# AUTOMATIC SPEECH RATE AS AN INDEX OF DEPRESSION AND ITS RELATIONSHIP TO PSYCHOLOGICAL AND MOTOR TESTS

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# AUTOMATIC SPEECH RATE AS AN INDEX OF DEPRESSION AND ITS RELATIONSHIP TO PSYCHOLOGICAL AND MOTOR TESTS

by

© Albert Michael Selby, B.A.

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the requirements for the degree of
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## ABSTRACT

The value of the automatic speech rate as an index of depression was investigated. Sixteen hospitalized depressed patients (ten diagnosed as suffering from Endogenous Depression and six with Reactive Depression) and 16 normal subjects were compared on rates of automatic speech and tests of psychomotor speed. In addition the 'patient group' was assessed on three measures of depression. Members of each group were tested weekly, the depressed patient group until discharged from hospital, the normal group for three consecutive weeks. Five weeks later, a 'follow-up' test was given to both groups. On every test day, excepting 'follow-up', the assessments were made at morning and afternoon tests sessions in order to investigate the diurnality of responses. A repeated measures design was employed to facilitate comparison of scores over time. The results showed a statistically significant difference between the depressed group and the normal group on measures of automatic speech. The depressed group showed statistically significant improvement on automatic speech rates with concomitant significant improvement on the clinical scales. The normal subjects also demonstrated a significant change in automatic speech rates over time and both groups showed diurnal variation on this measure. The depressed and normal groups could be differentiated from one another on tests of psychomotor speed. These results indicate that the automatic speech rate is a potentially useful measure for investigating and monitoring depression. Suggestions for further investigations are made, particularly those which study the effect of mental set on automatic speech rates.

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# CHAPTER I

## INTRODUCTION

### The Problem

#### Measures of Depression

Measures of depression in psychiatric patients find application both in research and in the clinical management of this disorder. Research uses of such measurements aim principally at elucidating aetiology and comparing the relative efficacy of treatment methods.

There have been two main approaches to the measurement of depression, one using a global score, based upon a number of signs and symptoms and the other measuring an individual symptom. They may employ both subjective and objective symptoms. Subjective symptoms such as dysphoria are notoriously difficult to measure, whilst objective symptoms such as sleep behaviour, appetite, weight loss and psychomotor retardation are more easily measured, they are not free from difficulties.

#### Choice of Psychomotor Retardation

An individual symptom which has attracted considerable attention, probably because it lends itself most readily to objective measurement is psychomotor retardation. Mendels (1970, pp 9-10) has described psychomotor retardation in depression as involving

> "... an apparent inhibition or slowing down of bodily movements and thinking and a reduction in spontaneous movements and expressive gestures... spontaneous speech is reduced... little attempt to initiate conversation... answers are sparse... patient becomes mute and also stuporous and may resemble catatonic schizophrenic..."

This investigation was aimed primarily at replicating and developing the work of Szabadi et al.(1976) who suggested that the rate of automatic speech was a more sensitive index of psychomotor retardation and hence depression, than the measures which had been conventionally used for this purpose.

Szabadi et al.(1976) employed four moderately depressed patients along with four healthy volunteers and used counting from 1 to 10 as an expression of automatic speech. The results indicated that both phonation time (the time taken to articulate the digits) and pause time (the time between articulating each digit) were constant for the control group over a two month period. In contrast to the normal subjects the depressed group exhibited a significant reduction in pause time as they improved. However, the phonation time remained constant over the course of the depressive episode.

This finding is based upon a small number of subjects and Szabadi et al.(1976) suggested that a larger sample of depressed patients be used in replication studies. In addition the relationship of this finding to different types of depression, diurnal variation, and other methods of measuring psychomotor speed, needs to be investigated.

This review will concentrate upon the evidence that psychomotor retardation occurs in depression, the specificity for depression of this observation and the possible explanation will be examined, as will the relationship to speech rates.

## Psychomotor Retardation in Patients with Depression

### The Evidence

**Clinical Observations** - Motor retardation, slowed movement and slowed

speech, is a salient characteristic of depression (Mayer-Gross, Slater and Roth, 1969). In those individuals where depression is the primary presenting complaint this symptom intensifies as the severity of depression increases. Coleman (1976:347) points out that "In the most severe degree of psychomotor retardation of depression, the individual becomes almost completely unresponsive and inactive." Beck (1974) the main proponent of the cognitive theory of depression, has also pointed to the salient position of psychomotor retardation in depressed individuals. He states that the depressed individual

> "...not only desire to avoid experiences which formerly gratified him or represented the mainstream of his life, but he is drawn towards a state of inactivity... He is completely devoid of spontaneous desire to do anything except remain in a state of passive inertia".

Likewise, Mendel's (1970) description of psychomotor retardation in depression emphasizes the slowing down of bodily movements and thinking and the reduction of spontaneous motor actions and speech.

In summary, therefore, clinical observers are in agreement that psymotor retardation is an important manifestation of depression, particularly when this condition is severe.

Test Results - Several investigators have attempted to empirically test these clinical observations. Beck, Feshback and Legg (1962) tested a group of depressed patients using the Digit Symbol Test and found their subjects to be greatly impaired in their performance. Friedman (1964) compared depressives and normals on several measures and found the depressed group significantly slower on reaction time and the Digit Symbol Test. Hall and Stride (1954) found a group of depressed patients over

40 years to be significantly slower than a comparable group of normals. Nelson (1953) reported on a group of manic-depressives who had poorer scores on motor tests than other functional psychotics.

The conclusion to be drawn from the literature is that test results appear to support the clinical observations that psychomotor retardation occurs in depression.

## Specificity of Psychomotor Retardation to Depression

### Psychomotor Retardation in Patients with Other Psychiatric Diagnoses

There is evidence suggesting that nearly every form of mental illness can be accompanied by a degree of general psychomotor retardation. For example, Payne's (1960) review of work which employed the Badcock Speed Tests suggests that psychomotor retardation "is a relatively sensitive barometer of the severity of mental illness". A number of studies are cited which suggest that neurotic patients, on average are slightly retarded, both depressed and manic patients are very retarded and schizophrenic patients are as retarded as depressed patients.

Considerable work has been conducted with schizophrenics in this area. A common finding has been that schizophrenics and depressives respond in much the same manner on tests of psychomotor retardation. Seligman's work (1975) indicates that schizophrenics are the only other group who appear to be as slow as depressives. Moreover, Colbert and Harrow (1968) found no significant difference between schizophrenics and depressed patients on reaction time.

Payne and Hewlett (1966) compared groups of normals, dysthymic neurotics, hysterics, endogenous depressives and schizophrenics on both

intellectual speed tests (Nufferno Speed Test) and on motor speed tests (Badcock-Levy). The investigators carefully matched for pre-morbid intelligence, age and education and reported that the depressives were consistently slower than the normal and neurotic groups, but not the schizophrenic group. However, it should be pointed out that the findings in schizophrenics are inconsistent. Some are nearly as fast as normals and others are slower than the slowest depressed patients. Those diagnosed as hebephrenic or catatonic schizophrenia tend to be slowest (Payne, 1960; King, 1967, 1969, Pugh, 1968). Several studies also indicates that process schizophrenics tend to be slower than reactive schizophrenics (Ward and Carlson, 1966; Claridge, 1967).

Court (1970) has extensively studied psychomotor retardation in a number of diagnostic groups. He compared nine groups of subjects (normal, psychopath, hypomanic, schizophrenic, alcoholic, neurotic, depressive and organic brain syndromes) on several tests including the OXOX test, the peg-board test and simple reaction time. As regards the first test all psychiatric diagnostic groups were significantly slower than the normal. The depressed group was only faster than one other group, the organic brain syndrome. The psychopath and hypomanic groups were the fastest of those with a psychiatric diagnosis. On the peg-board test normals were again significantly faster than all other groups. Again the depressed group was faster than one other group, the organic brain syndrome.

Is Psychomotor Retardation in Depression Specific to the Depression or to the Subject?

Changes in Psychomotor Retardation with Change in Depression

It was also found in Court's (1970) study that the depressed group

improved on this test simultaneously with improvement in their clinical state. Hetherington (1954) reported a similar finding. He compared the trends of 10 normals and 20 depressed subjects over four occassion of testing on the peg-board test. This resulted in a slight non-significant improvement for the normal group, whereas those with depression speeded up significantly with treatment. Fisher (1949) reported that depressed patients who were rated as improved after receiving E.C.T. also obtained significantly higher Digit-symbol scores than those rated as unimproved.

Subject Variables Other than Depression Possibly Affecting Psychomotor Speed

Court (1970) found simple reaction time to be the best part of his battery for making inferences about the mental state. However, a subgroup of Court's patients did not improve on this test in spite of clinical improvement. Court hypothesized that this was related to the type of treatment, E.C.T. received by this group, and this was supported by a subsequent investigation.

In addition to E.C.T., Court found the influence of the subject's sex to be relatively less in patients than in normal subjects.

Conclusions

The literature suggests that depressed patients exhibit psychomotor retardation on a number of tests. The work of some investigators (Court, 1970; Fisher, 1949; Hetherington, 1954) strongly suggests that psychomotor retardation exhibited by depressed patients, on some tasks, is closely related to their clinical state at the time of testing. However, other diagnostic groups, particularly schizophrenics, exhibit psychomotor retardation. Thus, one is cautioned against using tests of psychomotor

retardation as diagnostic tools. It appears more appropriate to use these tests as indices of the course of a psychiatric disorder, after the diagnosis has been agreed upon. Using these tests as such, one should keep in mind the possible influence that treatment may have on test results.

Explanations of Reasons for Psychomotor Retardation

There seems little doubt that at least a moderate degree of slowness is associated with depressed affect. However, the cause of this slowness is not clear. This is especially true with regard to depression as most studies concerned with explaining psychomotor retardation have been concerned with schizophrenics. Work by Shapiro and Nelson (1955) suggests that there may be two independent causes of slowness among abnormal subjects. This work strongly suggests that some patients are slow because they are distracted in some way. The second cause of slowness has not been as clearly defined. Payne (1960) has produced some evidence which is in line with the first hypothesis. This evidence indicates that neurotic introverted patients are slower than neurotic extroverted patients, which suggest that performance of the former group may be hindered by task-interfering anxiety responses. Depressed patients, therefore, may be slow as a result of distractions produced by their anxieties, worries and depressive thoughts.

Payne and Caird (1967) have stated two hypotheses which are very similar to those of Shapiro and Nelson (1955). These investigators (Payne and Caird) hypothesized and demonstrated that a slow reaction time could be a function of either overinclusion, which produces slowness as a function of the number of distractions, or retardation which produces a

consistent slowness that is not a function of the amount of distraction. Ashem (1969) has demonstrated that tapping speed of acute schizophrenics could be influenced by distractions by having either the experimentor or the subject saying "faster" or "slower". (Curiously, the schizophenics unlike the normals, were more distracted by their own speech than that of the examiner). This study supports the hypothesis that distraction can be one cause of slowness in psychiatric patients. The second cause of slowness has again not been as clearly identified as the first. However, several studies suggest that slowness may be a result of some physiological abnormality. Payne (1960) suggested that speed may be a function of the level of cortical arousal and cited some evidence to support this. He reported that even in a relatively homogenous student group speed was highly correlated with thyroid function. Payne also suggested that a higher level of "neuroticism" in normal subjects might be associated with an increased level of arousal and thus an increase in speed. Some evidence derived by testing university students on the Nufferno Speed Tests supported this view, however, it was suggested that in the special case of introverted neurotic subjects, this advantage may partly be offset by task-interfering anxiety responses of such subjects.

Evidence supporting the hypothesis that some physiological abnormality is a cause of psychomotor slowness has also been derived from studies employing psychiatric patients. Claridge (1967) demonstrated that reactive schizophrenics, who have a high level of arousal, tend to be fast, while process schizophrenics who have an unusually low level of arousal, tend to be slower. Venables (1966b) has also reported evidence which supports an association between reaction time speed and cortical arousal. He found

that chronic schizophrenics who performed best on Koh's block test were those whose general Galvanic Skin Response increased most during the testing period.

Thus, both the distraction hypothesis, and the hypothesis stating that some physiological abnormality is the cause of psychomotor retardation in psychiatric patients have received some empirical support. However, studies supporting these hypotheses have been concerned, primarily, with schizophrenic patients. To conclude that one or the other of these hypotheses can explain psychomotor retardation in depressed patients is, therefore, largely a matter of extrapolation.

It was pointed out above that depressed patients improve on various tasks as their mental state improve. In other words, these patients improve on psychomotor tasks concommitantly with diminution of their anxieties, worries and depressive thoughts. This observation appears to be consistent with the cognitive theory of depression. On the other hand, it can be argued that the alternate hypothesis of physiological arousal mentioned could explain psychomotor retardation in depressed patients. Depressed patients are usually inactive, slowed down and lack spontaneity, suggesting that these patients are 'under-aroused'. Furthermore, it may be the case that both these postulated mechanisms may operate, depending on the diagnostic group under study. It can be reasoned that patients suffering from "agitated" depression may be slow due to distraction, whereas patients suffering from "retarded" or "endogenous" depression may be slow as a result of some physiological abnormality. It is clear that carefully controlled studies are needed before any of the above explanations of psychomotor retardation in depressed patients can be rejected or accepted.

Speech Rates

Although several investigators have pointed to the clinical significance of speech in various forms of psychopathology very few have systematically analysed the rate of speech in depressed and non-depressed individuals. Moreover, the variance of an individual's speech rate both when depressed and not depressed has received little consideration.

Sapir (1927) was the first to point to the potential usefulness of using 'non-content' aspects of speech to explore personality. Despite the lack of scientific studies it was accepted that manics speak quickly and that depressives speak at a slower rate (Eisenson, 1938). Newman and Mathers (1938) had fellow psychiatrists listen to and rate 40 tape recordings of the speech of patients with affective disorders. The results of this study supported the above assumption. However, this study presented no empirical evidence but relied on clinical judgement.

Since this time there has been a great deal of research primarily in the area of attempting to relate vocal features to various characteristics of personality (see Davitz, 1964; Kramer, 1963; Mahl and Shulze, 1964). In an extensive series of studies Goldman-Eisler (1951; 1954, 1955) systematically investigated the relationship of speech to individual factors. She concluded that patterns and rates of speech tended to be consistent within individuals.

The relationship of anxiety to the rate of production of speech has received considerable investigation. Several studies have indicated that both rate of speech and productivity increase with anxiety (Davids and Eriksen, 1955; Eisenman, 1966; Siegman and Pope, 1965a, 1965b). These studies have often been cited as validating the activation hypothesis. Mahl has presented evidence that anxiety generally disrupts complex speech behaviours and this accounts for the apparent increase in speed (Mahl and Shulze, 1964). In

spite of these different explanations speech disturbance appears to be a sensitive index of anxiety (Pope et. al. 1970).

Unfortunately, depression has not received the empirical attention as that given to anxiety. Moreover, it has been pointed out (Vetter, 1966:131) that the relationship between affective states and vocal behaviours has not adequately been examined. Some investigations (Fairbanks and Hoaglin, 1964, Feldstein, 1964) have employed acoustical measures of vocal behaviours to evaluate "actor simulated emotional" states. Trimboli (1973) has seriously questioned the assumed equivalency between simulated emotions and those present in affective states. Some investigators have examined the vocal behaviour of clinical populations (Kanfer, 1960; Pope et. al. 1970). Pope et. al. (1970) studied high-anxiety and low anxiety, and high-depression and low depression monologues from a sample of psychosomatic patients. Their results indicated that depression was negatively related to the rate of productivity and filled pauses and positively related to silent pauses.

Several investigators have used a mood induced procedure (MIP) in the analysis of the relationship between vocal behaviour and affective states. These studies have largely supported the view that speech rate is slow under conditions of induced depression and rapid under conditions of induced elation. Using such a procedure with 45 female college students, Natale (1977) demonstrated that induced depression was positively correlated to silent pauses, whereas induced elation evinced shorter response latencies and less silent pauses. However, the effect of mood induced states on behaviours other than speech has not produced consistent results, this is exemplified by two studies (Velton, 1968; Matheny et. al. 1977).

Some investigators have more appropriately, for the purpose of this

study, employed clinical populations in their analyses of the relationship between verbal behaviour and affective states. Aronson and Weintraub (1967) have presented evidence based on the verbal behaviour of severely depressed patients which demonstrates that divergence from normal verbal productivity diminishes as clinical improvement occurs and increases with non-improvement or deterioration in the mental state. Traux (1971) has demonstrated that moderately depressed schizophrenic patients who show improvement in depression also show a decrease in abnormal verbal productivity. Whilst in those who show no such improvement or become more depressed the opposite occurs. These findings support those of Aronson and Weintraub, and widens their implication because the study utilized a sample of moderate rather than severely depressed patients.

Thus Traux states:

> "... it appears that abnormality of verbal productivity is a legitimate and meaningful outcome measure for in therapy patients... thus there is now some evidence to support the use of abnormality of verbal productivity, obtainable from early and late therapy tape recordings as a outcome measure for studies in psychotherapy and counselling".

Hutt et. al. (1965) employed a procedure which closely approximates Traux's suggestion. These authors report on the assessment of a 33 year old female with manic-depressive psychosis in whom changes in mood state occurred every 2-3 weeks. On her fourth admission she was taken off all medication in order to determine temporal regularity of mood changes and to indentify physiological and behaviour precedents of subsequent mood, if any. Speech was chosen as the primary measure since prior observation had suggested its sensitivity to mood changes. The MPI and the Digit Symbol subtest of the WAIS were also used. Scores on the MPI, which are theoretically independent of mood altered considerably. Although reading speed did not alter with mood, talking speed

and length of sentences did.

The authors state that:

> "the association between mood state and speech rate was sufficiently consistent to enable prediction of the former from the latter" (1965).

Szabadi et. al (1976) were the first to systematically quantify elongation of pause and phonation time in depressed patients and compared this to "normal healthy volunteers". These investigators taped the "automatic speech" of four moderately depressed patients and four volunteers. Speech rate was constant for the volunteers over a two month period. Pause times were significantly elongated while the patients were depressed compared to pause times measured after recovery. Phonation times were constant throughout the course of the study.

Conclusions

Speech rate appears to be a legitimate outcome-measure in studies assessing the course of depressive episodes. The findings of Szabadi et. al (1976) concerning the use of automatic speech in this regard are encouraging. Automatic speech rates are quickly and easily obtained and appear to be a sensitive index of the course of depressive episodes. Therefore, other studies supporting the findings of Szabadi, et. al. (1976) are needed.

Hypothesis I

Depressed patients have a slower rate of automatic speech than normal subjects.

Hypothesis 2

The automatic speech rate of the normal subjects will show no significant variation in time, whilst that of the depressed patients will increase as the mental state improves.

Hypothesis 3

Those patients diagnosed as suffering from endogenous depression will show a greater diurnal variation in the automatic speech rates, with the slowest in the morning, than those diagnosed as suffering with reactive depression, and the normal subjects.

Hypothesis 4

(a) Other tests of psychomotor speed will distinguish the normal and depressed groups.

(b) The depressed group's scores on these tests of psychomotor speed will be significantly correlated with automatic speech rate.

(c) That automatic speech rate will be more highly correlated with depression than these other test of psychomotor speed.

# CHAPTER II

# METHOD

## Subjects

### Depressed Group

Criteria for Selection - This group consisted of 16 consecutive admissions to the psychiatric unit of St. Clare's Mercy Hospital who met the following criteria: (i) a diagnosis of depression on admission, (ii) between 20 to 60 years, (iii) absence of any significant physical illness, including an organic psychosyndrome, or, a history of an organic psychosyndrome, (iv) a score of 10 or more on the Beck Depression Inventory, and (v) a discharge diagnosis of depression, being agreed at a discharge conference, by all the staff psychiatrists ( the diagnosis also included the type of depression). As a result of these criteria four patients who were potential subjects were excluded from the study. One patient's diagnosis was changed to acute schizophrenia, two patients were thought to have organic psychosyndromes, and one patient's mental status was complicated by a severe hearing deficit.

### Personal and Social Characteristics of Subjects

(i) Sex - This group consisted of 13 women and three men.

(ii) Age - These patients ranged in age from 21 years to 59 years (women: 21 to 53; men 27 to 59) with an average age of 37 years for the total group (an average of 37 years for the women and an average of 38 years for the men).

(iii) Marital Status - Ten of the 13 women in this group were married, one was divorced, one widowed and one single. The three men were married.

(iv) Occupations - Ten of the women were housewives, one was a Registered Nurse, one a baby-sitter and the other stated that she had been unemployed for some time. One of the men was a janitor, one a plumber and the other a machine operator.

Clinical Characteristics of the Subjects

(i) Diagnosis and Treatment - The final diagnosis of the subjects, as mentioned above, was that reached by consensus at a Diagnostic Discharge Conference attended by all the staff psychiatrists. The diagnostic criteria used were those given in the ICD-9.

Two female members of this group were diagnosed as suffering from bipolar depression, depressed type and two males and six females were diagnosed as suffering from endogenous depression. Two females were diagnosed as suffering from depressive neurosis and one male and three females were diagnosed as suffering from reactive depression. For the purpose of comparison this group was divided into two smaller groups: (a) an Endogenous Depression group consisting of the 10 patients with bipolar and endogenous depression and (b) a Reactive Depression group consisting of the remaining six patients.

Eight members of the former group were treated with E.C.T. in addition to anti-depressant medication, and the other two members were treated with anti-depressant medication. The six members of the latter group were treated primarily by psychotherapy, but all received some form of medication.

The medication that all patients were receiving was initiated prior to the first assessment and was kept constant throughout the period of the investigation.

(ii) Previous Psychiatric History - This group varied considerably with regard to past psychiatric history. Five of the members had not previously been admitted to hospital for psychiatric treatment. Three of these members belonged to the Endogenous Depression group and two belonged to the Reactive Depression group. Two members of the group, a male and a female, had previously been admitted for psychiatric treatment on one occasion. The male, who had been admitted as a result of aggressive behaviour was at this admission diagnosed as suffering from reactive depression. The female, who had been diagnosed as suffering from puerperal depression after the birth of her child was now given a diagnosis of reactive depression.

Three females and one male had previously been admitted for psychiatric care on two occasions. Two of the females who had been diagnosed as suffering from depression on both occassions, were on this admission diagnosed as suffering from reactive depression and endogenous depression, respectively. The other female who was hospitalized following an overdose on the first occassion, and on the second occassion had been diagnosed as suffering from reactive depression, was at this admission diagnosed as suffering from reactive depression. The male who had been suffering with "bad nerves" on both previous occassions was diagnosed at this admission as suffering from endogenous depression.

Three of the females had previously been admitted for psychiatric care on three occassions. Two of these who were diagnosed as suffering from manic-depression at this admission, were previously diagnosed as suffering from mania, and from depression. The other woman who was diagnosed as suffering from depression on all three previous admissions, was diagnosed as suffering from endogenous depression on this admission.

One woman who had previously been hospitalized and diagnosed as suffering from endogenous depression on five occasions was on this admission diagnosed as suffering from endogenous depression.

The last member of this group has a history of eight previous admissions and was dignosed as suffering from depression on each of those admissions. On this admission she was diagnosed as suffering from endogenous depression. See Appendix A for case histories.

Normal Control Group

Reasons for Employing this Group - This group was tested in order that:

(i) the speech rates of these subjects could be compared with those of the depressed group.

(ii) the variance of the speech rates of these subjects over time could be assessed.

(iii) the diurnal variation of speech rates of normal subjects could be examined.

(iv) the effect of age and sex on the speech rates could be assessed.

Criteria for Selection - Volunteers were required to be in good mental and physical health. A prior condition was that volunteers receiving a score of seven or more on the Beck Depression Inventory were not to be accepted into this study. The group was selected so that there were four members in each of the following age groups, 20 - 29 years, 30 - 39 years, 40 - 49 years, and 50 - 59 years, and there were equal numbers of each sex in each age group.

Sex and Age - Thus eight men and eight women comprised this group. The women ranged from 29 years to 57 years with an average of (approximately) 40 years. The men ranged from 24 to 54 years with an average of (approximately)

40 years.

Occupations - Six of the women were Registered Nurses and two were secretaries. Three of the men were Nursing Assistants and two Graduate Students. The other three men consisted of an Occupational Therapist Aid, an Inventory Manager and a Resident M.D.

Marital Status - Four of the women in this group were married and two were single. Of the remaining women one was divorced and the other widowed. Five of the men were married and three were single.

Design

This study was designed to compare depressed patients and normal subjects on speech rates and other objective tests of psychomotor speed. Moreover, it was questioned whether or not these tests of psychomotor speed, particularly speech-rate, were related to the severity of depression. It was hoped to accomplish this goal by comparing the results of these tests of psychomotor function with global measures of depression, the Beck Depression Inventory and the Hamilton Rating Scale. Diurnality was assessed by administering these psychomotor tests and the Depression Adjective Checklist, which is sensitive to mood changes, both in the afternoon and morning of the same day.

Apparatus and Test Instruments

Speech Rate - The apparatus for this test consisted of a Sony Cassette-Corder, model TCM-787, and a Sony Electret Condenser Microphone. A Lafayette polygraph, model 76103, was connected to a speech activated switch (built by the Technical Services of the Health Science Complex) with an attack time capability of 20-60 milliseconds and a decay time capability of 30-175 milliseconds. All tracing were made with an attack time of 20 milliseconds

and a decay time of 30 milliseconds. Connecting the Cassette-Corder to this apparatus and activating it produces voice prints on (Lafayette) calibrated paper. The running speed of the paper was adjustable. All voice prints were made with the paper running at 50 millimeters/second. This method of obaining quantifiable voice prints is very simple and efficient. It is far simpler than the method employed by Szabadi et al. (1976) which involved playing the taped recording through an oscilloscope, filming the signals displayed on the oscilloscope's screen by the use of a Gross cine camera, developing the film, and then projecting it on a screen and magnifying it.

Tapping Test - A copy of the Lafayette tapping board was used in this study. It is a board 45.7 cms. long with a sheet of paper 8.3 cms. square at each end. A piece of blotting paper was affixed under each piece of paper to increase the indentation.

Reaction Time - The reaction time apparatus consisted of an electronic counter calibrated in 1/100 (one-hundredths) of a second. Attached to this was a counter box with an "on-off" switch, a second switch which determined the type of stimulus presented, and a button which simultaneously started the clock and presented the stimulus. A vertical piece of board excluded the controls from the subject's view. The subject responded to the stimulus by releasing a telegraphic key, which stopped the counter.

Reasons for Using Reaction Time and Tapping Speed - Seashore, Buxton and McClullom (1940) factor analysed several components of fine psychomotor movement and found three major factors, speed of initiation, speed of oscillatory movement and precision. The reaction time test measures speed

of initiation and the tapping test measures speed of oscillatory movements. The tapping test is also a (gross) measure of precision because only those dots falling within the designated squares are counted.

By comparing the results of these tests with the speech rate, and examining their relationship to the global indicators of depression over the course of a depressive episode, it was hoped to identify which of these tests was the best indicator of depression. This is especially relevant because reaction time has been considered a sensitive indicator of psychopathology. In addition, it was of interest to determine if scores on reaction time and the tapping test were subject to diurnal variation.

Clinical Instruments

These consisted of the Beck Depression Inventory (Beck, 1975), the Hamilton Rating Scale (Hamilton, 1960) and the Depression Adjective Checklists (Lubin, 1965).

Reasons for Using These Clinical Instruments - The Beck Depression Inventory was employed as it is one of the more widely used, and recognised as the best test instrument for measuring the severity of depression. Investigators who may wish to replicate this study can easily match subjects on the severity of depression.

The Hamilton Rating Scale was employed because it is appropriate for the use by an independent observer and yields scores against which the reliability of other scales and tests can be precisely judged (Court, 1970). The Hamilton Rating Scale is also able to assess change over the course of treatment, although some patients exhibit symptomatic changes not covered by the items on this scale. However, it should be noted that this scale is not a diagnostic tool but provides a measure of the degree of depression

among patients after the diagnosis has already been made.

The examination of diurnality of affect on a fairly regular basis requires an instrument sensitive to mood changes with multiple parallel forms. The Depression Adjective Checklists, with several parallel forms, met these criteria. Forms A, B, C, D, E and G were used.

Procedure

Depressed Group

Order of Administrating Tests and Scales - Testing was usually started with these patients the day after admission with the stipulation that the initial test session occur no later than 48 hours after admission. Thereafter patients were scheduled to be tested on a weekly basis until discharge with the provision that no testing occur on those days on which patients received E.C.T. One follow-up testing session was also scheduled for four to six weeks after the discharge.

On each test-day excepting follow-up, patients were tested at two occassions. This took place between 8:30 A.M. and 10:30 A.M. and again between 4:00 P.M. and 5:45 P.M. At follow-up patients were scheduled to be tested between 8:30 A.M. and 10:30 P.M.

At the morning test sessions the tests and clinical scales were administered in the following sequence: (a) the Beck Depression Inventory, (b) the Depression Adjective Checklist, (c) the Speech Test, (d) the Tapping Test and (e) the Reaction Time Test. The Hamilton Rating Scale was not completed at the testing sessions. Interviews which formed the basis of this scale were conducted at various times between A.M. and P.M. testing sessions. At the afternoon testing sessions the tests were administered in the following sequence: (a) The Depression Adjective Checklist, (b) The Speech Test

(c) The Tapping Test and (d) The Reaction Time Test.

Test Instructions

The Beck Depression Inventory - Pointing to items of this inventory the examiner stated the following: "Each of these items, (A), (B), (C) and so on have several statements - one, two, three, and four..... I would like you to read each of these statements carefully for each of the items, (A), (B), (C) and so on, and then pick one statement of the four which best describes your feelings and behaviour..... Do you have any questions?" This procedure was explained until the subject understood what was required of him or her.

The Depression Adjective Checklist - Subjects were asked to read the instructions on this checklist. Afterward it was emphasized that they check those adjectives which described their feelings at the present time.

The Speech Test - Subjects were asked to speak into a microphone after the following instructions were given: "When I touch my thumb with this index finger..... ( the examiner showed the subject his index finger) I want you to count from one to twenty at your own pace". The subjects were required to count from one to twenty, three times, with a pause of 10 seconds between each trial.

Tapping Test - The subjects were seated with the tapping board before them and a sharpened pencil in the middle of the board. The following instructions were given: "When I say 'ready' pick up the pencil before you. When I say 'go' I want you to tap as rapidly as you can from one piece of white paper to the other with the point of the pencil. When I say 'stop' stop tapping immediately". Three trials, each lasting 10 seconds, were given at each test session, with a 30 second pause between each trial. Each sub-

ject was given 2 practice trials at their initial testing session.

Reaction Time - Subjects were seated with the telegraphic key directly before their preferred hand. The following instructions were given: "When I say 'ready' I want you to press the telegraphic key with the index finger of your preferred hand. Some seconds after this you will hear a buzzer like this (the examiner sounded the buzzer) when you hear the buzzer release the key as quickly as possible. Do you have any questions?". Subjects were given three trials with preparatory intervals of 6 (reaction time-A), 12 (reaction time-B) and 2 (reaction time-C) seconds respectively. At each testing session the order of presentation was randomized. Each subject was given 6 practice trials at the initial test sessions with two trials at each Preparatory Interval.

The Hamilton Rating Scale - Two psychiatrists conducted the interviews which formed the basis of this rating. These interviews took place on those days on which patients were tested on the other tests, and were not scheduled for any particular time of the day. Most interviews were conducted by only one of the psychiatrists (48 out of a total of 61). Both psychiatrists were present at 13 of the interviews and independently rated the patients on the Hamilton Rating Scale. This resulted in a inter-rater reliability of .765.

Control Group

Each member of this group was tested on four days, twice each day and between similar time periods as the depressed group. These testing sessions occurred over a 7 week period. The second test-day occurred one week after the first, the third test-day was 2 weeks after the first and the fourth test-day was 7 weeks after the first.

At the initial testing session these subjects received the Beck

Depression Inventory, the Speech Test, the Tapping Test and the Reaction Time Test in that order of presentation. Only the Speech Test, the Tapping Test and the Reaction Time Test, in that order were administered at the remaining seven sessions. This group received identical instructions and an equal number of practice trials on the various tests as did the depressed group.

Reasons for Occasions of Testing - Testing was conducted on the above stated occassions in order that both groups would be tested over similar periods of time. The average length of stay on the psychiatric unit where this study was conducted was 22 days. It was therefore reasonable to expect that patients included in this study would spend about two weeks on the unit and, therefore, data obtained weekly, from both groups, could be compared. In addition, follow-up data would be obtained from both groups approximately five weeks after their last testing session.

Data Preparation and Analysis

Test Scores

Total Speech and Pause Time Scores - The graph paper on which the voice prints were produced was set to run at a speed of 50mm/second. The speed was chosen by trial and error as the optimum one for analysis of the voice prints. At this speed each square on the graph paper represented 1/25 of a second and this facilitated calculation of time. Multiplying the total number of squares which comprised a complete voice print of counting from one to twenty by $\frac{1}{25} \times 100$ (or x 4) resulted in the total time of each counting trial, calculated in one hundredths of a second. Thus a voice print of 300 squares resulted in a total speech score of 300x4 = 1200 hundredths of a second (12 seconds).

The average score of the three total speech trials given each sub-

ject at each test session was used in the analysis of the data. The average scores were used because there were no significant differences between the scores obtained on the first, second and third trials, at particular test sessions for both the depressed and normal groups.

Pause time scores were obtained by adding together those troughs in the voice prints of one square or more which were at the level of the resting potential of the pen-recorder (see Figure 1). This was done for each of the trials at each test session. The average scores of the three trials given each subject at particular test sessions was used in further analysis. The average score was used because there were no significant differences between the scores obtained at the first, second and third trials at particular sessions, for both the depressed and normal groups. A sample of an initial portion of a voice print is presented in Figure 1.

Sighs and deep breaths which registered as small peaks on the voice prints, were considered pauses. By listening to the taped recordings, with the aid of headphones, while observing the development of the voice prints, the investigator was able to distinguish sighs and deep breaths from the articulation of digits and indicate this on the prints.

Tapping Scores - Subjects were administered three tapping test trials at each test session. The average score of the three trials was used as there were no significant differences between the scores obtained on the first, second and third trials, at particular test session, for both the normal and depressed groups.

Reaction Time - Three preparatory intervals (P.I.S.) were used in obtaining scores of reaction time. Throughout the remainder of this discourse each reaction time trial will be distinguished by refering to them as

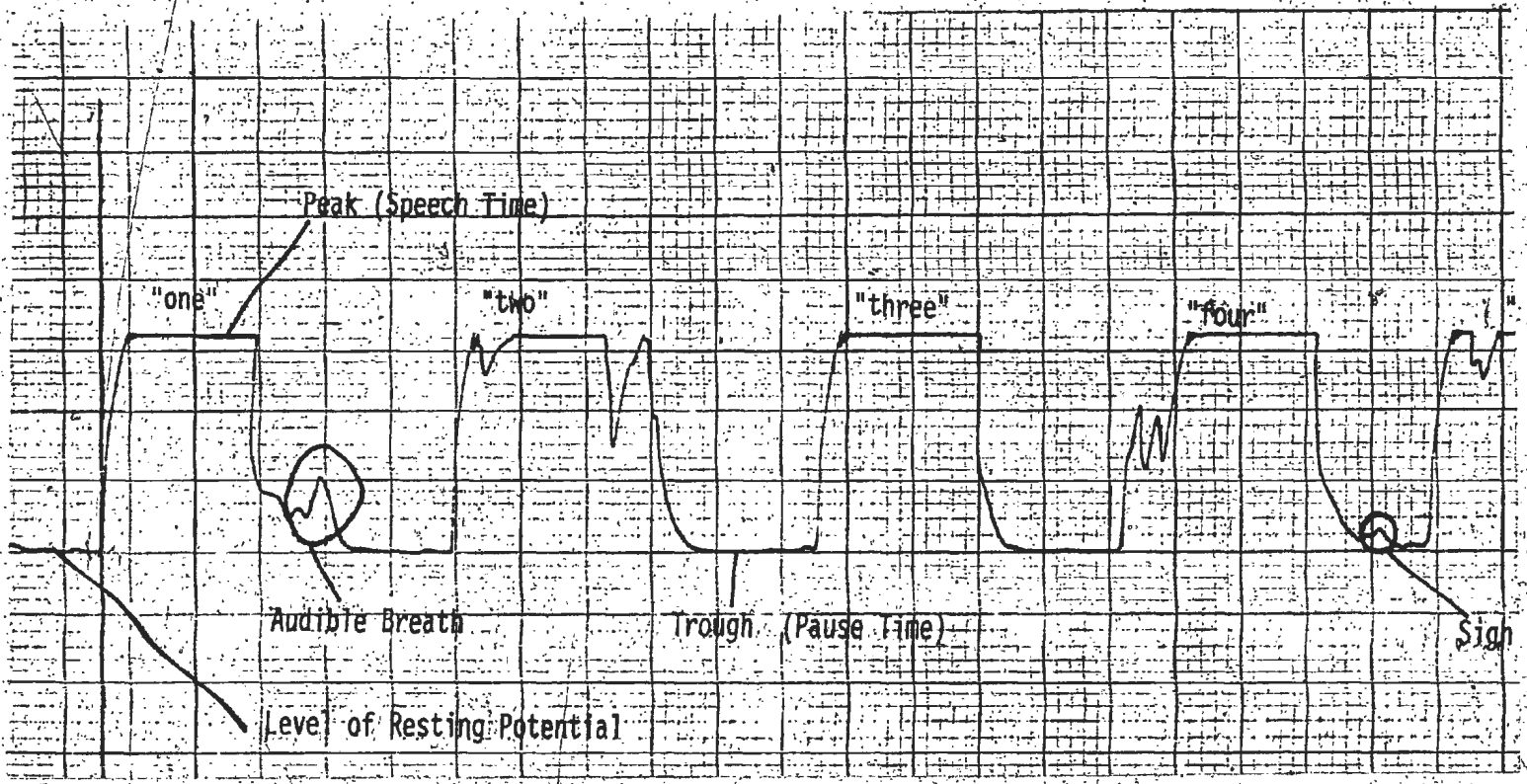



Figure 1. A Portion of a Voice Print Depicting Peaks, Troughs and the Level of Resting Potential.

reaction time-A, reaction time-B and reaction time-C. Reaction time-A refers to that trial with a 6 second P.I., reaction time-B refers to that trial with a 12 second P.I., and reaction time-C refers to that trial with a 2 second P.I.

Other Scores - Scores on the other tests and inventories were not tranformed in any way.

Rationale for the Data Used

Data Obtained while patients were Hospitalized

Members of the depressed group were hospitalized for various periods of time. As a result data obtained from the depressed group and the normal group could not be compared over the four occasions of testing as was the original intention. Six patients remained in hospital for less than two weeks and were therefore tested on two days while hospitalized - admission and one week thereafter.

Consequently, analyses of variance comparing data obtained by the two groups was conducted on those data collected on the initial test day and the second test day, as both groups were completely tested on these occassions.

For those analyses which involved comparing scores obtained by the depressed group over time in order to detect possible improvements on various tests, data collected at admission and pre-discharge was compared. The pre-discharge data was employed because at this time all members of this group were in a relatively similar clinical state as they were soon to be discharged. Also the differing numbers of testing sessions administered to the depressed subjects made comparisons between any sessions other than admission and pre-discharge impraticable.

Follow-up Data

There were several problems concerning the collection of follow-up

data on the depressed subjects. Three of these patients did not keep any of their appointments. As a result their previous, respective, test scores were averaged and these averages were used as follow-up data. This procedure was employed as it is one of the more conservative methods of accounting for missing data.

The remaining subjects, due to uncontrollable circumstances, were tested between three weeks and eight weeks after their pre-discharge test session.

Moreover, four of these subjects were tested in the afternoon.

In view of these occurences follow-up results are presented separately.

Data Analysis

The multiple Regression sub-program of the computer program "Statistical Package for the Social Sciences" (see Nie et. al 1975) was used for the analysis of the data collected.

The multiple regression sub-program was employed because of its flexibility, ability to compare unequal ns, ability to analyzed a repeated measures design and ability to analyze several variables. Moreover, this program is able to compute many statistics.

This program was slightly modified by employing a technique of coding subjects developed by Pedhazur (1976). This technique greatly facilitates the coding of subjects in repeated measures designs. Instead of using K-1 vectors to code individual subjects (K=number of subjects), subjects are coded by totaling their individual scores obtained on the dependent variable(s) over all occassions of testing. This total score is placed on each data record which represents the data collected at a particular occassion. Thus data records are less cumbersome and computation is facilitated.

# CHAPTER III

## RESULTS

The results will be reported as they bear upon hypotheses stated in the introduction.

A. Differences Between Normal and Depressed Subjects

The first hypothesis stated that depressed patients have a slower rate of automatic speech than normal subjects. This was tested by (a) comparing the total time taken by the respective groups to complete the speech test and (b) comparing the pause times of these groups while completing the speech test. Table 1 shows the means and standard deviations of total speech scores for the normal group and the depressed group obtained on the initial test day and the second test day.

Table 1

Mean Total Speech Times of Depressed and Normal Subjects Obtained on the Initial and Second Test Day, A.M. and P.M.

| Subjects | | A.M. | | P.M. | |
|---|---|---|---|---|---|
| Initial Testing | n | $\bar{x}$ | S.D. | $\bar{x}$ | S.D. |
| Depressed | 16 | 1412.91 | 395.950 | 1115.33 | 288.678 |
| Normal | 16 | 963.06 | 290.180 | 808.37 | 249.780 |
| Second Testing | | | | | |
| Depressed | 16 | 997.41 | 273.49 | 1020.16 | 301.51 |
| Normal | 16 | 769.91 | 206.81 | 757.89 | 205.98 |

Analysis of variance indicated that the normal group and the

depressed group differed significantly with regard to total speech scores obtained at the morning (A.M.) test session, $F$ (1,30)=13.437, $P<.01$ and the afternoon (P.M.) test session, $F$ (1.30)=10.345, $P<.01$, on the initial day of testing. These groups also differed significantly with regard to total speech scores collected at the A.M. testing session, $F$ (1,30)=6.966, $P<.05$, and the P.M. testing session, $F$ (1,30)=8.336, $P<.01$, conducted on the second test day. These results are summarized in Table 2.

Table 2

ANOVA Summary of Normal and Depressed Group Comparison on Total Speech Scores

| | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| **INITIAL DAY** | | | | | |
| A.M. | Reg. | 1618956.2 | 1 | 1618956.24 | 13.437** |
| | Res. | 3614651.4 | 30 | 120488.38 | |
| P.M. | Reg. | 762100.2 | 1 | 762100.20 | 10.532** |
| | Res. | 2170905.7 | 30 | 72363.53 | |
| **SECOND TEST DAY** | | | | | |
| | Reg. | 407704.6 | 1 | 407704.58 | 6.966* |
| | Res. | 1755860.5 | 30 | 58528.68 | |
| | Reg. | 557655.2 | 1 | 557655.21 | 8.336** |
| | Res. | 2006840.7 | 30 | 66894.69 | |

* Significant at .05; ** Significant at .01

Table 3 shows the means and standard deviations of pause time scores obtained by the depressed group and the normal group on the initial day and second day of testing.

Table 3

Mean Pause Time scores of Depressed and Normal Subjects on Initial and Second Day of Testing, A.M. and P.M.

| Subjects | | A.M. | | P.M. | |
|---|---|---|---|---|---|
| Initial Testing | n | $\bar{x}$ | SD | $\bar{x}$ | SD |
| Depressed | 16 | 443.29 | 280.490 | 234.08 | 178.824 |
| Normal | 16 | 124.41 | 156.502 | 75.41 | 110.370 |
| Second Testing | | | | | |
| Depressed | 16 | 165.62 | 150.771 | 180.00 | 202.819 |
| Normal | 16 | 49.66 | 59.810 | 42.83 | 51.800 |

These groups differed significantly with regard to pause time scores obtained at both the A.M. testing session, $F$ (1,30)=15.770, $P<.01$, and the P.M. testing session, $F$ (1,30)=9.121, $P<.01$, on the initial day of testing. On the second test day these groups differed significantly on pause time scores obtained at both the A.M. testing session, $F$ (1,30)=8.670. $P<.01$, and the P.M. testing session, $F$ (1,30)=6.889, $P<.05$. These results are presented in Table 4.

Table 4

ANOVA Summary of Normal Group and Depressed Group Comparison on Pause Time Scores

| | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| **INITIAL DAY** | | | | | |
| A.M. | Reg. | 813449.8 | 1 | 813449.85 | 15.77** |
| | Res | 1547511.8 | 30 | 51583.72 | |
| P.M. | Reg. | 201507.7 | 1 | 201507.68 | 9.127** |
| | Res. | 662175.8 | 30 | 22072.51 | |
| **SECOND DAY** | | | | | |
| A.M. | Reg. | 96208.0 | 1 | 96207.99 | 8.670** |
| | Res. | 332899.9 | 30 | 11096.67 | |
| P.M. | Reg. | 151985.1 | 1 | 151985.12 | 6.889* |
| | Res. | 661898.6 | 30 | 22063.29 | |

* Significant at .05; ** Significant at .01

B. Variation in Automatic Speech Rates Over Time

Hypothesis 2 stated that the automatic speech rate of normal subjects will not vary significantly over time whilst that of depressed patients will increase as mental state improves. Thus, as depressed patients show improvement on clinical scales an increase in speech rate is predicted. But, in the case of the depressed group, to merely demonstrate a significant relationship between the clinical scales and speech rate at (a) the initial testing (when scores on the clinical scales were highest) and at (b) pre-discharge (when scores on the clinical scales were lowest), is not adequate support for this hypothesis. However, a significant improvement in speech rate and in scores on the clinical scales from admission to pre-discharge, in addition to sign-

ificant relationships between the clinical scales and speech rates, at these respective occassions of testing, would lend considerable support to this hypothesis.

i) Depressed Group

Table 5 shows the means and standard deviations of the Beck, Hamilton, Total Speech and Pause Time scores of the depressed group obtained on the initial test day and at pre-discharge. The test for significance of the difference between means for correlated samples was used to test for differences between mean scores obtained on the respective variables, over the occassions of testing indicated above.

Mean Beck scores obtained at admission and at pre-discharge were significantly different, $t$ (14)=5.82, $P<.001$. The difference between mean Hamilton scores obtained at the stated occassion of testing was also significant, $t$ (14)=7.10, $P<.001$. The difference between the mean total speech scores obtained at the A.M testing sessions, at admission and pre-discharge, was significant, $t$ (14)=5.318, $P<.001$, and the mean total speech scores obtained at the P.M. testing sessions at admission and pre-discharge also differed significantly, $t$ (14)=3.33, $P<.01$. The mean pause time scores obtained at the A.M. testing sessions at admission and pre-discharge also differed significantly, $t$ (14)=5.097, $P<.001$, and the mean pause time scores obtained at the P.M. testing sessions also differed significantly, $t$ (14)=3.449, $P<.01$. These results are presented in Table 5.

Table 5

Changes in Mean, Beck, Hamilton, Total Speech (TSP) and Pause (PS) Scores from Admission to Pre-Discharge for the Depressed Group

| | | Initial Day | | Pre-Discharge | | | |
|---|---|---|---|---|---|---|---|
| | Test | $\bar{x}$ | SD | $\bar{x}$ | SD | df | t |
| A.M. | Beck | 27.00 | 9.75 | 11.75 | 9.64 | 14 | 5.82** |
| | Ham. | 23.38 | 6.66 | 6.13 | 5.55 | 14 | 7.100** |
| | TSP | 1412.91 | 395.95 | 918.00 | 262.23 | 14 | 5.318** |
| | PS | 443.29 | 290.49 | 113.31 | 138.86 | 14 | 5.097** |
| P.M. | TSP | 1117.02 | 286.94 | 901.12 | 296.71 | 14 | 3.33* |
| | PS | 234.12 | 178.78 | 106.08 | 202.34 | 14 | 3.449* |

** Significant at .001 level, * Significant at .01 level

In order to determine the relationships between scores on the clinical scales (the Beck and the Hamilton) and speech rate scores (total speech and pause time scores) product-moment correlation coefficients obtained from the computer print-out were checked for significance by means of the "table of critical values of the correlation coefficients".

Significant correlations between the clinical scales and speech rate did not exist for those scores obtained on the initial test day. Beck scores obtained at pre-discharge were not significantly related to total speech scores or the pause time scores obtained at this time. Total speech scores obtained at the A.M. testing session at pre-discharge were significantly correlated with Hamilton scores obtained at pre-discharge, $r$ (14)=.626, $P<.01$, and total speech scores obtained at the P.M. testing session at pre-discharge were significantly related to Hamilton scores

obtained at pre-discharge, $r$ (14)= .494, $P<.05$. Pause time scores obtained at the A.M. pre-discharge testing session were significantly related to the Hamilton scores obtained at pre-discharge, $r$ (14)= .584, $P>.01$, but pause time scores obtained at the P.M. pre-discharge testing session were not significantly correlated with the Hamilton scores obtained at pre-discharge. These results are presented in Table 6.

Table 6

Correlations Between Clinical Scales and Total Speech (TSP) and Pause Time (PS) scores

| | Admission | | | | Pre-Discharge | | | |
|---|---|---|---|---|---|---|---|---|
| | A.M. | | P.M. | | A.M. | | P.M. | |
| | TSP | PS | TSP | PS | TSP | PS | TSP | PS |
| Beck | 0.015 | -0.030 | 0.175 | 0.247 | 0.266 | 0.198 | 0.049 | -0.270 |
| Haml. | 0.052 | 0.020 | 0.083 | 0.135 | 0.626** | 0.584** | 0.494* | 0.372 |

** Significant at .01 level

* Significant at .05 level

ii) Normal Group

The means and standard deviations of total speech scores and pause time scores for the normal group are presented in Table 7.

Table 7

Changes in Mean Total Speech Scores and Mean Pause Time Scores over Occassions of Testing

| Tests | | A.M. | | P.M. | |
|---|---|---|---|---|---|
| Initial Testing | n | $\bar{x}$ | SD | $\bar{x}$ | SD |
| Total Speech | 16 | 963.06 | 290.180 | 808.37 | 249.781 |
| Pause | 16 | 124.41 | 156.502 | 75.41 | 110.373 |
| 2nd Testing | | | | | |
| Total Speech | 16 | 769.91 | 206.807 | 757.89 | 205.984 |
| Pause | 16 | 49.66 | 59.805 | 42.83 | 51.801 |
| 3rd Testing | | | | | |
| Total Speech | 16 | 730.00 | 200.57 | 704.00 | 182.6 |
| Pause | 16 | 34.58 | 44.96 | 26.49 | 27.07 |
| 4th Testing | | | | | |
| Total Speech | 16 | 732.58 | 200.07 | 692.71 | 215.91 |
| Pause | 16 | 30.00 | 48.21 | 22.17 | 43.33 |

As can be seen in Table 7 mean total speech scores obtained at the A.M. testing sessions decreased sharply from 963.06 at the initial testing to 769.91 at the second testing. Thereafter the decrease was not as sharp. Mean total speech scores obtained at the P.M. testing session followed a similar trend over the occassions of testing. Mean pause time scores showed a sharp decline from 124.41 obtained at the A.M. initial testing to 49.66 obtained at the second testing. Thereafter the decrease was not as pronounced. Mean pause time scores obtained at the P.M. testing sessions exhibted a similar trend over time.

Tests for the significance of the difference between correlated means was conducted on some of this data. Mean total speech scores obtained at the A.M. testing session on the initial test day and the second test day differed significantly, $t$ (14)=2.407, $P<.05$, but the mean total speech scores obtained at the P.M. testing sessions on the initial test day and the second test day, $t$ (14)=2.07, just failed to reach statistical significance.

Mean pause time scores obtained at the A.M. testing sessions on the initial test day and the second test day differed significantly, $t$ (14) =2.22, $P<.05$, but the mean pause time scores obtained at the P.M. testing day, $t$ (14)=2.04, did not reach statistical significance. These results are summarized in Table 8.

Table 8

Difference Between Mean Total Speech Scores and Mean Pause Time Scores Obtained on Initial and Second Test Day, A.M. and P.M.

| | Test | Initial Day | | Second Day | | | |
|---|---|---|---|---|---|---|---|
| | | $\bar{x}$ | SD | $\bar{x}$ | SD | df | t |
| A.M. | Tot. Sp. | 963.06 | 290.180 | 769.91 | 206.807 | 14 | 2.407* |
| | Pause | 124.41 | 156.502 | 49.66 | 59.805 | 14 | 2.22* |
| P.M. | Tot. Sp. | 808.37 | 241.781 | 757.89 | 205.984 | 14 | 2.07 |
| | Pause | 75.41 | 110.373 | 42.83 | 51.801 | 14 | 2.04 |

* Significant at $P < .05$

Similar analyses were conducted on total speech and pause time scores obtained on the second test day and the third test day. Mean total speech scores obtained at the A.M. testing sessions on the second and third test days did not differ significantly $t$ (14)=2.129 but mean total speech scores

obtained at the P.M. test sessions on these test days, $t$ (14)=2.700, P<.05 differed significantly.

Mean pause time scores obtained at the A.M. testing sessions on the second and third test days did not differ significantly $t$ (14)=1.890 whereas mean pause time scores obtained at P.M. testing sessions on these occassions of testing were significantly different $t$ (14)=2.276, P<.05. These results are presented in Table 9.

Table 9

Differences Between Mean Total Speech and Mean Pause Time Scores Obtained on the Second and Third Test Days, A.M. and P.M.

| | Test | Second Day | | Third Day | | | |
|---|---|---|---|---|---|---|---|
| | | $\bar{x}$ | SD | $\bar{x}$ | SD | df | $t$ |
| A.M. | Tot. Sp. | 769.9 | 206.8 | 730.0 | 200.6 | 14 | 2.129 |
| | Pause | 49.7 | 59.8 | 34.6 | 45.0 | 14 | 1.890 |
| P.M. | Tot. Sp. | 757.8 | 205.98 | 704.0 | 182.60 | 14 | 2.700* |
| | Pause | 42.8 | 51.80 | 26.5 | 27.07 | 14 | 2.276* |

* Significant at .05

Similar analyses were conducted on total speech scores and pause time scores obtained on the third and fourth day of testing. There was no significant difference between mean total speech scores or between mean pause time scores obtained at either the A.M. or P.M. testing session on these test days. Figure 2 is a graphical representation of total speech and pause time scores, obtained by the normal group over the occassions on which they were tested.

Diurnal Variation in Automatic Speech Rate

Hypothesis 3 stated that patients diagnosed as suffering from

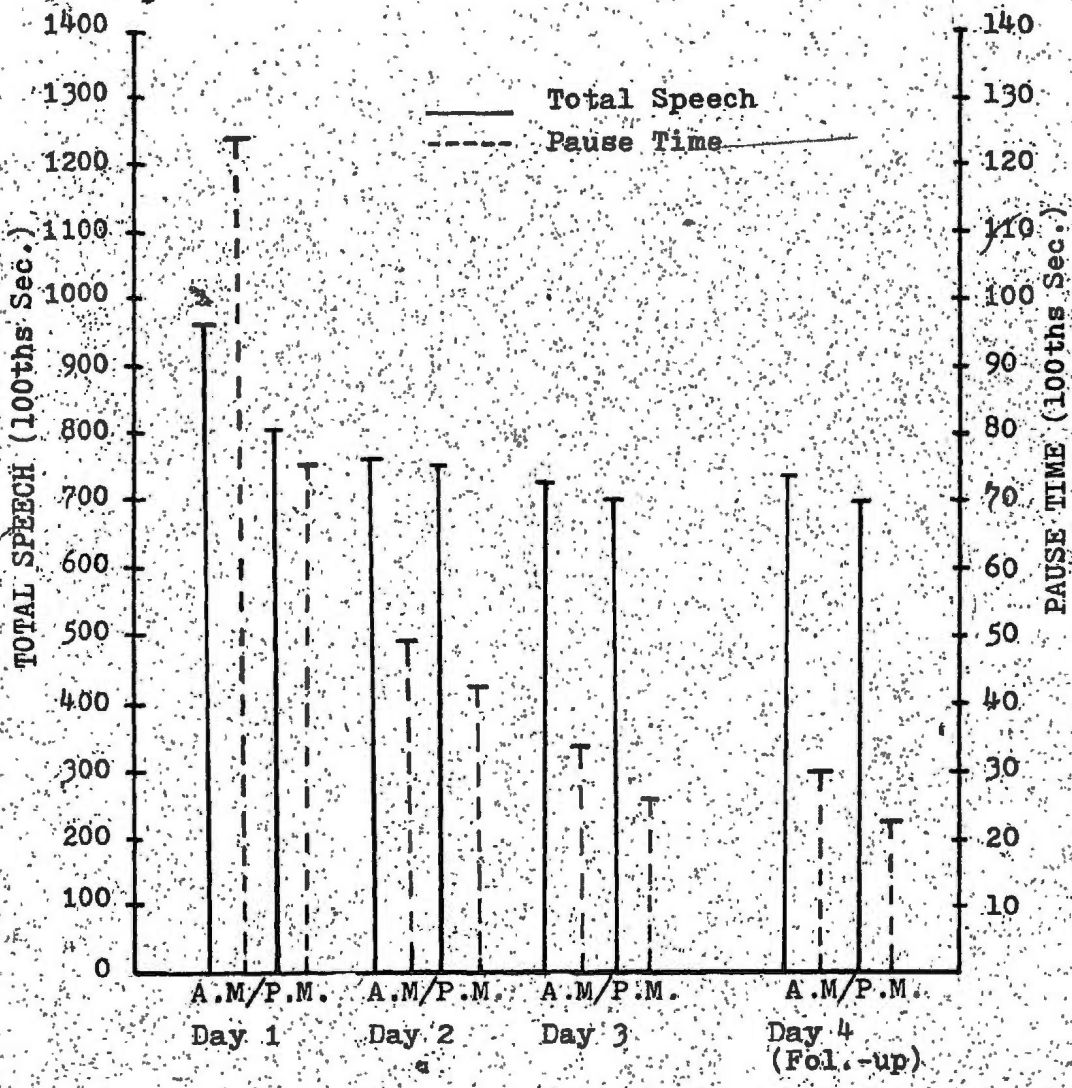



Figure 2.Changes in Normal Subjects Total Speech and Pause Time Scores Over Occassions of Testing

endogenous depression will show a greater diurnal variation in their automatic speech rates, with the slowest in the morning, than those diagnosed as suffering from reactive depression and the normal subjects. Table10 shows the morning and afternoon mean total speech scores for the depressed group and its sub-groups, the endogenous depression group and the reactive depression group, obtained on the initial test day and at pre-discharge. These occassions of testing, initial day and pre-discharge, were chosen as many depressed subjects were tested on only two occassions while hospitalized, the second of which was pre-discharge. It was therefore of interest to observe if diurnality of speech rate, if present on the initial test day would also be present at pre-discharge when there was significant improvement on the clinical scales.

As can be seen in Table10, the mean total speech scores obtained on the initial day of testing were significantly slower at the A.M. test session than at the P.M. test session for the depressed group, $t$ (14)=3.911, $P<.01$, the group suffering from endogenous depression, $t$ (18)=4.25, $P<.01$ and the group suffering from reactive depression, $t$ (4)=10.449, $P<.001$. Mean total speech scores obtained at the pre-discharge A.M. and P.M. testing sessions did not differ significantly for any of the three groups mentioned above.

Table 10

Differences Between Mean Total Speech A.M. and P.M. Scores of the Depressed, Endogenous and Reactive Groups on Initial Test Day and Pre-Discharge

| Subjects | n | A.M. | | P.M. | | |
|---|---|---|---|---|---|---|
| Initial Testing | | $\bar{x}$ | SD | $\bar{x}$ | SD | t |
| Depressed | 16 | 1412.9 | 395.95 | 1115.3 | 288.67 | 3.911** |
| Endogenous | 10 | 1538.0 | 424.27 | 1233.9 | 289.63 | 4.25** |
| Reactive | 6 | 1204.4 | 250.70 | 917.8 | 115.17 | 10.449*** |
| Pre-Discharge | | | | | | |
| Depressed | 16 | 918.0 | 262.23 | 901.1 | 296.71 | 0.54 |
| Endogenous | 10 | 973.5 | 319.04 | 939.73 | 373.85 | 1.29 |
| Reactive | 6 | 825.6 | 81.69 | 836.8 | 72.19 | 0.69 |

** Significant at .01

*** Significant at .001

Table 11 shows the A.M. and P.M. mean pause time scores obtained on the initial test day and pre-discharge, by the depressed group, the group suffering with endogenous depression and the group suffering from reactive depression.

As can be seen in Table 11 the depressed group's A.M. pause time scores obtained on the initial test day were significantly slower than those obtained at the P.M. testing session, $t$ (14)=4.50, $P<.001$. Mean A.M. pause time scores obtained on the initial test day by the endogenous group and the reactive group were significantly slower than mean P.M. pause time scores, $t$ (8)=5.376, $P<.001$, and, $t$ (4)=9.485, $P<.001$, respectively.

Table 11

Differences Between Mean Pause Time A.M. and P.M. Scores of the Depressed, Endogenous and Reactive Groups on Initial Test Day and Pre-Discharge

| Subjects | | A.M. | | P.M. | | |
|---|---|---|---|---|---|---|
| Initial Testing | n | $\bar{x}$ | SD | $\bar{x}$ | SD | t |
| Depressed | 16 | 443.29 | 280.490 | 234.08 | 178.824 | 4.50*** |
| Endogenous | 10 | 533.13 | 292.975 | 307.46 | 182.204 | 5.376*** |
| Reactive | 6 | 293.55 | 196.150 | 111.78 | 86.353 | 9.485*** |
| Pre-Discharge | | | | | | |
| Depressed | 16 | 113.31 | 138.856 | 106.08 | 202.335 | 0.28 |
| Endogenous | 10 | 147.43 | 187.806 | 134.13 | 255.854 | 0.53 |
| Reactive | 6 | 56.44 | 30.784 | 59.33 | 38.131 | 0.46 |

*** Significant at .001

Similar analyses were conducted on the mean total speech scores of the normal group for the data collected on all four test days. Table 12 shows that mean total speech scores obtained at the morning testing session were slower than mean total speech scores obtained at the P.M. testing session on each of the four test days. Mean A.M. total speech scores were significantly slower than mean P.M. total speech scores on the initial test day, $t$ (14)=2.99, $P<.01$. Mean total speech scores A.M. and P.M. scores did not differ significantly for the data collected on the second test day. Mean total speech scores obtained at the A.M. and P.M. testing sessions on the third test day differed significantly, $t$ (14)=2.25, $P<.05$, and mean A.M. and P.M. total speech scores obtained on test day four also differed significantly, $t$ (14)=2.980, $P<.01$. These results are presented in Table 12.

Table 12

Differences Between Mean Total Speech A.M. and P.M. Scores for the Normal Group on Test Days One, Two, Three and Four

| A.M. $\bar{x}$ | A.M. SD | P.M. $\bar{x}$ | P.M. SD | df | t |
|---|---|---|---|---|---|
| **Initial Test Day** | | | | | |
| 963.06 | 290.180 | 808.37 | 249.781 | 14 | 2.99** |
| **Second Test Day** | | | | | |
| 769.91 | 206.807 | 757.89 | 205.984 | 14 | 0.66 |
| **Third Test Day** | | | | | |
| 730.00 | 200.570 | 704.000 | 182.600 | 14 | 2.25* |
| **Fourth Test Day** | | | | | |
| 732.58 | 200.07 | 692.71 | 215.91 | 14 | 2.98** |

* Significant at .05; ** Significant at .01

Table 13 shows that the mean pause time scores for the normal group were greater at the morning testing sessions than at the afternoon testing sessions on all four test days. Mean A.M. and P.M. pause time scores obtained on the initial test day were significantly different, $t$ (14) =2.20, $P<.05$. Mean A.M. and P.M. pause time scores did not differ on the second and third test days respectively. On the fourth test day mean A.M. and P.M. pause time scores were significantly different, $t$ (14)=2.170, $P<.05$. These results are presented in Table 13.

Table 13

Differences Between Mean Pause Time A.M. and P.M. Scores for the Normal Group on Test Days One, Two, Three and Four

| A.M. | | P.M. | | | |
|---|---|---|---|---|---|
| $\bar{X}$ | SD | $\bar{X}$ | SD | df | t |
| **Initial Test Day** | | | | | |
| 124.4 | 156.50 | 75.4 | 110.37 | 14 | 2.20* |
| **Second Test Day** | | | | | |
| 49.7 | 59.81 | 42.8 | 51.80 | 14 | 0.69 |
| **Third Test Day** | | | | | |
| 34.6 | 45.0 | 26.5 | 27.1 | 14 | 1.63 |
| **Fourth Test Day** | | | | | |
| 30.0 | 48.2 | 22.2 | 43.3 | 14 | 2.17* |

* Significant at .05 level

Diurnal Variation as Measured By the Depression Adjective Checklist

It was of interest to determine the extent to which diurnality of affect would be measured by the Depression Adjective Checklist. In addition by correlating speech rate (total speech and pause time scores) with scores on this instrument it was intended to determine the extent to which these possible indices of diurnality were related in this sample of depressed patients.

Table 14 shows the mean Depression Adjective Checklist scores obtained by the depressed group, the sub-group suffering from endogenous depression and the sub-group suffering from reactive depression. The test of

significance of the difference between correlated means was applied to those scores obtained at the A.M. and P.M. testing sessions on the initial test day and at pre-discharge. As can be seen in Table 14 there was no significant

Table 14

Mean Intra-Daily Changes in Depression Adjective Checklist Scores for the Combined Depressed Group, the Endogenous and the Reactive Group.

| | Initial Day | | | | | |
|---|---|---|---|---|---|---|
| | A.M. | | P.M. | | | |
| Group | $\bar{x}$ | SD | $\bar{x}$ | SD | df | t |
| Depressed | 18.3 | 6.33 | 18.2 | 6.52 | 14 | 0.113 |
| Endogenous | 17.1 | 6.24 | 18.5 | 6.04 | 8 | 1.130 |
| Reactive | 20.3 | 6.50 | 17.7 | 5.13 | 4 | 1.184 |
| | Pre-Discharge | | | | | |
| Depressed | 8.9 | 8.56 | 7.9 | 6.90 | 14 | 0.885 |
| Endogenous | 10.2 | 7.96 | 9.3 | 7.09 | 8 | 2.778* |
| Reactive | 6.7 | 5.50 | 5.7 | 3.88 | 4 | 0.439 |

* Significant at .05

difference between A.M. and P.M. Depression Adjective Checklist scores obtained on the initial test day for any of the groups mentioned above. At pre-discharge mean A.M. and P.M. Depression Adjective Checklist scores obtained by the endogenous depression group differed significantly, $t$ (8)=21778, $P<.05$. Mean A.M. and P.M. Depression Adjective Checklist scores obtained by the depressed group and the reactive depression group did not differ significantly.

Scores obtained on the Depression Adjective Checklist and the measures of speech rate did not correlate at an acceptable level for any of the groups

at either the initial test day, A.M. and P.M., or at pre-discharge, A.M. and P.M.

Hypothesis four stated that

(a) Other tests of psychomotor speed will distinguish the normal and depressed groups.

(b) The depressed group's scores on these tests of psychomotor speed will be significantly correlated with automatic speech rate.

(c) That automatic speech rate will be more highly correlated with depression than these other tests of psychomotor speed.

(a) Other Tests of Psychomotor Speed

Table 15 shows the means and standard deviations of reaction time scores and tapping test scores obtained by the normal and depressed group, obtained on the initial day and second day. (see Appendix C for changes in psychomotor speed over time).

Reaction time scores and tapping test scores obtained by these groups on the initial test day and the second test day were compared by analyses of variance. These groups differed significantly on reaction-A scores and reaction time-B scores obtained at the A.M. testing session on the initial test day, $F(1,30)=5.857$, $P<.05$), and $F(1,30)=5.149$, $P<.05$, respectively. There was no significant difference between reaction time-C scores obtained by these groups at the A.M. testing session on the initial day. These groups also differed significantly on tapping test scores obtained at this testing session, $F(1,30)=33.297$, $P<.01$.

These groups did not differ significantly on reaction time-A and reaction time-B scores obtained at the P.M. test session on the initial day. However, reaction time-C scores and tapping test scores of the respective

Table 15

Means and Standard Deviations of Reaction Time Scores* and Tapping Test Scores of Normal and Depressed Group at Initial and Second Test Day

| Test | Normals (n=16) | | Depressed (n=16) | |
|---|---|---|---|---|
| A.M. Initial | $\bar{x}$ | SD | $\bar{x}$ | SD |
| RT-A | 17.63 | 6.682 | 27.69 | 15.230 |
| RT-B | 17.56 | 8.320 | 26.69 | 13.768 |
| RT-C | 24.44 | 10.910 | 34.63 | 27.379 |
| TAP | 36.20 | 7.720 | 21.31 | 6.853 |
| P.M. Initial | | | | |
| RT-A | 17.75 | 7.040 | 24.25 | 14.754 |
| RT-B | 17.94 | 6.730 | 26.75 | 19.764 |
| RT-C | 25.06 | 11.830 | 39.69 | 25.157 |
| TAP | 39.91 | 9.690 | 22.44 | 6.845 |
| A.M. Second | | | | |
| RT-A | 16.63 | 6.152 | 23.81 | 13.000 |
| RT-B | 14.44 | 3.425 | 20.38 | 8.817 |
| RT-C | 22.38 | 11.781 | 30.56 | 14.68 |
| TAP | 39.23 | 7.082 | 26.01 | 8.29 |
| P.M. Second | | | | |
| RT-A | 14.31 | 4.453 | 23.44 | 16.05 |
| RT-B | 13.31 | 2.915 | 21.14 | 7.57 |
| RT-C | 21.36 | 10.112 | 32.13 | 22.57 |
| TAP | 41.85 | 8.087 | 26.93 | 7.74 |

*RT-A = 6 second Preparatory Interval (P.I.)
RT-B = 12 second P.I., RT-C = 2 Second P.I.

groups did differ significantly at this testing session, $F$ (1,30)=4.428, $P<.05$, and $F$ (1,30)=34.710, $P<.01$ respectively. These results are presented in Table 16.

As can be seen in Table 16 the groups differed significantly on reaction time-A and reaction time-B scores obtained at the A.M. test session on the second day, $F$ (1,30)=4.3.3, $P<.05$, and $F$ (1,30)=5.995, $P<.05$, respectively. These groups did not differ significantly on reaction time-C scores obtained at this time, but differed significantly on tapping test scores $F$ (,30)=22.991, $P<.01$.

Reaction time-A and reaction time-B scores obtained by these groups at the P.M. testing session on the second day were not significantly different. Reaction time-C scores obtained by these groups at this time differed significantly, $F$ (,30)=4.453, $P<.05$ as did tapping test scores, $F$ (1,30)=26.334, $P<.01$.

(B) Correlation Between Automatic Speech Rate and Psychomotor Speed

Correlation coefficients of the relationship between total speech and pause time scores, on the one hand, and, reaction time and tapping test scores, on the other, were obtained from the data collected on the initial day and at pre-discharge. This was done to determine if the nature of the relationships between these scores was maintained over the course of the depressive episode. Correlation coefficients for those scores obtained on the initial test day are presented in Table 17.

As can be seen in Table 17 total speech scores and reaction time-A, -B and -C scores obtained at the A.M. testing session on the initial day were significantly correlated with each other, $r$ (14)=0.543, $P<.05$, $r$ (14) =0.596, $P<.05$ and $r$ (14)=0.535, $P<05$ respectively. Total speech scores and reaction time-A scores obtained at the P.M. testing session on the initial test day were significantly correlated with each other, $r$ (14)=0.524, $P<.05$. Total speech scores and tapping test scores obtained at the A.M. test session and at the P.M. test session on the initial test day were not significantly

Table 16

ANOVA Summary of Normals and Depressed Group Comparison on Reaction Time and Tapping Test on Initial and Second Test Days

| Test | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| A.M. Initial | | | | | |
| RT-A | Reg. | 810.0 | 1 | 810.03 | 5.857* |
| | Res. | 4149.2 | 30 | 138.31 | |
| RT-B | Reg. | 666.1 | 1 | 666.14 | 5.149* |
| | Res. | 3881.4 | 30 | 129.38 | |
| RT-C | Reg. | 830.3 | 1 | 830.28 | 1.912 |
| | Res. | 13029.7 | 30 | 434.32 | |
| TAP | Reg. | 1774.9 | 1 | 1774.88 | 33.297** |
| | Res. | 1599.1 | 30 | 53.30 | |
| P.M. Initial | | | | | |
| RT-A | Reg. | 338.0 | 1 | 338.00 | 2.530 |
| | Res. | 4008.0 | 30 | 133.60 | |
| RT-B | Reg. | 621.3 | 1 | 621.3 | 2.851 |
| | Res. | 6537.9 | 30 | 217.93 | |
| RT-C | Reg. | 1711.1 | 1 | 1711.12 | 4.428* |
| | Res. | 11592.4 | 30 | 386.41 | |
| TAP | Reg. | 2443.9 | 1 | 2443.89 | 34.710** |
| | Res. | 2112.3 | 30 | 70.41 | |
| A.M. Second | | | | | |
| RT-A | Reg. | 450.0 | 1 | 450.00 | 4.313* |
| | Res. | 3129.9 | 30 | 104.33 | |
| RT-B | Reg. | 264.5 | 1 | 264.50 | 5.995* |
| | Res. | 1323.9 | 30 | 44.12 | |
| RT-C | Reg. | 528.1 | 1 | 528.13 | 3.021 |
| | Res. | 5243.9 | 30 | 174.80 | |
| TAP | Reg. | 1440.2 | 1 | 1440.23 | 22.991** |
| | Res. | 1879.3 | 30 | 62.64 | |
| P.M. Second | | | | | |
| RT-A | Reg. | 5751.3 | 1 | 5751.28 | 1.987 |
| | Res. | 86845.7 | 30 | 2894.86 | |
| RT-B | Reg. | 3591.3 | 1 | 3591.28 | 2.852 |
| | Res. | 37775.2 | 30 | 1259.17 | |
| RT-C | Reg. | 2682.8 | 1 | 2682.78 | 4.453* |
| | Res. | 18065.2 | 30 | 602.17 | |
| TAP | Reg. | 2200.0 | 1 | 2200.00 | 26.334 |
| | Res. | 2506.3 | 30 | 83.54 | |

* Significant at .05; ** Significant at .01

Table 17

Correlations Between Total Speech and Pause Time Scores, and Reaction Time and Tapping Test Scores Obtained on the Initial Test Day A.M. and P.M.

| | Test | RT-A | RT-B | RT-C | TAP |
|---|---|---|---|---|---|
| A.M. | Tot.Sp | 0.543* | 0.596* | 0.535* | 0.001 |
| | Pause | 0.552* | 0.683** | 0.517* | -0.087 |
| P.M. | Tot.Sp. | 0.524* | 0.471 | 0.374 | 0.052 |
| | Pause | 0.627** | 0.495 | 0.440 | -0.127 |

* Significant at .05; ** Significant at .01

RT-A = 6 second P.I.; RT-B = 12 second P.I.; RT-C = 2 second P.I.

correlated with each other.

Pause time scores and reaction time-A, -B and -C scores, collected at the A.M. test session on the initial test day were significantly correlated with each other, $r(14)=0.552$, $P<.05$ and $r(14)=0.683$, $P$ .01 and $r(14)=0.517$, $P$ .05 respectively. Pause time scores and reaction time-A, obtained at the P.M. test session on the initial test day were significantly correlated with each other, $r(14)=0.627$, $P<.01$. At this time the correlation between pause time scores and reaction time-B scores just failed to reach statistical significance. Pause time scores and tapping test scores obtained at the P.M. test session were significantly correlated with each other.

Similar analyses were conducted on the scores obtained on the above tests at the pre-discharge A.M. and P.M. testing sessions. Total speech scores obtained at the A.M. pre-discharge test session were significantly correlated with reaction time-A, $r(14)=0.886$; $P<.001$, reaction time-B $r(14)$ $=0.783$ $P$ .001 and reaction time-C scores, $r(14)=0.754$, $P<.001$ obtained at

this time. Total speech scores and reaction time scores obtained at the P.M. pre-discharge testing session were not significantly correlated with each other. Pause time scores obtained at the A.M. pre-discharge test session

Table 18

Correlation Between Total Speech and Pause Time Scores, and Reaction Time and Tappping Test Scores Obtained at Pre-discharge A.M. and P.M.

| Test | RT-A | RT-B | RT-C | TAP |
|---|---|---|---|---|
| A.M. Pre-Discharge | | | | |
| Tot. Sp. | 0.886*** | 0.783*** | 0.754*** | -0.336 |
| Pause | 0.924** | 0.859** | 0.789** | -0.352 |
| P.M. Pre-Discharge | | | | |
| Tot. Sp. | 0.313 | 0.414 | 0.097 | -0.362 |
| Pause | 0.411 | 0.441 | 0.088 | -0.362 |

*** Significant at .001 level

were significantly correlated with reaction time-A scores, $r(14)=0.924$, $P<.001$, reaction time-B scores, $r(14)=0.859$, $P<.001$, and reaction time-C scores, $r(14)=0.789$, $P<.001$. Pause time scores and reaction time scores obtained at the P.M. pre-discharge test session were not significantly correlated. Tapping test scores did not correlate significantly with total speech scores and pause time.

Table 19 shows the correlation coefficients which represent the relationships between scores on the clinical scales and scores on the reaction time and tapping tests. Beck scores obtained on the initial test day were not significantly correlated with reaction time scores or with tapping test scores. At this time Hamilton scores were not significantly correlated with

scores obtained on either of the tests of psychomotor speed.

Table 19

Correlation Bweteen Clinical Scales and Reaction Time, and Tapping Test Scores on Initial Test Day and at Pre-Discharge

| Test | RT-A | RT-B | RT-C | TAP |
|---|---|---|---|---|
| A.M. Initial | | | | |
| Beck | 0.354 | 0.253 | 0.049 | -0.350 |
| Ham. | 0.114 | 0.126 | 0.365 | 0.116 |
| P.M. Initial | | | | |
| Beck | 0.189 | 0.199 | -0.114 | 0.446 |
| Ham. | 0.315 | 0.380 | 0.290 | 0.214 |
| A.M. Pre-Discharge | | | | |
| Beck | 0.305 | -0.058 | 0.361 | -0.153 |
| Ham. | 0.673** | 0.404 | 0.755*** | -0.548* |
| P.M. Pre-Discharge | | | | |
| Beck | -0.153 | 0.396 | 0.365 | -0.137 |
| Ham. | 0.194 | 0.414 | 0.025 | -0.557* |

* Significant at .05; ** Significant at .01; *** significant at .001

Beck scores and reaction time scores obtained at pre-discharge were not significantly correlated with each other. Hamilton scores obtained at pre-discharge and reaction time-A and reaction time-C scores obtained at the A.M. pre-discharge test session were significantly correlated with each other, $r(14)=0.673$, $P<.01$, and $r(14)=0.755$, $P<.001$ respectively. Hamilton scores obtained at pre-discharge were significantly correlated with tapping scores obtained at both the A.M. testing session, $r(14)=0.548$, $P<.05$ and the P.M.

testing session, $r(14) = -0.557$, $P < .05$.

Follow-Up

The means and standard deviations of total speech and pause time scores obtained by the depressed group and the normal group at follow-up are presented in Table 20

Table 20

| | Depressed | | Normal | |
|---|---|---|---|---|
| Test | $\bar{x}$ | SD | $\bar{x}$ | SD |
| Tot. Sp. | 937.79 | 94.295 | 732.58 | 200.07 |
| Pause | 99.102 | 82.864 | 30.00 | 48.21 |

Total speech scores obtained by these groups were compared by ANOVA, and were found to differ significantly, $F\ (1,30)=8.431$, $P<.01$.

These groups also differed significantly on pause time scores obtained at this time, $F\ (1,30)=8.313$, $P<.01$. An ANOVA summary for these analyses is presented in Table 21.

Table 21

ANOVA Summary of Normal and Depressed Group Compared on Total Speech and Pause Time Scores at Follow-Up

| Test | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| Tot. Sp | Reg. | 327713.9 | 1 | 327713.90 | 8.431* |
| | Res. | 1166137.5 | 30 | 38871.25 | |
| Pause | Reg. | 38202.6 | 1 | 38202.61 | 8.313* |
| | Res. | 137866.4 | 30 | 4595.55 | |

* Significant at .01

Table 22 shows the means and standard deviations of reaction time and tapping test scores obtained at follow-up, by the depressed group and the normal group.

Table 22

Mean Reaction Time and Tapping Test Scores of Depressed and Normal Group at Follow-up

| Test | Depressed | | Normal | |
|---|---|---|---|---|
| | $\bar{x}$ | SD | $\bar{x}$ | SD |
| RT-A | 19.00 | 5.203 | 14.38 | 2.680 |
| RT-B | 19.25 | 8.426 | 13.31 | 3.341 |
| RT-C | 25.75 | 14.177 | 18.56 | 7.118 |
| TAP | 30.12 | 10.361 | 43.87 | 7.746 |

Reaction time and tapping test scores obtained by members of these groups were compared by analyses of variances. The groups differed significantly on reaction time-A scores and reaction time-B scores, $F(1,30)=9.993$, $P<.01$ and $F(1,30)=6.865$, $P<.05$ respectively. The groups did not differ significantly on reaction time-C scores. Tapping test scores obtained by the two groups differed significantly, $F(1,30)=18.074$, $P<.01$.

Beck Scores

At this time the depressed subjects' Beck scores had a mean of 11.56 (SD=11.39). This was not significantly different from their mean score of 11.75 (SD=9.64) at pre-discharge.

Other Factors

(a) Age Differences

The ages of the subjects tested has been shown to have considerable

Table 23

AVONA Summary of Depressed and Normal Group Compared on Reaction Time and Tapping Test at Follow-up

| Test | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| RT-A | Reg. | 171.1 | 1 | 171.1 | 9.993** |
| | Res. | 513.8 | 30 | 171.13 | |
| RT-B | Reg. | 282.0 | 1 | 282.0 | 6.865* |
| | Res. | 1232.4 | 30 | 41.08 | |
| RT-C | Reg. | 413.3 | 1 | 413.28 | 3.284 |
| | Res. | 3774.9 | 30 | 125.83 | |
| TAP | Reg. | 1512.2 | 1 | 1512.22 | 18.074** |
| | Res. | 2510.0 | 30 | 83.67 | |

* Significant at .05; ** Significant at .01

influence on psychomotor tests scores. Therefore, several analyses were conducted on data collected from the normal subjects to determine the degree to which the above results may have been influenced by the age of the subjects used in this study. As mentioned in Chapter Two, 40 years of age was chosen as the cut-off point to divide the normal group into two smaller groups. Several ANOVA were conducted to determine the extent to which these groups differed on automatic speech rates and psychomotor speed.

Table 24 is an ANOVA summary showing the comparison of these sub-groups on total speech. As can be seen in this Table there was no significant differences between the sub-groups of the normal group on any of the occassions of testing.

Table 24

ANOVA Summary of the Two Age Sub-Groups of the Normal Group Compared on Total Speech Scores.

| | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| **Initial Day** | | | | | |
| A.M. | Reg. | 282760.6 | 1 | 282760.59 | 4.038 |
| | Res. | 980305.5 | 14 | 70021.82 | |
| P.M. | Reg. | 40333.7 | 1 | 40333.70 | 0.631 |
| | Res. | 895526.8 | 14 | 63966.20 | |
| **Second Day** | | | | | |
| A.M. | Reg. | 441.0 | 1 | 441.00 | 0.010 |
| | Res. | 641093.7 | 14 | 45792.41 | |
| P.M. | Reg. | 11574.0 | 1 | 11574.01 | 0.259 |
| | Res. | 624867.6 | 14 | 44633.40 | |

Similar analyses were conducted to compare the pause time scores of the sub-groups of the normal subjects. The summary of these analyses is presented in Table 26. The only significant difference between the sub-groups occurred at the A.M. testing session on the intial day of testing, $F(14,1)=4.705$, $p < .05$

Table 25

ANOVA Summary of the Two Age Sub-Groups of the Normal Group Compared on Pause Time Scores.

| Source | SS | df | MS | F | P |
|---|---|---|---|---|---|
| **Initial Day** | | | | | |
| Reg. | 92415.99 | 1 | 92415.99 | 4.705 | .05 |
| Res. | 274975.23 | 14 | 19641.09 | | |
| Reg. | 19507.01 | 1 | 19507.01 | 1.673 | N.S |
| Res. | 163226.52 | 14 | 11659.04 | | |
| **Second Day** | | | | | |
| Reg. | 160.40 | 1 | 106.40 | 0.042 | N.S |
| Res. | 53489.51 | 14 | 3820.68 | | |
| Reg. | 1878.14 | 1 | 1878.14 | 0.685 | N.S. |
| Res. | 38372.34 | 14 | 2740.88 | | |

The above mentioned sub-groups were also compared on reaction time and tapping test scores obtained on the first and second test days. These sub-groups did not differ significantly on reaction time scores or tapping test scores obtained on the initial day of testing. These sub-groups differed significantly on reaction time-A scores $F=4.758$, df=1 and 14, $P<.05$ and reaction time-B scores $F=5.965$, df=1 and 14, $P<.05$ obtained at the A.M. testing session on the second test day. These sub-groups also differed significantly on reaction time-A scores obtained at the P.M. testing session on the second test day $F=8.896$, df=1 and 14, $P$ .01. These sub-groups did not differ on reaction time-B or tapping test scores on any of the occassions of testing. These results are summarized in Table 26.

Table 26

ANOVA Summary of Age Sub-Groups of the Normal Groups Compared on Reaction Time and Tapping Test Scores.

| Test | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| A.M. Initial | | | | | |
| RT-A | Reg. | 100.00 | 1 | 100.00 | 2.457 |
| | Res. | 569.75 | 14 | 40.70 | |
| RT-B | Reg. | 126.56 | 1 | 126.56 | 1.944 |
| | Res. | 911.37 | 14 | 65.10 | |
| RT-C | Reg. | 150.06 | 1 | 150.06 | 1.284 |
| | Res. | 1635.87 | 14 | 116.85 | |
| TAP | Reg. | 3.36 | 1 | 3.36 | 0.053 |
| | Res. | 891.27 | 14 | 63.66 | |
| P.M. Initial | | | | | |
| RT-A | Reg. | 182.25 | 1 | 182.25 | 4.550 |
| | Res. | 560.75 | 14 | 40.05 | |
| RT-B | Reg. | 138.06 | 1 | 138.06 | 3.575 |
| | Res. | 540.87 | 14 | 38.63 | |
| RT-C | Reg. | 217.56 | 1 | 217.56 | 1.619 |
| | Res. | 1881.37 | 14 | 134.38 | |
| TAP | Reg. | 61.35 | 1 | 61.35 | 0.637 |
| | Res. | 1348.09 | 14 | 96.29 | |
| A.M. Second | | | | | |
| RT-A | Reg. | 144.00 | 1 | 144.00 | 4.758* |
| | Res. | 423.75 | 14 | 30.27 | |
| RT-B | Reg. | 52.56 | 1 | 52.56 | 5.965* |
| | Res. | 123.37 | 14 | 8.81 | |
| RT-C | Reg. | 324.00 | 1 | 324.00 | 2.581 |
| | Res. | 1757.75 | 14 | 125.55 | |
| TAP | Reg. | 0.01 | 1 | 0.01 | 0.000 |
| | Res. | 752.26 | 14 | 53.73 | |
| P.M. Second | | | | | |
| RT-A | Reg. | 115.56 | 1 | 115.56 | 8.896** |
| | Res. | 181.87 | 14 | 12.99 | |
| RT-B | Reg. | 7.56 | 1 | 7.56 | 0.883 |
| | Res. | 119.87 | 14 | 8.56 | |
| RT-C | Reg. | 182.25 | 1 | 182.25 | 1.888 |
| | Res. | 1351.50 | 14 | 96.53 | |
| TAP | Reg. | 0.34 | 1 | 0.34 | 0.005 |
| | Res. | 980.55 | 14 | 70.04 | |

* Significant at .05, ** Significant at .01

(b) Gender Differences

It was also of interest to determine the possible influence that the sex of the subjects tested may have on scores obtained on automatic speech rates and tests of psychomotor speed. This is especially relevant to this study as over 81 percent of the depressed group were women.

The total speech scores and the pause time scores obtained on the initial test day by the eight male and eight female members of the normal group were subjected to analysis of variance. This indicated that the males and females of the normal group did not differ significantly on total speech scores or pause time scores obtained at the A.M. and P.M. test session on the initial test day. These results are summarized in Table 27.

The male and female sub-groups of the normal group were also compared on reaction time and tapping test scores obtained on the initial test day. These groups did not differ on these tests of psychomotor speed. These results are summarized in Table 28.

Table 27

ANOVA Summary of Male and Female Sub-Groups of the Normal Group Compared on Total Speech and Pause Time Scores.

| Test | Source | SD | df | MS | F |
|---|---|---|---|---|---|
| A.M. | | | | | |
| Tot. Sp. | Reg. | 157011.98 | 1 | 157011.98 | 1.987 |
| | Res. | 1106054.13 | 14 | 79003.87 | |
| Pause | Reg. | 63000.99 | 1 | 63000.99 | 2.897 |
| | Res. | 304390.23 | 14 | 21742.16 | |
| P.M. | | | | | |
| Tot. Sp. | Reg. | 158800.21 | 1 | 158800.21 | 2.861 |
| | Res. | 777060.37 | 14 | 55504.31 | |
| Pause | Reg. | 16813.66 | 1 | 16813.66 | 1.419 |
| | Res. | 165919.87 | 14 | 11851.42 | |

Table 28

ANOVA Summary of Male and Female Comparison on Reaction Time and Tapping Test Scores

| Test | Source | SS | df | MS | F |
|---|---|---|---|---|---|
| A.M. | | | | | |
| RT-A | Reg. | 72.25 | 1 | 72.75 | 1.693 |
| | Res. | 597.50 | 14 | 42.68 | |
| RT-B | Reg. | 68.06 | 1 | 68.06 | 0.982 |
| | Res. | 969.88 | 14 | 69.28 | |
| RT-C | Reg. | 264.06 | 1 | 264.06 | 2.429 |
| | Res. | 1521.88 | 14 | 108.71 | |
| TAP | Reg. | 144.06 | 1 | 144.06 | 2.687 |
| | Res. | 750.57 | 14 | 53.61 | |
| P.M. | | | | | |
| RT-A | Reg. | 121.00 | 1 | 121.00 | 2.723 |
| | Res. | 622.00 | 14 | 44.43 | |
| RT-B | Reg. | 85.56 | 1 | 85.56 | 2.019 |
| | Res. | 593.37 | 14 | 42.38 | |
| RT-C | Reg. | 175.56 | 1 | 175.56 | 1.278 |
| | Res. | 1923.37 | 14 | 137.38 | |
| TAP | Reg. | 245.47 | 1 | 245.47 | 2.952 |
| | Res. | 1163.97 | 14 | 83.14 | |

Each subject's scores are presented in Appendix C.

# CHAPTER IV

## DISCUSSION

The first hypothesis which stated that depressed patients have a slower rate of automatic speech than normal subjects was supported by the results. These groups were differentiated on both indices of automatic speech.

The absence of similar studies prevents comparison of these results. However, this finding is important as it focuses on a relatively novel function - automatic speech rate - on which depressed subjects and normal subjects clearly differ. Similar studies supporting this result are needed before this finding can be generalized to other populations.

Hypothesis two which stated that the automatic speech rate of the normal subjects will show no significant variation in time, whilst that of the depressed patients will increase as mental state improves was partially supported by the results. The depressed group did show significant improvement on both indices of automatic speech with concomittant significant improvement on the clinical scales. Thus, it appears that as depressed patients show clinical improvement the rate of automatic speech increases. This finding is consistent with the work of Szabadi et. al. (1976) who found that as individual patients improve clinically, rate of automatic speech increased.

The finding that automatic speech rate was not significantly correlated with scores on the Beck Depression Inventory and not significantly correlated with scores on the Hamilton Rating Scale at all

occassions of testing may be accounted for by considering the information tapped by these respective tests. Whereas the Beck Depression Inventory focuses on cognitive manifestations of depression, the production of automatic speech is primarily a physiological function divorced from complex cognitive functions. The Hamilton Rating Scale is concerned with several physical aspects of behaviour including retardation and somatic symptoms. Therefore, it is reasonable to expect that automatic speech rates be more highly correlated with scores on the Hamilton Rating Scale as both instruments tap physical aspects of behaviour.

In summary, therefore, it is posited that scores obtained on tests which tap similar modes of experience or behaviour should be more highly correlated than scores obtained on tests which tap differing ones. Depression in some patients may also be manifested by the cluster of symptoms in a limited number of modalities. Thus, the lack of significant correlation between automatic speech rates and the scores on the clinical sclaes does not necessarily discredit the finding that depressed patients rate of automatic speech increases as they improve clinically.

However, the surprising finding that normal subjects varied significantly on automatic speech rates raises serious question as to whether the change in the depressed subjects can be attributed to relief of the depression. It may be possible that those factors which contributed to a reduction in the automatic speech rates of normal subjects were also operating on the depressed patients.

Before examining the factors which may have been responsible for variation in the automatic speech rates of normal subjects, it should be noted that the automatic speech rates of normal subjects employed by

Szabadi et. al. (1976) did not vary over time. Thus the finding in this study and that of Szabadi et. al. (1976) are difficult to explain, unless this investigation included other procedures which made exact replication impossible.

Several factors may have contributed in producing the considerable variance in automatic speech rates of the normal subjects employed in this study. Firstly, the instructions "to count at your normal speed" may not have been sufficiently precise. The subjects may have misunderstood the intention of this instruction as testing proceeded, believing that they were required to speak faster. This belief could have been engendered by the tests of psychomotor speed in which they were required to respond as quickly as possible. Therefore, after the first test session when subjects were familiar with the procedure, the subjects may have approached the remaining test sessions with the set of responding as quickly as possible on all tests. This is supported by the observation that many subjects were very enthusiastic about the testing and curious about their performance on the tests of psychomotor speed. This suggests that future studies of this kind should not test subjects on automatic speech rates and other tests of psychomotor speed at the same test sessions as instructions for one test may be confounded with instructions for another.

Secondly, the normal subjects may have acquired information concerning the nature of the study as most of them worked on the unit where the study was conducted. Thus, these subjects may have attempted to respond unlike depressed patients in an effort to please the investigator.

The third hypothesis which stated that patients suffering from endogenous depression will show greater diurnal variation in automatic speech rates, with the slowest in the morning, than those suffering with reactive depression, and the normal subjects was not supported by the results. On the initial test day the group suffering from reactive depression showed greater diurnal variation on total speech scores than either of the other groups. At this time both groups suffering from depression showed greater diurnal variation on pause time scores than the normal group. Thus the group suffering from endogenous depression did show greater diurnal variation on one index of automatic speech than the normal group, as was predicted, but did not differ from the group suffering from reactive depression in this regard.

Although these findings concerning the normal group and the group suffering from reactive depression are unexpected, these findings concerning the group suffering form endogenous depression are consistent with clinical observations,

> "Improvements of all symptoms (in endogenous depression) usually occurs towards the evening, the retardation and depressive mood particularly showing a change for the better" (Mayer-Gross, Slater and Roth, 1969, p.p 211).

This hypothesis is supported by the observations that the diurnal variation of automatic speech disappears in the depressed group when the depression has improved. However, it is confounded by the observation that the normal subjects exhibted diurnal variation.

It may be possible that the normal subjects do show diurnality in their speech rates as they do in some other physiological functions such as body temperature and heart rate (See Lobban, 1956, for a review of this research). And treatment of depression may abolish, perhaps

temporarily, this normal diurnal variation.

Alternatively, the possibility of contamination of the automatic speech rates by the other tests of psychomotor speed, which do show diurnal variation should be considered. The variation observed in the speech rates of normal subjects could be pseudo-diurnality due to the mental set as discussed previously.

Of the depressed groups only the group suffering from endogenous depression exhibted diurnal variation on scores on the Depression Adjective Checklist. Although this occured at pre-discharge it supports the clinical observation that these patients do feel better towards the evening (Mayer-Gross, Slater and Roth, 1969).

It was anticipated that the diurnal variation on this measure would be greater when the depression was greater i.e. on admission. However, this was not so. One explanation could be that the diurnal improvement was counterbalanced at this stage by the lack of volition and retardation of thought which would reduce the number of itmes checked in the morning, as opposed to the evening.

In view of this finding it appears inconsistent that this group did not exhibit diurnality of automatic speech rates at pre-discharge. This is probably because these respective measures - speech rates and the Depression Adjective Checklist - measure behaviour in different modalities.

Hypothesis four which stated that (a) other tests of psychomotor speed will distinguish the normal and the depressed groups, (b) that the depressed groups scores on these tests of psychomotor speed will be significantly correlated with automatic speech rate and (c) that automatic

speech rate will be more highly correlated with depression than these other tests of psychomotor speed was partially supported by the results. The tests of psychomotor speed did differentiate the normal group from the depressed group. The tapping test was more consistent in doing this than the reaction time tests.

It is of interest that the reaction time-A (12 sec. P.I.) and reaction time-B (6 sec P.I.) tests differentiated the groups at the morning testing sessions whereas the reaction time-C (2 sec. P.I.) tests differentiated the groups at the afternoon testing sessions.

The difference between groups on reaction time-C at the afternoon testing sessions is probably due to the increase in the depressed group's mean reaction time-C scores at these test sessions. There seems no apparent reason for increases on the depressed groups mean reaction time-C scores at the afternoon test sessions.

Bearing in mind the problems encountered with the depressed group's follow-up data the greatest change in the depressed group's reaction time scores over the course of the study were found on reaction time-C scores. Court (1970) has reported a similar finding. He states that:

> "When their (depressed subjects) response levels are compared with normal subject it is clear that the greatest change occurs in response to short P.I." (pp. 85).

Court (1970) suggests that this change occurs because when their condition is severe depressed patients find the very short P.I. insufficient time to prepare themselves to respond.

The finding that the depressed and normal group were consistently differentiated on the tapping test supports the work of Shakow and Hutson (1938) and Rafi (1960). This finding suggests that the tapping test is a

valuable test of psychomotor speed which clearly differentiates between normal and depressed subjects.

Automatic speech and reaction time scores were significantly correlated with each other on most occassions of testing. This suggests that automatic speech is a potentially useful index of psychomotor retardation, as reaction time scores have been found to be a sensitive indicator of this when making inferences about mental state. (Court, 1970).

The insignificant relationship between tapping test scores and automatic speech rate suggest that, in depressed patients, automatic speech may not be correlated with some aspects of psychomotor speed (speed of oscillatory movements and precision). This finding may be due to the different natures of the tasks involved. Relative to the tapping test automatic speech is a simple task which involves far less complex behaviours.

Measures of automatic speech and tests of psychomotor speed were not always significantly correlated with the clinical scales. These tests of psychomotor function were often significantly correlated with scores on the Hamilton Rating Scale (tapping test scores were only significantly correlated with Beck scores on one occasion). This may be due to the fact that the Beck Depression Inventory is primarily concerned with affect whereas the other instruments mentioned involve some physiological function. This reasoning is consistent with the earlier assertion that scores on tests which tap information from similar modalities should be more highly correlated.

The results suggests that the tapping test and total speech are better indices of depression than pause time and reaction time. In

addition to showing significant improvement from admission to pre-discharge, as did pause time, reaction time, Hamilton and Beck scores, the tapping test and total speech scores were more highly correlated with scores on the clinical scales. However, this latter finding was not consistent. Therefore, similar studies are needed before it can be unequivocally concluded that one of the other of the indices employed by this study is a better index of depression.

The finding that age did have some influence on pause time scores is important. If this result is replicated precautions should be taken to reduce this influence on pause time scores. In general, the findings concerning the influence of age on automatic speech rate suggests that age did not seriously affect scores on automatic speech rate.

Age appeared to be of some influence on reaction time tests with the longer P.I.. However, this finding was not consistent in this study.

Tapping test scores did not appear to be influenced by age.

Automatic speech and psychomotor speed were not influenced by the sex of the (normal) subjects. In view of Court's (1970) finding that, for reaction time, the influence of sex was greater in normal subjects than in patients, it can be suggested that the disproportion of male to female depressed subjects employed in this study did not influence mean reaction time scores of this group. However, we are uncertain what effect this disproportion may have had on tapping test and automatic speech rate.

Conclusion of This Study

In spite of the finding that most of the hypotheses stated were not clearly supported by the results there were some important findings. Automatic speech rate and the tests of psychomotor speed clearly differ-

entiated the normal from the depressed subjects. Moreover, these tests of psychomotor speed were well correlated with automatic speech rate. This suggests that automatic speech is a potentially useful measure of psychomotor retardation.

The several problems encountered in this study and the unexpected finding regarding the variance of automatic speech rates in normal subjects, confound any conclusions which are drawn about the performance of those with depression. Thus further investigations are needed.

Future Studies

1. Ideally one should seek to ensure that patients are tested the same number of times. This would mean that they stay in hospital for a fixed period. Unfortunately this is difficult to arrange given the exingencies of their clinical needs.

2. Although treatment was held constant during this study for the "depressive group" it is not possible to control the effect of E.C.T. A separate group of E.C.T patients with diagnoses other than primary depression should be investigated if such a group could be found.

3. The effect of tests of maximum motor speed upon automatic speech rate, which is supposed to proceed at normal speed requires further investigation. If a contamination effect can be demonstrated then separate testing sessions are required.

4. Alternative forms of instructions to the subjects whose automatic speech is being recorded need to be investigated. The possibility that Szabadi's method replicated in this study may lead to ambiguity and misunderstanding in the subjects has been already raised.

Other forms of investigating automatic speech could be devised as follows:

(a) The subject may be presented with several cards as follows:

1

1, 2, 3,.....10

2

A, B, C, D, ..... Z

3

2, 4, 6, 8, 9, 10,..... 20

and instructed to "Look carefully at each of these cards. You will soon be asked to recall exactly what is on each of the cards numbered 1, 2, 3,".

Such instructions will have the effect of distinguising the nature of the experiment and may result in a more accurate sample of automatic speech.

(b) Another method could involve having all subjects listen to a recording of someone counting at average speed and then instructing them to count at their normal speed.

Theoretically, it is of importance to discover if automatic speech is related to spontaneous speech. Ultimately, we are interested whether of not spontaneous speech is slowed when individuals are depressed. Measuring automatic speech should be recognized as a short method of obtaining this information. Thus studies correlating automatic speech with spontaneous speech are also needed.

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# APPENDIX A

## Clinical Summaries of Subjects

Patient No. 1 : A 36 year old married housewife.

Onset Depression: 3 weeks previous to admission. Precipitating Cause: Unknown Course: Inability to cope with minor things around the house for the last 3 weeks. Other Symptoms: Lethargy, anorexia, initial insomnia, feelings of worthlessness, despondency, poor appetite, diurnal mood variation. Treatment: 5 Bilaternal E.C.T.s, Etrofon and lithium. Previous Medical History: Rheumatic fever as a child, two pregnancies; cardiac decompensation, tubal ligation. Previous Psychiatric History: dates back 13 years, admitted on 3 previous occasions suffering from hypomania on two occasions and bipolar depression on the third; previous to this, patient saw psychiatrists on an outpatient basis for depression.

Family History: Parents separated, mother suffers from hypertention, Uncle institutionalized for past 30 years - paranoid schizophrenia, one of six sisters previous admitted with diagnosis of adolescent crisis; no other psychiatric history. Education: Grade 10. Occupational History: Trained as beautician. Marital History: Met husband several months before marriage; initial sexual conflicts, two children 10 & 8.

Pre-Morbid Personality: Happy, kind, cooperative and perfectionistic.
Physical Abnormalities: C.V.S. Grade I-II/VI systolic ejection murmur.
Mental Examination by Psychiatrist: showed a depressed woman, no evidence of thought disorder, well oriented, memory - normal, insight - poor.
Psychological Tests:

| EPI: | L | N | E |
|---|---|---|---|
| Raw Score | 3 | 15 | 15 |
| Percen. | 67 | 87 | 78 |

Shipley: Not completed

Psychiatric Diagnosis:
Manic Depressive Psychosis: Depressed type.

Patient No. 2: A 43 year old married housewife

Onset Depression: 6 months prior to admission. Precipitating Cause: probably worry about son's relationship with girlfriend after the child was given up for adoption.
Course: worsened progressively over 6 months. Other Symptoms: initial insomnia, crying spells, feeling she can't cope, suicidal ideation, constipation, no energy, interrupted sleep, diurnal variation of mood.
Previous Medical History: hospitalized 3 years previously for vaginal hysterectomy and bladder repairment.
Previous Psychiatric History: None.

Family History: Father 80 years old and in poor health; mother died 3 years ago, experienced nervous breakdown when 48 years old; patient's 3 brothers and 5 sisters are all alive and well. Education: Grade 8. Occupational History: Never worked outside home. Marital History: Married for last 20 years, husband unemployed; the couple have eleven children between 24 and 8 years; all well.

Pre-Morbid Personality: Kind, helpful and interested in people.
Physical Abnormalities: None
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 0 | 9 | 15 |
| Percen | 8 | 26 | 87 |

Shipley:
Raw Score = 31
I.Q. = 92

Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 3: A 59 year old married janitor

Onset Depression: 1 month prior to admission. Precipitating Cause: Unclear Course: symptoms intensified over last month. Other Symptoms: anxious feeling in stomach, tense all the time, diurnal variation of mood, early morning wakening, lack of energy, lack of volition.
Treatment: Librium, Tofranil, Sinequan and 10 E.C.T.s.
Previous Medical History: Appendectomy, Diabetes Mellitus and a G.I. ulcer.
Previous Psychiatric History: Admitted for "bad nerves" 25 years ago and 6 years ago. Marital History: Married for 25 years, good relationship with wife; they have five sons all in good health.

Family History: Mother and father died at 84 and 74 respectively; three brothers and two sisters; one brother died of liver problems; no history of psychiatric illness. Education: Grade 8. Occupational History: Patient primarily employed as a maintenance worker throughout his life.

Pre-Morbid Personality: Always anxious but outgoing.
Physical Abnormalities: None
Mental Examination by Psychiatrist: Looks older than stated age, some psychomotor retardation; Talk - coherent but not spontaneous; Thought - no formal thought disorder; Mood - subjectively and objectively depressed, feelings of hopelessness and apathy; no evidence of delusion, hallucinations or complusive phenomena; Orientation - normal; Intelligence - slightly below normal.

Psychological Test

| EPI: | L | N | E |
|---|---|---|---|
| Raw Score | 6 | 14 | 10 |
| Percen | 98 | 82 | 34 |

Shipley:
Raw Score = 31
I.Q. = 92

Other Findings:
Patient currently treated for diabetes mellitus and diet, and with tagament for an ulcer.
Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 4: A 51 year old widow.

Onset Depression: 2 months prior to admission. Precipitating Cause: Unclear. Course: depression grew progressively worse. Other Symptoms: tiredness, loss of appetite, loss of interest, loss of 10 lbs over last 2 months, interrupted sleep.
Treatment: Sinequan. Previous Medical History: hospitalized for iatronic hypothyroidism. Previous Psychiatric History: 5 previous psychiatric admissions - admitted 26 years ago for post-partem psychosis, hospitalized 2 years ago for Endogenous Depression, admitted one year ago for Endogenous Depression.

Family History: Father died at age 64 from Carcinomaof stomach, mother commited suicide at age 61, 10 siblings, 7 alive, 3 died at birth, two brothers have had psychiatric problems and one sister was diagnosed as schizophrenic. Education: Started school at age 7 and completed Grade 6. Occupational History: Worked as a seamtress for 2 years, at a bakery for 3 months and 2 years as a housekeeper. Marital History: Married for 26 years, husband died from lung cancer; they have 10 children living, one child died at birth.
Physical Abnormalities: Squint of left eye.
Mental Examination by psychiatrist: Appearance - slow movement and sad facial expression; speech and thought processes - normal; mood - objectively and subjectively depressed; no evidence of delusion, hallucinations or depersonalization; memory - below average; information and intelligence - normal; insight - good.
Psychological Tests:

| EPI: | L | E | N | Shipley: | |
|---|---|---|---|---|---|
| Raw Score | 3 | 9 | 5 | Raw Score | = 17 |
| Percen. | 67 | 26 | 21 | I.Q. | = 86 |

Other Findings: Living in small apartment with 3 children and finds the situation cramped.
Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 5: A 29 year old married housewife.

Onset Depression: 2 years prior to admission. Precipitating Cause: Pregnancy and financial problems.
Course: The depression grew progressively worse over this time. Other Symptoms: unwanted thoughts of harming children, poor appetite, weight loss, initial and terminal insomnia, diurnal mood variation, crying spells, nervous stomach.
Treatment: Anafranil. Previous Medical History: Four pregnancies, one miscarriage, tubal ligation 3 years ago. Previous Psychiatric History: None.

Family History: Mother died at 39 years of cancer, father died at 64 years of cancer; 3 brothers and 3 sisters but patient has had no contact with them since mother died (patient was 9 years at the time) as she was adopted; foster mother died at 49 years; strict upbringing by foster parents; foster father is a Pentecostal Minister; reported that foster father did fondle her sexually but never attempted intercourse. Education: Finished school at 16 years; failed Grade VI but was "pushed ahead" and finished Grade XI; popular at school. Occupational History: Worked as teacher for 3 months but was dissatisfied; failed to perform satisfactory as a teacher; worked as an office clerk for 2 months, left and completed 6 months typing course.
Marital History: Knew husband 1 year prior to marriage; before marriage husband threatened to leave her unless they engaged in premarital sex; no satisfaction in sex, only cooperates to please husband; patient has 3 children.

Physical Abnormalities: None.
Pre-Morbid Personality: Anxious individual.
Mental Examination by Psychiatrist: General behaviour - well groomed and crying; Mood - miserable; subjectively and objectively depressed; obsessive thoughts mostly about harming children; Memory - normal; no evidence of schizophrenic thought disorder.
Psychological Tests:

| EPI: | L | N | E |
|---|---|---|---|
| Raw Score | 0 | 16 | 12 |
| Percen. | 8 | 91 | 52 |

Shipley:
Raw Score = 36
I.Q. = 95

Other Findings:
1. Vaginal discharge
2. Chronic cervicitis
Psychiatric Diagnosis:
Endogenous Depression with obsessive compulsive features.

Patient No. 6 : A 53 year old housewife.

Onset Depression: 6 months prior to admission. Precipitating Cause: Unclear. Course: Grew progressively worse until admission. Other Symptoms: Inability to concentrate and do housework, tiredness, severe crying spells, hot and cold flashes.
Treatment: Serax, Halcion.
Previous Medical History: Removal of cyst from left breast 15 years ago, hypothyroidism 15 years ago, Hysterectomy 5 years ago.
Previous Psychiatric History: Admitted and diagnosed as suffering from Involution Depression 6 years ago; admitted and diagnosed as depressed 1 year ago.

Family History: Father died at 60 years from a heart attack; mother aged 84 suffering from psychiatric problems; the patient has 2 brothers and 1 sister all alive and well. Education: Stopped attending school at age 12.
Occupational History: Never worked outside the home.
Marital History: Married for 31 years and boasts of a good marriage; this couple has 4 children (2 male and 2 female) all alive and well.

Pre-Morbid Personality: Sensitive, shy and worrisome.
Mental Examination by Psychiatrist: Appearance - clean, neat and appropriately dressed; behaviour - cried alot, slight psychomotor retardation; Talk - low and shaky voice; thought - normal; mood - subjectively depressed, objectively depressed and anxious; memory - attention and concentration - normal; intelligence - below average.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 7 | 6 | 16 |
| Percen. | 99 | 10 | 91 |

Shipley:
Raw Score = 20
I.Q. = 83

Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 7: A 39 year old married housewife.

Onset Depression: 1 year prior to admission. Precipitating Cause: Not clear.
Course: Symptoms worsened progressively until hospitalized.
Other Symptoms: Weight loss, lack of interest in most activities, feeling of insecurity and inferiority, fearful that things she does "will not turn out right".
Treatment: Lithium and supportive therapy. Previous Medical History: Breast cyst removed 10 years ago; ovarian cyst removed 7 years ago; 4 vaginal deliveries, last complicated by chorioamnioitis. Previous Psychiatrist History: Manic episode followed by depression 5 years ago; manic episode followed by depression 1 year ago.

Family History: Father is dead, mother aged 83 is suffering with high blood pressure; 1 brother (54) suffers with Manic Depressive Psychosis; 3 sisters (47,51,53). Education: B.A. and Diploma in Education. Occupational History: taught in elementary school for 5 years until first pregancy; has not worked outside home since.
Marital History: Married for the last 14 years, 2 girls 11, 14 and two boys 5 , 8; currently experiencing problems with husband over raising of children.
Pre-Morbid Personality: Shy, quiet, passive, rigid.
Physical Abnormalities: None.
Mental Examination by Psychiatrist: Insight - good; intelligence - above average; absence of delusions and hallucinations.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 4 | 6 | 16 |
| Percen. | 83 | 10 | 91 |

Shipley:
Raw Score = 72
I.Q. = 122

Other Findings:
Very concerned over her children's attitude towards her.
Psychiatric Diagnosis:
Manic Depression: Depressed type.

Patient No. 8: A 39 year old house wife.

Onset Depression: 2 months prior to admission. Precipitating Cause: probably a combination of family problems and biological symptoms.
Course: Progressively worse until admission. Other Symptoms: Initial insomnia, poor appetite, constipation, extreme weakness and tiredness, lost 15 lbs in 2 months.
Treatment: for 2 weeks prior to admission - Sinequan 50 m.g.; current treatment-Sinequan and Dalmane.
Previous Medical History: Appendectomy age 11; benign breast tumour age 21; has a slight hearing problem; 5 miscarriages; tubal ligation 7 months ago.
Previous Psychiatric History: O.D. 3 years ago, hospitalized for 1 day; hospitalized for depression 1 year ago - responded well to E.C.T., but currently complaining of poor memory; treated on an outpatient basis for depression 2 years ago; hospitalized 4 years ago for depression - diagnosed atypical depression.

Family History: patient's father died at 68 - suffered with diabetes and heart attacks; 11 children in patient's family (40 - 25) 3 boys and 8 girls; one sister suffered with diabetes and one was admitted to a hospital for "nerve problems"; no history of epilepsy or alcoholism in family.
Education: Grade 8. Occupational History: Patient was only employed once, from 1960 - 1964 when she worked as a cleaner. Marital History: Married for 19 years and has had many separations from her husband, who has had a severe drinking problem for the last 14 years; they have 2 daughters and 1 son between 14 and 17 years; the patient has been accused by her sister-in-law of having sexual intercourse with her husband and her husband (patient's) is facing a court case of allegedly having sexual intercourse with his daughter and his niece.
Physical Abnormalities: Scars from surgery.
Pre-Morbid Personality: Slight speech and hearing defects.
Mental Examination by Psychiatrist: Slight psychomotor retardation, lack of spontaneity, sad face, montonous speech, good memory, average intelligence, some insight, diurnal mood variation - feels better in the evenings.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 4 | 11 | 22 |
| Percen | 83 | 42 | 99 |

Shipley:
Raw Score =52
I.Q. =110

Other Findings:
Both she and husband are on welfare
Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 9: A 29 year old married man

Onset Depression: Unclear. Precipitating Cause: Probably death of father and feeling of guilt associated with father's death.
Course: last six months. Patient stopped working six weeks ago because of poor concentration. Other Symptoms: Lack of energy, initial and terminal insomnia, guilt feelings about father's death, adbominal discomfort, low self-esteem, feels uncomfortable in social situation, irritable with family.
Previous Medical History: Experienced black outs in teens, 5 years ago treated for stomach ulcer. Previous Psychiatric History: None.
Treatment: Tofranil.

Family History: Father died of Leukemia 5 years ago; mother aged 60; one brother and two sisters between 37 and 32 years; all alive and well.
Education: Started school at 6 years and continued to Grade 8 repeated Grades 1 and 5; 2 years ago started technical school; patient has completed Grade 10 at night school. Occupational History: At age 16 started working at a fish plant and continued until 26 years; then moved to another province and worked with the railroad for 3 months; returned to Newfoundland and worked as a pipe-fitter's helper for 1 year and then quit his job 1 week after receiving a raise and promotion; patient expressed a fear of going to work in case he makes a mistake, but when he remains at home he feels guilty about this.
Marital History: Met his wife when he was 17 years; he married her 2 years later when she became pregnant; he experienced problems with her parents because she was a Roman Catholic and he was Anglican; they lived with his parents for five years after marriage.
Mental Examination by Psychiatrist: Behaviour observations - poor eye contact, no spontaneity; talk - slow, delibrate in a low tone; thought - no evidence of schizophrenic thought disorder, no blocking; mood - depressed, guilty, no hallucinations or complusions; orientation - good; memory - good; intelligence - below average; insight - poor.
Psychological Tests:

| EPI: | L | N | E |
|---|---|---|---|
| Raw Score | 3 | 20 | 13 |
| Percen. | 67 | 99 | 62 |

Shipley:
Raw Score = 36
I.Q. = 95

Psychiatric Diagnosis:
Endogenous Depression.

Patient No. 10 : A 52 year old housewife.

Onset Depression: 3 weeks prior to admission. Precipitating Cause: 3 weeks before admission son came home drunk and fought with patient and other family members; he treatened to kill the patient; was arrested; hospitalized and diagnosed as schizophrenic.
Course: Acute and intense.
Treatment: Dalmane and Elavil. Other Symptoms: Poor sleep pattern, poor appetite, neck pain, possible suicide attempt.
Previous Medical History: Frequent infection of fingers, tubal ligation three years ago, history of high blood pressure.
Previous Psychiatric History: 8 previous admissions for depression, usually occurring after some precipitating event, the first occurred when patient was 37 years old.

Family History: Mother died 15 years ago, father died 2 years ago.
Education: Patient stopped attending school at 14 years.
Occupational History: She was employed in several jobs until 17 years old when she married, she has not worked outside the house since.
Marital History: The patient's husband is 63 years, she said that they have had a good relationship until 3 years ago when he started to treat her poorly and deprive her of money, they no longer sleep in the same room, this couple has 7 children between 13 - 29 years, one son has a psychiatric history.
Physical Abnormalities: None.
Mental Examination by Psychiatrist: Appearance - not well groomed, sad facial expression; Talk - spontaneous; Affect - depressed, suicidal ideation; Thought - normal; Memory - good.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 6 | 8 | 18 |
| Percen. | 98 | 20 | 96 |

Shipley: Incomplete

Other Findings: Very unsatisfactory family situation - fighting, one son tried to run patient off the road with a car, history of criminal activity in family.
Psychiatric Diagnosis:
Endogenous Depression.

Patient No.11: A 23 year old housewife

Onset Depression: 3 months prior to admission. Precipitating Cause: Death of a friend.
Course: Depression worsened over last month. Other Symptoms: very irritable, initial insomnia, recurrent headaches, suicidal thoughts, diurnal mood variation, decreased libido, shouting at baby and threatening to kill him.
Treatment: Serax, Dalmane and supportive therapy.
Previous Medical History: 1 pregnancy. Previous Psychiatric History: Admitted 2 years earlier after birth of child, diagnosed reactive depression.

Family History: Father 55 a diabetic and chronic worrier; mother 51 and has been treated for involutional melancholia; patient has 4 sisters and 5 brothers, ranging between 10 and 34 years - all alive and well.
Education: Grade 9. Occupational History: Worked occasionally as a housekeeper until marriage. Marital History: Married for 3½ years, one child, husband has been diagnosed as a paranoid schizophrenic and is currently receiving anti-psychotic medication.

Pre-Morbid Personality: Insecure and chronic worrier.
Physical Examination by Psychiatrist: This revealed dull normal intelligence, with decreased abstraction, decreased recall and decreased attention and concentration.
Psychiatric Tests:

| EPI: | L | N | E |
|---|---|---|---|
| Raw Score | 2 | 19 | 10 |
| Percen. | 47 | 98 | 34 |

Shipley:
Raw Score = 17
I.Q. = 81

Other Findings: Husband unemployed, the family may soon be evicted from their home, three recent deaths (patient's close friend, her neighbour and the baby of a friend), conflict between the family and neighbours over the last 3 weeks.
Psychiatric Diagnosis:
Reactive Depression.

Patient No.12: A 28 year old divorced and unemployed woman

Onset Depression: One month prior to admission. Precipitating Cause: Family discord.
Course: Symptoms increased acutely three days prior to admission.
Other Symptoms: Initial and terminal insomnia, anorexia and weight loss, crying spells, suicidal ideation.
Treatment: Serax and much supportive psychotherapy. Previous Medical History: 3 years history of migraine headaches; 6 month history of gastroenteritis; 1 year history of hypertension; vaginal hysterectomy 6 years ago. Previous Psychiatric History: Counselled by psychiatrists at the time of her divorce; counselled by a psychiatrist 3 yearsago and diagnosed as suffering from Neurotic Depression.

Family History: Father 50 years, mother 49 years, 3 sisters and 2 brothers; her three sisters have suffered from serious medical problems; paternal aunt, paternal uncle and 1 sister all have psychiatric histories; mother currently being treated for depression; recently there has been much hostility between the patient and her mother. Education: Attended school up to Grade 8, stopped attending high school because of mother's illness, attempted to complete high school later but did not because of medical problems.
Occupational History: Patient stated that she did several menial jobs after leaving high school. Marital History: Married husband while 7 months pregnant and remained married for 3 years; 3 children aged 9, 10 and 11.
Pre-Morbid Personality: Insecure and anxious. Physical Abnormalities: None. Mental Examination by Psychiatrist: Essentially within normal limits except decreased libido and poor affect.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 1 | 9 | 19 |
| Percen. | 25 | 26 | 98 |

Shipley:
Raw Score= 26
I.Q. = 88

Other Findings:
Many family problems over the treatment of children and influence of aunt on patient.
Psychiatric Diagnosis:
Reactive Depression.

Patient No.13: A 21 year old woman, single and currently unemployed

Onset Depression: 3 weeks prior to admission. Precipitating Cause: Breaking up with boyfriend; family recently moved away.
Course: Grew in intensity until admission. Other Symptoms: Stomach pain, crying spells, terminal and intermittant insomnia.
Treatment: Serax, Psychotherapy.
Previous Medical History: Hospitalized for a head injury 7 years ago at the age of 12; hospitalized for three weeks for swollen feet and hands.
Previous Psychiatric History: None.

Family History: Mother, 42 suffers with high blood pressure and "bad nerves"; father and mother separated when the patient was 9 years old and this upset her considerably; father died when patient was 16 - "Took it very hard"; four sisters and 1 brother (22 - 12 years); the brother, 12, is being treated for emotional problems; grandmother - alcoholic. Education: Quit school at Grade IX (17 years) because father died. Occupational History: Sometimes employed as a baby sitter after leaving school.

Pre-Morbid Personality: Generally optimistic, sensitive, sociable.
Physical Abnormalities: None.
Mental Examination by Psychiatrist: Talk - spontaneous and coherent; Thoughts - normal; continuously thinking of ex-boyfriend; Mood - crying spells; Memory - average; Intelligence - average.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 2 | 14 | 17 |
| Percen. | 47 | 62 | 94 |

Shipley:
Raw Score = 41
I.Q. = 99

Other Findings:
Very unsatisfactory relationship with ex-boyfriend.
Psychiatric Diagnosis:
Reactive Depression.

Patient No. 14 : A 25 year old married housewife.

Onset Depression: 5 weeks prior to admission. Precipitating Cause: Bankruptcy of husband.
Course: Worsened progressively over last five weeks, suicidal gesture 1 week prior to admission. Other Symptoms: insomnia, poor appetite, crying spells, decreased libido, loss of interest, thoughts of harming self, loss of weight (5 lbs in last two weeks). Previous Medical History: Not significant.

Family History: Father 47 years, saleman; mother 44 described as strict, controlled the family; patient has 3 sisters and 5 brothers; no psychiatric illness in family. Education: Completed Grade 11, attended university for 2 years and received a Teaching Certificate. Occupational History: Taught Grade school for 4½ years. Marital History: Married at 21, courtship 3½ years, adopted one child 16 months ago as husband has low sperm count. Pre-Morbid Personality: Quiet, withdrawn. Physical Abnormalities: None. Mental Examination by Psychiatrist: General behaviour - well dressed, no psychomotor retardation; Talk - coherent, rational, spontaneous; Thought - no thought disorder; Abstraction - good; Affect - depressed, no suicidal ideas; Memory - very good.

Psychological Tests:

| EPI: | E | N | L |
|---|---|---|---|
| Raw Score | 13 | 81 | 4 |
| Percen. | 62 | 41 | 83 |

Shipley:
Raw Score = 62
I.Q. = 115

Psychiatric Diagnosis:
Reactive Depression

Patient No.15: A 25 year old married male.

Onset Depression: 3 days prior to admission. Precipitating Cause: Unclear, he said it "came out of the blue".
Course: Acute and intense. Other Symptoms: Initial insomnia, mood swings, suicidal gesture.
Treatment: Anafranil. Previous Medical History: Appendectomy, 2 hernia operations, cartilage removed from both knees. Previous Psychiatric History: Hospitalized five years ago as a result of aggressive behaviour and diagnosed as Reactive Depression.

Family History: He stated that he and his father did not have a good relationship and that his father was neglectful; mother, age 54 is suffering from severe medical problems, 4 siblings - 3 females and 1 male between the ages of 25 and 31 years. Education: He completed Grade 10 after repeating Grades 7 and 10; stated that he did not enjoy school and was not a good student. Occupational History: Worked in a supermarket for 3 years then as a general labourer for 3 years; after this he attended Trade School for 1 year and has worked as a pipe-fitter since that time (4 years).
Marital History: Married his wife at age 25 after knowing her for 1 year; good relationship; wife is two months pregnant.
Physical Abnormalities: Scars from operations.
Mental Examination by Psychiatrist: Appearance - well groomed and cooperative; Talk - rational, coherent and spontaneous; Thought - normal; Affect - subjectively depressed, objectively suicidal and depressed; Orientation - good; Insight - not impaired; Memory - normal.

Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 1 | 10 | 21 |
| Percen. | 25 | 34 | 99 |

Shipley:
Raw Score = 63
I.Q. = 116

Psychiatric Diagnosis:
Reactive Depression.

Patient No.16: A 43 year old married Registered Nurse.

Onset Depression: 4 months ago. Precipitating Cause: Has become increasingly depressed over last 4 months but not well since a hysterectomy one year ago. Other Symptoms: depressed mood, termihal insomnia, loss of energy, decreased appetite, decreased libido, suicidal ideation, unable to concentrate. Treatment: Supportive care, Dalmane and Anaframil (responded quite dramatically). Previous Medical History: Age 12 tonsillectomy; age 22 D & C; age 34 laparotomy; age 39 incision and drainage of rectal abscess; age 42 hysterectomy and D & C. Previous Psychiatric History: age 17 hospitalized for depression; age 30 hospitalized for depression.

Family History: Mother died age 61 from cerebrovascular disease; father died age 64 from carcinoma of stomach; 8 siblings, one died at the age of 43 from carcinoma of stomach; a history of alcohol abuse and diabetes mellitus in family; one brother and mother have received psychiatric counselling. Education: Completed high school at age 18 and then started training to become a R.N.. Occupational History: the patient has worked as a R.N. in several parts of N.A. over the last 20 years. Marital History: 5 years ago she married a gentleman 20 year her elder and the relationship has been very satisfying.
Pre-Morbid Personality: A friendly extroverted person.
Physical Abnormalities: scars from previous surgery; no other abnormality.
Mental Examination by Psychiatrist: General behaviour - initially reluctant to talk, tearful; speech - monotonour and deliberate; mood - subjectively and objectively depressed; thought - normal; memory - concentration and attention all normal; intelligence - average; insight - good but confused about marital situation.
Psychological Tests:

| EPI: | L | E | N |
|---|---|---|---|
| Raw Score | 4 | 16 | 19 |
| Percen. | 83 | 85 | 98 |

Shipley:
Raw Score = 51
I.Q. = 107

Psychiatric Diagnosis:
Reactive Depression.

# APPENDIX B

## SCORES OF SUBJECTS ON ALL MEASURES

Page

Patients with Endogenous Depression

Patients with Reactive Depression

*Normal Subjects

Notes

Patients # corresponds to that in Appendix A

"Beck" is Beck Depression Inventory

"Hamilton" is Hamilton Rating Scale for depression

"DACL" is Depress Adjective Check List

Total Speech and Pause Times are given in $10^{-2}$ seconds

Reaction Times are given in $10^{-2}$ seconds



RT-A, preparatory time = 6 seconds

RT-B, preparatory time = 12 seconds

RT-C, preparatory time = 2 seconds

Patient # and Sex: #1 Female
Age: 36 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-Discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 28 | 19 | 10 | 10 |
| Hamilton | | 22 | 18 | 0 | - |
| DACL | a.m. | 17 | 15 | 5 | - |
| DACL | p.m. | 17 | 15 | 4 | - |
| Total Speech | a.m. | 796.0 | 744.6 | 706.6 | 733.3 |
| Total Speech | p.m. | 796.0 | 722.6 | 604.0 | |
| Pause Time | a.m. | 188.0 | 187.3 | 68.0 | 42.6 |
| Pause Time | p.m. | 188.0 | 136.0 | 18.6 | |
| RT-A | a.m. | 16 | 19 | 19 | 12 |
| RT-A | p.m. | 16 | 74 | 22 | |
| RT-B | a.m. | 19 | 28 | 15 | 20 |
| RT-B | p.m. | 19 | 27 | 27 | |
| RT-C | a.m. | 20 | 26 | 19 | 21 |
| RT-C | p.m. | 20 | 69 | 27 | |
| Tapp Test | a.m. | 15.3 | 20.0 | 33.3 | 36.0 |
| Tapp Test | p.m. | 15.3 | 33.3 | 34.3 | |

Patient # and Sex: #2 Female
Age: 42 years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 23 | 1 | 0 | 0 |
| Hamilton | | 18 | 0 | 0 | - |
| DACL | a.m. | 11 | 9 | 6 | - |
| DACL | p.m. | 16 | 8 | 3 | - |
| Total Speech | a.m. | 1296.3 | 1040.0 | 806.6 | 953.3 |
| Total Speech | p.m. | 1206.6 | 880.0 | 813.3 | |
| Pause Time | a.m. | 290.6 | 186.0 | 63.1 | 42.6 |
| Pause Time | p.m. | 252.0 | 100.0 | 40.0 | |
| RT-A | a.m. | 27 | 45 | 20 | 19 |
| RT-B | p.m. | 22 | 21 | 22 | |
| RT-B | a.m. | 22 | 24 | 19 | 18 |
| RT-B | p.m. | 26 | 18 | 21 | |
| RT-C | a.m. | 24 | 36 | 18 | 22 |
| RT-C | p.m. | 24 | 22 | 23 | |
| Tapp Test | a.m. | 13.0 | 18.6 | 23.0 | 22.6 |
| Tapp Test | p.m. | 15.0 | 21.0 | 24.3 | |

Patient # and Sex: #3 Male
Age: 59 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 13 | 17 | 7 | 4 |
| Hamilton | | 6 | 14 | 2 | - |
| DACL | a.m. | 7 | 15 | 8 | - |
| DACL | p.m. | 14 | 17 | 9 | - |
| Total Speech | a.m. | 1701.3 | 999.3 | 676.0 | 770.6 |
| Total Speech | p.m. | 984.0 | 952.0 | 692.0 | |
| Pause Time | a.m. | 625.3 | 143.3 | 30.6 | 13.3 |
| Pause Time | p.m. | 82.6 | 121.3 | 34.6 | |
| RT-A | a.m. | 23 | 19 | 12 | 16 |
| RT-A | p.m. | 19 | 16 | 16 | |
| RT-B | a.m. | 24 | 16 | 16 | 12 |
| RT-B | p.m. | 18 | 16 | 18 | |
| RT-C | a.m. | 31 | 23 | 17 | 17 |
| RT-C | p.m. | 56 | 14 | 18 | |
| Tapp Test | a.m. | 21.6 | 28.6 | 41.6 | 45.6 |
| Tapp Test | p.m. | 22.6 | 33.0 | 38.6 | |

Patient # and Sex: #4 Female
Age: 51 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week * | Pre-discharge * | Follow-up |
|---|---|---|---|---|---|
| Beck | | 30 | 9 | 9 | - |
| Hamilton | | 22 | 13 | 13 | - |
| DACL | a.m. | 12 | 9 | 9 | - |
| DACL | p.m. | 11 | 9 | 9 | - |
| Total Speech | a.m. | 1969.3 | 1617.3 | 1617.3 | 1270.6 |
| Total Speech | p.m. | 1712.0 | 1865.3 | 1865.3 | |
| Pause Time | a.m. | 1025.3 | 548.0 | 548.0 | 220.0 |
| Pause Time | p.m. | 689.3 | 856.0 | 856.0 | |
| RT-A | a.m. | 60 | 41 | 41 | 32 |
| RT-A | p.m. | 45 | 23 | 23 | |
| RT-B | a.m. | 70 | 63 | 63 | 33 |
| RT-B | p.m. | 44 | 33 | 33 | |
| RT-C | a.m. | 41 | 64 | 64 | 18 |
| RT-C | p.m. | 66 | 22 | 22 | |
| Tapp Test | a.m. | 14.0 | 15.6 | 15.6 | 20.0 |
| Tapp Test | p.m. | 15.0 | 19.3 | 19.3 | |

* Patient was in hospital less than two weeks, therefore 'At One Week' and 'pre-dischage' scores are the same.

Patient # and Sex: #5 Female
Age: 29 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 22 | 15 | 0 | 11 |
| Hamilton | | 31 | 28 | 0 | - |
| DACL | a.m. | 19 | 14 | 2 | - |
| DACL | p.m. | 16 | 10 | 4 | - |
| Total Speech | a.m. | 1656.0 | 829.3 | 710.6 | |
| Total Speech | p.m. | 825.3 | 790.6 | 668.0 | 1183.3 |
| Pause Time | a.m. | 560.6 | 101.3 | 28.0 | |
| Pause Time | p.m. | 122.6 | 82.6 | 24.0 | 294.3 |
| RT-A | a.m. | 19 | 16 | 16 | |
| RT-A | p.m. | 21 | 21 | 15 | 18 |
| RT-B | a.m. | 24 | 17 | 20 | |
| RT-B | p.m. | 18 | 34 | 15 | 22 |
| RT-C | a.m. | 22 | 18 | 16 | |
| RT-C | p.m. | 44 | 27 | 11 | 19 |
| Tapp Test | a.m. | 25.3 | 30.0 | 31.6 | |
| Tapp Test | p.m. | 27.0 | 31.6 | 34.0 | 28.5 |

Patient # and Sex: #6 Female
Age: 52 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 23 | 24 | 6 | 6 |
| Hamilton | | 31 | 28 | 0 | - |
| DACL | a.m. | 19 | 14 | 2 | - |
| DACL | p.m. | 16 | 10 | 4 | - |
| Total Speech | a.m. | 1656.0 | 829.3 | 710.6 | 1183.3 |
| Total Speech | p.m. | 825.3 | 790.6 | 668.0 | |
| Pause Time | a.m. | 560.6 | 101.3 | 28.0 | |
| Pause Time | p.m. | 122.6 | 82.6 | 24.0 | 294.3 |
| RT-A | a.m. | 19 | 16 | 16 | |
| RT-A | p.m. | 21 | 21 | 15 | 18 |
| RT-B | a.m. | 24 | 17 | 20 | |
| RT-B | p.m. | 18 | 34 | 15 | 22 |
| RT-C | a.m. | 22 | 18 | 16 | |
| RT-C | p.m. | 44 | 27 | 11 | 19 |
| Tapp Test | a.m. | 25.3 | 30.0 | 31.6 | |
| Tapp Test | p.m. | 27.0 | 31.6 | 34.0 | 28.5 |

Patient # and Sex: #7 Female
Age: 39 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 19 | 19 | 17 | 4 |
| Hamilton | | 29 | 25 | 3 | - |
| DACL | a.m. | 22 | 16 | 22 | - |
| DACL | p.m. | 18 | 13 | 22 | - |
| Total Speech | a.m. | 1137.3 | 825.3 | 812.0 | |
| Total Speech | p.m. | 1352.0 | 884.0 | 793.0 | 710.6 |
| Pause Time | a.m. | 185.3 | 44.0 | 45.3 | |
| Pause Time | p.m. | 252.0 | 74.6 | 37.3 | 20.0 |
| RT-A | a.m. | 23 | 11 | 15 | |
| RT-A | p.m. | 13 | 15 | 16 | 16 |
| RT-B | a.m. | 25 | 16 | 17 | |
| RT-B | p.m. | 18 | 17 | 15 | 15 |
| RT-C | a.m. | 18 | 13 | 14 | |
| RT-C | p.m. | 28 | 20 | 36 | 16 |
| Tapp Test | a.m. | 37.0 | 48.0 | 44.3 | |
| Tapp Test | p.m. | 39.3 | 46.6 | 44.0 | 52.0 |

Patient # and Sex: #8 Female
Age: 39 years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 47 | 51 | 12 | 24 |
| Hamilton | | 21 | 26 | 15 | - |
| DACL | a.m. | 28 | 29 | 12 | - |
| DACL | p.m. | 28 | 26 | 8 | - |
| Total Speech | a.m. | 1986.6 | 914.6 | 812.0 | 802.6 |
| Total Speech | p.m. | 1474.6 | 982.6 | 725.3 | |
| Pause Time | a.m. | 704.0 | 112.9 | 64.0 | 125.3 |
| Pause Time | p.m. | 450.6 | 164.0 | 29.0 | |
| RT-A | a.m. | 50 | 25 | 22 | 20 |
| RT-A | p.m. | 33 | 25 | 21 | |
| RT-B | a.m. | 37 | 18 | 20 | 29 |
| RT-B | p.m. | 27 | 34 | 13 | |
| RT-C | a.m. | 40 | 62 | 40 | 60 |
| RT-C | p.m. | 35 | 82 | 17 | |
| Tapp Test | a.m. | 22.0 | 17.3 | 21.2 | 19.6 |
| Tapp Test | p.m. | 17.0 | 17.6 | 22.3 | |

Patient # and Sex: #9 Male
Age: 29 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 25 | 18 | 9 | 15 |
| Hamilton | | 24 | 16 | 10 | - |
| DACL | a.m. | 17 | 15 | 0 | - |
| DACL | p.m. | 20 | 9 | 2 | - |
| Total Speech | a.m. | 1492.0 | 1394.6 | 1145.3 | 1084.0 |
| Total Speech | p.m. | 1330.6 | 1378.0 | 1150.6 | |
| Pause Time | a.m. | 490.6 | 400.0 | 170.6 | 156.0 |
| Pause Time | p.m. | 372.0 | 369.3 | 102.6 | |
| RT-A | a.m. | 18 | 14 | 18 | 26 |
| RT-A | p.m. | 19 | 15 | 15 | |
| RT-B | a.m. | 21 | 18 | 15 | 35 |
| RT-B | p.m. | 27 | 20 | 10 | |
| RT-C | a.m. | 33 | 26 | 17 | 20 |
| RT-C | p.m. | 39 | 45 | 12 | |
| Tapp Test | a.m. | 26.6 | 28.0 | 30.0 | 27.0 |
| Tapp Test | p.m. | 28.0 | 27.6 | 30.6 | |

Patient # and Sex: #10 Female
Age: 52 Years
Diagnostic Group: Endogenous Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 35 | 43 | 31 | 41 |
| Hamilton | | 24 | 25 | 17 | - |
| DACL | a.m. | 23 | 29 | 33 | - |
| DACL | p.m. | 30 | 31 | 21 | - |
| Total Speech | a.m. | 1260.0 | 1394.6 | 1361.3 | |
| Total Speech | p.m. | 1277.3 | 330.6 | 1065.3 | 1321.3 |
| Pause Time | a.m. | 337.3 | 424.0 | 329.3 | |
| Pause Time | p.m. | 228.0 | 340.0 | 105.3 | 217.3 |
| RT-A | a.m. | 16 | 25 | 34 | |
| RT-A | p.m. | 25 | 46 | 18 | 23 |
| RT-B | a.m. | 27 | 49 | 25 | |
| RT-B | p.m. | 45 | 33 | 44 | 28 |
| RT-C | a.m. | 35 | 33 | 45 | |
| RT-C | p.m. | 29 | 72 | 29 | 51 |
| Tapp Test | a.m. | 23.3 | 25.6 | 27.3 | |
| Tapp Test | p.m. | 25.0 | 25.0 | 28.3 | 26.0 |

Patient # and Sex: #11 Female
Age: 23 Years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Week * | Pre-discharge * | Follow-up |
|---|---|---|---|---|---|
| Beck | | 41 | 31 | 31 | 13 |
| Hamilton | | 25 | 6 | 6 | - |
| DACL | a.m. | 11 | 8 | 8 | - |
| DACL | p.m. | 15 | 4 | 4 | - |
| Total Speech | a.m. | 1404.0 | 916.0 | 916.0 | 946.6 |
| Total Speech | p.m. | 1080.0 | 890.6 | 890.6 | |
| Pause Time | a.m. | 410.6 | 81.3 | 81.3 | 96.0 |
| Pause Time | p.m. | 229.3 | 84.0 | 84.0 | |
| RT-A | a.m. | 19 | 23 | 23 | 13 |
| RT-A | p.m. | 17 | 13 | 13 | |
| RT-B | a.m. | 18 | 17 | 17 | 6 |
| RT-B | p.m. | 17 | 18 | 18 | |
| RT-C | a.m. | 20 | 36 | 36 | 17 |
| RT-C | p.m. | 25 | 23 | 22 | |
| Tapp Test | a.m. | 21.6 | 24.3 | 24.3 | 22.0 |
| Tapp Test | p.m. | 23.0 | 26.6 | 26.6 | |

* This patient was hospitalized for less than 2 weeks therefore 'at one week' and 'pre-discharge' scores are similar.

Patient # and Sex: #12 Female
Age: 28 Years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Day * | Pre-discharge * | Follow-up |
|---|---|---|---|---|---|
| Beck | | 35 | 22 | 22 | 28 |
| Hamilton | | 27 | 9 | 9 | - |
| DACL | a.m. | 17 | 14 | 14 | - |
| DACL | p.m. | 20 | 10 | 10 | - |
| Total Speech | a.m. | 961.3 | 746.6 | 746.6 | |
| Total Speech | p.m. | 922.6 | 742.6 | 742.6 | 854.0 |
| Pause Time | a.m. | 85.3 | 34.6 | 34.6 | |
| Pause Time | p.m. | 54.6 | 34.6 | 34.6 | 60.0 |
| RT-A | a.m. | 25 | 18 | 18 | |
| RT-A | p.m. | 23 | 15 | 15 | 22 |
| RT-B | a.m. | 27 | 15 | 15 | |
| RT-B | p.m. | 31 | 17 | 17 | 21 |
| RT-C | a.m. | 54 | 29 | 29 | |
| RT-C | p.m. | 43 | 15 | 15 | 41 |
| Tapp Test | a.m. | 12.6 | 15.6 | 15.6 | |
| Tapp Test | p.m. | 12.6 | 17.3 | 17.3 | 14.2 |

* This patient was hospitalized for less than 2 weeks therefore 'at one week' and 'pre-discharge' scores are similar

Patient # and Sex: #13 Female
Age: 21 Years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Week | Pre-Discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 9 | 12 | 10 | 10 |
| Hamilton | | 30 | 1 | 1 | - |
| DACL | a.m. | 18 | 3 | 3 | - |
| DACL | p.m. | 13 | 8 | 10 | - |
| Total Speech | a.m. | 1337.3 | 782.6 | 782.6 | 732.0 |
| Total Speech | p.m. | 984.0 | 914.0 | 914.0 | |
| Pause Time | a.m. | 393.3 | 82.0 | 82.0 | 34.6 |
| Pause Time | p.m. | 114.0 | 97.3 | 97.3 | |
| RT-A | a.m. | 16 | 14 | 14 | 15 |
| RT-A | p.m. | 12 | 13.5 | 13.5 | |
| RT-B | a.m. | 16 | 20 | 20 | 14 |
| RT-B | p.m. | 13 | 15 | 15 | |
| RT-C | a.m. | 19 | 22 | 22 | 33 |
| RT-C | p.m. | 28 | 21.5 | 21.5 | |
| Tapp Test | a.m. | 27.6 | 31.6 | 31.6 | 33.0 |
| Tapp Test | p.m. | 26.6 | 28.9 | 28.9 | |

Patient # and Sex: #14 Female
Age: 29 Years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Week * | Pre-discharge * | Follow-up |
|---|---|---|---|---|---|
| Beck | | 28 | 0 | 0 | 14 |
| Hamilton | | 17 | 4 | 4 | - |
| DACL | a.m. | 30 | 1 | 1 | - |
| DACL | p.m. | 25 | 0 | 0 | - |
| Total Speech | a.m. | 926.6 | 792.0 | 792.0 | 859.3 |
| Total Speech | p.m. | 854.6 | 872.0 | 872.0 | |
| Pause Time | a.m. | 108.0 | 61.3 | 61.3 | 84.6 |
| Pause Time | p.m. | 60.0 | 69.3 | 69.3 | |
| RT-A | a.m. | 17 | 18 | 18 | 18 |
| RT-A | p.m. | 16 | 11 | 11 | |
| RT-B | a.m. | 12 | 12 | 12 | 12 |
| RT-B | p.m. | 18 | 13 | 13 | |
| RT-C | a.m. | 20 | 20 | 20 | 20 |
| RT-C | p.m. | 23 | 14 | 14 | |
| Tapp Test | a.m. | 24.3 | 31.6 | 31.6 | 28.0 |
| Tapp Test | p.m. | 24.0 | 34.6 | 34.6 | |

* Note this patient was only tested on the initial day and one week thereafter, therefore 'at one week' and pre-discharge' scores are similar.

Patient # and Sex: #15 Male
Age: 27 years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Week | Pre-discharge | Follow-up |
|---|---|---|---|---|---|
| Beck | | 22 | 11 | 15 | 2 |
| Hamilton | | 19 | 9 | 4 | - |
| DACL | a.m. | 23 | 9 | 12 | - |
| DACL | p.m. | 21 | 13 | 4 | - |
| Total Speech | a.m. | 1525.3 | 876.0 | 941.3 | 1016.0 |
| Total Speech | p.m. | 1021.3 | 1029.3 | 753.3 | |
| Pause Time | a.m. | 576.0 | 89.3 | 102.6 | 62.6 |
| Pause Time | p.m. | 198.6 | 150.6 | 30.6 | |
| RT-A | a.m. | 15 | 16 | 18 | 13 |
| RT-A | p.m. | 13 | 19 | 11 | |
| RT-B | a.m. | 15 | 15 | 17 | 9 |
| RT-B | p.m. | 6 | 16 | 11 | |
| RT-C | a.m. | 25 | 15 | 22 | 8 |
| RT-C | p.m. | 17 | 33 | 10 | |
| Tapp Test | a.m. | 27.0 | 33.0 | 25.6 | 43.3 |
| Tapp Test | p.m. | 28.3 | 28.3 | 39.0 | |

Patient # and Sex: #16 Female
Age: 43 Years
Diagnostic Group: Reactive Depression

| | | Initial Day | At One Week * | Pre-discharge * | Follow-up |
|---|---|---|---|---|---|
| Beck | | 33 | 7 | 7 | 2 |
| Hamilton | | 25 | 10 | 10 | - |
| DACL | a.m. | 23 | 2 | 2 | - |
| DACL | p.m. | 12 | 6 | 6 | - |
| Total Speech | a.m. | 1072.0 | 774.6 | 774.6 | |
| Total Speech | p.m. | 644.0 | 26.6 | 26.6 | 785.3 |
| Pause Time | a.m. | 188.0 | 848.0 | 848.0 | |
| Pause Time | p.m. | 12.0 | 40.0 | 40.0 | 17.3 |
| RT-A | a.m. | 51 | 19 | 19 | |
| RT-A | p.m. | 24 | 15 | 15 | 21 |
| RT-B | a.m. | 30 | 21 | 21 | |
| RT-B | p.m. | 21 | 18 | 18 | 16 |
| RT-C | a.m. | 22 | 33 | 33 | |
| RT-C | p.m. | 38 | 21 | 21 | 33 |
| Tapp Test | a.m. | 13.0 | 18.3 | 18.3 | |
| Tapp Test | p.m. | 18.3 | 19.6 | 19.6 | 27.3 |

* This patient was only tested on the initial day and one week thereafter, therefore 'at one week' and 'pre-discharge' scores are similar.