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Unawareness of deficits in Huntington’s disease

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The University of Arizona, 1989
UNAWARENESS OF DEFICITS IN HUNTINGTON'S DISEASE

by

Susan Mary McGlynn

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DEPARTMENT OF PSYCHOLOGY
In Partial Fulfillment of the Requirements
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1989
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ABSTRACT

Several new techniques were developed to assess quantitatively the degree to which patients with Huntington's disease (HD) are aware of their deficits, to evaluate the relation between cognitive impairment and unawareness of deficits, and to determine whether patients exhibit differential awareness of their motor disturbance and cognitive deficits. Results of a questionnaire measure indicated that HD patients rated their own difficulties with motor and cognitive activities of daily life significantly lower than relatives rated patients' problems, and this discrepancy was related to patients' level of cognitive impairment. In contrast, patients were reasonably accurate when predicting their performance on specific motor and cognitive tasks when compared to both their actual performance and relatives' predictions. Several interpretations of these findings are discussed, and the role of frontal lobe dysfunction in the awareness problems characterizing dementia is considered.
CHAPTER 1

INTRODUCTION

Damage to different regions of the brain can produce a wide variety of cognitive, motor, and behavioral disturbances. A significant proportion of brain-damaged patients are entirely unaware of their deficits, even when they interfere profoundly with their ability to perform everyday activities. Unawareness of deficits has been observed in a variety of neuropsychological syndromes. For example, some amnesic patients will maintain that their memory is completely normal, aphasic patients are frequently unaware of their disturbed linguistic output, and hemiplegic patients often do not realize, and sometimes deny, that they have a motor deficit. The term anosognosia was introduced by Babinski (1914) to describe the lack of knowledge, awareness, or recognition of disease observed in patients with hemiplegia attributable to stroke. The term has since been used more generally to refer to unawareness of any neuropsychological deficit. The terms anosognosia, unawareness of deficits, and lack of insight will be used interchangeably in this paper to refer to patients who are unable to become aware of a neuropsychological deficit.

Dementia generally reflects brain dysfunction associated with widespread cognitive impairment. Consequently, one might expect that demented patients would exhibit disturbed cognition in the domain of awareness. Yet there has been relatively little systematic study of awareness in dementing populations, in contrast to the substantial amount of research on awareness disturbances in other cognitively
impaired populations (McGlynn & Schacter, 1989). The purposes of the present paper are to: (1) critically review the existing literature concerned with unawareness of deficits in dementia, (2) describe some new techniques for quantitatively assessing the degree to which dementing patients, specifically those with Huntington's disease (HD), are aware of their deficits, and report results of a study evaluating awareness in this population, (3) discuss the methodological problems associated with evaluating awareness in dementing populations, and (4) consider the role of frontal lobe dysfunction in the awareness problems characterizing particular types of dementing illnesses.

Unawareness of deficits has significant implications for patient treatment and management. Patients who are unaware of their problems are unlikely to cooperate with treatment plans or accept help from concerned family members. Furthermore, patients may attempt to perform activities that are entirely unrealistic given their disabilities. Demented patients who lack awareness of their deficits may pose serious problems for family members and other caretakers. Informing families of the awareness disturbance and possible consequences would help them prepare for and deal with the difficult situations they may confront.

In addition to the practical importance of studying awareness, the theoretical insights that may be gained from research in this area could be far reaching. Examination of disturbed awareness in different neurological disorders, as well as the potential neuropathological factors involved, may help to elucidate the process by which awareness is compromised.

There is little experimental evidence for unawareness of deficits
in the dementing illnesses; however, consideration of clinical
descriptions and those few systematic studies suggest that unawareness
phenomena do occur in dementing syndromes. A brief overview of this
literature will be presented in the next section.

Unawareness of Deficits in Different Dementing Disorders

Patients with certain kinds of dementing illnesses have been
described as lacking awareness or insight into their condition.
Frederiks (1985) referred to this phenomenon as "anosognosia for
dementia." In the dementia literature, unawareness of deficits is most
frequently reported as a clinical feature of so-called "cortical"
dementias such as Alzheimer's disease (AD) and Pick's disease (e.g.,
Benson, 1983; Gustafson & Nilsson, 1982; Mahendra, 1984; Neary et al.,
1986; Reisberg, Gordon, McCarthy, & Ferris, 1985; Schneck, Reisberg, &
Ferris, 1982). However, lack of insight has also been observed as a
striking aspect of Huntington's disease (HD), a hereditary neurological
disorder accompanied by what has been classified as a "subcortical" or
"frontal–subcortical" dementia syndrome (Cummings & Benson, 1984; Joynt
& Shoulson, 1985; McHugh & Folstein, 1975). In contrast, patients with
the predominantly subcortical disorder of Parkinson's disease (PD) have
been described as exhibiting good comprehension of their illness, even
in the most advanced stages of the disease (Danielczyk, 1983).

Awareness of deficits may be a valuable prognostic indicator for
ability to function in everyday life. Bergmann, Proctor, and Prudham
(1979) examined psychiatric profiles in hospital and community resident
elderly persons with dementia and found that lack of insight into their
disability was one of the most important features differentiating the
two groups. Patients who are unaware of their deficits are unlikely to accept the help and support required to survive in the community and are therefore at risk of being placed in an institutionalized setting.

Alzheimer's disease is the most prevalent and widely researched dementing illness occurring in adult life. Clinical descriptions of the more advanced stages of this disease often include loss of insight as a major feature. Schneck, Reisberg, and Ferris (1982) outlined three main phases in the clinical syndrome of AD. During the initial "forgetfulness phase," patients are described as cognizant of and becoming increasingly anxious about their memory difficulties. As the disease progresses, patients are said to enter the second, or "confusional phase," at which time they show definite signs of cognitive impairment, particularly for memory of recent events. According to Schneck et al., patients at this stage reveal a loss of insight into their own deficits and earlier anxiety is replaced with unawareness of illness. In the most advanced, or "dementia phase," patients appear extremely disoriented and may exhibit substantial anxiety despite the continued unawareness of their condition. These phases are thus held to reflect a pattern of decreasing insight and knowledge with increasing severity of the disease process.

Reisberg, Gordon, McCarthy, and Ferris (1985) assessed awareness of deficit in 25 AD patients, 5 subjects with a primary diagnosis of age-associated cognitive decline consistent with "senescent forgetfulness," and 10 control subjects with no memory impairment. Subjects were interviewed and questioned about their own functioning as well as their spouses' functioning. Spouses of subjects were similarly
interviewed and questioned about their own functioning and the subject's functioning. Findings revealed that subjects with senescent forgetfulness rated their memory problems as somewhat worse than did the controls, and "Early Confusional Phase" AD patients rated their problems as being considerably worse than did the "Forgetfulness Phase" AD patients. However, once beyond the "Early Confusional Phase," AD patients tended to rate the degree of their memory impairment as progressively less severe, whereas objective measures of memory function provided evidence of progressive deterioration. Spouses' reports of patients' memory deficit increased consistently as patients' level of impairment increased on objective measures. Patients with moderate to severe memory impairment also tended to minimize their emotional difficulties. They rated their emotional problems as substantially less severe than did their spouses. Patients did exhibit preserved insight into two domains: (a) throughout the illness they showed insight into their ability to communicate with the spouse and (b) despite marked unawareness of their own deficits in the final phase, patients continued to display awareness of their spouses' cognitive functioning, i.e., patients' ratings of spouses' cognitive abilities closely matched the spouses' ratings of themselves. Based on the latter observation, Reisberg et al. concluded that AD patients were engaging in defensive denial, resulting in an apparent "lack of insight" into their own deficits.

Contrary to the foregoing results, the findings of Neary et al. (1986) suggest that more globally demented patients may have greater insight into their disabilities than those patients at an earlier stage
of cognitive deterioration. These investigators found that different subgroups of AD patients demonstrated different degrees of insight. Eighteen patients diagnosed with AD were separated into four groups based on their neuropsychological profiles. A group of 11 patients characterized by a language disorder, amnesia, and a perceptuo-spatial disorder showed clear signs of anxiety when required to perform difficult tasks, suggesting some awareness of their cognitive problems. A second group (n=3) with amnesia and a perceptuo-spatial disorder similarly exhibited anxiety with respect to their defects. Two patients with a profound apraxia and amnesia tended to minimize their difficulties but possessed some knowledge of their disability. Finally, two patients with amnesia alone would admit to memory impairment but appeared not to understand the severity of the disorder, and exhibited no overt anxiety. These findings suggest that there may be substantial variability in awareness among dementia patients.

Other clinical reports of AD have emphasized an early loss of insight as opposed to unawareness in the late stage (Frederiks, 1985; Joynt & Shoulson, 1985; Mahendra, 1984). For example, Frederiks (1985) indicated that the patient is usually unaware of the gradual onset of dementia occurring in both AD and Pick's disease. Similarly, Mahendra (1984) noted the early loss of insight in both AD and Pick's disease. However, Gustafson and Nilsson (1982) found that early loss of insight is a useful dimension for differentiating between AD and Pick's disease. They developed rating scales to identify AD and Pick's disease that evaluated a number of clinical features. Patients with Pick's disease were rated substantially higher than AD patients with
respect to early loss of insight on these scales. Thus, loss of insight may progress at a different rate in Pick's disease than AD. Interestingly, both of these kinds of dementia are typically associated with signs of frontal lobe pathology (see Kaszniak, 1986; Mahendra, 1984), but frontal degeneration is generally more severe in the early stages of Pick's disease than AD.

Experimental evidence of unawareness of memory dysfunction in AD patients was provided by Schacter, McLachlan, Moscovitch, and Tulving (1986). Alzheimer's patients were given a categorized list and were asked to predict how many items they would be able to recall. Relative to control subjects, AD patients grossly overestimated their ability to remember.

Danielczyk (1983) designed a clinical rating scale consisting of 18 parameters, including "insight into own illness," to assess mental deterioration in four groups of patients: Parkinson's disease (PD), Alzheimer's disease (AD), atypical Parkinson's disease (AP) with signs of vascular disease, and multiple infarction dementia (MID). Although the PD group had suffered from the disease for over 8 years, there was little disturbance in their memory, reading, writing, orientation, motivation, and initiative, or apraxia. In contrast, the other three groups were impaired to a significantly greater extent on these measures. In addition to the functional differences observed between PD patients and the other groups, EEG data revealed significant differences. The "alpha reaction" registered in the EEG of the PD group was near normal while that of all other groups was diminished or absent, and there were significantly fewer "general changes" and "focal
signs" in the PD group than in the other three groups. The specific scale for the "insight" parameter ranged from 0 to 3, where 0 indicates no awareness disturbance and 3 reflects a severe disturbance. Patients with PD were found to retain reasonably good insight into their illness, whereas those in the other three groups exhibited disturbed awareness of their deficits. The AD patients showed the least comprehension of their illness followed by the AP group. The MID patients, though also lacking awareness of their condition, were significantly less impaired on this dimension than the AD group.

The foregoing study suggests that in PD patients with little evidence of cortical dysfunction and dementia, there is a retention of insight about their illness. In contrast, patients with disorders involving cortical atrophy and cognitive impairment appear to lose insight into their deficits. Huntington's disease is generally considered to be a "frontal-subcortical" dementia syndrome; thus, one might expect that awareness would be compromised in this group. In fact, there is some evidence suggesting that HD patients lack awareness of their defects. Clinical observations of unawareness of deficits in HD were reported as early as 1923 when Meggendorfer (cited in Bruyn, 1968) conducted a major study on the psychiatric symptoms of HD. He noted that a prominent characteristic of HD is a lack of insight into one's disease. Similarly, Bruyn (1968) included loss of insight as a main feature of the dementia associated with HD. He also noted that despite marked impairment of intellectual processes, HD patients rarely exhibit confusional states, disorientation, or delirium. Thus, the unawareness could not be attributed to confusional kinds of
disturbances in this population. In a discussion of psychopathology in HD, Wilson and Garron (1979) pointed out that self-report measures would not be a valid method of investigating psychopathology in this syndrome since insight is often compromised.

More recently, Caine and Shoulson (1983) evaluated 30 patients with HD regarding their insight into the process of their disease. Patients were asked such questions as, "Do you have problems with your memory?" "Has your personality changed since you've had Huntington's?" and "What do you see happening to you in the future?" Patients' responses to these questions were judged by the interviewer in terms of degree of awareness. Results revealed that 19 of the 30 patients were judged fully insightful about their condition, seven exhibited partial insight (i.e., described some deficiency but denied other changes) and four completely denied changes in either behavior or intellectual function. Ten of the eleven patients lacking awareness of their deficits had been classified as moderately or severely impaired individuals based on their functional disability in everyday life. Rated functional disability correlated highly with increased caudate atrophy as assessed using computerized tomography. Of 10 mildly disabled patients, one had partial insight and the other nine were completely realistic in assessing their problems. Consistent with these findings, Mahendra (1984) noted that insight may be preserved until more advanced stages of the disease process. The high frequency of suicide in the initial stages of the disease (Oltman & Friedman, 1961) as opposed to later stages may also be consistent with the notion that insight declines with progression of the disease. Interestingly,
Caine and Shoulson (1983) also reported that the majority of moderately and severely impaired patients in their study manifested a lack of self-initiated activities whereas less than half of the mildly affected individuals exhibited this apathy. Apathy can be a sign of frontal lobe damage. This suggests the possibility that, with progressive frontal degeneration and caudate atrophy, both apathy and lack of insight become apparent.

Bradley (1984) provided a revealing description of an HD patient who appeared to be completely unaware of his movement disturbance: He fidgeted, sat about, got up, sat about some more and was euphoric. When I asked about his ability to perform certain movements, he said he was fine and walked over to the bookcase, picked up a book and threw it into the air and let it crash to the deck. This event did not worry him, he just said it was a mistake (p. 338).

The possibility that HD patients may be unaware of their choreiform movements has not, to my knowledge, been reported in the literature before. The Bradley (1984) case description suggests that this phenomenon may occur in HD.

Contrary to the above, there also exist several clinical descriptions arguing for a preservation of insight in most HD patients. Caine et al. (1978) maintained that the 18 HD patients assessed in their study were acutely aware of their cognitive disabilities. This conclusion was based on the observation that 16 of the 18 patients complained of their inability to perform mental functions at the level they had attained previously. In addition, many patients noted a
change of temperament or disposition. These observations were derived from frequent clinical interviews and longitudinal followups. Similar findings were reported by Aminoff, Marshall, Smith, and Wyke (1975). Clinical records suggested that 9 of 11 HD patients seen during assessment of cognitive functions retained insight into their condition. No criteria for assessing awareness were provided. The two patients considered to be lacking awareness were those with the lowest Wechsler Adult Intelligence Scale (WAIS) IQs. Based on his clinical impressions, Lishman (1987) noted that judgment is often severely impaired as part of the widespread intellectual decline in HD, but insight is commonly preserved for a considerable length of time. According to Lishman, the patient may thus be aware of his cognitive deficits, complaining that he feels dulled, slow, and forgetful and that his thinking is confused.

In summary, the paucity of experimental evidence for unawareness of deficits in various dementing illnesses, and conflicting clinical reports of the phenomenon, make it impossible to reach any conclusions about the degree to which disturbed awareness occurs in these disorders. Two major methodological shortcomings are evident in studies of anosognosia in dementia. First, clinicians and investigators have often relied solely on their subjective observations of the patient to determine the presence of anosognosia; few investigators have developed quantitative methodologies for objectively evaluating the presence or degree of awareness disturbance. In a number of reports, the criteria for assessing awareness were not even discussed. Second, although the relation of intellectual impairment
and generalized confusion to anosognosia is an important issue, the nature and severity of these deficits were rarely assessed in a systematic fashion.

Another problem concerns the justification for inferences drawn from published observations. Reisberg et al. (1985) argued that the discrepancy they observed between AD patients' assessment of their own and others' cognitive functioning indicates that patients are engaging in defensive denial. However, such a discrepancy does not necessarily imply that denial is motivated. It may simply reflect the fact that patients are basing their judgments on past information concerning themselves and their spouse. Since the spouse's level of functioning has presumably not changed substantially, patients' judgments of them will be accurate. However, since their own condition has changed, patients' inability to incorporate and monitor new information about themselves would result in defective insight. Related to this issue is the possibility that patients' apparent "preserved" insight into spouses' cognitive functioning may be attributable to measurement range problems. That is, since there is little variability in spouses' functioning over time, it is not surprising that patients and spouses ratings appear very similar. It is not clear whether patients would exhibit preserved insight in this domain if they had to rate cognitive functioning of others who have, like themselves, changed in their cognitive abilities over time.

Finally, most investigators have failed to consider that degree of awareness may vary for different deficits within a given individual. Reports of unawareness in dementia have primarily referred to
diminished insight into one's condition or into the process of one's disease, rather than unawareness of a specific deficit. Yet, in many neuropsychological syndromes, a striking specificity can be observed, whereby patients may be acutely aware of one disability and entirely oblivious of another (see McGlynn & Schacter, 1989).

No attempts have been made to investigate systematically whether HD patients lack insight into their deficits, yet there are a number of advantages to studying awareness in this dementia group. First, HD patients become progressively demented and could therefore be examined at different stages of their disease to determine the relation between cognitive impairment and development of unawareness. Furthermore, these patients remain relatively verbal and are thus able to answer questions about their condition until the most advanced stages of their disease. Second, HD patients have both memory and motor deficits, permitting assessment of differential awareness of the two impairments. Third, the frontal lobe pathology associated with HD provides a theoretically-based reason to suspect that some degree of unawareness may develop in this population.

Consideration of clinical reports of unawareness in HD patients and the literature concerned with anosognosia in other neuropsychological syndromes raises a number of interesting questions with respect to unawareness phenomena in HD. First, given the progressive frontal lobe pathology associated with HD and, to a lesser extent, atrophy in posterior cortical regions, do HD patients lack awareness of their deficits and does degree of awareness correlate with progression of disease and severity of dementia? Second, are there
differences in terms of the degree of awareness for different deficits? Third, is it the case that HD patients possess a general awareness of the existence of their deficits but underestimate the degree to which these disabilities affect their performance in everyday life?

Neuropathological investigations of HD reveal atrophy of the basal ganglia, particularly the caudate nucleus and putamen, extending to the frontal, parietal, and occipital cortex as the disease progresses (Bruyn, 1968; Bruyn, Bots, & Dom, 1979). Two prominent deficits are evident relatively early in HD: choreiform movements and a severe memory impairment. The chorea consists of irregular, involuntary movements of certain muscles or muscle groups that cause considerable difficulty in performing everyday activities. Patients commonly exhibit dysarthric, incoherent speech, smacking and licking movements of the lips and tongue, facial grimaces, twitching fingers and flexed toes, athetoid twisting movements of the arms, shoulder shrugging, and an unsteady gait (Bradley, 1984; Joynt & Shoulson, 1985; Lishman, 1987; Mahendra, 1984). In the domain of memory function, HD patients have considerable difficulty learning new material on short-term and long-term recall tasks and have significant problems in retrieval of information from long-term memory (Butters, Sax, Montgomery, & Tarlow, 1978; Butters, Wolfe, Granholm, & Martone, 1986; Martone, Butters, Payne, Becher, & Sax, 1984; Wilson, Como, Garron, Klawans, Barr, & Klawans, 1987).

Several investigators have suggested that patients with HD demonstrate impaired "cortical executive functions" closely resembling that observed in classical frontal lobe patients (e.g., Benson &
Geschwind, 1975; Blumer & Benson, 1975; Caine et al., 1978). Both HD patients and patients with frontal damage exhibit loss of initiative, slowness, indifference, and apathy. These similarities may be attributable to the close anatomical relation between the frontal region whose destruction likely causes these personality alterations and the basal ganglia affected in HD—damage affecting either of these regions or their interconnections may lead to similar behavioral manifestations (Blumer & Benson, 1975). The frontal lobe symptomatology observed in HD patients lead to the hypothesis that some degree of unawareness occurs in this dementia syndrome.

The present study was designed to assess whether HD patients lack awareness of their deficits, to investigate the possible relation between cognitive impairment and unawareness, and to determine whether patients exhibit differential awareness of their motor disturbance and cognitive deficits. There were three main components to this study. The first part involved administering a self-rating questionnaire to assess patients' general awareness of their motor and memory deficits. Patients were asked to rate themselves and their spouses on the questionnaire items. Similarly, spouses were asked to rate their own and patients' functioning. A significant difference between patients' self-ratings and relatives' ratings of patients on this questionnaire would suggest some degree of unawareness on the part of patients. That is, if patients rate themselves as having considerably less difficulty than relatives report them having, patients may be underestimating their problems. If patients' ratings of relatives closely match relatives' ratings of themselves, this would rule out the possibility
that a general impairment of judgment is responsible for patients' underestimation of their difficulties. Finally, analysis of the type of item (motor vs. cognitive) contributing most to a patient-relative discrepancy regarding patients' functioning, may reveal differential awareness of deficits.

The second part of the study is concerned with assessing HD patients' awareness of their severe motor deficit. Patients and spouses were asked to estimate patients' performance on a number of motor tasks, and objective measures of patients' performance were obtained. Deviations of patients' estimates from objective measures and spouses' predictions provide an index of unawareness of motor defect. The degree to which patients' accurately predict their performance is compared to the accuracy of relatives' predictions.

The final section of the study investigates patients' awareness of their memory deficit by asking patients to predict their performance on a variety of memory tasks prior to their administration, and also asking relatives to predict patients' performance on these tasks. Patients' predictions are compared to both their actual performance and to relatives' estimates of patients' retrieval ability, in order to determine the degree to which HD patients lack awareness of their memory impairment. The accuracy of patients' estimates of their own performance is compared to the accuracy of relatives' estimates of patients' performance on the different memory tests.
CHAPTER 2

METHOD

Subjects

Patients with Huntington's disease. A group of eight HD patients were examined in this study. Patient information is presented in Table 1. Five patients exhibited clear cognitive impairment on the Mini-Mental State Examination (MMSE, see Appendix A) (Folstein et al., 1975), as defined by a cutoff score of 25. Patients' scores on the MMSE ranged from 12 to 29. These patients ranged in age from 22 to 68 years and were at various stages of the disease process. According to the Shoulson and Fahn (1979) scale of functional capacity, three patients were at Stage 2, one at Stage 3, two at Stage 4, and two at Stage 5. One of the severely demented patients (Stage 5) only participated in the initial part of the study.

Control subjects. Spouses or other family members of the HD patients served as control subjects.

Procedure

1. Daily Difficulties Questionnaire (Appendix B). Patients were asked to rate, on a 7-point scale, the degree to which they currently experience difficulty performing a variety of activities in everyday life, compared to five years ago. This questionnaire was administered verbally by the examiner. Subjects were shown the rating scale numbered 1 through 7, and could respond to each item with a verbal rating or simply by pointing to the number on the rating scale. The questionnaire consists of 12 items concerned with motor abilities (e.g., walking up a flight of stairs, signing your name) and 12 items
Table 1  Huntington's disease patient information

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related to cognitive, particularly memory, functions (e.g., remembering a 5-item shopping list if you did not have it written down, recalling the order of things that you did yesterday). Patients were asked to rate themselves and control subjects on these items. In addition, controls were asked to rate their own functioning and patients' functioning on the questionnaire items. Patients and control subjects were seen individually at their homes.

II. Motor Task Performance Predictions (Appendix C). This measure is specifically concerned with assessing patients' awareness of their choreiform movements. Patients were asked to perform each of six motor tasks immediately following prediction of their own performance on each task. The tasks included writing and reading out loud a list of 10 relatively high frequency words (Kucera & Francis, 1967) that were judged by the author to be phonetically complex, performing the Grooved Pegboard task with the dominant hand (Klove, 1963), walking in a straight line for 10 feet, completing one 10-second trial of the Finger Tapping Test with the dominant hand (Russell, Neuringer, & Goldstein, 1970), and catching a ball 10 times from 10 feet away. Control subjects were also asked to estimate patients' motor ability on these tasks. Predictions of performance on some of these tasks would be extremely difficult without knowing how people generally perform. Consequently, for two of the tasks—the Finger Tapping Test and the Grooved Pegboard—patients and relatives were told how an average person would perform based on available normative data, and they could thus make judgments about patients' performance in comparison to this standard. Hence, subjects were told that the average person can
complete 22 of the 25 holes on the Grooved Pegboard in one minute (Matthews & Haaland, 1979). Similarly, subjects were told that the average person can tap the key of the Finger Tapping Test about 50 times in 10 seconds (Dodrill, 1979).

III. Cognitive Task Performance Predictions (Appendix D).

Patients' insight into their memory disorder was evaluated using three retrieval tasks—a paired-associate recall test (immediate and delayed), a digit span task (Wechsler, 1958), and a verbal fluency task (Benton, 1968). The paired-associate recall test consists of ten unrelated word pairs developed by Schacter and Graf (1986). The pairs include randomly selected common words from the Kučera and Francis (1967) norms. The target words are between 5 and 10 letters in length and of medium frequency. Patients and control subjects were asked to predict how many of the ten target words patients would be able to remember immediately after hearing the list of word pairs, and how many they would be able to recall after a delay interval of 20 minutes. This task represents a test of both short-term and long-term memory. Patients' actual performance on the immediate and delayed recall tests was measured following their predictions.

The digit span task, a short-term memory test, was taken from Wechsler (1958), and required patients to repeat back digits in the same order that they were presented. There were two trials for each string of digits (string length ranged from 3 to 9 digits) and patients were given credit for a particular string length if they completed one of the two trials. Patients were asked to predict how many digits they would be able to repeat back prior to administration of the test.
Control subjects also predicted patients' performance on this task. Finally, the Verbal Fluency Test assesses patients' ability to generate words from long-term memory. Patients were asked to predict how many words that begin with a particular letter they would be able to generate in one minute, and they were subsequently given the letters 'F' and 'S' for one minute each. Actual performance was based on the average number of words generated for the two letters. Control subjects also predicted patients' performance on the Verbal Fluency Test. Patients and control subjects were told how the average person performs on the digit span and verbal fluency tasks in order to provide a standard for comparison and ease the task of predicting. Thus, they were told that the average person can repeat about seven digits (Spitz, 1972) on the Digit Span task, and can generate approximately 12 words on the Verbal Fluency Test in one minute (Benton & Hamsher, 1976).
CHAPTER 3

RESULTS

Quantitative Data

An analysis of variance for a repeated measures design was conducted on each of two parts of the Daily Difficulties Questionnaire data. The first analysis was concerned with patients' and relatives' ratings of patients' difficulties. Variables entered into this analysis included patients' MMSE score (measure of cognitive impairment), rater (patient vs. relative), and item type (motor vs. cognitive). Results revealed that patients' ratings of their own difficulties on both the motor and cognitive items were significantly lower than relatives' ratings of patients' problems ($F(1,18)=9.45$, $p<.01$). These results are presented in Figure 1. No main effect of item type was observed ($F(1,18)=0.92$, $p>.05$), nor was there any interaction between item type and rater ($F(1,18)=0.81$, $p>.05$). Thus, there was no evidence for differential awareness of motor versus cognitive problems. A significant interaction was found between degree of cognitive impairment and rater (patient vs. relative) ($F(1,18)=7.50$, $p<.05$), indicating that patients who were relatively intact in terms of their cognitive functioning tended to rate themselves as more impaired than their relatives rated them, whereas more demented patients tended to rate themselves as less impaired than relatives reported. This interaction is illustrated in Figures 3 and 4 for the motor items and cognitive items, respectively.

The second analysis was performed on the data concerned with patients' and relatives' ratings of relatives' performance. The same
variables were included in this analysis as those described for the former one. In contrast to results of the first analysis, no difference was observed between patients' ratings of relatives' and relatives' ratings of themselves (F(1,18)=1.45, p>.05) (see Figure 2). If we assume that relatives are reasonably accurate in their judgments about patients' difficulties, these results suggest that HD patients do not appreciate the severity of their motor and cognitive disabilities. The fact that patients were accurate in their assessment of relatives clearly indicates that patients understood how to use the rating scale, thus eliminating the possibility that their unawareness of their own deficits was simply a consequence of a general impairment of judgment.

Contrary to the lack of awareness evident on the questionnaire data, results from the Motor Task Performance Predictions and Cognitive Task Performance Predictions suggest that HD patients are reasonably good at estimating their performance on specific motor tasks and cognitive tasks. Mean accuracy scores for patients' and relatives' predictions are provided in Table 2. Accuracy scores were calculated by dividing the predicted performance by the actual performance for each task. Thus, an accuracy score of 1.0 indicates a perfect match between predicted performance and actual performance, whereas a score greater or less than 1.0 reflects an overestimation or underestimation of patient performance, respectively. The differences between patients' and relatives' accuracy scores are also provided in Table 2.

The accuracy data indicate that patients and relatives are about equally as good at predicting patients' performance on the majority of motor and cognitive tasks. Large differences between patient and
Figure 1. DAILY DIFFICULTIES QUESTIONNAIRE RESULTS
Figure 2. DAILY DIFFICULTIES QUESTIONNAIRE RESULTS
Figure 3. INTERACTION BETWEEN MMSE SCORES AND RATER ON MOTOR ITEMS
FIGURE 4. INTERACTION BETWEEN MMSE SCORES AND RATER ON COGNITIVE ITEMS
Table 2  Mean accuracy scores for motor and cognitive task performance predictions

<table>
<thead>
<tr>
<th>Task</th>
<th>Patient Predicted/Actual</th>
<th>Relative Predicted/Actual</th>
<th>Patient-Relative Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write word list</td>
<td>1.92</td>
<td>1.13</td>
<td>.79</td>
</tr>
<tr>
<td>Grooved pegboard</td>
<td>1.09</td>
<td>1.15</td>
<td>-.06</td>
</tr>
<tr>
<td>Walk on line</td>
<td>1.03</td>
<td>.43</td>
<td>.60</td>
</tr>
<tr>
<td>Catch ball</td>
<td>1.59</td>
<td>.98</td>
<td>.61</td>
</tr>
<tr>
<td>Finger tapping</td>
<td>1.11</td>
<td>1.53</td>
<td>-.42</td>
</tr>
<tr>
<td>Pronounce words</td>
<td>2.24</td>
<td>.86</td>
<td>1.38</td>
</tr>
<tr>
<td>Paired assoc-immed</td>
<td>4.38</td>
<td>1.93</td>
<td>2.45</td>
</tr>
<tr>
<td>Paired assoc-delay</td>
<td>3.79</td>
<td>1.29</td>
<td>2.50</td>
</tr>
<tr>
<td>Digit span</td>
<td>.98</td>
<td>.88</td>
<td>.10</td>
</tr>
<tr>
<td>Verbal fluency</td>
<td>1.42</td>
<td>1.54</td>
<td>-.12</td>
</tr>
</tbody>
</table>
relative accuracy scores are only evident on three of the ten tasks. The three tasks that patients substantially overpredicted their performance on compared to relatives include pronouncing a list of words clearly, and a paired-associate task involving immediate and delayed tests, with patient-relative difference scores of 1.38, 2.45, and 2.50, respectively. These results suggest that patients are generally aware of their motor and cognitive disabilities, and can make reasonable judgments about how they will perform, given specific tasks in these domains.

Qualitative Observations

Qualitative observations of patients' behavior and their responses to general questions about their situations provide a rich source of information with respect to their awareness. One of the most demented patients, D.A., was in a wheelchair because of her severe chorea and myoclonic jerks, and had extreme difficulty speaking as a consequence of her dysarthria. When asked how many words from a list of 10 she would be able to pronounce correctly so others could easily understand her, D.A. reported that she could say all ten. However, her husband accurately predicted that she could not pronounce any of them. When asked how many times she would go off the line while tracing a star-shaped drawing (task not included in formal study), D.A. predicted five. The husband remarked that if she could hold the pencil at all, which was unlikely, she would probably go off the line about 80 times. It took several attempts for D.A. to grasp the pencil in her fist and she subsequently made some random marks on the paper wherever the pen happened to make contact. On the paired associate recall test, D.A.
predicted that she would be able to recall all 10 word pairs both on an immediate and delayed test, whereas her husband predicted 3 and 0, respectively. Her actual performance was zero on both the immediate and delayed tests. These examples clearly demonstrate that this particular patient was "unaware" in some respects, yet on some of the other motor and cognitive tasks, she was entirely accurate in her predictions.

Another patient, M.O. was generally reasonable in predicting her performance on specific motor and cognitive tasks, yet rated herself as having little or no difficulty on all of the Daily Difficulties Questionnaire items. This patient is constantly bumping into objects, grimacing, losing her balance, spilling things, dropping her cigarettes while they are burning, and has even set her bed on fire by accident. When not taking her medication (usually because she has dropped her pills on the floor and cannot pick them up), she exhibits hallucinatory behavior and is unable to look after herself or her house. She commented several times during the testing session that she wants custody of her four children who are currently in foster homes. This patient appears oblivious to her disabilities in everyday life, yet knows that she will not perform like an average person on specific motor and cognitive tasks.

All patients were asked whether they notice their involuntary movements when they look in the mirror. Only three of the eight patients reported noticing any choreiform movements, two of whom only reported noticing finger movements even though they actually exhibited considerable facial grimacing. One patient with little evidence of
chorea reported that he did not notice any movements. The other four patients with obvious chorea claimed that they do not see any adventitious movements when they look in the mirror.
CHAPTER 4
DISCUSSION

This study was designed to assess awareness of motor and cognitive deficits in HD patients using two different types of measures. The seemingly contradictory conclusions of the questionnaire data and the task prediction data may be interpreted in several ways. First, it is possible that patients were accurately reporting the extent of their problems whereas relatives were exaggerating the degree to which patients experience difficulty on the everyday kinds of activities of the Daily Difficulties Questionnaire. If this were the case, one would expect relatives to demonstrate this bias in their predictions of patients' performance on the specific motor and cognitive tasks as well; however, this pattern did not emerge. The finding that patients substantially overpredicted their abilities on a few of the prediction tasks also serves to weaken the argument that relatives' inflated ratings of patients' disabilities are responsible for patients' apparent lack of awareness on the questionnaire. Thus, it does not appear likely that inaccurate judgment on the part of the relatives can account for the discrepant findings.

Second, patients may be engaging in defensive denial to minimize the psychological impact of their progressive deterioration. The problem with this interpretation is that, although patients seem to be underestimating their difficulty on the questionnaire items, they are not doing so when predicting their actual performance on many of the specific motor and cognitive tasks. Furthermore, two of the three...
patients without evidence of cognitive impairment actually rated themselves as more severely disabled on the questionnaire items than did their spouses. This finding suggests that early in the disease process when patients are beginning to recognize changes in their functioning, and would be most likely to use the defense mechanism of denial, they are instead readily admitting and possibly dramatizing their difficulties. Finally, even severely demented patients rated themselves as having considerable difficulty on certain items of the questionnaire, but reported having no difficulty on other items that were clearly a severe problem for them. If patients were denying their illness, these kinds of inconsistencies in their responses with respect to equally devastating disabilities would not be expected. Thus, although defensive denial may play a role in patients' apparent lack of awareness on the questionnaire data, it is probably not the major factor accounting for the results.

A third explanation of these findings concerns the different kinds of questions patients are being asked on the questionnaire versus the performance prediction tasks. On the questionnaire, patients are asked to rate the extent to which they currently experience difficulty with various everyday activities compared to five years ago. In order to make reasonable judgments on this questionnaire, patients must be aware of how much they have changed over time. The motor and cognitive task performance predictions only require patients to judge their present ability. Thus, the two measures may be tapping into different aspects of awareness. McGlynn and Schacter (1989) have pointed out that awareness should not be viewed as a unitary construct whereby patients
are either "aware" or "unaware" of their deficits. There may be different components or levels of awareness that can be differentially affected depending on the particular pattern of brain impairment. According to this interpretation, one would not necessarily expect to obtain convergent validity by assessing awareness with a number of different measures, since each measure may be sensitive to different dimensions of awareness. The HD patients in this study may be aware of their present level of motor and cognitive functioning, i.e., know that they are below average on these kinds of tasks. However, they may be unaware of the extent to which their performance has deteriorated over the past five years. A further study that could test this hypothesis would involve asking patients and relatives to predict the patients' current performance on the motor and cognitive tasks as well as their probable performance on these same tasks five years ago. If patients' predictions of their earlier performance do not differ from their performance predictions for the present, whereas relatives' predictions are significantly different for the two times, then we may conclude that patients lack awareness in the sense that they do not appreciate the progressive deterioration from the "self before" to the "self now".

Another account, not incompatible with the latter, is that patients do lack awareness of their deficits, but are able to recruit the limited awareness they still possess to make reasonable performance predictions when presented with specific, concrete motor and cognitive tasks. When asked to engage in a more abstract task of rating how much difficulty they generally have with a variety of motor and cognitive activities in everyday life, like signing their name or remembering a
five-item shopping list, patients are not able to use their preserved self-knowledge to make realistic judgments about their disabilities.

The two interpretations proposed so far to explain the discrepancy between questionnaire and task prediction results do not address the issue of why patients appeared to lack awareness of their deficits when predicting their performance on three of the ten motor and cognitive tasks. The latter finding suggests that even within a particular measure one may find pockets of unawareness. Even though patients appeared to be aware of their performance abilities on many of the motor and cognitive tasks, they clearly did not appreciate how much difficulty they would have pronouncing words, nor did they realize how little they would be able to remember on the paired-associate immediate and delayed tests. Thus, not only is it possible to demonstrate dissociations in awareness by asking different questions as has been done on the questionnaire and the prediction tasks, but awareness can also appear fragmented at a far more specific level, as a function of the particular task characteristics patients are asked to consider.

The notion that disruptions in awareness can occur at different levels and in specific domains is further suggested in this study by a number of striking instances of unawareness. Several examples were described in the foregoing section concerned with qualitative observations. These descriptions certainly suggest that unawareness phenomena do occur in HD, but they also illustrate the variability both within and between individuals in terms of their awareness disturbance. Although the Daily Difficulties Questionnaire was sensitive to a general lack of awareness across patients, there is clearly a need for
more sophisticated measures to tap into the complex patterns of unawareness within individuals. The motor and cognitive task performance predictions included in this study represented an attempt to examine patients' awareness in a more concrete and direct fashion, but was insensitive to the intraindividual awareness disturbances. At this stage, carefully designed single case studies of unawareness in HD patients may prove to be the most appropriate strategy for understanding the kinds of awareness disturbances that occur in this population. Until we have a better sense of the manifestations of unawareness phenomena at different stages of HD, it is difficult to develop objective measures for assessing awareness in this group.

The literature concerned with unawareness of deficits in dementia, as well as results of this study examining unawareness in HD, raise a number of theoretical questions about the processes affected in dementing illnesses that disrupt patients' ability to be aware of and monitor their own state of functioning.

A number of investigators have proposed that unawareness of deficits reflects primarily motivated use of the psychological defense mechanism of denial (e.g., Goldstein, 1932, 1942; Reisberg et al., 1985; Weinstein & Kahn, 1955). According to this account, anosognosia is considered an expression of the patient's "drive to be well," a means of protection against the recognition of disease or defect. Several problems exist with the motivational account of anosognosia with respect to dementia. First, the majority of studies assessing unawareness in dementia, including the present study of HD, indicate that patients are acutely aware of, and openly express anxiety about,
changes in their cognitive functioning early in the disease process. It is not until later stages of the disease that patients appear to lose insight into their deficits. The time course for motivated denial would not be expected to follow this pattern of development; rather, if patients are predisposed to deny their defects, they would likely deny or minimize the early signs of disease to avoid facing the potentially devastating or even fatal implications.

The gradual development of unawareness in dementia raises the issue of the role of intellectual deterioration in awareness disturbances. Findings from this research with HD patients suggest that patients with generalized cognitive impairment are more likely to lack awareness of their disabilities, whereas those with relatively intact cognitive abilities are generally realistic in assessing their difficulties. The study by Reisberg et al. (1985) of unawareness in AD provided additional evidence for a relation between cognitive decline and loss of insight in dementia. Thus, it appears that cognitive decline may be an important factor contributing to the development of an awareness disturbance in dementia.

Several theorists who view anosognosia as a manifestation of intellectual impairment, have attributed the disturbance to diffuse cerebral dysfunction (e.g., Schilder, 1935; Stengel & Steele, 1946; Ullman, 1962). However, in certain dementing disorders like HD, brain dysfunction is primarily restricted to subcortical structures and the frontal lobes. Stuss and Benson (1984, 1986) discussed the possible contribution of frontal lobe damage to the pathogenesis of anosognosia. They maintained that regions of the frontal lobe are involved in self
awareness and monitoring of one's own cognitive function, and that anosognosia could reflect a deficit in self monitoring. Support for this view has been presented by McGlynn and Schacter (1989). For example, evidence that unawareness of memory deficits is generally observed in cases of amnesia attributable to various etiologies involving the frontal lobes, but not in amnesic patients with restricted lesions in the temporal lobe, strongly suggests that frontal dysfunction contributes to unawareness of deficits. The role of frontal damage in unawareness of deficits is further indicated by the extensive literature on head-injured patients who often exhibit symptoms of frontal lobe damage in addition to unawareness of deficits.

A striking feature of anosognosia in a variety of neuropsychological syndromes that must be accounted for by any theoretical account is the frequent specificity of the awareness disturbance (e.g., Bisiach et al., 1985; Bisiach et al., 1986; McGlynn & Schacter, 1989). For example, stroke patients are often entirely unaware of their hemiplegia, but may complain about other equally serious defects. Observations of the specificity of anosognosia have argued against the view that the unawareness is attributable to a generalized intellectual impairment. However, there are also a number of reports indicating that brain-damaged patients can be unaware of multiple deficits simultaneously. Two recent theoretical frameworks for anosognosia have attempted to account for the specific disruptions of awareness observed in various neuropsychological disorders as well as awareness disturbances involving multiple deficits (Bisiach et al., 1985; McGlynn & Schacter, 1989).
There have been no systematic studies investigating the specificity issue in dementia, with the exception of the current study with HD patients. Results from this study suggest that HD patients generally lack awareness of both their motor deficit and their memory impairment. However, individual patients may exhibit variable awareness depending on the particular kinds of motor tasks or memory tasks they are asked to report on. Thus, the question of specificity in dementia remains unclear at this time. Based on current views of anosognosia as a disruption of executive functions, and the rather extensive frontal pathology associated with certain dementing disorders, it would not be surprising to find that dementia patients exhibit a general self-monitoring deficit rendering them unable to maintain awareness of their numerous disabilities. Nor would it be surprising to discover that intellectual impairment correlates highly with unawareness in these disorders, given that frontal dysfunction produces a broad range of cognitive deficits. The finding that PD patients without cognitive impairment and EEG abnormalities exhibit good awareness of their condition, whereas those with AD, MID, and PD with vascular disease demonstrate a loss of insight (Danielczyk, 1983), is suggestive of a relation between cortical involvement, cognitive decline, and unawareness. At this early stage, one can only speculate about the neural substrates of unawareness in dementia.
THE MINI-MENTAL STATE EXAMINATION (Revised)
(Folstein et al., 1975)

Patient Name
Date of Birth

Patient Number
Date of Examination
Examined by

ORIENTATION
1. What is the Year?
   Season?
   Date?
   Day?
   Month?

2. Where are we? State?
   County?
   Town or city?
   What is the address here?

REGISTRATION
3. Name three objects, taking one second each. Then ask the patient all three after you have said them. Give one point for each correct answer. Repeat the answers until the patient learns all three.

ATTENTION AND CALCULATION
4. Serial sevens. Give one point for each correct answer. Stop after five answers. Alternate:
   Spell WORLD backwards.

RECALL
5. Ask for names of three objects learned in Question 3. Give one point for each correct answer.

LANGUAGE
6. Point to a pencil and a watch. Have the patient name them as you point.
7. Have the patient repeat "No ifs, ands, or buts." 
8. Have the patient follow a three-stage command:
   "Take the paper in your right hand. Fold the paper in half. Put the paper on the floor."
9. Have the patient read and obey the following:
   "CLOSE YOUR EYES."
10. Have the patient write a sentence of his or her own choice. (The sentence should contain a subject and an object and should make sense. Ignore spelling errors when scoring.)
11. Enlarge the design printed below to 1-5 cm per side and have the patient copy it. (Give one point if all sides and angles are preserved and if the intersecting sides form a quadrangle.

= Total 30

COMMENTS
APPENDIX B: DAILY DIFFICULTIES QUESTIONNAIRE

Rater: Patient ____ Relative ____

Name: _______________________________

Rating Scale:

1 2 3 4 5 6 7
No difficulty A great deal of difficulty

Compared to five years ago, how much difficulty do you currently have:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Self</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>buttoning up a shirt or blouse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>walking up a flight of stairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>remembering a five-item shopping list if you did not have it written down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>solving an arithmetic problem in your head, e.g., 3x17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>turning around when you hear your name called from behind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recalling the names of famous politicians and movie stars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>using a fork and knife to cut meat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>brushing your teeth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>finding the words to say what you want to say</td>
<td></td>
<td></td>
</tr>
<tr>
<td>keeping track of the thread of a story while reading the newspaper or watching television</td>
<td></td>
<td></td>
</tr>
<tr>
<td>signing your name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>remembering the names of family members and friends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>writing a letter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>remembering what you just said a few minutes ago</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
catching a ball or some other object when it is tossed to you
remembering events from your childhood
drawing a picture of a house
remembering conversations with members of your family
driving a car
hammering a nail
recalling the order of things that you did yesterday
remembering the day of the week and the date
pronouncing words clearly so people can understand you
concentrating on a task without being easily distracted
APPENDIX C: MOTOR TASK PERFORMANCE PREDICTIONS

I am going to ask you to perform some motor tasks, but before you do each task I want you to predict how well you will be able to do it.

1. First, I am going to show you a list of 10 words and I want you to write them at a normal writing speed. How many words do you think you will be able to write at a normal writing speed that others would be able to read easily?

Predictions: Patient ____ Relative ____
Actual Patient Performance: ____

2. Grooved Pegboard (Klove, 1963). You see these pegs here. Each peg has a notch on its side and each hole has a notch in it. These pegs will fit into the holes on this board. You have to turn the peg the right way. I want you to place the pegs into the holes on the board. Work from left to right, using only your right/left (dominant) hand and pick up only one peg at a time. There are a total of 25 holes. The average person completes about 22 of 25 holes in one minute (Matthews & Haaland, 1979). How many of the 25 holes do you think you can complete in one minute?

Predictions: Patient ____ Relative ____
Actual Patient Performance: ____

3. Now I want you to walk in a straight line for 10 feet trying your best not to step off this line of tape. How many times do you think you will step off the line while you are walking?

Predictions: Patient ____ Relative ____
Actual Patient Performance: ____

4. I am going to throw this ball to you 10 times from 10 feet away. How many times do you think you will be able to catch it with your hands without dropping it?

Predictions: Patient ____ Relative ____
Actual Patient Performance: ____

5. Finger Tapping Test (FTT) (Russell, Neuringer, & Goldstein, 1970). I want you to tap this key as quickly as you can for 10 seconds using the forefinger of your right/left (dominant) hand. You must keep the rest of your hand still while only moving the one finger. The average person taps approximately 50 times in 10 seconds.
(Dodrill, 1979). How many times do you think you can tap the key in 10 seconds?

Predictions: Patient ____  Relative ____

Actual Patient Performance: ____

6. Now I am going to show you a list of 10 words for you to read out loud. How many of the 10 words do you think you will be able to pronounce correctly so others would understand you?

Predictions: Patient ____  Relative ____

Actual Patient Performance: ____
APPENDIX C (continued)

Word List for Writing and Reading Tasks of Motor Task Performance Predictions

RESPONSIBILITY
THROUGHOUT
ESTABLISHED
DISTRIBUTION
CIRCUMSTANCES
FREQUENTLY
SUCCESSFUL
OBJECTIVE
STRUCTURE
PARTICULAR
APPENDIX D: COGNITIVE TASK PERFORMANCE PREDICTIONS

Paired Associate Recall Test
(unrelated word pairs from Schacter and Graf, 1986)

I am going to read you a list of ten unrelated word pairs, and after I have read the list I will give you the first word of each pair and ask you to tell me what word went with it. How many of the ten words do you think you will be able to remember immediately after you hear the list? 20 minutes after you hear the list? Now listen carefully as I read the list of word pairs.

<table>
<thead>
<tr>
<th>Cue</th>
<th>Target</th>
<th>Immediate Recall</th>
<th>Delayed Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURSE</td>
<td>GARDEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAMMER</td>
<td>MONKEY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COFFEE</td>
<td>FOREST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UMBRELLA</td>
<td>BASKET</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLANKET</td>
<td>PARADE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAND</td>
<td>THIEF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TURTLE</td>
<td>BRIDGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOCKEY</td>
<td>FLAG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOTEL</td>
<td>CANDLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOLLARS</td>
<td>CARPET</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patient Predictions

Predicted Recall (/10) = Immediate
Predicted Recall (/10) = Delayed

Relative Predictions

Predicted Recall (/10) = Immediate
Predicted Recall (/10) = Delayed

Actual Patient Performance

Actual Recall (/10) = Immediate
Actual Recall (/10) = Delayed
Digit Span (Wechsler, 1958)

Predictions: Patient _____ Relative _____

Actual Patient Performance: _____

How many digits would you be able to say back to me in the same order that I read them to you? The average person can repeat about seven (Spitz, 1972).

<table>
<thead>
<tr>
<th>Digits</th>
<th>Patient Performance</th>
<th>Relative Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) 5 - 8 - 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 9 - 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) 6 - 4 - 3 - 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 2 - 8 - 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) 4 - 2 - 7 - 3 - 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 5 - 8 - 3 - 6</td>
<td></td>
<td></td>
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<tr>
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<td>7 - 1 - 3 - 9 - 4 - 2 - 5 - 6 - 8</td>
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Verbal Fluency Test (Benton, 1968)

Predictions: Patient ___ Relative ___

Actual Patient Performance: ___

I am going to say a letter of the alphabet. Then I want you to give me as many words that begin with that letter as quickly as you can. For instance, if I say 'B', you might give me 'bad, battle, bed ....' I do not want you to use words which are proper names such as 'Boston, Bob, or Brylcreem.' Also, do not use the same word again with a different ending such as 'eat and eating.' The average person can come up with about 12 words in one minute (Benton & Hamsher, 1976). How many words do you think you can come up with in one minute when I give you a letter of the alphabet? Now I want you to tell me all the words you can think of that begin with the letter 'F'. (Repeat for 'S')

F

S
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