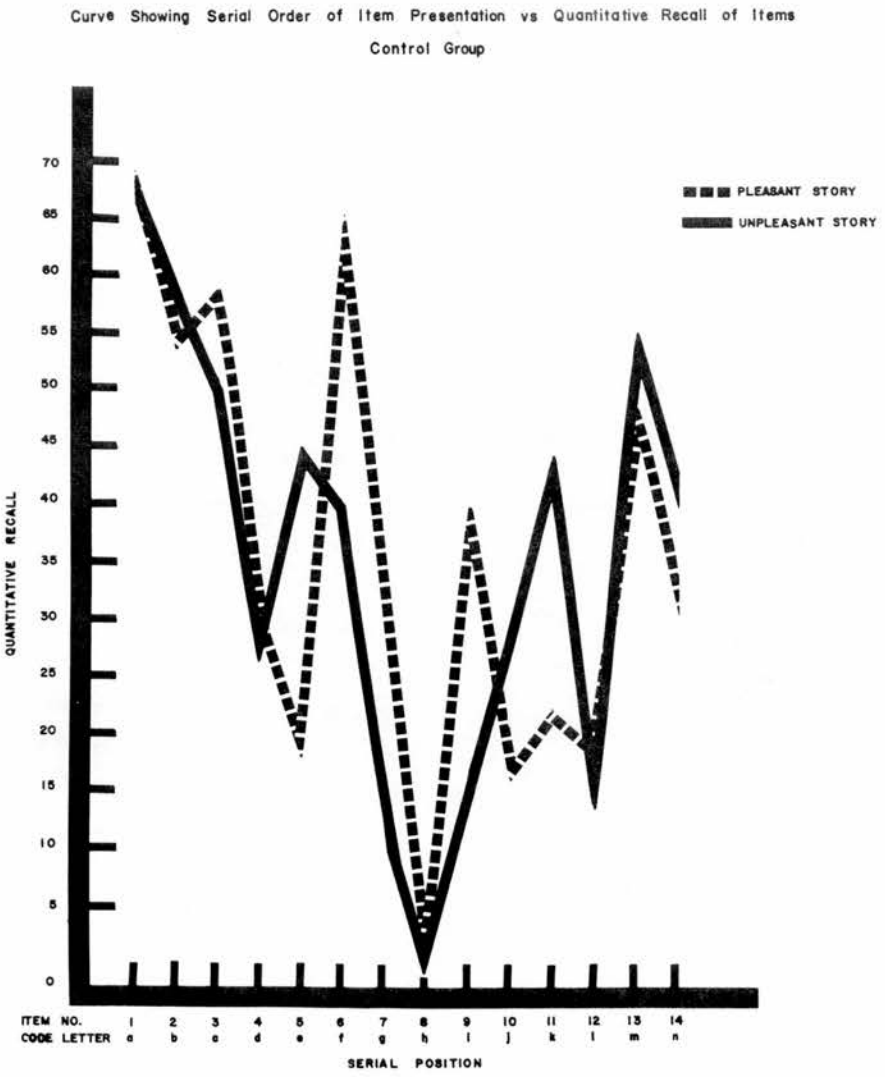
Significance * $p < .05$
** $p < .01$

Table 77 shows a positive relationship between serial order of concept presentation and quantitative recall of concepts. In five of the six recalls of the pleasant story, these positive coefficients of correlation reach the level of statistical reliability. In the unpleasant story, the positive associations are maintained but do not reach the level of statistical significance. A general conclusions is that the serial order of presentation is important as regards later recall especially in the pleasant story. The test groups in general have higher coefficients of correlation than their control group equivalents. This might indicate that the serial order of presentation is of greater importance in determining what will be remembered in the post-convulsive confusional state.

Figure 9 shows the serial position vs quantitative recall curve of individual items of both the pleasant and unpleasant stories in the control groups. The scores of all recalls are summed to give quantitative remembrance.

Figure 9 shows the importance of serial position of the items as regards quantitative recall. As in Phase I it can be seen that there is greatest quantitative remembrance of the early concepts in the stories with progressive decrement in subsequent items followed by an increase in the last few concepts. Although the Spearman Coefficient of Correlation (8) between the items of the pleasant and the unpleasant story ranked by quantitative remembrance was .609 ($p < .05$), nevertheless, considerable discrepancies occur between stories in several items; namely: Items 5,

Figure 9.


Curve Showing Serial Order of Item Presentation vs Quantitative Recall of Items
Control Group
PLEASANT STORY
UNPLEASANT STORY
QUANTITATIVE RECALL
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
ITEM NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14
CODE LETTER a b c d e f g h i j k l m n
SERIAL POSITION

6, 7, 9, and 11. These differences probably result from differential contribution of individual items to the total meaningfulness of the stories rather than due to emotional factors or differences in familiarity.

Table 78 shows the arraying and grouping of means by Duncan's Multiple Range Test (3) of the data in Figure 9.

Table 78.

Duncan's Multiple Range Test
Arraying and Grouping of Means

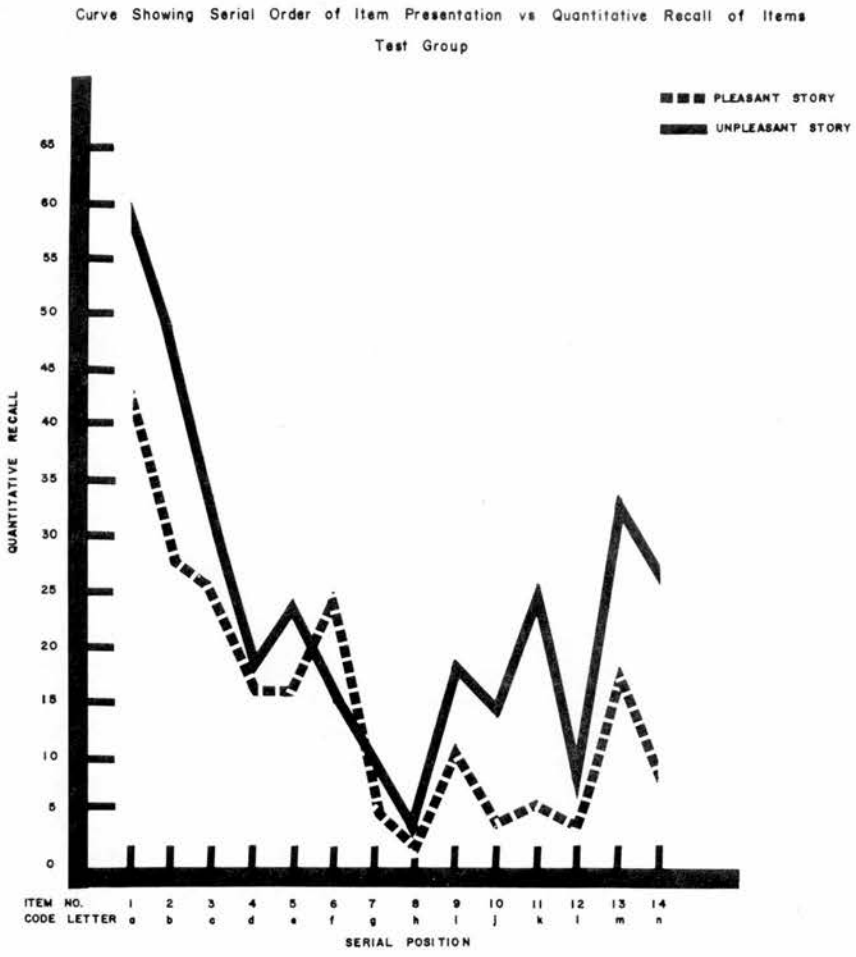
Code Letter of Means (Fig. 9)	a	b	c	f	m	n	k	e	i	d	j	g	l	h
	1			2					3					4

Table 78 shows that the arrayed means grouped into four discrete areas. By and large groups 1 and 2 represent the earliest and latest items in the stories. Group 3 represents the concepts in an intermediate serial position.

Group 4 consists of one item (h) which was remembered significantly less often than any other item. This item (the fortunate young lady - pleasant story; the unfortunate young lady - unpleasant story) was probably least well remembered because of two factors, namely: (a) its being an obscure item; and (b) its serial position.

Figure 10 shows the serial position versus quantitative recall curve of individual items of both the pleasant and unpleasant

Figure 10.


Curve Showing Serial Order of Item Presentation vs Quantitative Recall of Items
Test Group
PLEASANT STORY
UNPLEASANT STORY
QUANTITATIVE RECALL
0
5
10
15
20
25
30
35
40
45
50
55
60
65
ITEM NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14
CODE LETTER a b c d e f g h i j k l m n
SERIAL POSITION

stories in the test groups of subjects. The scores of all recalls are summed.

Figure 10 shows the importance of serial position of the items as regards quantitative remembrance in the test groups. As in the control groups there is greatest quantitative recall of the first few items with progressive decrement in recall in subsequent items. The last two items again show greater quantitative recall, although this is most marked in the unpleasant story group. There is a marked similarity between the profiles of the pleasant and unpleasant stories with the quantitative remembrance of the unpleasant story items being generally greater than the equivalent items of the pleasant story. The Spearman Coefficient of Correlation (8) between the items of the pleasant story and the unpleasant story marked by quantitative remembrance, was +.853 ($p < .01$).

Table 79 shows the arraying and grouping of means by Duncan's Multiple Range Test (2) of the data in Figure 10.

Table 79.

Duncan's Multiple Range Test
Arraying and Grouping of Means

Code Letter of Means (Fig. 10)	a	b	c	m	f	e	n	k	d	i	j	q	l	h

Table 79 shows the arrayed means of the number of times individual items were remembered and underlined to illustrate

groupings. Unlike the control group data there was no discrete grouping of these data. The only single mean which is significantly different from any other is the mean of Item a, the first concept in the story (the daughter of a preacher).

Conclusions: In both the control and test groups the serial order of item presentation was of extreme importance as regards the quantitative recall of the individual item. (a) The correlational analysis Table 77 showed that in the overall data of both control and test groups there was a positive relationship between early presentation of an item in a story and greater quantitative recall of that item. This relationship was more clearly defined in the pleasant story than the unpleasant story and better defined in the test groups than in the control groups. (b) As in Phase I of this study, the phenomenon of "primacy" and "recency" (9 - 12) was shown by both control and test groups, i.e. the first and last items to be presented were remembered better than the intermediate items.

Table 80 (a) (b) (c) and (d) shows the coefficients of correlation between recalls of the individual items ranked by quantitative remembrance.

Table 80.

Coefficients of Correlation of Quantitative Remembrance of Individual Items between Recalls

(Spearman's Rank Coefficients of Correlation)

(a). Control Group - Pleasant Story

	Recall No. 2	Recall No. 3
Recall No. 1	.943**	.962**
Recall No. 2		.975**

(b). Control Group - Unpleasant Story

	Recall No. 2	Recall No. 3
Recall No. 1	.977**	.981**
Recall No. 2		.994**

(c). Test Group - Pleasant Story

	Recall No. 2	Recall No. 3
Recall No. 1	.857**	.908**
Recall No. 2		.911**

Significance ** $p < .01$

Table 80.
(continued)

Coefficients of Correlation of Quantitative Remembrance of Individual Items between Recalls

(d). Test Group - Unpleasant Story

	Recall No. 2	Recall No. 3
Recall No. 1	.770**	.892**
Recall No. 2		.893**

Significance ** $p < .01$

Table 80 shows significantly high positive associations of individual items between recalls in both stories in both the control and test groups. The coefficients of correlation between recalls in the test groups are lower than those for the control groups.

This analysis shows there is a marked stability in individual item remembrance from one recall to another. Disruption of central nervous system functioning by shock treatment causes only minor modification in the stability of individual item remembrance.

XV. SUMMARY OF CONCLUSIONS - PHASE II

"An' the most interesting things are things that didn't occur."

Foss - Back Country Poems
Things that didn't occur.

A. Emotional Factors

1. The first experimental hypothesis was not substantiated, in fact, converse results were obtained. Namely, significantly more of the concepts of the unpleasant story were remembered in the post-convulsive recalls than of the pleasant story. In the control groups no significant differences in quantitative remembrance occurred between any of the recalls of either pleasant or unpleasant stories. In the test groups significantly more concepts of the unpleasant story were remembered at both the post-convulsive recalls of the unpleasant story than at either of the post-convulsive recalls of the pleasant story.

2. The second experimental hypothesis was also not substantiated. There was no practical evidence to suggest that there was selective forgetting in the post-convulsive recalls of the predefined most unpleasant items.

3. Diagnostic category was an important variable in defining quantitative remembrance. In all recalls of both stories in both control and test groups, the depressive subjects had greater quantitative recall than the schizophrenic subjects. These differences reached the level of statistical reliability in many

of the recalls.

4. Concept distortion: Contrary to our prediction, the general tendency was to distort this material on recall to render it more unpleasant. However, hedonistic distortion was significantly greater in the recall of the unpleasant story by the control group. By exemplification it was illustrated that the test group in the post-convulsive recalls were more crude in the verbal expression of the unpleasant concepts. A common method of weakening the emotional significance of the unpleasant story was to incorporate the test instructions in the recall, e.g. using the term "this is not a true story".

B. Mechanistic Factors

1. Age: Age alone was a negligible factor in determining quantitative remembrance except with the pleasant story in the control group where there was a significant negative relationship between these two variables.

2. Intelligence: Verbal intelligence was a significant variable in determining quantitative remembrance of both stories in the control groups.

3. A correlational analysis was performed to define the interaction of age, intelligence and diagnostic category in determining quantitative remembrance.

In both test and control groups a similar pattern emerged. In each analysis a general learning ability factor was extracted positively associated with superior intelligence and a depressive

diagnosis. A second factor common to all three analyses was a factor denoting difficulty in learning and recalling this material. This learning difficulty was associated with lower intelligence and schizophrenic diagnosis. A modification of this position occurred in the test group to which the pleasant story was administered. Factor II in this group showed that the more intelligent schizophrenic patient had no difficulty in remembering at the pre-convulsive recall, but in the subsequent post-convulsive recalls there was marked inhibition of the remembrance of this material.

4. As in Phase I of the study, the serial order of presentation of the items was of extreme importance. The same phenomena were elicited, namely; (a) there was a significant positive relationship between serial order of presentation and quantitative recall of items; (b) the phenomenon of primacy and recency occurred.

XVI. DISCUSSION (PHASE I AND PHASE II)

"Truth lies within a little and certain compass, but error is immense."

Henry St. John, Viscount Bolingbroke
Reflections Upon Exile

The discrepancy in results between Phase I and Phase II as regards the differential recall of pleasant and unpleasant material clearly indicates that while the first study confirmed the experimental hypothesis, the second one failed to confirm this finding. This, however, is not the only interpretation which could be made of these results.

The excellent degree of inter-rater reliability, the well-defined statistical trends and significances indicate that this method in general is a satisfactory and reliable method of investigating verbal memory functioning in acute cerebral organic states. However, the discrepant results between the two studies indicate either that there is no actual substance in the experimental hypothesis or that weaknesses in the experimental technique invalidated this method of approach to the problem. One critical area lies in the selection of emotionally loaded recall material. The difficulty in arbitrarily assigning material to a specific emotional category was previously discussed in some detail as Sections VI and XII. In advance of the clinical phases of the study it was predicted that improper assignment of emotional material might be a source of controversy in the interpretation

of results. We consider that the significant differences that occurred between stories in both phases of the study could not be accounted for by differential meaningfulness or familiarity[20] of the material and that these differences occurred as a result of the emotional connotations of the texts. The difficulty encountered in arbitrary assignment of material into pleasant and unpleasant categories is compounded in this study by two factors: (a) The verbal material was presented to the test subjects under emotional stress, anticipating the forthcoming convulsive therapy[21]; and (b) the material was recalled in the post-convulsive confusional state[22]. Theoretically both of these factors could have altered the emotional significance of the recall material. One might then speculate that, in fact, the experimental hypothesis is "true"

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[20] The Thorndike, Lorge word count (1) showed no significant differences occurred in frequency usage between individual words in the two stories.

[21] It has been observed that in order for material to be unpleasant it must conflict with preponent motives (p. 203, 2). In this study the sadistic nature of both unpleasant stories would appear to be emotionally appropriate to the emotional set of the subjects who were fearfully anticipating electroconvulsive therapy (p. 93, 3).

[22] The post-convulsive disturbance in consciousness might also have altered the emotional significance of the recall materials. Cerebral dissolution (p. 38, 4) with loss of frontal lobe inhibition (5) and loss of conventional moral values might conceivably ameliorate the unpleasant nature of the rape story. Descriptive studies of the post-convulsive state have described: that subjects pass through the ontogenic phases of emotional development including the genital phase (6) and that the general behavior of post-convulsive patients tends to be erotic and sexually uninhibited (7, 8). These latter factors may have facilitated recall of sexual material.

and the reason for the different direction of results in the different phases was the improper assignment of stories as regards their true emotional significance. With the available data it is impossible to give a conclusive explanation of the paradoxical results.

An alternative to the experimental method used in this study is the experimental technique devised by Janis (9). Janis' method required the subject population to select individually the recall material and designate its emotional significance as pleasant or unpleasant according to their own subjective judgment. Enhancement of personal meaningfulness of the material would obviate the arbitrary assignment of material into emotional categories and probably increase the validity of the generated data. This increased validity, however, would be obtained at the expense of the reliability of the data. Sacrifice of the standardized method of story presentation and recall and increased variability in the quality and quantity of recall material would certainly result in an increase in variance in the resulting data and possibly obscure differences which might in fact exist.

In reviewing this study, it is considered that the psychiatric diagnoses of the subject population are also critical as regards both the reliability and validity of the study. This is of special significance as the study itself produced differences between the depressive and schizophrenic populations. In all recalls of the four stories the depressive group remembered more concepts than the

schizophrenic subjects. This finding is in accordance with other experimental findings which generally define a specific verbal learning disability peculiar to schizophrenia (10 - 12). More remarkable than the overall poor performance of the schizophrenic population is their disproportionately poorer performance in Phase II (romantic story and rape story), where the interdiagnostic differences were quite substantial reaching the level of statistical significance in five of the twelve recalls. Theories relating to the relationship of psycho-sexual developmental difficulties and to sexual psychopathology in schizophrenia are numerous.[23] Behavioral descriptions in schizophrenia of withdrawal from interpersonal relationships, especially bisexual ones, are also well-documented (p. 396 - 408, 17). We fully subscribe to the view that psycho-sexual pathology almost invariably exists in schizophrenia. The abysmal failure of the schizophrenic subjects in the test group to recall the rape story is probably a reflection of the intense difficulties schizophrenics have in passive-aggressive attitudes in heterosexual relationships.

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[23] In his description of the Schreber case, Freud (1958) described bizarre sexual delusions. In the analysis of this case he formulated the theory that repressed homosexuality was a major etiological factor in paranoia (p. 12 - 82, 13). Later, authors extended this interpretation to schizophrenia in general (14, 15). Weiner (1958) (p. 113, 16) in describing the clinical features of schizophrenia, states, "Again, he may demonstrate in his sexual behavior the entire gamut of perverse acts, but generally there is a decline in sexual activity, except perhaps of a masturbatory nature."

The diagnostic categorizations used in this study are the formal hospital diagnoses returned at medical staff conference. At the time of inception of this project, local studies had shown a high degree of reliability and agreement between psychiatrists in assigning psychiatric populations into depressive and schizophrenic categories (18). However, subsequent studies have shown marked variability in diagnostic agreement and reliability internationally and in different national geographic regions (19 - 21).[24]

We now consider, in retrospect, that stringent symptomatic and behavioral criteria should have been predefined in the protocol for admission of a subject to the project. In planning the experimental method the possible importance of psychiatric diagnosis was considered (Section VII); however, the universal variation in reliability of psychiatric diagnosis was not appreciated at that time. The use of well-defined emotional and

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[24] Sandifer et al (1964) (18), in a study conducted in North Carolina showed a 76 percent diagnostic agreement among psychiatrists in placing a subject in a depressive category and 74 percent agreement in placing the subject in a schizophrenic category. Comparing states in the United States, there is a considerable variability in the ratio of schizophrenia to depressive diagnosis in admissions to state hospitals. A typical ratio is two depressive diagnoses to one schizophrenic diagnosis. However, in New York State, the ratio is 65 percent schizophrenic to 35 percent depressive diagnoses (19). International studies have shown higher within-national-group agreement than cross-national-group agreement in diagnosis (20, 21).

behavioral criteria for admission to the study would have resulted in a symptomatically homogeneous population with the obvious advantage of reducing variance in the data resulting from psychological mechanisms specific to different diagnostic groups. Detailed description of the symptomatic pictures of the subject population would also facilitate replication of this study in other geographic areas.

Another critical omission in the experimental protocol was lack of control or measurement of the psychopharmaceutical agents used during the study period in the experimental population. The test groups, in fact, were free from psychotropic agents during the treatment period. This was unrelated to the experimental procedures, but resulted from the Unit Director's desire to evaluate specifically, and partition out, the therapeutic effect of electroconvulsive therapy. However, the control groups were medicated mainly with phenothiazine and tricyclic antidepressant medications appropriate to the symptomatic clinical picture. These medications were always used, during the study period, in therapeutic dosage range. Reputedly these medications in this dosage range do not cause any clouding of awareness or impairment in intellectual functioning which would influence the capacity for verbal memorialization (22 - 24). However, these medications reputedly have a profound effect on the emotional status of the subjects (25 - 28). One might infer that

alteration of the subject's emotional set (p. 203, 2) by psychopharmaceutical manipulation might profoundly influence the remembering of emotionally loaded materials. As a result this factor becomes an important confounding variable in the study procedure. We postulate that the influence of psychotropic agents would modify the results in the same direction as electroconvulsive therapy. The similarity in the direction of findings between the test and control groups in this study in most aspects of verbal recall may have been produced artificially by the difference in medications between the test and control groups.

Any one or a combination of the above factors may have contributed to the production of the paradoxical and inexplicable findings in this study. Perhaps the pleasant-versus-unpleasant dichotomy is much too crude and simplistic to define the subtleties of this phenomenon.

XVII. SUMMARY

"I think that I am drawing to an end:
For in a sudden came a gasp for breath
And stretching of the hands and blinded eyes,
And a great darkness falling on my soul
O Hallelujah."

Barry Pain - The Poets at Tea

In previous research projects while studying verbal memory impairment in the post-convulsive confusional state, it was noted that many subjects made statements in the nature of obvious wish fulfilment. It was then decided to test the hypothesis that in the post-electroconvulsive confusional state there would be selective forgetting of unpleasant concepts.

Before structuring the experiment the following areas of literature were reviewed: theories pertaining to the therapeutic mode of action of convulsive therapy; organic versus functional amnesias; biological and psychological aspects of memory and its pathology; and emotions and memory.

It was decided to test the comparative post-convulsive recall of pleasant verbal material as compared to unpleasant material. Schilder's shark story, a sadistic story of a sea captain, who was mutilated by a shark, was selected as the unpleasant story. A fishing story was fabricated with the same number of concepts, similar syntax and containing words of equal familiarity. This was arbitrarily called the pleasant story.

Both stories come recorded on a tape-recorder and presented to all subjects in a standard procedure. Two tests populations were used: One population was tested with the pleasant story before treatment, one of a series, then with the unpleasant story before treatment two. The second population was tested with the stories presented in the reverse order. Two control populations were tested with exactly the same procedures except for the omission of convulsive therapy. Each subject had three recalls of each story at fixed time intervals. The recalls were tape-recorded, then typed verbatim. Rationale are provided for the control or measurement of preconceived important variables.

Results: In both the test and control groups, significantly more of the pleasant material was remembered than of the unpleasant material. There was interaction between the emotional nature of the story and the order of presentation. Unpleasant material caused pro-active inhibition of pleasant material, whereas, pleasant material caused pro-active facilitation of unpleasant material.

Following Schilder's studies in general paretics, the data were analyzed to test for distortion of concepts. In both the test and control groups, both stories showed significant hedonistic concept distortion. The most bizarre distortions occurred in the post-convulsive recalls of the unpleasant story where diametrically opposite concepts were often recalled.

The data were then analyzed by correlational and factor analytic methods to determine the influence of age, diagnosis and intelligence on quantitative recall. These studies showed both diagnosis and intelligence to be important factors in determining the quantity of recalled material. These were, generally, significant positive relationships occurred between verbal intelligence and quantity of recall and the depressive subjects in general, recalled a greater number of concepts than the schizophrenic subjects.

The specific sado-masochitic nature of the unpleasant material resulted in difficulty in generalizing the results to all emotional modalities. This led to a second phase of the study which was essentially a repetition of the first phase except for substitution of an unpleasant sexual story for the shark story and an equivalent substitution for the pleasant story.

Converse results were obtained in this phase with significantly more concepts of the predefined unpleasant story being remembered in the post-convulsive confusional state. Age, diagnosis and intelligence were again found to be important variables.

These data led to speculation about various factors which influenced the results and possibly accounted for the paradoxical results in the two study phases. Reference was made to flows in the experimental design which possibly influenced the generated data.

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APPENDIX A

Matching of First and Third Recalls

GROUP A
(Pleasant story - Control group)

Recall 1

1. A famous preacher's son from Belmont, N. C., caught a sailfish on a steamer at Wilmington, N. C., without any help, he landed the fish, and a stream of blood behind with the waves washed high.

2. The son of Preacher Tate of Belmont, near Charlotte, N. C., was a chartered member on a vessel from Wilmington, N. C. Despite the big waves, he caught a tuna fish at the admiring glances of his shipmates, and the fish left a trail of sea water behind him.

3. A preacher's son from Belmont, N. C. out from Charlotte, a chartered member of a boat from Wilmington, N. C., caught a tuna. And I can't remember the rest of it. That's as far as I can go. I remember some parts of it. I can't tell you. (Do the best you can.) I'm afraid I'll mess it up. I believe I'll just give up.

4. There was a preacher's son who caught a shark, and he pulled it ashore on a Wilmington boat in Wilmington N. C., and when he pulled it to shore, there was no help available, so he done something - I don't know what - to it. That's not very good, but I declare I don't remember. Why do I have to remember that.

Recall 3

A. The son of Preacher Tate of Belmont, near Charlotte, N. C., landed a big tuna fish. He was dragged to the bottom of the ocean by a large seaweed, leaving behind him...

B. The son of Preacher Tate of Belmont, near Charlotte, N. C., caught a tuna fish. It had followed the steamer. Since help was impossible, he landed it alone. It was dragged to the bottom of boat, leaving a pool of sea water behind.

C. The son of Preacher Tate of Belmont, near Charlotte, N. C., was a charter member off the coast of Wilmington, N. C. In spite of the large waves, he dragged to shore a large tuna fish, and the admiring glances of his shipmates, and the fish left a trail of sea water behind.

D. A famous preacher's son from Belmont, N. C., caught a sailfish off a steamer at Wilmington, N. C. Without any help, he landed the sailfish, and then he left a stream of blood. The waves were high, I believe it's the way it was.

GROUP A (Continued)

Recall 1

5. The son of Preacher Tate of Belmont, near Charlotte, N. C., caught a big tuna fish while on a chartered vessel from Wilmington. He had no help, so he landed the fish alone, as the fish came through big waves in the ocean. He put it in the bottom of the boat, where it left a trail of sea water.

6. A young man was on a - a young man chartered a - a young man was on a fishing trip who chartered a vessel from Wilmington, N. C. A tuna fish followed the steamer, leaving a big wave behind. The young man had no help, so the tuna fish followed the steamer, and the young man landed the fish in the bottom of the boat. I guess that's all I can remember, cause I didn't understand it to start with. I thought you meant if I told a lie.

7. The son of Preacher Tate of Belmont, near Charlotte, N. C., caught a tuna fish. Since help was impossible, he landed the fish - tuna - fish - himself. He was dragged to the bottom of the boat, leaving a pool of sea water behind.

Recall 3

E. Preacher Tate's son went out on a fishing boat. I'm sleepy for some reason. And, let's see, on this fishing boat. I'm so sleepy I can't remember what the rest of it was. Anyway he caught a tuna fish. It was put in the bottom of the boat, and what did he do with it. He must have done something with it.

F. A young man, the son of Preacher Tate of Belmont, near Charlotte, N. C., caught a large tuna fish while he was on a chartered fishing vessel from Wilmington. He landed the tuna despite the large waves. There was no help - he had no help while he was pulling it in and had to land it alone. He put it on the bottom of the boat, where it left a trail of sea water behind it.

G. There was a lad whose father's name was Preacher Tate. He caught a fish on a Wilmington boat in N. C. Because there was no help, he pulled the fish to the bottom of the sea, and that's all I remember. That ain't nothing.

GROUP A (Continued)

	Recall 1		Recall 3
8.	I can't remember it. There was a preacher named Tate from Charlotte, N. C., and I can't remember it. Charlotte, N. C., and he went fishing with the steamer, and the tuna fish followed him out to the shore, and he left a big trail of sea water behind him.	H.	There was a preacher, and he had a son named Tate, and he went fishing in Belmont, caught a tuna fish, and he followed the steamer on out and left a trail of sea water behind him.
9.	The son of Preacher Tate of Belmont, near Charlotte, N. C., caught a big tuna fish. And I'm messed up. He was dragged to the bottom of the ocean, by a large seaweed, leaving behind him... (Can you think of anything else?)	I.	The son of Preacher Pate from Belmont, N. C., out from Charlotte, a chartered member on a boat from Wilmington, caught a tuna and that's as far as I go.
10.	Preacher Tate's son was in a fishing vessel down at Wilmongton, N. C. Let's see, what happened. I'm just like the average human being. I'm not as interested in good as in bad. He caught a large fish that was following behind the boat that had been washed up by a large wave and got into the bottom of the boat, is what I understood you to say. And that was the end, wasn't it?	J.	A young man from Charlotte, N. C., chartered a vessel on a fishing trip. A tuna fish followed the steamer all the way, leaving a wave behind. He was unable to land the fish without any help. He landed that fish in the bottom of the boat. That's all I remember.

Key to Group A: 1 D, 2 C, 3 I, 4 G, 5 F, 6 J, 7 B, 8 H, 9 A, 10 E.

GROUP B
(Unpleasant story - Control group)

Recall 1	Recall 3
1. Preacher Tate's son at Belmont near Charlotte was swallowed by a shark. A steamer at Wilmington, N. C., and with unfortunate - fortunate help, he was swallowed by a shark and left a stream of blood.	A. The son of Preacher Tate of Belmont, near Charlotte, N. C., went fishing in the Atlantic Ocean. Due help to being impossible, he was swallowed by a shark. He was first officer of a fishing vessel out of Wilmington, N. C. Due to the steamer being followed, the men were able to catch the shark and drag it to bottom of the sea, leaving behind him a stream of blood. That's all I know.
2. There was a man, the son of Preacher Tate of Belmont, near Charlotte, N. C., who was first captain of a vessel, and he was on a fishing trip and was caught in a windstorm. He was thrown overboard and there was a whale. He was left behind by the vessel, and there was a big stream of blood.	B. A son of Preacher Tate of Belmont, near Charlotte, N. C., was petty officer of a steamer, was swallowed by a shark. Unable to be rescued, was dragged to the bottom of the sea, leaving a stream of blood.
3. Son of Preacher Tate of Belmont, near Charlotte was captain of a Wilmington fishing boat and was swallowed by a shark.	C. The son of Preacher Tate from Charlotte, N. C., was washed overboard by a big wave from a seagoing vessel, which friends stood by and saw impossible for him to be rescued. He was drug to the bottom of the sea by a shark, which made it impossible for him to be saved.

GROUP B (Continued)

Recall 1		Recall 3
4. The son of Preacher Tate of Belmont, near Charlotte, N. C., went fishing in the Atlantic Ocean, and due, uh. He was swallowed by a whale, not by a whale, by a shark. Due to help's seeming impossible, he was swallowed, by a shark. I can't think of any more. I can remember that he was drugged to the seashore, leaving behind him blood, and he was rescued; but shucks, I can't remember the words like it's supposed to come.	D.	Son of Preacher Tate from Belmont, N. C., outside of Charlotte, the captain of a Wilmington fishing vessel, was swallowed by a shark.
5. The son of Preacher Tate - he was swallowed by a shark near Belmont, N. C., was upon a fishing vessel near Charlotte, N. C., and because there was no help, he pulled it to the bottom of the sea, leaving a big spot of blood.	E.	A son of Preacher Tate of Belmont, near Charlotte, N. C., was swallowed by a whale. He was first officer of a fishing vessel near Wilmington, N. C. He was drug down by a shark.
6. A son of Preacher Tate from Belmont, near Charlotte, N. C., was swallowed by a shark. He was the first officer of a fishing vessel of Wilmington, N. C.	F.	The son of Preacher Tate near Belmont, N. C. was caught in an unfortunate shipwreck. He was swallowed by a wave, and something about his terrified shipmates. The only thing that was left was a dark stream of blood.
7. The son of Preacher Tate was washed overboard from Charlotte. The son of Preacher Tate from Charlotte, N. C. was washed overboard from a seagoing vessel, which his friends thought that he couldn't be saved, a shark drug him to the bottom of the sea, leaving a dark stream of blood.	G.	There was a man, the son of Preacher Tate of Belmont, near Charlotte, N. C. He was first officer of a fishing vessel. While on a fishing trip, he was thrown overboard and was caught in the eyes of a shark. He was dragged to the bottom of the ocean and was left by a stream of blood.

GROUP B (Continued)

	Recall 1		Recall 3
8.	The son of Preacher Tate of Belmont, near Charlotte, N. C., was petty officer of the vessel, was swallowed by a whale. Being unable to be rescued, he was dragged to the bottom of the sea, leaving behind a stream of blood.	H.	Preacher Tate's son was swallowed by a whale and was pulled to a fishing boat near Charlotte, N. C., and because there was no help, he was pulled to the bottom of the sea and leaving a big stream of blood.
9.	The son of Preacher Tate of Belmont, near Richmond, Va., was swallowed by a shark, and I can't remember any - he left a streak of blood and was carried to the bottom of the sea. That's all I can remember.	I.	The son of a Preacher of Belmont, near Richmond, Va., was swallowed by a whale. He was the officer of a Wilmington - and he left a streak of blood and was buried at the bottom of the sea.
10.	The son of Preacher Tate of Belmont, N. C., was caught in an unfortunate shipwreck. His shipmates were terrified when he was swallowed by a wave, and the only thing that was left was the large stream of blood.	J.	A famous preacher's son named Tate of Belmont near Charlotte, N. C., was swallowed by a whale. And a steamer of Wilmington, N. C. He was unfortunate to have any help and was swallowed by a whale and - by a shark, and it left a streak of blood.

Key to Group B: 1 J, 2 G, 3 D, 4 A, 5 H, 6 E, 7 C, 8 B, 9 I, 10 F.

GROUP C
(Pleasant story - Test Group)

Recall 1	Recall 3
1. Mr. Tate's young son near Charlotte, N. C., caught a large tuna fish by himself. It brought in a large wave, and he had many admirers, and he had chartered a Wilmington vessel.	A. The son of Preacher Tate, and something about a fishing vessel. Something about he pulled the fish on aboard, and the waves were high or something. (Can you think of anything more?) He pulled the fish on board, and the waves were high. I can't remember the rest of it.
2. The son of Preacher Tate of near Wilmington - of Charlotte, N. C., chartered a boat at Wilmington, N. C., to go fishing, and he landed a fish by himself - there was no one there to help him, so he got it himself. So this large boat brought it into shore, and everyone was pleased at the catch.	B. Le's see, the son of Preacher Tate of Belmont, N. C. near Charlotte, caught a tuna. And I don't remember anything else except - I don't remember anything else. (Can you think of any more parts?) No.
3. The son of Preacher from Charlotte, N. C., went on a chartered fishing trip to Wilmington, N. C. He caught a large tuna, and in spite of the big waves, he dragged the big fish to shore, leaving a trail of sea water behind him.	C. The son of Preacher Tate of Belmont, near Charlotte, N. C., caught a tuna fish. He was a charter passenger aboard a fishing vessel from Wilmington, N. C. Despite - he managed to land the fish despite the fact there was no help available. There was something about getting the fish aboard before the admiring eyes of his fellow passengers. That's about all I remember.

GROUP C (Continued)

Recall 1

4. A young man, the son of Preacher Tate of Belmont, near Charlotte, N. C., caught a tuna fish. He was a charter passenger aboard a fishing vessel from Wilmington, N. C. He managed to land the fish despite the fact there was no help available. There was something about huge waves and before the admiring eyes of the fellow passengers, he pulled the fish - I would say aboard, but I don't believe that's the proper word - to the bottom of the vessel.

5. Preacher Tate's son near Charlotte, N. C., caught a large tuna fish in Belmont. The fish was so big, and without help he chartered a boat out into the deep waters, and because help was impossible, he landed the fish into the boat out near his shipmates. They could see out near the boat where his shipmates could see where, the fish had been was just a large pool of water.

6. This man by the name of Preacher Tate near Belmont, of Charlotte, N. C., was out on a fishing, on a vessel, and he caught something about a tuna fish, and was the vessel, this ship you know, from Wilmington, N. C., and he caught this fish, tuna fish, and something or other about the admirers. All admired this fish. Something or other about the big waves, and you know, he - I mean I just got it mixed up cause I'm so nervous.

Recall 3

D. The son of Preacher Tate from Wilmington, N. C., landed a - chartered a boat at Wilmington and landed a fish. He had to do it all by himself since he had no one to help him.

E. A man from Belmont, near Charlotte, N. C., was on a shipping vessel near Wilmington, N. C., and I can't think of the next word. And due to the vessel - I can't think of that word. Whatever kind of vessel it was, and he landed the fish in spite of the big waves. It was aboard the ship.

F. The son of a preacher from Charlotte, N. C., went on a chartered fishing trip to Wilmington, S. C. He caught a large tuna, and in spite of the big waves, he dragged it to shore, leaving a trail of sea water behind him.

GROUP C (Continued)

Recall 1

7. The son of Preacher Tate near Belmont, N. C., near Charlotte, caught a tuna. And I don't remember anything else until he landed the tuna fish, leaving a large stream of water. (Can you think of any more parts?) I sure can't. (Anything at all?)

8. A son of Preacher Tate of Belmont, near Charlotte, N. C., went to Wilmington, N. C., where he board a ship. He landed a big tuna and had no help to get it in, so he finally brought it into the ship himself, leaving behind a pool of water.

9. A man from Bel - the son of Preacher Tate from Belmont, N. C., chartered a fishing vessel and caught a tuna, and something about some admiring eyes. Anyway, he drug it aboard. Something about the waves were so high, and all he left behind him was sea water.

10. The son of Preacher Tate from a town, a small town of Belmont, near Charlotte, N. C., was on a fishing vessel with several admirers, and then took a fishing trip, and in front of the eyes of all the admirers, the son landed a large tuna fish, and as help was not available, he managed to land the fish himself in the bottom of the boat in spite of the big waves.

Recall 3

G. It was about the boy that chartered a boat after catching a big tuna fish out you know where his shipmates were. Without help - he chartered a boat, that's the way it was, out from Belmont to where he was at. His shipmates were - because he didn't have any help, he caught the fish and somehow landed him into the boat where his shipmates could see - something like that.

H. This man near Belmont, of Belmont, near Charlotte, N. C., he was a fisherman, and he was from Wilmington, N. C., and he caught a tuna fish, and something about the waves, you know. This tuna fish was going ahead of the vessel, ship, a whatever it was.

I. ...Belmont? A son of Preacher Tate. I don't know why I've got that word "Belmont" on my mind. Of Belmont, went to Wilmington, N. C., and went on a fishing trip or what - I can't remember. Did he catch a fish? Something about leaving behind a stream of something. I believe that's all I can think of - I'm sorry.

J. Preacher Tate's young son from Charlotte, N. C., chartered a boat in Wilmington, caught a big fish.

Key to Group C: 1 J, 2 D, 3 F, 4 C, 5 G, 6 H, 7 B, 8 I, 9 A, 10 E.

GROUP D
(Unpleasant story - Test group)

Recall 1

1. The son of a Charlotte minister from Belmont, N. C., was fishing on a - I thought at first they said a fishing boat - off Wilmington, and he apparently fell into the water and was swallowed by shark. And in front of all his fellow mates on the boat, and the last they saw was a stream of blood, following the shark. And they - another one said something about it was a steamer, and then the other one said something about a vessel. (?) A little deviation. Well, in each one of them he was followed by a stream of blood. The same idea, but it seems as though to me the vessels were different in each one of them. Now I could be wrong on that. It said he was cruising one time. That's all.

2. The son of Preacher Tate of Belmont, near Charlotte, N. C. was washed ashore by a shark. He was first mate on a Wilmington boat, and the terrified friends watched as he was pulled to the bottom of the ocean, leaving behind a stream of blood.

Recall 3

A. A son of Preacher Tate from Belmont, near Charlotte, N. C., was swallowed by a shark. He was washed overboard by a big wave. I don't remember any more. Well, it was something about he was caught by the shark before the terrified eyes of his fellow passengers.

B. There was a fellow on this fishing trip, and he was out fishing, and there was a streamer, and he was outside of Charlotte on a fishing vessel. I think it was a shark. Anyway, it was a streak of blood, and he was swept overboard, I think. That's about all I can remember. Pool of blood left behind. That's about all I can remember about it.

GROUP D (Continued)

Recall 1

3. It was a young man, the son of Preacher Tate, who was swallowed by a shark. They were from Belmont, near Charlotte, N. C. He was first officer of a ship, and he was washed overboard, and the ship was near Wilmington, N. C., and when he was washed overboard, he was swallowed by a shark, and his terrified shipmates couldn't help him, and they had to go off and leave him, leaving a trail of blood behind him.

4. Preacher Tate's son of near Belmont, I mean Belmont, near Charlotte, N. C. was caught by a shark. He was first officer of a shipping vessel in Wilmington, N. C. Before help could be signaled - before he could signal for help, the big shark caught him before the terrified eyes of his own shipmates and threw him to the floor of the big vessel, and where he had been just left a long, dark streak of blood.

5. The son of Peacemaker, I guess his name is, went fishing with some of his friends. He was swept overboard by a heavy wave and was followed back to the fishing vessel by a large shark. And before - he was from Charlotte, N. C. near Belmont. He was attacked before the horrified fishing friends of his and drug to the bottom of the ocean and left a dark streak of blood. I can't get the name straight.

Recall 3

C. A man from Charlotte, W. Va., was swallowed by a whale - no a shark - and he was dragged to the bottom of the sea while his terrified mates looked on. Later he was drug off the Wilmington coast and left a dark stream of blood behind.

D. Let's see, there was a young man, the son of Preacher Tate of Belmont, near N. C., Belmont near...N. C. He was swallowed by a shark, and a minute ago I remembered all of it. Washed over. To the terrifying of his shipmates in front of the seamen, and there wasn't nothing they could do to help him, and he was just swallowed by a shark. They had to go off and leave him. I remember last time now I told him the sentence he asked me the day before about the young man from Richmond.

E. The son of Preacher Tate was first - no near Belmont - of Belmont, N. C., near Charlotte. He was first mate on a shipping vessel, I think. Anyway, something about a shark. There was a big wave, and anyway they knocked him overboard, and he left behind a dark streak of blood, and that is all.

GROUP D (Continued)

Recall 1

6. The son of Preacher Tate from Belmont, near Charlotte, N. C., was swallowed by a shark. He was washed overboard by a big wave. I don't remember exactly how it went. He was caught by this shark that had been following the steamer before the terrified eyes of his fellow passengers and dragged to the bottom of the sea, leaving behind a trail of dark red blood, I believe.

7. The son of Preacher Tate of Belmont, near Charlotte, N. C., went on a fishing boat. I believe he was washed overboard by a large wave and was swallowed by a shark. It was viewed by the terrified onlookers, but they were unable to help him, and they saw the shark drag him to the bottom of the sea, leaving a dark stream of blood behind him.

8. The son of Preacher Tate of Belmont, near Charlotte, N. C. He was first mate on a shipping vessel, and something about he went out and a shark. Anyway it was a big wave, and it washed him overboard, and before his friend's terrified eyes - terrified or horrified one - the shark dragged him down, leaving behind him a dark streak of blood.

Recall 3

F. The son of a man in Charlotte went on a fishing trip. He was injured by a shark, leaving behind him a stream of blood. Did it say anything about Wilmington? He moved to Wilmington.

G. There was a son of Peacemaker, and he was out on a fishing vessel, and he went overboard or something. Anyway, he was swallowed by a shark - he was swept overboard by a large wave. Then he was swallowed by a shark, and before the terrified friends - eyes of his friends, he was drug under the water and left a dark streak of blood.

H. He was washed ashore by a shark or something about as his friends looked about him, he was washed ashore by a big shark. He left behind him a vessel of blood - something - a stream of blood.

GROUP D (Continued)

	Recall 1		Recall 3
9.	A young man from Charlotte, U. S., was swallowed by a whale - by a whark - while his terrified shipmates looked on. He was carried to the bottom of the sea. Later he was took ashore off of the Wilmington coast, leaving a dark stain of blood.	I.	Preacher Tate's son of near Belmont, near Charlotte, N. C., was caught by a shark, and before the eyes of his shipmates before anyone could be told, he was caught before the eyes of his shipmates and thrown to the bottom of the vessel. He was first officer of a shipping vessel of Wilmington, N. C., and before it could be told of his troubles, the shark had thrown him to the bottom of the floor before the very eyes of his shipmates.
10.	A son of Preacher Tate of Charlotte, N. C., later moved to Wilmington. He was injured by a whale, leaving behind a dark stream of blood. That's all I can think of.	J.	The son of Preacher Tate of Belmont, near Charlotte, N. C., event on a chartered fishing trip. He was washed overboard by a large wave and swallowed - no - somehow he was swallowed by a large tuna, and he must have dragged him somewhere and left a stream of blood - no that isn't right. My head won't clear up.

Key to Group D: 1 B, 2 H, 3 D, 4 I, 5 G, 6 A, 7 J, 8 E, 9 C, 10 F.

APPENDIX B

Factor Analytic Studies

FACTOR ANALYTIC STUDIES

PHASE I

A. Control Group - Pleasant Story First

Table 1. Correlation Matrix (Table 21 of text; page 117)

Table 2. First Residual Correlation Matrix

Table 3. Second Residual Correlation Matrix

Table 4. Centroid Factor Matrix (Unrotated factors referring to Table 22 of text; page 118)

FACTOR ANALYTIC STUDIES

PHASE I

Table 1.

Correlation Matrix

			P. Story			U. Story			
	Age	I.Q.	R1	R2	R3	R1	R2	R3	
	1	2	3	4	5	6	7	8	
1	(199)	±199	±199	±188	±175	±156	±148	±158	-1.223
2	±199	(656)	519	602	612	651	656	641	3.482
3	±199	519	(862)	862	820	647	799	804	4.252
4	±188	602	862	(899)	899	675	785	803	4.438
5	±175	612	820	899	(899)	593	746	758	4.253
6	±156	651	647	675	593	(885)	885	845	4.140
7	±148	656	799	785	746	885	(909)	909	4.632
8	±158	641	804	803	758	845	909	(909)	4.602
	-1.223	3.482	4.252	4.438	4.253	4.140	4.632	4.602	28.576 = V_1
Col.1	1.223	3.880	4.650	4.814	4.603	4.452	4.928	4.918	33.468
T V_1	1.422	4.536	5.512	5.713	5.502	5.337	5.837	5.827	39.686 = T_1
	.226	.720	.875	.907	.873	.847	.926	.925	6.299682531 = $\frac{\sqrt{T_1}}{.158738157}$ = $\frac{1}{\sqrt{T_1}}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 2.

First Residual Correlation Matrix

			P. Story			U. Story			
	Age	I.Q.	R1	R2	R3	R1	R2	R3	
	226	**** 720	875	907	873	* 847	** 926	*** 925	
	1	2	3	4	5	6	7	8	
226--1	061 (148)	±037	001	-017	-022	±035	±061	±051	
**** 720--2	±037	111 (138)	±111	±051	±016	041	-011	-025	
875--3	001	±111	111 (096)	068	056	±094	±011	±005	
907--4	-017	±051	068	107 (076)	107	±093	±055	±036	
873--5	-022	±016	056	107	146 (137)	±146	±062	±049	
* 847--6	±035	041	±094	±093	±146	146 (168)	101	062	
** 926--7	±061	-011	±011	±055	±062	101	101 (052)	053	
*** 925--8	±051	-025	±005	±036	±049	062	053	062 (054)	
	000	002	000	-001	005	004	006	003	
V_2	-148	-136	-096	-077	-132	-164	-046	-051	-850
Col. 6	-078	-218	092	109	160	164	-248	-175	-194
Col. 7	044	-196	114	219	284	366	248	-281	798
Col. 8	146	-146	124	291	382	490	354	281	1.922
Col. 2	072	146	346	393	414	572	332	231	2.506
T V_2	133	257	457	500	560	718	433	293	3.351 = T_2
	073	140	249	273	306	392	236	160	1.83057368 = $\frac{T_2}{.546276837}$ = $\frac{1}{T_2}$

PACTOR ANALYTIC STUDIES

PHASE I

Table 3.

Second Residual Correlation Matrix

				P. Story			U. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		073	* 140	** 249	*** 273	**** 306	392	236	160	
		1	2	3	4	5	6	7	8	
073	1	047 (056)	±047	±017	±037	±044	006	044	039	
* 140	2	±047	075 (091)	075	013	-027	±014	±044	±047	
** 249	3	±017	075	075 (049)	000	-020	±004	±048	±035	
*** 273	4	±037	013	000	037 (033)	024	±014	±009	±008	
**** 306	5	±044	-027	-020	024	044 (052)	±026	±010	±000	
392	6	006	±014	±004	±014	±026	026 (-008)	009	-001	
236	7	044	±044	±048	±009	±010	009	048 (045)	015	
160	8	039	±047	±035	±008	±000	-001	015	047 (036)	
		000	000	000	002	001	000	002	-001	
V_3		-056	-091	-049	-031	-051	008	-043	-037	-350
Col.	2	038	091	-199	-057	003	036	045	057	014
Col.	3	072	241	199	-057	043	044	141	127	810
Col.	4	146	267	199	057	-005	072	159	143	1.038
Col.	5	234	213	159	105	005	020	179	143	1.059
T V_3		281	288	234	142	049	046	227	190	1.457 = T_3
		233	238	194	118	040	038	188	157	$1.207061550 = \frac{T_3}{.828457481} = \frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 4.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III
1	-226	073	233
2	720	-140	238
3	875	249	-194
4	907	273	-118
5	873	306	-040
6	847	-392	038
7	926	-236	188
8	925	-160	157

FACTOR ANALYTIC STUDIES

PHASE I

B. Control Group - Unpleasant Story First

Table 5. Correlation Matrix (Table 23 of text; page 120)

Table 6. First Residual Correlation Matrix

Table 7. Second Residual Correlation Matrix

Table 8. Third Residual Correlation Matrix

Table 9. Centroid Factor Matrix (Table 24 of text; page 121)

FACTOR ANALYTIC STUDIES

PHASE I

Table 5.

Correlation Matrix

			P. Story			U. Story			
	Age 1	I.Q. 2	R1 3	R2 4	R3 5	R1 6	R2 7	R3 8	
1	(141)	141	071	-002	-068	-007	-014	-054	067
2	141	(527)	451	440	465	515	470	527	3.009
3	071	451	(928)	928	888	845	814	792	4.789
4	-002	440	928	(928)	924	822	823	807	4.742
5	-068	465	888	924	(924)	824	857	817	4.707
6	-007	515	845	822	824	(905)	897	905	4.801
7	-014	470	814	823	857	897	(903)	903	4.750
8	-054	527	792	807	817	905	903	(905)	4.697
V_1	067	3.009	4.789	4.742	4.707	4.801	4.750	4.697	31.562
$T\ V_1$	208	3.536	5.717	5.670	5.631	5.706	5.653	5.602	37.723 = T_1
	034	576	931	923	917	929	920	912	6.141905241 = $\frac{T_1}{.162815927}$ = $\frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 6.

First Residual Correlation Matrix

				U. Story			P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		**034	*576	931	923	917	929	920	912	
		1	2	3	4	5	6	7	8	
**034	1	122 (140)	122	±039	±033	±099	±038	±045	±085	
*576	2	122	122 (195)	±085	±092	±063	±020	±060	±002	
931	3	±039	±085	085 (061)	069	034	-020	-042	-057	
923	4	±033	±092	069	092 (076)	078	-035	-026	-035	
917	5	±099	±063	034	078	099 (083)	-028	013	-019	
929	6	±038	±020	-020	-035	-028	058 (042)	042	058	
920	7	±045	±060	-042	-026	013	042	064 (057)	064	
912	8	±085	±002	-057	-035	-019	058	064	085 (073)	
		001	-001	-001	002	-001	001	003	001	
V_2		-139	-196	-062	-074	-084	-041	-054	-072	-722
Col.	2	-383	196	108	110	042	-001	066	-076	062
Col.	1	383	440	030	176	240	075	156	094	1.594
		505	562	115	268	339	133	220	179	2.321 = T_2
		331	369	075	176	222	087	144	117	1.52348 = T_2
										.65639 = $\frac{1}{T_2}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 7.

Second Residual Correlation Matrix

					U. Story		P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		331	**** 369	* 075	** 176	*** 222	087	144	117	
		1	2	3	4	5	6	7	8	
331	1	064 (013)	±000	±064	±025	±026	099	-003	046	
**** 369	2	±000	057 (-014)	057	027	-019	±012	±007	±045	
* 075	3	±064	057	066 (079)	056	017	±026	±053	±066	
** 176	4	±025	027	056	056 (061)	039	±050	±051	±055	
*** 222	5	±026	-019	017	039	047 (050)	±047	±019	±045	
087	6	009	±012	±026	±050	±047	050 (051)	030	048	
144	7	-003	±007	±053	±051	±019	030	053 (043)	047	
117	8	046	±045	±066	±055	±045	048	047	066 (071)	
		002	001	000	002	002	003	001	001	
V_3		-011	015	-079	-059	-048	-048	-042	-070	-342
Col.	3	117	-099	079	-171	-082	004	064	062	-026
Col.	4	167	-153	191	171	-160	104	166	172	658
Col.	2	115	115	339	202	122	222	190	352	1.758
Col.	5	115	-115	225	249	160	198	204	262	1.298
T V_3		179	172	405	359	169	272	243	418	2.217 = T_3
		120	115	272	241	113	183	163	281	1.488959368 = $\frac{T_3}{.671609999}$ = $\frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 8.

Third Residual Correlation Matrix

				U. Story			P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		* 120	*** 115	** 272	241	113	183	163	**** 281	
		1	2	3	4	5	6	7	8	
* 120	1	039 (050)	-014	031	-004	-039	-013	-022	-012	
*** 115	2	-014	032 (044)	026	-001	-032	-009	-026	013	
** 272	3	031	026	031 (-012)	-009	-014	-024	009	-010	
241	4	-004	-001	-009	013 (-002)	012	006	012	-013	
113	5	-039	-032	-014	012	039 (034)	026	001	013	
183	6	-013	-009	-024	006	026	026 (017)	000	-003	
163	7	-022	-026	009	012	001	000	026 (027)	001	
**** 281	8	012	013	-010	-013	013	-003	001	013 (-013)	
		001	001	-003	001	001	000	002	000	
V_4		-049	-043	009	003	-033	-017	-025	013	-142
Col.	1	049	-015	-053	011	045	009	019	-011	054
Col.	3	111	-067	053	029	073	057	001	009	266
Col.	2	083	067	105	031	137	075	053	-017	534
Col.	8	107	093	085	057	111	081	051	017	602
		146	125	116	070	150	107	077	030	.821 = T_4
		161	138	128	077	165	118	085	033	.90609 = T_4
										1.10364251 = $\frac{1}{T_4}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 9.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III	IV
1	034	-331	120	-161
2	576	-369	115	-138
3	931	075	-272	128
4	923	176	-241	077
5	917	222	-113	165
6	929	087	183	118
7	920	144	163	085
8	912	117	281	-033

FACTOR ANALYTIC STUDIES

PHASE I

C. Test Group - Pleasant Story First

FACTOR ANALYTIC STUDIES

PHASE I

Table 10.

Correlation Matrix

			P. Story			U. Story			
	Age	I.Q.	R1	R2	R3	R1	R2	R3	
	1	2	3	4	5	6	7	8	
1	(285)	285	149	079	119	094	003	188	
2	285	(370)	291	370	249	305	229	290	
3	149	291	(699)	699	651	-087	008	-203	
4	079	370	699	(772)	772	-237	246	-098	
5	119	249	651	772	(772)	-339	020	-247	
6	094	305	-087	-237	-339	(577)	141	577	
7	003	229	008	246	020	141	(486)	486	
8	188	290	-203	-098	-247	577	486	(577)	
V_1	.917	2.019	1.508	1.831	1.225	.454	1.133	.993	$10.080 = V_1$
$T V_1$	1.202	2.389	2.207	2.603	1.997	1.031	1.619	1.570	$14.618 = T_1$
	.314	.625	.577	.681	.522	.270	.423	.411	$3.823349 = T_1$
									$.261550781 = \frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 11.

First Residual Correlation Matrix

				P. Story			U. Story				
		Age	I.Q.	R1	R2	R3	R1	R2	R3		
		***** 314	**** 625	577	681	522	* 270	*** 423	** 411		
		1	2	3	4	5	6	7	8		
***** 314	1	135 (187)	089	±032	±135	±045	009	-130	059		
**** 625	2	089	136 (021)	±071	±056	±077	136	-035	033		
577	3	±032	±071	440 (366)	306	350	±243	±236	±440		
681	4	±135	±056	306	421 (308)	417	±421	±042	±378		
522	5	±045	±077	350	417	480 (500)	±480	±201	±461		
* 270	6	009	136	±243	±421	±480	480 (504)	027	466		
*** 423	7	-130	-035	±236	±042	±201	027	312 (307)	312		
** 411	8	059	033	±440	±378	±461	466	312	466 (408)		
		002	-002	000	-001	003	-002	002	-001		
V_2		-185	019	-366	-309	-497	-506	-305	-409	-2.558	V_2
Col.	6	-203	-253	120	533	463	506	-359	-1.341	-0.534	
Col.	8	-321	-319	1.000	1.289	1.385	1.438	-983	1.341	4.830	
Col.	7	-061	-249	1.472	1.373	1.787	1.492	983	1.965	8.762	
Col.	2	-239	249	1.614	1.485	1.941	1.764	913	2.030	9.758	
Col.	1	239	427	1.678	1.755	2.031	1.782	653	2.149	10.714	
		374	563	2.118	2.176	2.511	2.262	965	2.615	13.584 = T_2	
		101	153	575	590	681	614	262	709	3.68564 = T_2	
										.27132272 = $\frac{1}{T_2}$	

FACTOR ANALYTIC STUDIES
PHASE I

Table 12.

Second Residual Correlation Matrix

				P. Story			U. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		101	153	575**	590	681	614	262*	709***	
		1	2	3	4	5	6	7	8	
101	1	156 (125)	074	±026	076	-024	-053	±156	±013	
153	2	074	075 (113)	±017	-034	-027	042	±075	±075	
575**	3	±026	±017	-110 (109)	±033	±041	±110	085	032	
590	4	076	-034	±033	112 (073)	015	059	±112	±040	
681	5	-024	-027	±041	015	062 (016)	062	±023	±022	
614	6	-053	042	±110	059	062	134 (103)	±134	±031	
262*	7	±156	±075	085	±112	±023	±134	156 (243)	126	
709***	8	±013	±075	032	±040	±022	±031	126	126 (-037)	
		003	001	-001	004	002	000	000	002	
V_3		-122	-112	-110	-069	-014	-103	-243	039	-734
Col.	7	190	038	-280	155	-060	165	243	-213	238
Col.	3	242	072	280	221	022	385	413	-277	1.358
Col.	8	268	222	344	301	066	323	665	277	2.466
T V_3		424	297	454	413	128	457	821	403	3.397 = T_3
		230	161	246	224	069	248	445	219	1.84309 = T_3
										.542565564 = $\frac{1}{T_3}$

FACTOR ANALYTIC STUDIES
PHASE I

Table 13.

Third Residual Correlation Matrix

				P. Story			U. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		* 230	** 161	246	224	069	248	**** 445	*** 219	
		1	2	3	4	5	6	7	8	
* 230	1	110 (103)	037	-030	025	-040	-110	054	-037	
** 161	2	037	070 (049)	-023	-070	-038	002	003	040	
246	3	-030	-023	049 (050)	-022	024	049	-024	-022	
224	4	025	-070	-022	070 (062)	000	004	012	-009	
069	5	-040	-038	024	000	054 (057)	045	-054	007	
248	6	-110	002	049	004	045	110 (073)	024	-085	
**** 445	7	054	003	-024	012	-054	024	054 (-042)	029	
*** 219	8	-037	040	-022	-009	007	-085	029	085 (078)	
		002	000	002	002	001	002	002	001	
V_4		-101	-049	-048	-060	-056	-071	044	-077	-418 = V_4
Col.	1	101	-123	-012	-110	024	149	-064	-003	-014
Col.	2	175	123	058	030	100	145	-070	-083	478
Col.	8	101	203	102	048	086	315	-128	083	810
Col.	7	209	209	150	024	194	267	128	141	1.322
T V_4		319	279	199	094	248	377	182	226	1.924 = T_4
		230	201	143	068	179	272	131	163	1.38708 = T_4
										.720937 = $\frac{1}{T_4}$

Appendix B.

FACTOR ANALYTIC STUDIES

PHASE I

Table 14.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III	IV
1	314	-101	230	-230
2	625	-153	161	-201
3	577	575	-246	143
4	681	590	224	068
5	522	681	069	179
6	270	-614	248	272
7	423	-262	445	-131
8	411	-709	219	-163

FACTOR ANALYTIC STUDIES

PHASE I

D. Test Group - Unpleasant Story First

FACTOR ANALYTIC STUDIES

PHASE I

Table 15.

Correlation Matrix

			U. Story			P. Story			
	Age	I.Q.	R1	R2	R3	R1	R2	R3	
	1	** 2	* 3	4	5	6	7	8	
1	(247)	±211	±247	-121	097	169	-142	186	
2	±211	(315)	315	±079	±089	±139	±124	±034	
3	±247	315	(315)	±097	±308	±017	±267	±253	
4	-121	±079	±097	(397)	397	240	213	212	
5	097	±089	±308	397	(397)	-041	021	032	
6	169	±139	±017	240	-041	(646)	508	646	
7	-142	±124	±267	213	021	508	(781)	781	
8	186	±034	±253	212	032	646	781	(781)	
V_1	153	407	-064	959	725	1.644	990	1.638	$6.452 = V_1$
Col. 3	647	-223	<u>064</u>	765	109	1.678	1.524	2.144	6.708
Col. 2	225	<u>223</u>	694	923	287	1.400	1.772	2.076	7.600
$T V_1$	472	538	1.009	1.320	684	2.046	2.553	2.857	$11.479 = T_1$
	139	159	298	390	202	604	753	843	$3.38806 = T_1$
									$.29515 = \frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 16.

First Residual Correlation Matrix

				U. Story			P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		139	*** 159	298	** 390	* 202	604	753	843	
		1	2	3	4	5	6	7	8	
139	1	247 (228)	±233	206	±175	±069	085	-247	069	
*** 159	2	±233	268 (290)	±268	017	057	±235	±004	±168	
298	3	206	±268	368 (226)	±213	±368	-163	043	002	
** 390	4	±175	017	±213	318 (245)	318	±005	±081	±117	
* 202	5	±069	057	±368	318	368 (356)	±163	±131	±138	
604	6	085	±235	-163	±005	±163	235 (281)	053	137	
753	7	-247	±004	043	±081	±131	053	247 (214)	146	
843	8	069	±168	002	±117	±138	137	146	168 (070)	
		002	000	001	-001	000	000	001	001	
V_2		-226	-290	-225	-246	-356	-281	-213	-069	-1.906 = V_2
Col.	5	-364	-404	511	-882	356	045	049	207	-482
Col.	4	-014	-438	937	882	992	035	211	441	3.046
Col.	2	452	438	401	916	1.106	505	203	777	4.798
T V_2		699	706	769	1.234	1.474	740	450	945	7.017 = T_2
		264	266	290	466	556	279	170	357	2.64896 = T_2
										.377506 = $\frac{1}{T_2}$

FACTOR ANALYTIC STUDIES
PHASE I

Table 17.

Second Residual Correlation Matrix

					U. Story		P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		264	266	*290	***466	**556	279	****170	357	
		1	2	3	4	5	6	7	8	
264	1	292 (177)	163 ±	130 ±	052 ±	216	011 ±	292	-025	
266	2	163	345 (197) ±	345 ±	107 ±	091	161 ±	049	073	
*290	3 ±	130 ±	345	345 (284)	078	207 ±	244	-006 ±	101	
***466	4 ±	052 ±	107	078	135 (101)	059 ±	135	002 ±	049	
**556	5 ±	216 ±	091	207	059	216 (059) ±	008	037 ±	060	
279	6	011	161 ±	244 ±	135 ±	008	244 (156) ±	006	037	
****170	7 ±	292 ±	049	-006	002	037 ±	006	292 (218) ±	085	
357	8	-025	073 ±	101 ±	049 ±	060	037 ±	085	101 (041)	
		000	002	003	001	003	000	001	001	
V_3		-177	-195	-281	-100	-056	-156	-217	-040	-1.222
Col. 3		-437	495	281	-256	-470	332	-205	162	-098
Col. 5		-005	667	695	-374	470	316	-279	282	1.782
Col. 4		-109	891	851	374	588	586	-283	380	3.278
Col. 7		475	989	839	378	662	574	283	210	4.410
		767	1.334	1.184	513	878	818	575	311	$6.380 = T_3$
		304	528	469	203	348	324	228	123	$2.52586 = T_3$
										$.395906 = \frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 18.

Third Residual Correlation Matrix

				U. Story			P. Story			
		Age	I.Q.	R1	R2	R3	R1	R2	R3	
		304**	528	469	203	348***	324	228*	123	
		1	2	3	4	5	6	7	8	
304**	1	272 (200)	003	-272	-114	110	-087	223	-062	
528	2	003	097 (066)	097	000	-093	-010	-071	008	
469	3	-272	097	272 (125)	-017	044	092	-113	043	
203	4	-114	000	-017	114 (094)	-012	069	-044	024	
348***	5	110	-093	044	-012	121 (095)	-121	-042	017	
324	6	-087	-010	092	069	-121	121 (139)	-080	-003	
228*	7	223	-071	-113	-044	-042	-080	223 (240)	-113	
123	8	-062	008	043	024	017	-003	-113	113 (086)	
		001	000	-001	000	-002	-001	000	000	
V_4		-199	-066	-126	-094	-097	-140	-240	-086	-1.048 = V_4
Col.	7	-645	076	100	-006	-013	020	240	140	-088
Col.	1	645	070	644	222	-233	194	686	264	2.492
Col.	5	865	256	556	246	233	436	602	230	3.424
		1.137	353	828	360	354	557	825	343	4.757 = T_4
		521	162	379	165	162	255	378	157	2.181054 = T_4
										.458493 = $\frac{1}{T_4}$

FACTOR ANALYTIC STUDIES

PHASE I

Table 19.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III	IV
1	139	264	304	-521
2	-159	266	528	162
3	-298	290	-409	379
4	390	-466	203	165
5	202	-556	348	-162
6	604	279	324	255
7	753	170	-228	378
8	843	357	123	157

FACTOR ANALYTIC STUDIES

PHASE II

A. Control Group - Pleasant Story

FACTOR ANALYTIC STUDIES

PHASE II

Table 20.

Correlation Matrix

	Age* 1	I.Q. 2	Diag. 3	P. Story R1 4	R2 5	R3 6		
1*	(406)	±003	±101	±331	±406	±347		
2	±003	(682)	215	469	502	682		
3	±101	215	(553)	553	415	410		
4	±331	469	553	(919)	919	917		
5	±406	592	415	919	(970)	970		
6	±347	682	410	917	970	(970)		
V_1	-986	1.865	1.694	2.527	2.400	2.632	10.132	
Col. 1	986	1.871	1.492	3.189	3.212	3.326	14.076	
	1.392	2.553	2.045	4.108	4.182	4.296	18.576	$= T_1$
	323	592	474	953	970	997	4.310	$= T_1$
							.232	$= \frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 21.

First Residual Correlation Matrix

		Age	I.Q.	Diag.	R1	P. Story R2	R3		
		323	592*	474**	953	970	997***		
		1	2	3	4	5	6		
323	1	254 (302)	±188	±254	023	093	±025		
592*	2	±188	188 (332)	-066	±095	±072	092		
474**	3	±254	-066	254 (328)	±101	±045	-063		
953	4	023	±095	±101	101 (009)	-005	±033		
970	5	093	±072	±045	-005	093 (029)	±003		
997***	6	±025	092	-063	±033	±033	092 (024)		
		001	003	001	000	003	000		
V_2		-301	-329	-327	-009	-026	024	-968	
Col. 2		075	<u>329</u>	-195	181	118	-160	348	
Col. 3		583	197	<u>195</u>	-021	208	-034	1.128	
Col. 6		533	381	069	045	202	034	1.264	
T V_2		787	569	323	146	295	126	2.246 = T_2	
		525	380	215	097	197	084	1.499 = T_2	
								.667 = $\frac{1}{T_2}$	

FACTOR ANALYTIC STUDIES

PHASE II

Table 22.

Second Residual Correlation Matrix

					P. Story				
		Age	I.Q.	Diag.	R1	R2	R3		
		** 525	380	* 215	097	*** 197	084		
		1	2	3	4	5	6		
** 525	1	141 (-022)	-012	141	-028	-010	-069		
380	2	-012	148 (044)	-148	058	-003	060		
* 215	3	141	-148	148 (208)	-122	003	-081		
097	4	-028	058	-122	122 (092)	-024	025		
*** 197	5	-010	-003	003	-024	024 (054)	-020		
084	6	-069	060	-081	025	-020	081 (085)		
		000	-001	001	001	000	000		
V_3		022	-045	-207	-091	-054	-085	-460	
Col. 3		-260	251	207	153	-060	077	368	
Col. 1		260	275	489	209	-040	215	1.408	
Col. 5		240	281	495	257	040	255	1.568	
T V_3		381	429	643	379	064	336	2.232 = T_3	
		255	287	430	254	043	225	1.494 = T_3	
								.66935 = $\frac{1}{T_3}$	

FACTOR ANALYTIC STUDIES

PHASE II

Table 23.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III
1	-323	525	-255
2	592	-380	287
3	474	-215	-430
4	953	097	254
5	970	197	-043
6	997	-084	255

FACTOR ANALYTIC STUDIES

PHASE II

B. Control Group - Unpleasant Story

FACTOR ANALYTIC STUDIES

PHASE II

Table 24.

Correlation Matrix

	Age 1	I.Q. 2	Diag. 3	U. Story R1 4	U. Story R2 5	U. Story R3 6		
1	(251)	171	251	098	150	030	700	
2	171	(849)	188	812	849	798	2.818	
3	251	188	(282)	161	230	282	1.112	
4	098	812	161	(919)	919	816	2.806	
5	150	849	230	919	(919)	887	3.035	
6	030	798	282	816	887	(887)	2.813	
V_1	700	2.818	1.112	2.806	3.035	2.813	13.284	
$T V_1$	951	3.667	1.394	3.725	3.954	3.700	17.391 =	T_1
	228	880	335	894	949	888	4.171 =	T_1
							.23975 =	$\frac{1}{T_1}$

Appendix B.

FACTOR ANALYTIC STUDIES

PHASE II

Table 25.

First Residual Correlation Matrix

					U. Story			
		Age	I.Q.	Diag.	R1	R2	R3	
		*228	880	**335	894	949	888	
		1	2	3	4	5	6	
*228	1	175 (199)	±030	175	±106	±066	±172	
880	2	±030	107 (075)	±107	025	014	017	
**335	3	175	±107	175 (170)	±138	±088	±015	
894	4	±106	025	±138	138 (120)	071	022	
949	5	±066	014	±088	071	088 (018)	044	
888	6	±172	017	±015	022	044	172 (098)	
		000	-006	-003	-006	-007	-006	
	V_2	-199	-081	-173	-126	-025	-104	-708
Col.	1	199	-021	-523	086	107	240	088
Col.	3	549	193	523	362	283	270	2.180
T	V_2	724	300	698	500	371	442	3.035 = T_2
		416	172	401	287	213	254	1.742 = T_2
								.57406 = $\frac{1}{T_2}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 26.

Second Residual Correlation Matrix

					U. Story			
		Age	I.Q.	Diag.	R1	R2	R3	
		**416	172	401	287	213	*254	
		1	2	3	4	5	6	
**416	1	066 (002)	-042	008	-013	-023	066	
172	2	-042	042 (077)	038	-024	-023	-027	
401	3	008	038	087 (014)	023	003	-087	
287	4	-013	-024	023	051 (056)	010	-051	
213	5	-023	-023	003	010	023 (043)	-010	
*254	6	066	-027	-087	-051	-010	087 (107)	
		-002	-001	-001	001	000	-002	
V_3		-004	-078	-015	-055	-043	-109	-304
Col. 6		-136	-024	159	047	-023	109	132
Col. 1		136	060	143	073	023	241	676
T V_3		202	102	230	124	046	328	1.032 = T_3
		199	100	226	122	045	323	1.016 = T_3
								.98425 = $\frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 27.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III
1	228	-416	-199
2	880	172	100
3	335	-401	226
4	894	287	122
5	949	213	045
6	888	254	-323

FACTOR ANALYTIC STUDIES

PHASE II

C. Test Group - Pleasant Story

FACTOR ANALYTIC STUDIES

PHASE II

Table 28.

Correlation Matrix

					P. Story		
	Age 1	I.Q. 2	Diag. 3	R1 4	R2 5	R3 6	
1	(276)	074	-129	067	276	136	
2	074	(532)	-139	532	098	-207	
3	-129	-139	(588)	-223	466	588	
4	067	532	-223	(532)	088	-066	
5	276	098	466	088	(782)	782	
6	136	-207	588	-066	782	(782)	
V_1	424	358	563	398	1.710	1.233	
T V_1	700	890	1.151	930	2.492	2.015	$8.178 = T_1$
	245	312	403	326	872	705	$2.859 = T_1$
							$.34977 = \frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 29.

First Residual Correlation Matrix

					P. Story			
		Age	I.Q.	Diag.	R1	R2	R3	
		*** 245	* 312	403	** 326	872	705	
		1	2	3	4	5	6	
*** 245	1	228 (216)	-002	±228	-013	±062	±037	
* 312	2	-002	430 (435)	±265	430	±174	±427	
403	3	±228	±265	354 (426)	±354	115	304	
** 326	4	-013	430	±354	430 (426)	±196	±296	
872	5	±062	±174	115	±196	196 (022)	167	
705	6	±037	±427	304	±296	167	427 (285)	
		-002	-003	-002	-003	-004	-004	
V_2		-218	-438	-428	-429	-026	-289	-1.828
Col. 2		-214	438	102	-1.289	322	565	-076
Col. 4		-188	1.298	810	1.289	714	1.157	5.080
Col. 1		188	1.294	1.266	1.263	590	1.231	5.832
T V_2		416	1.724	1.620	1.693	786	1.658	7.897 = T_2
		148	614	577	603	280	590	2.810 = T_2

$$.35587 = \frac{1}{T_2}$$

FACTOR ANALYTIC STUDIES

PHASE II

Table 30.

Second Residual Correlation Matrix

					P. Story			
		Age	I.Q.	Diag.	R1	R2	R3	
		*148	614	**577	603	280	590	
		1	2	3	4	5	6	
*148	1	143 (206)	-093	143	-102	-103	-050	
614	2	-093	093 (053)	-089	060	002	065	
**577	3	143	-089	143 (021)	006	-047	-036	
603	4	-102	060	006	102 (066)	027	-060	
280	5	-103	002	-047	027	103 (118)	002	
590	6	-050	065	-036	-060	002	065 (079)	
		001	-002	-002	-003	-001	000	
V_3		-205	-055	-023	-069	-119	-079	-550
Col. 1		205	131	-309	135	087	021	270
Col. 3		491	309	309	123	181	093	1.506
T V_3		634	402	452	225	284	158	2.155 = T_3
		432	274	308	153	193	108	1.468 = T_3
								.6819 = $\frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 31.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III
1	245	-148	432
2	312	-614	274
3	403	577	-308
4	326	-603	153
5	872	280	193
6	705	590	108

FACTOR ANALYTIC STUDIES

PHASE II

D. Test Group - Unpleasant Story

FACTOR ANALYTIC STUDIES

PHASE II

Table 32.

Correlation Matrix

				U. Story			
	Age 1	I.Q. 2	Diag. 3	R1 4	R2 5	R3 6	
1	(229)	-003	-229	-057	218	140	069
2	-003	(309)	167	162	309	180	815
3	-229	167	(694)	694	623	679	1.934
4	-057	162	694	(940)	597	940	2.336
5	218	309	623	597	(984)	984	2.731
6	140	180	679	940	984	(984)	2.923
V_1	069	815	1.934	2.336	2.731	2.923	
$T\ V_1$	298	1.124	2.628	3.276	3.715	3.907	$14.948 = T_1$
	077	291	680	847	961	1.011	$3.86626 = T_1$
							$.25864 = \frac{1}{T_1}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 33.

First Residual Correlation Matrix

		Age	I.Q.	Diag.	R1	R2	R3	
		077	291	680*	847**	961	1.011***	
		1	2	3	4	5	6	
077	1	281 (223)	-025	±281	±122	144	±062	
291	2	-025	114 (224)	±031	±084	029	±114	
680*	3	±281	±031	281 (232)	118	±030	-008	
847**	4	±122	±084	118	217 (223)	±217	084	
961	5	144	029	±030	±217	217 (060)	±012	
1.011***	6	±062	±114	-008	084	±012	114 (-038)	
		001	-001	000	002	-002	-002	
V_2		-222	-225	-232	-221	-062	036	-926
Col.	3	340	-163	232	-457	-002	052	002
Col.	4	584	005	468	457	432	-116	1.830
Col.	6	460	233	452	625	408	116	2.294
T V_2		741	347	733	842	625	230	3.518 = T_2
		395	185	391	449	333	123	1.87563 = T_2
								.53315 = $\frac{1}{T_2}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 34.

Second Residual Correlation Matrix

					U. Story			
		Age	I.Q.	Diag.	R1	R2	R3	
		** 395	185	* 391	449	333	123	
		1	2	3	4	5	6	
** 395	1	127 (125)	-098	127	-055	012	-111	
185	2	-098	098 (080)	-041	001	-033	091	
* 391	3	127	-041	127 (128)	-058	-100	-056	
449	4	-055	001	-058	067 (015)	067	029	
333	5	012	-033	-100	067	100 (106)	-053	
123	6	-111	091	-056	029	-053	111 (099)	
		000	000	000	-001	-001	-001	
V_3		-125	-080	-128	-016	-107	-100	-556
Col. 3		-379	002	128	100	093	012	-044
Col. 1		379	198	382	210	069	236	1.472
T V_3		506	296	509	277	169	345	2.102 = T_3
		349	204	351	191	117	238	1.44982 = T_3
								.68973 = $\frac{1}{T_3}$

FACTOR ANALYTIC STUDIES

PHASE II

Table 35.

Centroid Factor Matrix
(Unrotated Factors)

	I	II	III
1	077	395	-349
2	291	185	204
3	680	-391	-351
4	847	-449	191
5	961	333	117
6	1.011	-123	238