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THE RECOGNITION OF FACIAL EXPRESSIONS OF EMOTION
IN PERSONS WITH A DEMENTIA OF THE ALZHEIMER'S TYPE

by

Cara A. Zaskow

B.A., University of British Columbia, 1980
M.A., Simon Fraser University, 1986

THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the Department
of
Psychology

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Name: Cara A. Zaskow

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Title of thesis: Recognition of Facial Displays of Emotion in Persons with a Dementia of the Alzheimer's Type

Examining Committee:

Chair: Bruce Whittlesea, Ph.D.

Marilyn Bowman, Ph.D.
Senior Supervisor

Raymond E. Koepsman, Ph.D.
Associate Professor

Elinor Ames, Ph.D.
Associate Professor

David N. Cox, Ph.D.
Associate Professor

Robert Sainsbury, Ph.D.
External Examiner
Professor, Department of Psychology
University of Calgary

Date Approved: 9 Dec 94
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The Recognition of Facial Displays of Emotion in Persons With

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The ability to perceive facial expressions of emotion was examined in 47 persons with Alzheimer's disease and 27 normal elderly. All participants were given five emotion-related tasks: to discriminate between same/different geometric patterns, neutral facial expressions and emotional expressions; to verbally identify a pictured facial expression of emotion; and to match a target emotional expression to one of a group of six other expressions. Also assessed was overall cognitive functioning and level of dementia severity. Alzheimer's participants were also assessed in terms of expressive language ability, visuo-spatial skills and degree of behavioral disturbance. The results indicated a decrease in the accuracy of identifying and matching facial expressions of emotion among the different dementia severity levels. Deficits, however, did not follow a simple, linear model of disease progression and the importance of addressing the heterogeneity of Alzheimer's is discussed. The relationship between behavior and emotion perception is emphasized as important with pragmatic implications for the remediation of behavioral disturbances that often accompany Alzheimer's.
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INTRODUCTION

Dementia of the Alzheimer's Type (DAT) is a degenerative disorder of insidious onset, characterized by a multifaceted loss of intellectual abilities, changes in personality, and behavioral disturbances (American Psychiatric Association, 1987). Although contemporary neuropsychological investigations have successfully delineated performance decrements in memory, language, visuo-spatial abilities and other higher-order functions which characterize the cognitive losses associated with DAT (Kaszniak, 1986; Albert, 1981; Jarvik, 1980; Lezak, 1983), our knowledge of the accompanying behavioral and social skills deficits remains inadequate (Teri, 1986; Teri, Larson, & Reifler, 1988; Teri, Borson, Kiyak, & Yamagishi, 1989). The lack of such information represents a serious shortcoming on two fronts. First, it is often the level of behavioral functioning rather than cognitive deficits per se that determines whether the individual with DAT can remain in the community or requires institutional care (Chenoweth & Spencer, 1986; Colerick & George, 1986). Secondly, an incomplete understanding of the relationship between cognitive loss and any associated behavioral sequelae limits the ability to plan remediation strategies (Teri et al., 1988; 1989). Until recently much of what was known about the behavioral concomitants of Alzheimer's stemmed from unsystematic clinical observations (Hussian, 1986; Liston, 1979; Mace & Rabins, 1981). There is now a slowly growing body of controlled, empirical data that provides support for some of the clinical assumptions about the nature and severity of behavioral problems in DAT. These data also raise some interesting questions.

The clinical assumption that persons with DAT show a high prevalence of personality
change and behavioral problems such as aggression, agitation, wandering, irritability, repetitive gestures and questions, and hoarding, has received unequivocal empirical support (Baumgarten, Becker, & Gauthier, 1990; Skurla, Rogers & Sunderland, 1988; Swearer, Drachman, O'Donnell, & Mitchell, 1988; Rubin, Morris, Storandt, & Berg, 1987; Teri et al., 1988; 1989). On the other hand, the assumption that there is a positive correlation between cognitive impairment and behavioral/functional decline has received rather mixed empirical support. For example, although Teri et al. (1988) found an increase in the number of behavioral problems among those patients most severely cognitively impaired, in follow-up studies the researchers found that the level of behavioral disturbance was largely unrelated to cognitive or functional ability (Teri et al., 1989; Teri, Truax, Logsdon, Uomoto, Zarit, Vitaliano, 1992). Similarly, Swearer and colleagues (1988) found that cognitive impairment correlated with only one target behavior: assaultiveness. The authors suggested that their findings indicate that aberrant behavior may not be a direct product of intellectual decline but may be related to global disease severity. Baumgarten et al. (1990) also found that the prevalence of behavioral disturbance increased with severity. In contrast, Skurla et al. (1988) found only a moderate correlation between a functional measure of daily living activities and severity of dementia, suggesting that these areas should be assessed independently when evaluating DAT patients. A more detailed review of this issue will be presented later.

An important aspect of behavioral functioning is the ability to respond appropriately in social interactions. Among other factors, appropriate responding requires an accurate appraisal of the emotional context of the situation. A failure to appreciate the emotional
context due to impaired recognition of facial expressions would seem to have important consequences for the maintenance of appropriate behavior. Research on the processing of emotional information in individuals with diffuse brain damage is just beginning to emerge. With a few exceptions (Albert, Cohen, & Koff, 1991; Drexler, 1988; Murphy & Boeglin, 1990) most of the research has provided evidence suggesting a loss of ability to recognize facial displays of affect in persons with some type of dementia (Kurucz, Feldmar & Werner, 1979; Brosogle, Kurucz, Plahovinsak, & Gumiela, 1981; Brosogle, Kurucz, Plahovinsak, Sprotte, & Haveliwala, 1983; Allender & Kaszniak, 1989). Several questions, however, remain unexplored. Many studies have compared elderly with some form of dementia to normal elderly and have treated "dementia" as a relatively singular disease. There are, in fact, a great variety of organic disorders that result in a dementia. To be meaningful the specific diagnosis of the dementia that is present should be specified. Studies that have specifically used elderly with DAT have typically focussed on one level of dementia severity. As a result it is unclear if and how emotional processing may change with the severity of DAT. Finally, the overall relationship between cognitive functioning, behavioral functioning, and the recognition of facial cues of emotion remains unexplored.

A deficit in emotional processing may have direct impact on an individual's care in the community or institution. As Kurucz et al. (1979) have pointed out, persons with DAT may be impaired with respect to perceiving goodwill, anger, or disapproval on the faces of people around them. Such a disability would require understanding and a special approach on the part of the caregiver or the therapeutic team. Similarly, Teri and
colleagues (1988; 1989) stated that information on the nature and rate of behavioral problems in DAT and on the relationship of these problems to different disease stages is important. For example, problems that are common to most DAT patients and to the disease course could be predictable, thus families and patients could be provided with knowledge about what to expect and be assisted accordingly. Problems that are not common and seem idiosyncratic to the disease progression could be examined with an eye toward understanding the mediating variables. Families and patients could be encouraged that some problems are not "inevitable" and instead reflect individual variation.

**Literature Review**

Two bodies of literature are relevant to the present investigation: studies that have attempted to quantify the behavioral concomitants of DAT, and studies involving the decoding or labelling of facial expressions of affect. The review of the literature in each of these areas will be followed by a brief critical summary.

**Behavioral Concomitants of DAT**

Alois Alzheimer's (1907/1977) first description of the clinical course of dementia stressed the behavioral disturbances of the illness. Until recently, however, there has been little empirical study of the behavioral symptoms concomitant with DAT; instead, most of the existing research has focussed upon delineating the cognitive losses that are characteristic of the dementia progression (Kaszniak, 1986; Reisberg, Borenstein, Salob, Ferris, Franssen, & Georgotis, 1987).
Much of our understanding of the behavioral sequelae of DAT stems from clinical observations (Liston, 1979; Mace & Rabins, 1981). Books available on the market as resources for families and/or caregivers have a focus on problematic behaviors, and often suggest coping/remediation strategies concerning these behaviors (Kociol & Schiff, 1989; Leven, Sinclair & Gorbach, 1989; Miner, Winters-Miner, Blass, Richter & Valentine, 1989). Unfortunately, most of the information provided in these sources is based on anecdotal observations rather than controlled, quantitative empirical data. The following is a brief review of the investigative studies that have sought to delineate, quantitatively, the behavioral presentation of DAT.

Most of the studies that documented the prevalence of behavioral problems in DAT stemmed from investigations of the impact of dementia on the family and/or caregiver. Rabins, Mace, & Lucas (1982) interviewed the primary caregivers of 55 patients suffering from irreversible dementia (Alzheimer's disease = 60%, multi-infarct dementia = 18%, or other causes = 22%). Families of these patients were asked an open-ended question seeking to identify the "biggest problem in caring for the patient" (p. 333). Twenty-two different problems were identified, with 50% or more of the respondents noting the following problem areas: memory, catastrophic reactions, suspiciousness, making accusations, demanding/critical behavior, night wakening, hiding things, communication difficulties, behavior at mealtime, daytime wandering, and behavior at bathing. The most serious problems were rank-ordered as follows: physical violence, memory disturbance, incontinence, catastrophic reactions, making accusations, and suspiciousness. Rabins and colleagues (1982) concluded that behavioral problems are part of the dementia process
and, to an extent, these problems facing caregivers could be lessened with individually-tailored care plans.

A more quantitative approach was taken by Greene, Smith, Gardiner, & Timbury (1982) in assessing the behavioral disturbance of elderly demented patients in the community and its impact on relatives. Relatives of 38 patients diagnosed with senile dementia were given a structured interview, the Behavior and Mood Disturbance Scale (BMD): (Greene et al., 1982) which consisted of 34 items each rated on a 5-point scale. They were also asked 15 structured questions which comprised the Relatives' Stress Scale (RS). Submitting the data obtained for each scale to factor analysis revealed the following: BMD items yielded 3 subscales "Apathetic-Withdrawn", "Active-Disturbed", and "Mood Disturbance". The RS also yielded 3 subscales: "Personal Distress", "Domestic Upset", and "Negative Feelings". Correlations between the factors on the two scales suggested that personal distress was associated with the patients' apathetic-withdrawn behavior, while negative feelings were in response to mood disturbance. Domestic upset was not correlated with any aspects of disturbed behavior and mood, but was related to poor physical self-maintenance of the patient. The finding that active-disturbed patient behavior was not correlated with any of the stress factors was unexpected and Greene et al. (1982) speculated that active-disturbed behavior is tolerated so long as it is not accompanied by an excess of disturbance of mood. Overall, these findings demonstrated that relatives' stress was not related to patient's level of cognitive functioning or capacity for independent self-care, rather, it was the behavioral manifestations of dementia and accompanying disturbance of mood that relatives were less
able to tolerate.

Haley, Brown & Levine (1987) also found that behavioral problems were of greatest concern to caregivers. In this study, 44 primary family caregivers of elderly patients diagnosed with senile dementia were interviewed concerning the prevalence of specific behavioral problems in the home setting, the subjective stressfulness of each problem and caregiver perceived self-efficacy in managing each problem. Measures used to assess these areas included the Activities of Daily Living Scale (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963), the Instrumental Activities of Daily Living (Lawton & Brody, 1969), and the 17 behavioral items of the Memory and Behavior Problems checklist (Zarit & Zarit, 1983). Results indicated that although self-care deficits and disorientation were extremely common, they were of less concern to caregivers than such behavioral problems as agitation, hallucinations, and dangerous or embarrassing behaviors.

These findings seem to contradict the earlier study by Greene and associates (1982) who found that agitated-disturbed behavior was not perceived as stressful by caregivers. The disparate findings between the two studies is likely a result of the different measures used to assess behavioral functioning. There are several problems with the BMD (Greene et al., 1982) subscale for "active-disturbed" which render their findings questionable. This subscale contains several items (e.g., those related to orientation to person, place, and time) that were highly prevalent but not rated as stressful in the Haley et al. (1987) study. These items are questionably representative of "active-disturbed" behavior and likely biased the data obtained from this scale.

These studies underscore the need for the development of a valid and reliable measure
of behavioral functioning in DAT. At the same time, methodological weaknesses should not overshadow the consistent finding of the prevalence of behavioral disturbance in DAT (Reisberg et al., 1987; Rubin et al., 1987) and the association of these behavioral problems with family burden and institutionalization of the individual with DAT (Argyle, Jestice, & Brook, 1985; Chenoweth & Spencer, 1986; Cohen-Mansfield & Billig, 1986; Colerick & George, 1986; Lezak, 1988). More recent studies have attempted to address the need for psychometrically sound measures of behavioral functioning, and/or have focused on understanding the relationships between behavior, cognitive functioning and disease severity.

Reisberg and colleagues (1987) conducted a chart review of 57 outpatients with a diagnosis of Alzheimer's disease to quantify information regarding the incidence, nature, and treatment of behavioral problems in DAT. Results indicated that 58% (33 of the patients) had significant behavioral symptomatology. The most frequent symptoms noted were the delusion that people were stealing things from the patient, non-specific agitation, and diurnal rhythm disturbances. Of these 33 patients, 27 were treated with thioridazine, and 15 were then judged to have demonstrated a positive response.

These investigators then went on to use the results of their study to design a new clinical scale for the assessment of pharmacologically remediable behavior problems, the Behavioral Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD). The authors noted that there appears to be a tendency for behavioral symptoms to occur in a relatively stage-specific sequence, and this assumption forms the basis of their Global Deterioration Scale. They consider that use of BEHAVE-AD would permit a separation of
unremediable cognitive symptomatology from more accessible behavior problems, and
allow further study of the stage-specific aspects. It was also thought that the separation
of cognitive and behavioral features of DAT would permit investigators to examine the
effects of pharmacologic agents on behavior and cognition independently. While other
uses of BEHAVE-AD have been proposed, a recent survey of the literature shows little
use of this measure in empirical studies.

Swearer and colleagues (1988) evaluated behavioral disturbance in dementia and
examined the relationship between disruptive behavior, diagnosis, and disease severity.
One hundred and twenty-six patients participated, with 57 diagnosed as probable
Alzheimer's (AD), 17 as having multi-infarct dementia (MID), and 17 as AD/MID mix.
The remaining 17 patients were diagnosed as having other dementing diseases. Severity
of dementia was determined by two measures: (1) a scale developed by the authors,
"Degree of Disease Severity Grading Scale", and (2) the Clinical Dementia Rating Scale
(CDR, Hughes, Berg, Danziger, Coben, & Martin, 1982). The mental status of each
patient was assessed using the Mini-mental State Examination (MMSE, Folstein, Folstein,
& McHugh, 1975) and the information-memory-concentration portion of the Blessed
Dementia Rating Scale (Blessed, Tomlinson, & Roth, 1968). Evaluation of behavioral
functioning was done through telephone interviews with the primary caregiver using a
structured interview that asked questions regarding the occurrence and severity of nine
target behaviors: angry outburst, assaultive/violent behavior, bizarre behavior,
hallucinations/delusions, paranoid thoughts, phobias, dietary changes, sleep disturbances,
and incontinence. Questions were also asked to assess anxiety and depressive symptoms.
The results of the study were consistent with previous research regarding the prevalence of disruptive behavior in DAT; 83% of patients exhibited one or more of nine targeted behaviors. The degree of impairment on mental status testing correlated only weakly with a single target behavior: assaultiveness. This suggests that such intrusive aberrant behaviors are not a simple or direct product of intellectual deterioration. Severity of dementia correlated significantly with the presence and severity of assaultiveness/violence, bizarre behavior, paranoid thoughts, and incontinence. No significant differences on any measure were found between the diagnostic groups of AD, MID, AD/MID. Overall, the authors concluded that as impairment on tests of mental status correlated only weakly with the severity of a single target behavior (assaultiveness) and that disordered behaviors may occur in patients with mild dementia, it is possible that the behavioral disturbances observed occurred independently and were not necessarily the result of secondary complications from neural impairments in dementia. The precise mechanism and neural substrates were not speculated upon and remain to be determined.

Teri and colleagues (1988) also investigated the presence of behavioral disturbance in DAT, and the relationship of such disturbance to disease characteristics. Of particular interest was the rate of behavioral problems among DAT patients, and the relationship of such problems to the level of cognitive impairment. Subjects were 127 outpatients who met the DSM-III criteria for DAT and had no other primary diagnosis. Behavioral problems were evaluated with the Blessed Dementia Rating Scale (DRS: Blessed et al., 1968) and eight additional items concerning the presence or absence of restlessness, suspiciousness, agitation, wandering, falling, hallucination, incontinence, and problems
with hygiene. The mean DRS was 5.2 indicating significant behavioral disturbance and characterizing these patients as severely impaired. Cognitive functioning was evaluated with the MMSE (Folstein et al., 1975), Wechsler Adult Intelligence Scale - Revised (WAIS-R, Wechsler, 1955), and Wechsler Memory Scale (Wechsler, 1945). All patients were severely impaired according to cognitive testing.

The findings of the study by Teri et al. (1988) showed that behavioral problems varied in prevalence among DAT patients: restlessness affected 45% of the sample, 28% had problems of falling, 28% had difficulties with hygiene, 26% with wandering, 24% experienced agitation and suspiciousness, 21% had hallucinations, and 16% had problems with incontinence. An average of three problems was reported per patient. In general, particular problems were not related to patient's age, gender, duration of DAT or age of onset. The one exception to this was falling, with older patients significantly more likely to fall than younger DAT patients. The severity of cognitive impairment was significantly and positively related to the total number and nature of problems reported. Specifically, patients with more cognitive impairment were more likely to have problems with personal hygiene, incontinence, and wandering, while these patients were not more likely to have problems with restlessness, falling, agitation, suspiciousness, or hallucinations. The authors concluded that behavioral problems affected a significant portion of DAT patients and seemed related to severity of cognitive impairment rather than other disease or patient characteristics.

Teri and colleagues (1989) conducted a study to replicate and expand upon the
previous findings. Fifty-six patients diagnosed as having DAT were assessed for behavioral disturbance, cognitive dysfunction, and functional skill. For this study the authors developed the "Behavior Problems Checklist" (BPC) to assess the behavioral and psychiatric symptoms of interest. The BPC asks the caregiver to indicate the frequency of 48 emotional and behavioral problems and to rate each on a 5-point Likert scale for occurrence over the past month. Functional competence was assessed using the "Instrumental Activities of Daily Living" (Lawton & Brody, 1969) and "Self-Care Skills - Older Adults Resources Survey" (Fillenbaum & Smyer, 1981). Cognitive status was evaluated with the "Dementia Rating Scale - Coblentz" (DRS-C, Coblentz, Mattis, & Zingesser, Kass, Wisniewski, and Katzman, 1973). The average DRS-C score was 11.5, which placed patients in the moderately impaired range of cognitive functioning.

The study found that patients were able to perform the self-care and instrumental activities of daily living. The behavioral problems most frequently reported by caregivers were those concerning cognitive functioning: confusion, disorientation, and memory loss. The next most common problems concerned activity and emotional distress, including under-activity, loss of interest in activities, tension, depression, and apathy. An average of 10 (out of a possible 48) behavioral problems were reported by caregivers and an average of seven problems occurred more than twice a week. The correlations between cognitive and behavioral problems indicated that dementia severity score was unrelated to any index of behavioral problem.

Teri and colleagues (1989) contended that these findings support clinical reports of the pervasiveness and severity of behavioral problems among DAT patients. At the same
time however, the finding that no behavioral problem, individually or collectively, correlated with cognitive impairment, was a failure to replicate the previous study (Teri et al., 1988) which had reported a positive association between MMSE score and rating of behavioral problems. These results also contradicted Reisberg’s (1983) theory that stages of DAT are characterized by levels of associated cognitive and behavioral impairment. Teri et al. (1989) suggested that the contradictory findings may be the result of two major limitations. The first was the use of a new and largely untested measure of behavioral disturbance, the Behavior Problems Checklist, the second was that information on behavioral functioning was obtained from home-based caregivers, raising concerns about the possibility of response bias.

Given the limitations of their previous research and in an effort to provide a reliable clinical and research tool with which to empirically assess behavior problems in dementia, Teri and colleagues (1992) developed the Revised Memory and Behavior Problems Checklist (RMBPC). The RMBPC is a 24-item caregiver report measure that yields one behavior summary score and three subscale scores: memory-related behavior problems, depression problems, and disruptive behavior problems. The measure also yields parallel summary and subscale scores for caregiver reactions to such behavior problems. Data were collected from 201 geriatric patients and their caregivers. The diagnostic groups were not restricted to DAT but included other forms of dementia and depression. The broad diagnostic grouping was done to evaluate the RMBPC’s applicability to the varied disorders that are present in a geriatric population. Exploratory factor analysis found three first-order factors consistent with the subscales proposed and one general factor of overall behavior disturbance. In terms of other psychometric properties, overall scale reliability
was good with alphas of .84 for patient behavior and .90 for caregiver reaction. Validity was confirmed via comparisons of the RMBPC scores to well established indices of depression, cognitive impairment and caregiver burden.

The findings of the study (Teri et al., 1992) also demonstrated that while memory-related behavior problems were significantly related to level of cognitive functioning, disruptive behaviors were significantly associated with level of depression but not with cognitive impairment or type of dementia. These findings support other research (Swearer et al., 1988; Teri et al., 1989) that has suggested that the assumption that there is a positive correlation between cognitive impairment and behavioral/functional decline is perhaps not warranted.

In another study, Baumgarten, Becker, and Gauthier (1990) noted that a major problem with existing instruments designed to quantify behavior disturbance among patients with dementia is that these tools tend to be quite heterogeneous in nature. Typically, they include many items that do not refer to behavioral disturbance as such, but rather to a range of cognitive, psychological, somatic symptoms and/or functional impairments. To avoid some of these problems and to develop some clarity about the behavioral symptomatology in DAT, they developed a 28-item "Dementia Behavior Disturbance" scale (DBD).

Unlike in previous studies, the authors provided an operational definition of behavior disturbance: "the outward manifestation of some underlying cognitive, psychological, or physiological deficit, regardless of etiology, likely to cause stress to those caring for the patient" (p.221) and based the scale development on this working definition. DBD items
were sampled from all the major domains of behavior disturbance usually associated with dementia: passivity, agitation, eating disturbance, aggressiveness, diurnal rhythm disturbance, and sexual misdemeanour. The scale was designed so as to include only items that refer to specific observable behaviors, and not to psychological, physical or cognitive symptoms. Each behavior was rated on a Likert-type scale with five possible responses corresponding to the frequency of the behavior in the preceding week.

All subjects who participated in the study were diagnosed as having a primary dementia of the Alzheimer's type. For each subject, cognitive status was determined using the MMSE (Folstein et al., 1975) and functional capacity was assessed using a measure of Activities of Daily Living (Katz et al., 1963). The Behavior-Mood Disturbance scale developed by Greene et al. (1982) was also administered to provide a measure of construct validity for the DBD. The results of the study were consistent with other studies in which it was reported that the most pervasive behavioral problems were: repetitive questions, losing or hiding things, lack of interest in daily activities, nocturnal wakefulness, unwarranted accusations, excessive daytime sleeping, pacing, repetitive gestures, and verbal abusiveness. The examination of the relationship between scale scores and several clinical variables revealed that, in general, increased behavioral disturbance was positively associated with disease duration and severity, as well as with cognitive and functional impairment. The authors take these latter findings as providing further indirect evidence of the validity of the DBD scale. Unfortunately, given the equivocal nature of a positive relationship between behavioral symptoms and cognition, this claim does not seem warranted.
In terms of psychometric properties, the DBD does evidence high internal consistency, suggesting that items of the scale do, in fact, measure a single phenomenon. The test-retest reliability of the scale was only moderate; however, as the authors noted, a correlation of .71 between scores observed within a two week interval is as high as can be expected given the fluctuating nature of behavioral symptoms in dementia. The authors have suggested that the construct validity of the DBD scale is supported by the relatively high correlation with the BMD scale developed by Greene et al. (1982) and, in particular, with the BMD active/disturbed subscale. Caution, however, seems advisable regarding this demonstration of construct validity given the questionable representativeness of items included in the BMD active-disturbed subscale addressed earlier. The authors acknowledge that future work should focus on determining the DBD scales' validity and reliability in larger samples and in different settings.

Critical Summary: Behavioral disturbance in DAT

Quantitative empirical studies have unequivocally supported clinical observations reporting a high prevalence of personality change and behavioral problems concomitant with DAT. However, the relationships of these behavioral problems to cognitive functioning and dementia severity has only recently been studied and the findings have not been consistent. The inconsistency seems to stem from the psychometric properties of the measures of behavioral functioning, which have not yet been well established. On a positive note, these inconsistencies necessitate the rethinking and continued exploration of the progressive course of dementia. There is now some evidence, for example, to suggest that the declining course does not reflect a homogeneous progression of
impairment, contradicting Reisberg's (1983) theory that the stages of DAT are characterized by associated levels of cognitive and behavioral impairment. Clearly more study is needed to expand our understanding of the relationships between behavioral functioning, cognition, and disease severity.

Recognition of Facial Displays of Emotion in DAT

Research on the processing of emotional information has generally overlooked individuals with diffuse brain damage in favour of other clinical populations or normal subjects (Allender & Kaszniak, 1989). Over the past two decades there have been only eight published studies and one doctoral dissertation in the area of emotion processing in the broad class of diffuse brain damage. Only since 1981 have there been studies that have focussed their inquiry on DAT specifically. The relative lack of knowledge regarding the perception of affect in DAT should be addressed in terms of expanding our theoretical knowledge base of the sequelae of DAT and because there are possible pragmatic implications for remediation strategies of the behavioral disturbances that often accompany DAT.

Kurucz, Feldmar, & Werner (1979) were the first to have identified an impaired ability to recognize facially expressed emotions in chronically disoriented patients with chronic organic brain syndrome. Kurucz and colleagues conducted a series of studies (Kurucz et al., 1979; Kurucz & Feldmar, 1979) that greatly influenced the subsequent research in this area in terms of method used and conclusions drawn and, as such, warrants a detailed discussion.
Three groups of subjects were selected by Kurucz et al. (1979) for study and comparison. Group 1 consisted of 14 inpatients (men and women) with a mean age of 69.8 years. Each was disoriented to one of the following: time, time and place, or time, place and person. Diagnoses included senile or presenile dementia with or without cerebral arteriosclerosis, schizophrenia or major affective disorder with deterioration having developed during the course of the illness, alcoholic deterioration, and non-specified brain-damage. All subjects met the DSM-II criteria for chronic organic brain syndrome. Group 2 consisted of 14 inpatients matched for age and sex with the patients in Group 1. None of the subjects in Group 2 were disoriented in any sphere. The reported diagnosis for Group 2 was schizophrenia with no signs of dementia, however, two patients carried an additional diagnosis of convulsive disorder which is often believed to arise from an underlying organic pathology. As the authors indicated, the factor that differed most between Groups 1 and 2 was the presence of disorientation rather than organic impairment. Group 3 consisted of 14 volunteers from the hospital staff. Group 3 participants could not be matched for age and it is not clear if they were matched with the other groups for sex.

Kurucz and colleagues (1979) attempted to design a test that was sufficiently easy that it could be successfully completed by patients with chronic schizophrenia or an affective disorder. The test they used consisted of 12 pictures of faces presented in four sets. Each set contained pictures intended by the researchers to depict happy, sad, and angry faces. The four sets of facial stimuli varied along a continuum as follows: Set 1 consisted of three simple line drawings of faces depicting the three emotional states; Set
2 consisted of three line drawings where the emotional expressions were more accentuated than those in the first set (i.e., the drawings contained additional visual cues such as tears and facial wrinkles characteristic of the emotion depicted); Set 3 consisted of three even more realistic drawings of faces expressing the three emotional states; and Set 4 consisted of frontal view photographs of a Caucasian adult male displaying a happy, sad, and angry face respectively.

The four sets of faces were shown to the subjects under two conditions. In the first condition, all pictures were presented consecutively and withdrawn immediately following a response. The subjects were given the following instructions: "I am going to show you a face. Please tell me: is this face happy, sad, or angry?" The subjects were required to give a verbal response. In the second condition of each testing session, one set of three pictures was presented to the subjects with the following instructions: "On the table in front of you there are three drawings of faces. I would like you to point to the happy face (or to the sad face, or to the angry face)." A verbal response was not required in the second part of the session.

The percentage of correct responses by each subject was tabulated and related to orientation, age, and length of illness. The mean proportion of correct responses on the test was 66% for Group 1; 95% for Group 2; and 100% for Group 3. The differences between Group 1 and the other groups were significant, and Groups 2 and 3 were also significantly different. Across all subjects the level of performance on the test was not related to their age or the length of their illness. Kurucz et al. (1979) concluded that these findings demonstrated a deficit in the ability of patients with chronic OBS to match
correctly the verbal label of an emotion with the appropriate emotional facial expression. Given that the patients had the ability to comprehend verbal instruction, had normal visual acuity and an adequate ability to name objects, the impairment observed was named prosopo-affective agnosia (PAA) and was thought to denote an impairment of facial affect recognition in the absence of any underlying related perceptual-cognitive disorder.

A follow-up study by Kurucz and Feldmar (1979) attempted to answer the following questions: was the measure of PAA reliable in a test/retest situation and what was the relationship between prosopo-affective agnosia and prosopagnosia (the inability to recognize familiar faces). The results of the re-test of many of the original subjects from Groups 1 and 2 following a six month interval showed that the test of PAA again demonstrated a highly significant difference between the groups. In addition, the test/retest scores were significantly correlated in all subjects. As the authors pointed out, the difference between facial affect recognition scores remained remarkably consistent across the time interval, in spite of the fluctuating level of arousal of many subjects.

Kurucz and Feldmar (1979) also concluded that prosopagnosia and prosopo-affective agnosia (PAA) were independent phenomena. Prosopagnosia was assessed in two ways: subjects were asked to orally identify pictures of several U.S. presidents and facial photographs of ward personnel. For recognition of presidents the difference in mean performance levels between the two groups was significant and, as predicted, impairment on this task was not correlated with performance on the PAA test. It should be noted however, that the correlation coefficient was calculated for Group 1 only, with an N of only 11, limiting the degree of variance possible. Another problem was that subjects were
told that the pictures were of U.S. presidents, stimulating a certain response set. As no adjustments were made for guesses, it seems likely that subjects who guessed would be able to give correct answers because of the very familiar names required. The question remains what the level of performance of the subjects would have been had they received no such confounding clues. The recognition of ward personnel was also not related to PAA test performance, and this similarly raises the question of whether performance was based more on guessing of high probability of exemplars than on recognition per se.

Based on the higher rates of impairment on the PAA test relative to the prosopagnosia tests the authors concluded that the former is more sensitive to organic disease. Aside from the methodological problems with their prosopagnosia tests, they seem to have assumed that prosopagnosia and impairment in sensory processing mechanisms for facial features are equivalent. Other researchers, however, have suggested that agnostic failures can be understood as the combined results of a primary sensory processing disturbance and generalized deterioration, or as a combination of disturbed perception and faulty sensory-motor exploration (Bender & Feldman, 1972). Geschwind (1965) has suggested that recognition is not a unitary process and that agnosia results from disconnection of intact cortical sensory regions from intact speech areas; thus, accuracy in recognition would seem to be inversely proportional to the extent of disconnection. More thorough evaluation of the relationship of PAA and ability to process facial features is needed. Nevertheless, the conclusion drawn by Kurucz and Feldmar (1979), that a person's ability to recognize facial expressions is very sensitive to organic insults, seems warranted.

In the 1979 follow-up study, Kurucz and Feldmar also emphasized that the three
emotions were not equally well recognized. They reported the PAA test results for Group I as follows: happy = 76.1%, sad = 66.5%, and angry = 48.9%. These findings seemed to indicate that PAA in subjects with organic disorders was more striking in the recognition of angry stimuli and the least evident in the recognition of happy stimuli. In discussion of these findings, the authors suggested that areas in the limbic cortex or undefined subcortical areas are important in facial affect recognition. The relative retention of recognition of happy facial expression may present evidence for a neurological regression in the impaired subjects (Kurucz & Feldmar, 1979). This hypothesis was not supported in a later study (Brosgole, Kurucz, Plahovinsak, Boettcher, Sprotte & Haveliwsala, 1983). A simpler and alternative explanation to a neurological regression hypotheses is that different affective facial displays represent different levels of task difficulty. Studies have demonstrated that different affective displays do in fact vary on a number of important and perceptible dimensions such as the number and tone of muscles used (Ekman & Friesen, 1976; Izard, 1971).

Brosgole et al. (1981) reported the results of two studies in which they attempted to specify more precisely the underlying causes of PAA. One aim of the first study was to determine whether senile demented patients would manifest PAA when not required to produce a verbal response. Three picture sets of stimuli from the PAA test (Kurucz et al., 1979) were administered simultaneously and subjects were asked to point to the face depicting the emotion specified by the experimenter; this was referred to as the "prompting" task. Another aim of the first study was to determine whether the facial stimuli were discriminable at input, irrespective of prompting. Subjects were shown
three faces from the same set simultaneously with two of the faces depicting the same emotion and one expressing a different emotion. The subject was asked to point either to the one face that appeared to "feel different" or to the two faces that were felt to be the same. This procedure, referred to as the "oddity" task, was designed to make it possible to determine whether the expressive differences between the faces were being registered perceptually.

The subject group consisted of two males and seven females, all inpatients with a primary diagnosis of senile dementia. The mean age was 80.2 years. In the statistical analysis, errors made during the prompting and oddity tasks to each facial expression were converted to error rates for the total subject group. There was a significant difference found between prompting and oddity task error rates: 23% versus 10% respectively. Faced with these interesting differences between the procedures, the authors speculated that entirely different strategies may have been used by subjects in responding to the prompting and oddity tasks; perhaps emotional cues were not serving as the basis for the discriminations in the oddity task. Specifically, subjects may have been selecting the "different" stimulus on the basis of feature or line differences between the faces, and the strategy used to compensate for a deficit in facial-affect recognition may have resulted in a performance level that was more efficient than that obtained during prompting.

To explore this hypothesis, 6 of the original 9 subjects were retested on the oddity procedure after a 4 - 6 week interval, but with the subjects now required to account verbally for the discriminations made. As before, discriminations were rather accurate
(9.7% error rate). However, intertrial interviews with each subject indicated that discriminations were often being made on the basis of an analysis of feature differences characteristic of the stimuli and not by the affect itself. If the verbal interview responses had been scored instead of, or in addition to, the pointing responses, the error rate would have jumped to 64%. Even though subjects could determine which face was different, the affect was often misinterpreted depending on the context, for example, a sad face was often seen as peaceful or calm in the context of two angry faces. The authors interpreted their results as indicating the presence of a facial-affective agnosia in their demented subjects, in that there was a pronounced failure to attribute emotional meaning appropriately to the visually presented stimuli.

The researchers suggested two possible mechanisms for this prosopo-affective agnosia in their demented subjects. The first possibility is that the senile process has resulted in the complete destruction of the associative connections between facial expression and its affective meaning. In this case, visual stimuli would need to be augmented by input from other modalities, such as audition, in order to arouse an affective set. A second interpretation is that the tract joining the sense impression with its meaning has been impaired, but not destroyed. If that were so then senile patients might be capable of extracting affective meaning if "forced" to do so by not permitting them to rely on the easier strategy of using simple feature analysis in discriminating stimuli.
The second study reported by Brosgole et al. (1981) was undertaken to critically evaluate these hypothesized mechanisms. New stimuli were created consisting of "realistic line drawings" of three different faces that allowed the researchers to compare prompting and oddity procedures under two different modes of presentation. The first method of presentation was essentially the same as before (i.e., the same individual appeared in each of the facial stimuli used to depict the different emotions on a given trial, whether the trial involved prompting or oddity). In the second presentation method, the three sets of facial stimuli were combined for presentation so that the emotions being expressed in a trial were depicted by different faces.

By using different facial stimuli on a single trial, the researchers felt they were able to address the question of whether or not senile patients are capable of using auditory cues (on prompting) for purposes of abstracting emotional concepts and generalizing them across facial feature characteristics. In addition, using different facial stimuli in the oddity procedure was assumed to subvert the cognitive strategy of choosing the unique face on the basis of line or feature differences. Thus, patients would be forced to "shift" their approach to one of selecting the unique expression on the basis of the affective differences contained in the visual stimuli. The extent to which such a cognitive shift could be effected was felt to relate to the level of integrity of the associative bonds joining visual stimuli with affective meaning.

Subjects selected for this study were three male and four female inpatients, all diagnosed as senile demented. When sets of stimuli presented to the subjects contained the same face depicting different emotions, the results of prompting and
oddity procedures were similar to those obtained earlier; the error rate was 27.8% and 9.5% respectively and the difference was significant. The authors concluded that the results are not dependent on the particular set of stimuli used. When the facial stimuli were cross-matched between sets, prompting resulted in a 23.8% error rate, whereas the error rate for oddity rose to 32.5%.

The authors concluded that with prompting, subjects were more capable of recognizing and identifying facial affect. The meaning imparted by the verbal cues was generalized across stimuli and was not restricted to the specific feature characteristics of one particular face, as evidenced by the fact that the two prompting conditions did not differ. Affect identification was not perfect even with prompting, and the authors concluded that there was an obvious impairment in affect recognition. Being confronted with this deficit, the authors suggested that subjects approached the oddity task by using a more efficient strategy, namely, discrimination on the basis of feature differences. On the oddity task when this strategy of discriminating between faces was subverted by cross-matching the stimuli, performance deteriorated to the level of prompting.

As cross-matching did lead to a deterioration in performance, the question of how to account for this remains. One possibility is that the cross-matching did serve to obscure rather specifically the featural stimuli that had been relied on earlier for making decisions during the oddity task. But if that were true, then what are the relevant facial features? Such information would be of interest in its own right. Also, if (as the authors suggest) use of cross-matching did force subjects to shift from a
cognitive strategy based on simple visual feature analysis to one based on a meaningful appreciation of affective expression, then where is the point at which such a shift occurs? In other words, how many features must be changed between the facial stimuli before the shift in strategy is made? To begin to answer these questions a more detailed study of the oddity tasks would be helpful; for example, the sets could be varied successively in terms of the specifics and the number of featural stimuli that would be different between faces.

In another study Brosgole, Kurucz, Plahovinsak, Sprotte, et al. (1983) compared recognition of facial and postural affective expressions in senile elderly persons. To determine if deficits in the recognition of facial displays of emotion would be observed when assessed with facial stimuli other than those used previously (Kurucz et al., 1979), the performance on the PAA test was compared to two other sets of facial stimuli. Set 1 consisted of 18 caricature drawings of a man, woman, and child displaying a happy, angry, sad or neutral facial expression. Set 2 consisted of 18 caricature drawings of a bird, squirrel, and dog displaying the three different emotions and a neutral pose. Another question addressed by this study related to whether or not deficits in affect recognition noted with facial stimuli, would similarly be observed in a series of drawings designed to communicate emotion through the use of posture. Thus, a "set of sketches was created, consisting of a man, woman, and child, where joy, sadness, and anger were communicated artistically manipulating body position and muscle tone." (p. 38). Facial features were omitted in these stimuli.
Subjects in this study included 8 males and 8 females, each with a primary diagnosis of senile dementia. Their mean age was 75.1 and all were patients at a large state hospital. Affect recognition was assessed with facial stimuli presented in the first three conditions and postural stimuli in the last. Within each condition, sets of three stimuli (happy, sad, and angry expressions) were presented simultaneously, and subjects were required to respond by pointing to the stimulus corresponding to the verbal prompt. The total number of errors for all patients were summed and reported for each condition. Findings indicated that deficits in the recognition of facial displays of emotion were evident regardless of the facial stimuli used. On the PAA test there was a 20% error rate, with the caricature people drawings a 24% error rate, and with the animal caricatures a 25% error rate. A relatively small error rate of 11% was found with the presentation of postural stimuli. Given these results, Brosgole, Kurucz, Plahovinsak, Sprotte, et al. (1983) speculated that the patients gained a greater appreciation of affect from the postural stimuli than they did from facial expressions.

In discussing their findings, Brosgole, Kurucz, Plahovinsak, Sprotte, et al. (1983) pointed out that these results could either be due to failure to appreciate the facial expressions themselves or to an inability to comprehend the verbal prompts. However, if verbal comprehension was the problem, then no difference should have been observed between facial and postural stimuli. Alternatively, it is possible that facial stimuli conveyed so much information that the processing capacity of the senile subjects was exceeded. While the authors presented this possible explanation, they argued that if this were the case, then the number of errors made to facial stimuli should not have varied.
depending on affect as there is no reason to believe that any of the facial stimuli contained and conveyed more information than any of the others. Studies have demonstrated, however, that different facial displays of affect do in fact vary on a number of important and perceptible dimensions (Ekman & Friesen, 1976; Izard, 1971). It is possible that the authors were premature in rejecting the premise that deficits in facial affective recognition could be attributed to the informational properties of the facial stimuli.

While all of the preceding studies have concluded that there is good evidence that persons with a dementia of some type demonstrate an impaired ability to recognize facial expressions of emotions, several problems render these conclusions equivocal. In these studies, the diagnoses of the subject population were not well specified and it remains unclear whether subjects had any diagnoses concurrent with dementia. Further, dementia itself is not a singular disease and the type of dementia in the subject population was often not well clarified. Finally, most of the research was also based on extremely small sample sizes severely limiting the validity and generalizability of the findings.

Drexler (1988) sought to address some these issues and to assess the impact of depression, concurrent with DAT, on the ability to recognize facial expressions of emotion. Two groups of subjects were selected for study and comparison. The first group consisted of 19 patients with a diagnosis of DAT and varying levels of depression. The second group was comprised of 16 patients (5 males and 11 females) with varying levels of depression and cognitive functioning, but showing no evidence of any
dementia. The groups did not differ on demographic characteristics such as sex, education, or estimated premorbid I.Q.

All subjects were assessed using the following measures: Hamilton Rating Scale for Depression (Hamilton, 1960; 1967), Beck Depression Inventory - Short Form (Beck, Ward, Mendelson, Mock & Erbaugh, 1961), Benton's Facial Recognition Test - 13 Item Version (Benton & Van Allen, 1968) and the Mattis Dementia Rating Scale (Mattis, 1975). The Pictures of Facial Affect (PFA), (Ekman & Friesen, 1976) were used to measure subjects' ability to recognize facial displays of affect. As this measure formed the core of Drexler's (1988) study and was the measure of affect used in the present study, the protocol will be described in some detail. The PFA consists of black and white slides of models posing facial expressions that have been empirically validated as representative of the emotions of anger, happiness, sadness, disgust, surprise, and fear. There is no set protocol for how the PFA should be used in studies and the developers of the measure have encouraged researchers to adapt the PFA to the specific needs of the research question. In Drexler's (1988) study, data consisted of responses to slides of each affective category (6 in total) and one neutral expression with a total of 42 responses per subject. An answer sheet was given to each subject with the six affective categories and the neutral choice written in rows across the page. The instructions were as follows: "On this test I will show you some photographs of people. You are to look at each photograph and select one word from the choices on your answer sheet which best describes the emotion expressed in each slide." (p. 197). Subjects were encouraged to take their best guess and if the response was given verbally it was recorded by the
As each testing session also included the administration of the other test measures noted, the sessions were rather lengthy, approximately 2 - 3 hours.

The hypothesis that the demented-depressed group would be significantly less accurate than the nondemented-depressed group in the ability to recognize facial displays of affect was supported and this difference was thought not to be attributable to depression as the subject groups manifested comparable levels of depression. The subject groups did not differ in terms of the degree of depression manifest as there was no variance between the groups to be measured. As Drexler (1988) noted, the inclusion of a nondepressed-demented (NDD) group would have introduced some variance on this factor. Yet, given that the level of depression was reported to be mild, even the inclusion of an NDD group would likely leave the major group difference to be DAT. Owing to these research design limitations, the relative impact of depression concurrent with DAT on the recognition of facial displays of emotion remains largely unanswered. Although further exploration of this question has merit, in a review of the literature in the study of emotion recognition in normal subjects with depression, Mayhew (1992) found the results to be controversial and inconclusive. Less equivocal findings need to emerge before assessing the contribution of depression in emotion recognition in DAT.

As Drexler (1988) also found that groups differed with respect to their ability to analyze facial features as assessed by the Benton Facial Recognition Test (BFR, Benton & Van Allen, 1968), it was necessary to determine the degree of variance attributable to facial feature processing. Using the BFR as the single covariate, the differences between the groups only approached significance, suggesting that the differences observed on the
PFA measure were largely accounted for by differences in feature processing. Further analyses revealed a significant relationship across the subject groups between overall mental status (as measured by the Mattis Dementia Rating Scale) and accurate recognition of facial expressions of emotion, even when the effects of depression and/or ability to process facial features were partialled out. Drexler (1988) concluded that deficits in the ability to accurately recognize facial expressions of affect may be seen more in association with impaired overall mental status rather than as a defining feature of DAT. The importance of Drexler's (1988) findings is that it again calls into question studies that have not clearly specified the parameters of the dementia studied. Aside from the type of dementia present, these findings suggest that the level of dementia is also an important variable that must be assessed.

Allender and Kaszniak (1989) conducted a study designed to evaluate the perception of emotional cues in persons with DAT and to compare perception of emotional cues to other cognitive tasks. It was hypothesized that DAT patients would demonstrate a deficit in perception of emotional cues that would reflect specific problems in emotional processing not entirely accounted for by other cognitive deficits. Of further interest was the exploration of the pervasiveness of emotional processing deficits across modalities by assessing performance on recognition of vocal affect as well as that of facial affect.

Subjects included 30 DAT patients and 13 normal, healthy individuals all over the age of 60. None of the subjects with a dementia carried any psychiatric diagnosis other than primary degenerative dementia of the Alzheimer's type (DAT). A test battery consisting of two perception of emotion tasks and seven other cognitive tasks was administered to
each subject. The seven cognitive tasks were chosen either for their similarity in task requirements to the perception of emotion task or for their demonstrated utility in identifying cognitive deficits in dementia. The measures selected were as follows: Short Form of the Token Test (Spellacy & Spreen, 1969), the Boston Naming Test (Goodglass & Kaplan, 1983), Form L of the Benton Facial Recognition Test (Benton, Van Allen, Hamsher & Levin, 1975), the Seashore Rhythm Test (Boll, 1981), the Stanford-Binet Picture Absurdities Test (Terman & Merrill, 1960), the Finger Oscillation Test (Boll, 1981), the Digit Cancellation Test (Moran & Mefford, 1959), and the Mattis Dementia Rating Scale (Mattis, 1976).

The perception of emotion tasks involved pictures of faces and tape recordings of speech. The recognition of facial emotion task used the I-M series of posed expressions developed by Izard (1971). Each picture is of a face expressing one of nine emotions: interest, joy, surprise, sadness, disgust, anger, shame, and contempt. Subjects were given a printed list of the nine emotions and asked to classify each picture in terms of the emotion expressed. Four examples of each expression were presented. The perception of vocal emotion task was that developed by Heilman, Scholes & Watson (1975) and expanded by Tucker, Watson & Heilman (1977). In the first part of the task, four neutral sentences are spoken in each of four emotional tones: angry, sad, happy and indifferent. Subjects heard 16 sentences and chose the emotion expressed by pointing to one of a set of four line drawings of faces expressing the emotions and labelled with the printed name of the emotion. In the second portion of the task, subjects were asked to indicate if the
two sentences were spoken in the same or different emotional tone, for a set of 32 pairs of sentences.

The results supported the hypothesis that individuals with DAT have a deficit in the ability to identify facial cues of emotion and in the ability to identify and discriminate vocal emotional cues as compared to normal elderly. Allender and Kaszniak (1989) suggested that these findings demonstrated that the deficits in DAT are the result of an impairment in emotional processing that is not modality specific. A serious confound exists with the vocal emotion task that limits this possibility. After receiving a vocal stimulus the subject was required to point to one of the line drawings of faces expressing emotion and, although not clearly stated, it is assumed that the response given would be scored as correct only if the vocal and pictured facial expression matched. The requirement to recognize both vocal and facial affect for each emotional stimulus presented would have actually increased task complexity, making it a multi-modal task. In assessing the relative impact of other cognitive tasks contributing to the performance deficits observed in the recognition of facial expressions of emotion, only naming ability made a significant contribution, although it was not sufficient to account for group differences. Submitting the cognitive variables to a hierarchial regression analysis supported the interpretation of a specific emotional processing deficit, as opposed to alternative explanations that the deficit was based on other task factors.

A more recent study by Albert et al. (1991), however, provides support for Drexler's (1988) conclusion that deficits in the recognition of facial expressions of emotion may be seen more in association with impaired overall cognitive functioning and do not reflect,
as Allender and Kaszniak (1989) suggested, a primary impairment in the perception of emotion.

The study by Albert et al. (1991) was undertaken to examine the ability of mild to moderately impaired patients with DAT to process emotional stimuli. A variety of cognitive abilities were also assessed to determine their relationship to the processing of emotional stimuli. Subjects selected for this study were 19 patients with DAT (4 men and 15 women) and 19 control patients (6 men and 13 women) who had chronic medical illnesses but no evidence of dementia.

The assessment of the perception of affect consisted of an interesting series of nine tests, clustered into three different task areas: 1) discrimination between same/different facial expressions of emotion (ie., Do these people feel the same or different?) and between same/different facial identities (ie., Are these pictures of the same or a different person?); 2) recognition of a verbal emotion label (ie., Point to the sad person.) and the provision of an emotion label (ie., What type of emotion is that person feeling?); and 3) recognition of emotion in drawings of emotional settings and in verbal descriptions of emotional settings. Ekman and Friesen's (1976) Pictures of Facial Affect served as the emotional stimulus for seven of the tests. The aspects of emotion portrayed in the photographs shown were restricted to happy, sad, angry, and indifferent.

To determine whether decline in the cognitive functions of memory, conceptualization, language, and visuospatial processing were related to performance on the affective tasks, the following tests were used: Digit Span (Forward) and Similarities from the WAIS-R (Wechsler, 1955), the Boston Naming Test (Goodglass & Kaplan, 1983), Delayed
Recognition Span Test (Moss, Albert, Butters, & Payne, 1986), and figure copying from the Wechsler Memory Scale (Wechsler, 1945).

The initial results indicated that there were significant differences between the groups on most of the perception of affect tests. When performance on these tests was adjusted for the cognitive deficits evident in naming and abstraction ability, only two of the affect tests continued to differentiate the groups, namely, provision of a verbal label of a pictured facial expression of emotion and recognition of emotion given a verbal description of emotional situations. Further, when the additional cognitive test scores of verbal memory and overall cognitive functioning (scores that had not been selected on an a priori basis) were entered into the regression equations, there was no longer a significant difference between the groups on any of the nine measures of affect used. Albert et al. (1991) concluded that the differences between the patients with DAT and control patients on perception of affect tasks were likely secondary to cognitive defects and not the result of a primary impairment in the perception of emotion.

While the study by Albert and colleagues (1991) clearly identified the type of dementia present and the level of severity in the patient group, a problem remains. The subject population consisted of patients with mild and those with moderate DAT, but the impact of severity on the emotion tasks or on the cognitive tasks was not determined. Once again, DAT was treated as if it was a relatively homogeneous variable.

**Critical Summary:** Recognition of facial displays of affect in DAT

Although most studies have demonstrated an impairment in the recognition of facial displays of affect in persons with dementia, as has been noted, several methodological
issues render these findings questionable. With few exceptions (Allender & Kaszniak, 1989; Drexler, 1988) most studies have based their conclusions upon very small sample sizes, limiting the strength and generalizability of the findings. Another problem is the possibility of concurrent diagnoses within the dementia sample population. It is unclear from some of the studies whether subjects were screened for the presence of any other Axis I diagnosis concurrent with the diagnosis of dementia, so diagnostic overlap is clearly a serious potential confound. Also, few studies have specified the type of dementia present and, while noting the level of dementia to be "severe", there is often no report of how severity level was assessed. The most serious flaw of the studies reviewed, however, is the treatment of DAT as if it were a homogeneous variable. While studies using subjects representative of only one stage of the disorder are valid, interpretation is problematic and likely accounts for some of the contradictory findings. The conclusion that has often been drawn is that the inability to recognize facial displays of emotion is characteristic of DAT and could be considered a defining feature of the disease. Clearly, as the studies by Drexler (1988) and Albert et al. (1991) have suggested, this deficit is not a defining characteristic of mild DAT or moderate DAT and, as such, certainly not of DAT in general. It is well accepted that DAT is a disorder that manifests as a progressive decline of functioning and the stages of DAT are reflective of this progressive change. Given this understanding, it is surprising that emotion recognition has not been examined in terms of change within the progression of the disease. It seems reasonable to speculate that emotion recognition becomes impaired as the severity of the DAT progresses. Before conclusions can be drawn about "defining"
or "characteristic features" of DAT, or that deficits in emotion processing that may be evident in severe DAT represent a specific processing deficit factor, the question must be addressed at all the various levels of the disease.

Two bodies of research literature have been reviewed. One focussed on the investigations of the behavioral concomitants of DAT, and the other on the recognition of facial displays of emotion in dementia. In the review of each area of the literature a brief critical summary identified questions that warranted further investigation. While each area has merit for further study on its own, the need to bridge our knowledge between the neuropsychological and the behavioral research has been repeatedly argued (Heaton & Pendleton, 1981; Teri, 1986). The present study attempted to do so not only by examining how emotion perception may be different across severity levels of dementia, but also by examining the relationships among emotion perception, behavioral functioning, and cognition.

Statement of Investigation

The present study examined a number of hypotheses to determine if deficits in the identification and matching of facial expression of emotion are characteristic of DAT. In addition, a number of exploratory issues were pursued to expand the current understanding of the inter-relatedness of behavioral functioning, cognitive functioning, and
the recognition of emotion. The relative impact of these factors in predicting the outcome of "living arrangements" was also examined.

Hypotheses:

1. The levels of accuracy in the identification of facial expressions of emotion will differ among the severity levels of dementia.

2. The levels of accuracy in the matching of facial expressions of emotion will differ among the severity levels of dementia.

3. The hypothesized decreased accuracy in the identification and matching of facial expressions of emotion among the dementia severity levels will remain evident even when the impact of differences in cognitive functioning is controlled.

Exploratory Issues:

1. The literature suggests that there are at least three distinctly separate factors that comprise the syndrome of DAT: cognitive factors, behavioral factors, and emotion recognition factors. There is, however, no existing research that has examined this factor structure. The present study sought to examine the relationships among dementia severity, cognitive functioning, behavioral disturbance, and the perception of emotion.

2. Research has demonstrated that it is often the level of behavioral functioning rather than the cognitive deficits that determines whether the individual with DAT will remain in the community or require institutional care (Chenoweth & Spencer, 1986; Colerick & George, 1986). The extent to which the loss of the emotion perception skills contributes
to that outcome is unknown. The present study sought to examine whether this latter factor is an important predictor of living situation for persons with DAT.

3. The assumption that there is a positive correlation between cognitive impairment and behavioral decline has received rather mixed empirical support. The present study examined the relationships among behavior disturbance, overall cognitive functioning, and dementia severity in an effort to help clarify the conflicting findings.

**METHOD**

**Subjects:**

*Participants with DAT:*

Seventy-five out-patients from the Alzheimer's Clinic of the University of British Columbia, Health Sciences Centre were recruited for participation. Initial contact was made by letter to the primary caregiver informing them of the study (Appendix A contains a copy of the contact letter). A follow-up phone contact was made to ask if they were willing to participate in the study. Of the 75 letter and phone contacts made, 30 persons declined to participate, 13 were never available for phone contact and 32 persons were willing to participate. With the exception of one caregiver and out-patient who were seen at the Alzheimer's Clinic, all other caregivers requested that the study be conducted at the primary residence of the individual with DAT. Consent forms were signed by the primary caregiver (copies of the consent forms appear in Appendix A).
Twenty-five in-patients from the Geriatric Division of Riverview Hospital near Vancouver, B.C. were recruited for participation in the study. The consent forms for each preselected participant was signed by the Director of the institution (copies of the consent forms used appear in Appendix A). These pre-selected patients were approached on their hospital ward and asked if they would like to participate in a study looking at facial expressions of emotion. No patient refused to participate. Patients were briefly informed about the study and assured that they could stop participation at any time without consequence.

Inclusion criteria:

1. Age 60 years or greater. The prevalence and incidence of dementia are age-related, with the majority of cases found in those 60 years of age or older (La Rue, Dessomulle, & Jarvik, 1985).

2. Have a diagnosis of probable or possible Primary Degenerative Dementia - Alzheimer's Type as determined by the DSM-III-R (American Psychiatric Association, 1987).

3. Have Hachinski Ischemia scores less than 5. This scale provides a quantitative measure of symptoms that can be helpful in distinguishing Primary Degenerative Dementia from dementia due to multi-infarct conditions, with scores of 5 or greater generally associated with the latter variety. (Hachinski, Lassen, & Marshal, 1974; Rosen, Terry, Field, Katzman, & Peck, 1980).
Exclusion criteria:

1. If dementia was definitely due to any of the following: toxic causes, metabolic illness, infection, deficiency state, vascular disorder, intracranial conditions (such as normal pressure hydrocephalus, subdural haematoma, concussion, or abscess), tumour, subcortical disorder (such as Parkinson's, Huntington's, or other movement disorder), or multi-infarct condition.

2. If the individual had a previous significant neurological history including trauma and neurosurgery. Obviously the neuropsychological deficits associated with such conditions would have led to a serious confound.

3. If the individual had a significant drug or alcohol abuse, defined as four or more drinks per night for five or more years. Excessive alcohol consumption contributes to a deterioration of cognitive functions (American Psychiatric Association, 1987).

4. If the individual had a history of psychiatric illness, hospitalizations, psychosis, or current psychoses, thus, any DSM-III-R Axis I diagnosis in addition to DAT changes in neuropsychological test results have been associated with these conditions (Heaton, Vogt, Hoehn, Lewis, Crowley, & Stallings, 1979), and were excluded to avoid confound.

5. If mental retardation or borderline mental retardation by history was evident (i.e.: evidence of pre-morbid IQ <80). These conditions are associated with unusual performances on neuropsychological evaluation (Lezak, 1983) and thus would have been a confound.
6. If the individual demonstrated focal findings on any available EEG, CT-scan or other neuro-radiodiagnostic technique. Focal findings tend to suggest a dementia other than DAT (American Psychiatric Association, 1987).

7. If the individual had corrected visual acuity sufficiently poor that it precluded the reading of certain test letters. This criterion was necessary in order to help ensure that poor visual acuity did not contribute to any performance deficits.

8. If the individual had corrected auditory acuity sufficiently poor that it precluded the comprehension of initial introduction to the primary researcher. This criterion was necessary in order to help ensure that poor audition did not contribute to any performance deficits.

Community Participants with no DAT:

To understand more fully how the perception of facial expressions of emotion may change as the level of dementia severity changes, it was necessary to compare the performance levels of persons with DAT to those of community dwelling elderly with no signs of dementia. Thirty-seven participants were recruited from two community centres that provided programs for the elderly only (Edmonds Community Centre and Centennial Community Centre). Recruitment consisted of making a brief presentation about the study and a request for participation at the start of various recreation classes offered at the community centre. The names and phone numbers were obtained from interested participants. Each was then later contacted to arrange a convenient time and participation always took place at the community centre they attended. Consent forms were signed by the participants (a copy of the consent form used appears in Appendix A).
Inclusion criteria:

1. Age 65 years or greater.
2. Score of 23 or greater obtained on the Mini-Mental State Examination (Folstein et al., 1975). Scores below 23 are indicative of organic involvement (Folstein, Anthony, Pahad, Duffy, & Gruenberg, 1985).

Measures:

A series of visual tests were chosen to measure subjects' abilities to make simple pattern discriminations, facial identity discriminations, and to recognize facial expressions of emotion. Separate measures assessed cognitive functioning, expressive language, visuo-spatial skills, and dementia severity; while a final group of measures concerned behavioral functioning. In general, measures were selected if they were relatively brief and could be easily understood by subjects at all levels of dementia severity. The particular measures included the following:

Visual recognition: discrimination of simple patterns

Six geometric line drawings were adapted from the pattern recognition section of the Mattis Dementia Rating Scale (Mattis, 1976). Each line drawing was black and white, measured 5 x 7 inches, and was mounted on a 6 x 8 inch white cardboard. This measure was used as a test of very simple visual decoding skills without any emotional aspects. Examples of the geometric patterns used appear in Appendix B.

Visual recognition: facial expressions of emotion

A set of 36 photographs of facial expressions of emotion were chosen from the standardized facial poses of fundamental emotions compiled by Ekman and Friesen
These photographs represent a serious attempt to develop a set of photographs depicting facial emotion, which would yield consistent agreement among viewers about the emotion depicted (Ekman & Friesen, 1976). The set of pictures comprising the PFA consists of 110 35mm black and white slides (Ekman & Friesen, 1976). From hundreds of photographs, the present set was chosen by the researchers on the basis of empirical studies that measured the consistency of judgements about the emotions being expressed in the various pictures. Six frequently experienced emotions, believed to yield characteristic facial expressions, were chosen: happiness, sadness, fear, anger, disgust, and surprise. Photos reliably seen as neutral were also selected. Except for the neutral picture, the emotions depicted were posed. Posers were trained to contract or relax different facial muscles associated with various facial expressions. Male and female models were used for posing and ages ranged from late 20's to the 50's.

Normative data are provided by Ekman and Friesen (1976) in the form of the percentage of observers judging each picture as depicting the intended emotion. All photographs in the standardized set were judged as showing the intended emotion by at least 70 percent of the observers, all but 11 were judged as showing the intended emotion more than 80 percent of the time and 59 were judged as depicting the intended emotion more than 90 percent by the raters.

For the present study a subset of the photograph set was chosen to fulfill the specific requirements of the present study, as recommended by Ekman and Friesen (1976). One criterion for selection was that only photographs that had been judged with a reliability of 90% as depicting a particular emotion would serve as stimuli. Other criteria were
specific to the experimental task and are discussed in the Procedure section. The final subset consisted of 36 photographs. The slides selected were then developed into black and white 5 x 7 prints and mounted on 6 x 8 white cardboard. These photos were used in four different tasks: facial identity discrimination, emotion discrimination, emotion identification, and emotion matching. Examples of the pictured stimuli used for the emotion identification task appear in Appendix B.

*Visual organization: The Hooper Visual Organization Test (HVOT)*

The HVOT (Hooper, 1958) was developed to identify those patients in mental hospitals with organic brain conditions. The test is essentially a perceptual puzzle which provides a measure of an individual's ability for visuospatial conceptualization and organization. These perceptual functions are not dissimilar to those that would be used in the decoding of facial expressions of emotions.

The HVOT consists of 30 pictures of more or less readily recognizable cut-up objects. The individual is required to conceptually reorganize the disarranged stimuli and name the object verbally. This test does not correlate significantly with sex, education, age or intelligence except at lower intellectual ability levels and at ages above seventy (Lezak, 1983). As the participants in the present study fell into one or both of the latter categories, the HVOT is a useful measure of cognitive functioning. It is also an easy test to administer, scoring is unambiguous, and Lezak (1983) found test-retest reliability to be high. Intellectually intact persons generally fail no more than five HVOT items. Persons who make 6-10 failures comprise a borderline group that includes emotionally disturbed or psychotic patients as well as those with mild to moderate brain disorders. More than
ten failures usually indicates organic pathology. In the present study the HVOT was administered by the principal examiner during the experimental session for the participants with DAT only. This measure was not administered to the community dwelling elderly. In the data analysis, established norms were used for this group. See Appendix B for a copy of the HVOT score sheet.

Cognitive Functioning: Folstein Mini-Mental State Examination (MMSE)

The Folstein Mini-Mental State Examination (Folstein et al., 1975) is a brief measure used for screening organic impairment. It provides a score of global cognitive deficits and taps a range of cognitive tasks including orientation, verbal reasoning, visual-perceptual skills, language and memory. Scores range from 0 - 30 with scores of 27 considered to be mild to normal and scores below 23 considered to indicate organic involvement (Folstein et al., 1985). The MMSE was administered to all participants with DAT by the principal investigator or a trained psychology assistant employed at Riverview Hospital. See Appendix B for a copy of the MMSE.

Expressive language: The Boston Naming Test (BNT)

Increasing disturbances in verbal thought and language production are characteristic of Alzheimer's disease and generally reflect the nature of the cognitive deterioration. The BNT (Goodglass & Kaplan, 1983) provides a measure of the individual's verbal abilities and is sensitive to the word finding problems (dysnomia) evident in the Alzheimer's disease. This test consists of 85 large pen and ink drawings of items ranging in familiarity from such common objects as a tree and pencil at the beginning of the test to sphinx and trellis at its end. When an individual is unable to name a drawing, the
examiner gives a stimulus cue, if the individual is still unable to give a correct name, a phonetic cue is provided (e.g., for pelican, "it's a bird", "pe"). The examiner notes how often cues are needed and which items are identified successfully. In the present study the BNT was administered by the principal examiner during the experimental session for the participants with DAT only. This measure was not administered to the community dwelling elderly, but in the data analysis, established norms (Van Gorp, Satz, Kiersch, & Henry, 1986) were used for this group. See Appendix B for a copy of a BNT score sheet.

Dementia Severity: Clinical Dementia Rating Scale (CDR)

The Clinical Dementia Rating Scale (Hughes, Berg, Danziger, Coben, & Martin, 1982) is a global rating scale permitting the staging of dementia into four categories of severity: Questionable Dementia (CDR=0.5), Mild Dementia (CDR=1), Moderate Dementia (CDR=2), and Severe Dementia (CDR=3). There is a fifth category of No Dementia (CDR=0). The CDR requires the rating of an individual on 6 scales assessing cognitive and behavioral functioning: memory, orientation, judgement and problem-solving, community affairs, home and hobbies, and personal care. Each scale is rated from defined criteria as Healthy (CDR=0) to Severe Dementia (CDR=3) and each scale is to be rated as independently as possible. See Appendix B for a copy of the criteria used for determining severity level (Berg, 1988) and a copy of the CDR score sheet.

Scoring:

The global CDR is derived from the scores in each of the six categories as follows (Berg, 1988). Memory (M) is considered the primary category and all others are
secondary. CDR = M if at least three secondary categories are given the same score as the memory score. Whenever three or more secondary categories are given a score greater or less than the memory score, CDR = the score of the majority of secondary categories. The exception is the unusual circumstance in which three secondary categories are scored on the other side of M, in that instance CDR = M. When M = 0.5, CDR = 1 if at least 3 or the other categories are scored 1 or greater. If M = 0.5, CDR cannot be 0, it can only be 0.5. If M = 0, CDR = 0 unless there is questionable impairment in two or more secondary categories, in which case CDR = 0.5. The level of dementia severity for the participants with DAT was determined by ratings on the CDR made by the principal investigator. To provide a measure of rater reliability, severity ratings were also made by psychologists on staff at Riverview Hospital or the Alzheimer's Clinic at the University of British Columbia. Inter-rater reliability was determined by percentage agreement on 43 severity ratings and was found to be 81%. A dementia severity level of zero was assigned to all community-dwelling elderly participants with a Mini-Mental State Examination score of 23 or greater as by definition this indicates no organic involvement (Folstein et al., 1975).

Behavioral Functioning: Dementia Behavior Disturbance Scale (DBD):

Behavioral functioning was assessed with the DBD developed by Baumgarten, Becker, and Gauthier (1990). The DBD contains 28 items that sample from all the major domains of behavior disturbance usually associated with dementia: passivity, agitation, eating disturbance, aggressiveness, diurnal rhythm disturbance, and sexual misdemeanour. The scale was designed to include only those items that refer to specific observable behaviors
and not to psychological, physical or cognitive symptoms. Each behavior is rated on a Likert-type scale with five possible responses corresponding to the frequency of the behavior in the preceding week (0 = never, 4 = all the time). Higher scores indicate more disturbed behavior. Behavioral ratings were obtained for the participants with DAT only and were made by each participant's primary caregiver during the time that the DAT participant was completing the research protocol. See Appendix B for a copy of the DBD.

**Behavioral Functioning: The Revised Memory and Behavior Problems Checklist**

The Revised Memory and Behavior Problems Checklist (RMBPC, Teri et al., 1992) incorporates several recent advances in the assessment of dementia-related behavioral problems. The 24 items comprising the scale were selected to assess three domains of problematic behavior: memory-related problems, depressive problems, and disruptive problems. The RMBPC assesses the occurrence of these behaviors using an objective scaling criterion. Each behavior is given a frequency rating: 0 = never occurs, 1 = occurs infrequently and not in the last week, 2 = occurred 1-2 times in the last week, 3 = occurred 3-6 times in the last week, and 4 = occurs daily or more often. The RMBPC yields a global summary score as well as more specific sub-scores for behavioral disturbance. In the present study the RMBPC was completed only for the participants with DAT and the ratings were made by the participant's primary caregiver during the time that the participant with DAT was completing the research protocol. See Appendix B for a copy of the RMBPC.
Procedure

The purpose of using the following measures was to obtain an estimate of the individual's ability to discriminate between patterns, faces, and emotions, to correctly label different facial expressions of emotion, and to match the facial expression to a target emotion. These measures of visual recognition were chosen for the following reasons:

1) tasks varied in complexity but each task was simple and short in duration (no more than an average of 5 minutes for the first three tasks and 20 minutes for the last two tasks combined). This increased the likelihood that the task demands would be understood and that fatigue would not be a problem. The short duration of each task and, thus the entire procedure, permitted the inclusion of subjects excluded from previous research; and

2) the tasks were reflective of procedures routinely used in emotion research (Albert et al., 1991; Allender & Kaszniak, 1989). Each subject was asked to complete five tasks. The first two tasks provided a baseline measure of pattern discrimination and facial identity discrimination, while the remaining three tasks required the more complex visual discrimination of emotions, emotion identification and matching. The order of tasks was always the same, ranging from simple to more complex.

1) Baseline measure of pattern discrimination:

Each trial of this task required that the subject examine two geometric line drawings from the Mattis Dementia Rating Scale (Mattis, 1976) and indicate, with a verbal response, whether the line drawings were the same or different. There was a total of six trials in which three pairs were the same and three were different. The order of presentation was randomized for each participant.
2) **Baseline measure of facial discrimination:**

On each of 12 trials of this task, the subject was presented with two pictures of either the same person or two different persons displaying a neutral facial expression. The photographs were from the Pictures of Facial Affect series (Ekman & Friesen, 1976). The subject was required to indicate, with a verbal response, whether the people in the two pictures were the same or different. There was a total of eight trials in which four pairs were the same and four were different. The order of presentation was randomized for each participant.

3) **Emotion discrimination:**

On each trial of this task, the subject was presented with two pictures of a person portraying either the same or different facial expressions of emotion. The photographs were from the Pictures of Facial Affect series (Ekman & Friesen, 1976). The subject was required to indicate, with a verbal response, whether the emotions portrayed in the two pictures were the same or different. There was a total of twelve trials in which six pairs were of the same expression and six pairs were of different expressions. The order of presentation was randomized for each participant. Five emotions were used in the stimulus materials - happiness (two repetitions), anger, sadness, disgust, and fear.

4) **Emotion identification:**

On each trial of this task the subject was presented with a stimulus photograph of a person portraying one of six fundamentals emotions - happiness, sadness, anger, disgust, fear, or surprise. The order of presentation was randomized. The
photographs were from the Pictures of Facial Affect series (Ekman & Friesen, 1976). The subject was instructed to look at the stimulus photo and verbally label what that person was feeling. If the subject was unable to provide a label for the emotion portrayed, or did so incorrectly, he/she was provided with a verbal prompt of three choices (one correct, the other two random selections of the five other emotions, order of choices also randomized). These verbal prompts were repeated as often as necessary to obtain a response from the subject and the number of prompts given for each pictured emotion was recorded.

5) Emotion matching:

After an emotion label had been provided by the subject, each subject was then presented with six additional photos, one of which portrayed the same emotion as the stimulus photograph. The subject was then asked to choose another photograph from a group of six in which the person was "feeling the same way" as the person in the stimulus photo. There was a total of twelve trials for each subject, two presentations for each fundamental emotion in which one presentation was female and the other male. The order of presentation was randomized.

In addition to these tasks, the participants with DAT were also assessed in terms of their level of dementia severity, global cognitive functioning, expressive language ability, visuo-spatial skills and degree of behavioral disturbance. With the exception of the assessment of behavioral disturbance which was made by the primary caregiver during the testing session, all other measures were administered by the primary investigator. The research protocol was always completed in one session lasting between one to one and
RESULTS

**Demographic Data:**

Ninety-four persons were recruited from various facilities in the Lower Mainland of B.C. to participate in the present study, but 20 of these had to be excluded for various reasons. Thirty-seven of the initial recruits had volunteered from the Edmonds Senior Community Centre and Confederation Senior Community Centre and, of these, ten were excluded from the final data analysis because they did not meet the age requirement of a minimum of 65 years. The remaining twenty-seven participants demonstrated no evidence of a dementia of any type and were considered normal, community-dwelling elderly.
The remaining fifty-seven initial recruits were all diagnosed with possible/probable dementia of the Alzheimer's type (DAT). Twenty-five of these recruits were inpatients at Riverview Hospital - Geriatric Division; of these participants, eight were excluded because they gave no indication of any comprehension of the research protocol. Thirty-two recruits were outpatients from the Alzheimer's Clinic at the University of British Columbia, Health Sciences Centre; two of these participants were excluded from the final sample as they demonstrated no comprehension of the research protocol. The final sample used for the data analyses consisted of a total of seventy-four participants: twenty-seven community-dwelling elderly and forty-seven elderly with a diagnosis of DAT.

A major focus of the present study was to determine how the perception of facial expressions of emotion may differ across severity levels of DAT, thus it was necessary to structure the organization of the database to represent the dementia severity levels present in the sample. The seventy-four participants were classified into one of four groups on the basis of dementia severity determined by scores on the Clinical Dementia Rating Scale (Hughes et al., 1982). The four groups and number of subjects within each group were as follows: 1) no dementia, n=27; 2) mild dementia, n=15; 3) moderate dementia, n=18; 4) severe dementia, n=14.

An analysis of variance was conducted to determine if there were any severity-group differences on the demographic variables of sex and age. Due to the number of analyses
conducted in the present study, to decrease the possibility of Type 1 error, a more stringent level of significance, \( p < .001 \), was used throughout (Pagano, 1994). Using this level of probability, no significant differences were evident for age (\( F = 1.15, \text{df} = 3,53, p < .334 \)) or for sex (\( F = 2.89, \text{df} = 3,53, p < .044 \)).

Prior to any other statistical analyses being performed, the raw scores for the two baseline measures of pattern and facial identity discrimination and those from the three measures involving various judgements of facial expressions of emotion were converted to accuracy scores shown as percentages of correct responses. This data transformation has been done in similar studies (Brosgole, Kurucz, Plahovinsak, Sprotte, et al. 1983) to facilitate comparisons and it also enabled the discussion of the severity-group means on measures with differing numbers of items. Using BMDP 7M, the data were initially screened for distributional form, outliers, and trends across severity groups. Aside from the identification of missing data, no other anomalies or problems in the data were evident. Table 1 provides the means and standard deviations for each of the dementia severity-groups on the measures relating to cognitive functioning, assessing pattern and facial identity discriminations, assessing identification and matching of emotions, and the measures of behavioral functioning. The task which required subjects to provide an emotion label for the facial affect displayed was analyzed with percentage of correct responses with no prompt and also as the total of percentage correct responses, those achieved with and without prompts.
<table>
<thead>
<tr>
<th>MEASURE</th>
<th>LEVEL OF DEMENTIA SEVERITY</th>
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<tbody>
<tr>
<td></td>
<td>No Dem (1)</td>
</tr>
<tr>
<td></td>
<td>n = 27</td>
</tr>
<tr>
<td>FACIAL IDENTITY DISCRIM.</td>
<td>X = 93.52</td>
</tr>
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<td></td>
<td>SD = 10.57</td>
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<tr>
<td>PATTERN DISCRIM.</td>
<td>X = 98.76</td>
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<td></td>
<td>SD = 6.42</td>
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<tr>
<td>EMOTION DISCRIM.</td>
<td>X = 85.80</td>
</tr>
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<td></td>
<td>SD = 13.26</td>
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<tr>
<td>EMOTION IDENTIFY (NO PROMPT)</td>
<td>X = 64.80</td>
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<tr>
<td></td>
<td>SD = 15.05</td>
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<tr>
<td>EMOTION IDENTIFY (TOTAL)</td>
<td>X = 90.72</td>
</tr>
<tr>
<td></td>
<td>SD = 7.43</td>
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<tr>
<td>EMOTION MATCH</td>
<td>X = 78.11</td>
</tr>
<tr>
<td></td>
<td>SD = 16.69</td>
</tr>
<tr>
<td>MMSE</td>
<td>X = 27.26</td>
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<tr>
<td></td>
<td>SD = 2.79</td>
</tr>
<tr>
<td>BOSTON NAME TEST</td>
<td>X = 53.18</td>
</tr>
<tr>
<td></td>
<td>SD = 1.75</td>
</tr>
<tr>
<td>HOOPER VIS. ORGANIZA.</td>
<td>X = 22.63</td>
</tr>
<tr>
<td></td>
<td>SD = 1.82</td>
</tr>
<tr>
<td>RMBPC</td>
<td>N/A</td>
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<td></td>
<td></td>
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<tr>
<td>DBD</td>
<td>N/A</td>
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</table>
Accuracy in perception of facial expressions of emotion:

The first two hypotheses of the study were that the accuracy of identification and matching of facial expressions of emotion would differ among the dementia severity levels. A series of ANOVAs were carried out to determine the significance of the mean differences between the severity groups on the tasks assessing identification and matching of facial expressions of emotions. In addition, the ANOVAs also examined mean differences on the measures assessing pattern, facial identity, and emotion discrimination. Table 2 presents a summary of the findings of the ANOVAs.

<table>
<thead>
<tr>
<th>TABLE 2. ANALYSES OF VARIANCE: EMOTION MEASURES</th>
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<tbody>
<tr>
<td>MEASURE</td>
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<tr>
<td></td>
</tr>
<tr>
<td>FACIAL DISCRIM.</td>
</tr>
<tr>
<td>PATTERN DISCRIM.</td>
</tr>
<tr>
<td>EMOTION DISCRIM.</td>
</tr>
<tr>
<td>EMO-ID (NO PROMPT)</td>
</tr>
<tr>
<td>EMO-ID (TOTAL)</td>
</tr>
<tr>
<td>EMO-MATCH</td>
</tr>
</tbody>
</table>

(* significant at p<.001)

In all the analyses of variance a probability level of .001 was used for significance to compensate for the increased possibility of Type 1 errors with multiple ANOVAs. In
addition, on examination of the Levene’s test for variances it was evident that the variances were heterogeneous for all but two of the emotion tasks, emotion discrimination and matching and, as such, the analysis of variance F-value needed to be based on the Brown-Forsythe procedure as the variances are not assumed equal (Brown & Forsythe, 1974). As is evident from Table 2, of the six variables examined in the analyses, five demonstrated significant effects relative to the differences in the severity of dementia. All of the tasks measuring the ability to discriminate, identify or match facial expressions of emotion demonstrated significant severity group mean differences: the ability to discriminate whether the emotional expressions were of the same or different emotions (F = 9.45, df = 3.49, p<.0005); the ability to identify and verbally label a facial expression of emotion without the assistance of a verbal prompt (F = 14.03, df = 3.51, p<.0005); the overall ability to verbally label a facial expression of emotion (with and/or without prompts) (F = 18.43, df = 3.58, p<.0005); and the ability to match facial expressions of emotion (F = 26.65, df = 3.58, p<.0005). A significant difference was also evident for the baseline measure of pattern discrimination (F = 8.89, df = 3.20, p < .0006). Of the emotion related variables included in the analyses only the baseline measure of facial identity discrimination was not significant (F = 4.59, df = 3.44, p < .007).

Although the analyses of variance did demonstrate significant differences on tasks assessing pattern and emotion discrimination and emotion recognition/matching tasks as related to dementia severity, these analyses provide no information on which severity-groups differ significantly from each other. The heterogeneity of the variances required that the Tukey-Kramer method (Hinkle, Wiersma & Jurs, 1994), which adjusts for heteroscedasticity, be used to determine how the severity-groups differed from one
another on the tasks. The results of the significant group mean differences at the .01 probability level are summarized in Table 3.

TABLE 3. MULTIPLE COMPARISONS: PERFORMANCE ON EMOTION MEASURES WITH LEVEL OF DEMENTIA SEVERITY

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>LEVEL OF DEMENTIA SEVERITY</th>
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<tbody>
<tr>
<td></td>
<td>No Dem (1)</td>
</tr>
<tr>
<td>PATTERN DISCRIM.</td>
<td></td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>EMOTION DISCRIM.</td>
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<tr>
<td>EMOTION IDENTIFICATION (NO PROMPT)</td>
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<td>1</td>
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<tr>
<td>EMOTION IDENTIFICATION (TOTAL)</td>
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<td>4 *</td>
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<tr>
<td>EMOTION MATCHING</td>
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</table>

(* Indicates significant group differences at the .01 level)

On the task measuring simple discrimination of basic geometric patterns the severe dementia group was significantly different from all other groups. The next task drew closer to the central issue of the study in that it measured the ability to discriminate whether two pictured facial expressions of emotion were the same or different. The
severely demented group differed significantly from the no-dementia and mild-dementia groups, while the moderately demented group was not distinguishable from the others.

On the more demanding emotion task that required subjects to correctly identify the facial expression of emotion pictured, interesting findings emerged between the results of the "emotion identify - no prompt" and "emotion identify - total". In the "emotion identify - no prompt" tally, the subject was scored as correct if he or she was able to independently provide the appropriate verbal description of the pictured emotion. In this tally, the no-dementia group differed significantly from all other groups, but the remaining groups did not differ from each other. In the "emotion identify - total", the subject was given a score for each facial expression of emotion identified correctly, whether or not a prompt was given. When the verbal identification of the emotion of pictured facial expressions included total percentage correct a significant shift was evident. In this comparison the no-dementia group was now significantly different from only the severe dementia group, and the severe dementia group was now significantly different from both the mild and moderate dementia groups. This separation of dementia groups was not evident in the "emotion identify - no prompt" tally.

The final, and likely most demanding emotion task required the matching of a pictured emotion to one within a group of six pictured emotions. Results showed a decrease in the accuracy of matching among dementia groups as severity level increased. The no-dementia and mild-dementia groups differed from the severe group, and the moderate dementia differed from no-dementia and severe, but not from the mild dementia group.
Cognitive and behavioral functioning in relation to perception of emotion tasks:

Also of interest in the present study was an exploration of the differences among dementia severity groups on various aspects of cognitive and behavioral functioning and how these aspects inter-relate with the emotion measures. A series of ANOVAs was conducted to determine the significance of mean differences among severity groups on three measures of cognitive functioning and two measures assessing degree of behavioral disturbance. Data on the behavioral disturbances were collected and analyzed for the participants with dementia only. Table 4 presents a summary of the findings of the ANOVAs.

**Table 4. Analysis of Variance: Cognitive and Behavioral Measures**

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>ANALYSIS OF VARIANCE</th>
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<tbody>
<tr>
<td></td>
<td>df</td>
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<tr>
<td>MMSE</td>
<td>3.56</td>
</tr>
<tr>
<td>BNT</td>
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<tr>
<td>HVOT</td>
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<tr>
<td>RMBPC</td>
<td>2.37</td>
</tr>
<tr>
<td>DBD</td>
<td>2.40</td>
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</table>

(* significant at p < .001).
As with the previous ANOVAs, in the analyses of variance a probability level of .001 was used to compensate for the increased possibility of Type I errors; in addition, as the Levene's test for variances indicated heterogeneity of variance for all but the behavioral measures, the analysis of variance F-value was based on the Brown-Forsythe procedure (Brown & Forsythe, 1974). As is evident from Table 4, all of the tasks assessing various aspects of cognitive functioning demonstrated significant effects relative to the differences in the severity of dementia present. Significant differences were evident in the measure of overall cognitive functioning, MMSE ($F = 150.11$, $df = 3.56$, $p < .0005$), the ability to name common objects, BNT ($F = 93.02$, $df = 3.33$, $p < .0005$), and on the measure assessing visuo-spatial skills, HVOT ($F = 76.77$, $df = 3.32$, $p < .0005$). No significant severity group mean differences were evident on either of the two scales that assessed the degree of behavioral disturbance present, RMBPC ($F = 0.67$, $df = 2.37$, $p < .520$) and the DBD ($F = 0.98$, $df = 2.40$, $p < .383$). Multiple comparisons using the Tukey/Kramer method (Hinkle, Wiersma & Jurs, 1994) were carried out to further understand how the severity groups differed from each other on the measures of cognitive functioning. The results of the significant group mean differences at the .01 probability level are summarized in Table 5.
The MMSE briefly assesses orientation to time and place, short-term memory, expressive and receptive language, and graphomotor skills and provides a single score of overall cognitive functioning. On this measure, the multiple comparisons of group means indicated that each dementia severity group differed significantly from every other group. On a more extensive measure of expressive language skills, the Boston Naming Test, the no-dementia and the mild-dementia groups differed from one another, and each of them differed from the moderate and severe-dementia groups. The mean comparisons indicated

\[\text{TABLE 5. MULTIPLE COMPARISONS: PERFORMANCE ON COGNITIVE MEASURES WITH LEVEL OF DEMENTIA SEVERITY}\]

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>NO DEM (1)</th>
<th>MILD DEM (2)</th>
<th>MOD DEM (3)</th>
<th>SEV DEM (4)</th>
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</thead>
<tbody>
<tr>
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<td>1*</td>
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<td></td>
<td>2*</td>
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<td>4*</td>
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<td>4</td>
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<tr>
<td>BOSTON NAMING TEST (BNT)</td>
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<td>1*</td>
<td>1*</td>
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<td>2*</td>
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<td>4*</td>
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<tr>
<td>HOOPER VIS. ORGAN. TEST (HVOT)</td>
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<td>1*</td>
<td>1*</td>
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</tbody>
</table>

(* significant difference at p < .01)
that the moderate and severe-dementia groups did not differ from each other in terms of this word-finding ability. This pattern was also evident with the Hooper, which measured visuo-spatial conceptualization and organization. The no-dementia and the mild dementia groups differed from each other, and each of them differed from the moderate and severe dementia groups, however, these latter two groups did not differ from each other on these perceptual functions.

The third hypothesis of the present study was that the observed decreased accuracy in the identification and matching of facial expression of emotion among dementia severity levels would remain evident even when the impact of differences in cognitive functioning were controlled for. To examine this hypothesis a BMDP IV ANCOVA was conducted. Table 6 reports the results of the ANCOVA where scores on the Mini-Mental State Exam (MMSE), Boston Naming Test (BNT), the Hooper Visual Organization Test (HVOT), and pattern discrimination (Pattern) were used as covariates, the emotion tasks of discrimination, identification, and matching were the dependent variables, and dementia severity remained the grouping variable.
As is evident from Table 6, after all other effects are considered, only MMSE provided a significant and unique adjustment to the other dependent variables of emotion-identify (no prompt) and emotion-identify (total). The remaining cognitive variables, although not necessarily making significant contributions as covariates could not be omitted from the analyses because it could not be assumed that they make no contribution independently and/or with MMSE. For example, for emotion-identify (no prompt) the
BNT covariate approached significance and it may be that the sample size was too small to detect the covariance with greater certainty. Given the contribution of MMSE to the variance among the groups, the t-test matrices for adjusted group means were examined in order to determine which group means remained significantly different. A Scheffe' adjustment was applied to compensate for inflated Type I error (Tabachnick & Fidell, 1989). The results of the comparisons are summarized in Table 7.

**TABLE 7. T-TEST MATRICES WITH PROBABILITIES**

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<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>No Dem.</td>
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</tr>
<tr>
<td>Mild Dem.</td>
<td>-0.873</td>
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<tr>
<td></td>
<td>(.386)</td>
<td></td>
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<tr>
<td>Mod Dem.</td>
<td>1.541</td>
<td>2.876*</td>
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<td></td>
<td>(.128)</td>
<td>(.005)</td>
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<tr>
<td>Sev Dem.</td>
<td>1.044</td>
<td>1.882</td>
<td>-.407</td>
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</tr>
<tr>
<td></td>
<td>(.300)</td>
<td>(.064)</td>
<td>(.684)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>No Dem.</td>
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<tr>
<td>Mild Dem.</td>
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<tr>
<td></td>
<td>(.448)</td>
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<td></td>
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</tr>
<tr>
<td>Mod Dem</td>
<td>1.812</td>
<td>1.914</td>
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<tr>
<td></td>
<td>(.073)</td>
<td>(.059)</td>
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<tr>
<td>Sev Dem.</td>
<td>.462</td>
<td>0.131</td>
<td>-2.150</td>
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<tr>
<td></td>
<td>(.645)</td>
<td>(.896)</td>
<td>(.035)</td>
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</tbody>
</table>

(‘*’ significant with Scheffe' adjustment, reaches critical F-value of 8.26)
The ANCOVA indicated that overall cognitive functioning as measured by the MMSE was a significant covariate for both emotion identification tasks; however, the post hoc comparisons with a Scheffe' adjustment demonstrated a more conservative result. No comparisons within the emotion-identify (total) variable reached significance and only one group comparison was significant with emotion-identify (no prompt). The results of the previous comparisons indicated that the no-dementia group differed from all other groups on this variable, however, when compensating for overall cognitive impairment, only differences between the mild and moderate-dementia groups were significant. These results also suggest that the ANOVAs which reflected differences between the severity groups on all of the measures except for emotion-identify (no prompt) were not attributable solely to differences in cognitive functioning.

Exploratory Issues:

Three exploratory issues were examined in the present study. One sought to explore the factor structure that comprises the syndrome of DAT, another the extent to which the loss of ability to recognize facial displays of emotion is a significant predictor of living situation and, finally, how behavior disturbance is related to overall cognitive functioning and dementia severity.

To examine the structure of the emotion processing aspects and their relationship to cognitive and behavioral variables, a BMDP 4V principal components factor analysis with an orthogonal rotation was performed. The following measures yielded numerical scores for each participant that were used in the factor analysis to examine that structure of emotion recognition in dementia: Clinical Dementia Rating Scale, Mini-Mental State
Exam, Boston Naming Test, Hooper Visual Organization Test, Dementia Behavior Disturbance Scale, Revised Memory and Behavior Problems Checklist, as well as the accuracy scores obtained from both baseline measures of facial and pattern discrimination, and from the three measures involving judgements of emotion. Table 8 provides a summary of the rotated factor loadings.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>FACTOR 1 (Emotion)</th>
<th>FACTOR 2 (Cognitive)</th>
<th>FACTOR 3 (Behavioral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotion Identify (total)</td>
<td>.825</td>
<td>.320</td>
<td>-.239</td>
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<tr>
<td>Emotion Match</td>
<td>.816</td>
<td>.322</td>
<td>-.047</td>
</tr>
<tr>
<td>Emotion Discrimination</td>
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<td>.100</td>
<td>-.311</td>
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<tr>
<td>Emotion Identify (np prompt)</td>
<td>.683</td>
<td>.262</td>
<td>-.054</td>
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<tr>
<td>Pattern Discrimination</td>
<td>.521</td>
<td>.414</td>
<td>.216</td>
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<tr>
<td>Facial Identity Discrimination</td>
<td>.443</td>
<td>.262</td>
<td>-.054</td>
</tr>
<tr>
<td>Boston Naming Test</td>
<td>.198</td>
<td>.878</td>
<td>-.005</td>
</tr>
<tr>
<td>Hooper Visual Organization</td>
<td>.198</td>
<td>.878</td>
<td>-.005</td>
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<tr>
<td>Clinical Dementia Scale</td>
<td>-.474</td>
<td>-.760</td>
<td>-.019</td>
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<tr>
<td>Mini-Mental State Examination</td>
<td>-.486</td>
<td>.759</td>
<td>-.080</td>
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<td>Dementia Behavior Disturbance</td>
<td>-.235</td>
<td>-.084</td>
<td>.842</td>
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<tr>
<td>Revised Memory &amp; Behavior</td>
<td>-.001</td>
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<td>.825</td>
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<tr>
<td>Problems Checklist</td>
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</table>

As is evident from Table 8, many of the variable loadings on the factors were in excess of .71 (50% of the overlapping variances) which Comrey (1973) suggests represents an excellent standard. The variables that loaded most heavily on Factor 1 represented a visual, emotion-recognition factor; the variables for Factor 2 all related to cognitive functioning; and the variables for Factor 3 related to behavioral functioning.

The Clinical Dementia Rating Scale and the Mini-mental State Exam loaded primarily
on Factor 2 "Cognitive" but loadings of -.445 and .490 respectively also occurred on Factor 1 "Emotion" which suggests that there is a fair degree of overlapping variance between these two variables. Pattern discrimination loaded almost equally on both Factor 1 and Factor 2 suggesting a strong degree of shared variance between emotion and cognition with this task.

The extent to which emotion tasks, measures of cognitive functioning, level of behavioral disturbance, and dementia severity predicts living situation was also explored. Living condition was coded as a continuous variable with the following codes applied to each of the different living arrangements in the present sample population: 1 = completely independent, 2 = home with caregiver, 3 = senior home with independent apartment/room, 4 = intermediate care facility, and 5 = full care facility. Using a BMDP 9R all subset regression analysis, only the data for persons with DAT were included in the analysis so that all the possible predictive variables could be included. Table 9 presents a summary of the all subset analysis using three, four, five, and six predictor variables and demonstrates clearly which variables consistently contribute to the outcome variable of living condition (see page 71 for Table 9). The variables that consistently emerged as the best predictors were level of dementia severity as measured by the Clinical Dementia Rating Scale, emotion identify-total, and degree of behavioral disturbance as measured by the Dementia Behavior Disturbance scale. Important, but somewhat less consistent contributions were also provided by overall level of cognitive functioning as measured by the MMSE and by the other measure of behavioral disturbance, the Revised Memory and Problems Checklist. Interestingly, two of the
TABLE 9. PREDICTOR VARIABLES OF LIVING OUTCOME

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<th>Adjusted R²</th>
<th>MMSE</th>
<th>Face-dis</th>
<th>Pattern</th>
<th>Emo-dis</th>
<th>Emo-id (np)</th>
<th>Emo-id (l)</th>
<th>Emo-mat</th>
<th>BNT</th>
<th>HVOT</th>
<th>RMBPC</th>
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perception of affect tasks, discrimination of same/different facial expressions of emotion and
matching to a target emotion, never emerged as predictors.

The final analysis explored the question of how behavior disturbance itself was related to
overall cognitive functioning and dementia severity. Using SPSS/PC+ (Norusis, 1991) a Pearson
product-moment correlation analysis was conducted using MMSE as the measure of cognitive
functioning, the CDR as the measure of dementia severity, and the two behavioral scales. Table
10 presents the correlation coefficients and probability levels.

**TABLE 10. CORRELATIONS BETWEEN BEHAVIOR, COGNITIVE FUNCTIONING AND SEVERITY**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CDR</th>
<th>MMSE</th>
<th>DBD</th>
<th>RMBPC</th>
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<tr>
<td>CDR</td>
<td>---</td>
<td>-0.7897 (p = .001)*</td>
<td>0.1776 (p = .232)</td>
<td>-0.1044 (p = .485)</td>
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<tr>
<td>MMSE</td>
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<td>-0.1058 (p = .479)</td>
<td>0.0334 (p = .824)</td>
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<tr>
<td>DBD</td>
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<td>0.4984 (p = .001)*</td>
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<tr>
<td>RMBPC</td>
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(* significant at p<.001)

As indicated from Table 10, the degree of behavioral disturbance, whether measured with
the RMBPC or the DBD, was not significantly related to level of cognitive impairment
or dementia severity. There was, not surprisingly, a significant negative correlation
between degree of cognitive functioning and dementia severity. A significant but moderate correlation was evident between the two scales that assessed the degree of behavioral disturbance.

**DISCUSSION**

The present study examined a number of hypotheses to determine whether deficits in the perception of facial expressions of emotion were characteristic of DAT and to explore the overall relationship between emotion, cognitive functioning, and behavior. With few exceptions (Albert et al., 1991; Drexler, 1988; Murphy & Boeglin, 1990) much of the previous research has provided evidence suggesting a loss of ability to recognize facial displays of emotion in persons with some type of dementia (Allen & Brosgole, 1993; Allender & Kaszniak, 1989; Brosgole et al., 1981; Kurucz et al., 1979). The results of the present study supported an explanation for the disparate findings between the previous studies and suggestions for future research.

The first two hypotheses of the present study were that the accuracy of identification and matching of facial expressions of emotion would differ among dementia severity levels. While, for the most part, these hypotheses were supported, it was also evident that the disruption in the perception of affect does not follow a simple and linear disease severity progression. Although decreases in the performance on emotion tasks were primarily related to disease severity, it was evident that task complexity and the impact of overall cognitive functioning were contributing factors.
When not accounting for the impact of differences in cognitive functioning, only one of the five emotion-related tasks, emotion-identify (no prompt), which required the independent provision of the correct name for a pictured emotion, did the no-dementia group significantly differ from all other dementia-severity groups. If this had been the only analysis of the ability to verbally identify pictured displays of emotion, support would have been demonstrated for the previous studies that had found similar performance deficits (Allender & Kaszniak, 1989; Brosgae el al., 1981; Allen & Brossole, 1993). A striking finding of the present study, however, was that the provision of a verbal prompt resulted in a dramatic shift and differences were no longer evident among the no-dementia, mild, and moderate-dementia groups. The verbal prompt consisted of the correct emotion term embedded in a list with two other emotion terms, the entire sequence of which had been randomly predetermined for each emotion pictured. Subjects, with and without DAT, who were unable to provide an emotion name or had done so incorrectly were given the following instruction: "If you had to choose between one of the following three emotions (ie., sad, angry or disgust), which one do you think best describes what this person is feeling?". The results demonstrated that, when given this verbal prompt, subjects with mild and moderate levels of DAT became more capable of correctly identifying the facial affect displayed, while the impact for the severe-dementia group was not demonstrable.

Although it is important to identify and understand the decrements in the performance abilities of persons with DAT on emotion-related tasks, on a pragmatic level, it is as important to identify under what conditions these performance deficits may be ameliorated
The present study suggests that appropriate "cueing" in emotional contexts may be helpful. The underlying dimension of what "helpful" function cueing may have provided can only be speculated upon at present. One possibility is that cueing reduced the complexity of the task demand. By giving the subject a choice of three emotions the task became somewhat similar to the pattern and facial discrimination tasks which, interestingly, also demonstrated no differences between the no-dementia, mild, and moderate groups. Cueing may have helped to orient the subject to scan the pictured emotion for the specific facial characteristics that matched their prototype for one of the emotions provided in the verbal prompt. There is support for this possible explanation from the studies (Ekman & Friesen, 1978; Ekman, Friesen, & Ellsworth, 1982; Izard, 1971; 1977) that have demonstrated that different facial displays do vary on a number of important and perceptible dimensions and by Brosgole et al. (1981) who found that persons with a dementia were capable of extracting affective meaning of pictured stimuli by using feature analysis. An important direction for future research would be to explore the underlying dimensions and usefulness of emotion cueing in contexts that are more reflective of naturally occurring social and emotional interactions.

Other interesting findings emerged with the remaining three of the five emotion tasks; pattern discrimination, the ability to discriminate between same/different facial expressions of emotion, and matching to a target emotion. These findings provide a plausible explanation for the disparate findings among the previous studies. The results of the present study underscore the need to determine and clearly delineate the level of dementia severity in the sample used. Unlike the present study that compared a cross-section of
dementia severity levels to a no-dementia control group, most other studies used only two groups for comparative analysis: a control group of normal, community-dwelling elderly and a group of persons with DAT. In some instances the level of dementia severity was not clearly stated (Allender & Kaszniak, 1989) or, if stated, included a sample collapsed across severity levels (Albert et al., 1991).

The impact of differing severity levels on the perception of emotion tasks was clearly demonstrated in the present study. The mild-dementia group did not differ from the no-dementia group on the emotion tasks of pattern or emotion discrimination, or that of matching to a target emotion. These findings are consistent with Murphy and Boeglin (1990) who also used a sample of persons with only mild DAT. A more complex performance profile emerged for the moderate-dementia group in the present study. No differences were evident between the moderate and no-dementia group for pattern discrimination. For the emotion discrimination task the moderate-dementia group did not differ from the no-dementia, mild, or severe group, and finally, on the matching task this group did differ from the no-dementia and severe but not from the mild-dementia group.

For the severe-dementia group a performance profile emerged which demonstrated that this group differed from the other groups on the tasks of pattern discrimination and emotion matching, but did not differ from the moderate group on the emotion discrimination task. Alone, these findings suggest that collapsing across levels of severity could create potential problems by obscuring some results and making others more difficult to interpret.
What this illustrates is that the present study provided support both for research that has not found deficits in the perception of affect (Drexler, 1988; Murphy & Boeglin, 1990) as well as support for research that has demonstrated deficits (Allender & Kaszniak, 1989; Brosogole et al., 1981; Brosogole, Kurucz, Plahovinsak, Sprotte, et al., 1983; Brosogole, Kurucz, Plahovinsak, Boettcher, et al., 1983). Aside from the fact that the emotion tasks used in each study were not exactly the same and therefore the disparate findings could have been a reflection of task differences, a more likely determining factor is that previous studies did not emphasize dementia severity level as an important variable. The implication of the present study is that DAT cannot be treated as a single, homogeneous variable. The varying nature of DAT as the disease progresses must be taken into account because, as was clearly evident in the present study, different levels of severity, when compared to a control group of normal elderly, will yield differentiated results.

With this in mind, it is conceivable that the disparate findings between previous studies regarding the perception of emotion in DAT are the result of studies either having used sample populations with differing severity levels or with cases collapsed across severity levels. For example, Allender and Kaszniak (1989) reported deficits in the ability to identify facial emotional cues. These authors do not explicitly state the levels of dementia severity of the subject population but from one of the reported means of 107.6 and a standard deviation of 19.3 for the Dementia Rating Scale (DRS; Mattis, 1976), it would appear that most scores fell within a range of 88.3 to 126.9. From the published norms (Mattis, 1976; Vitaliano, Breen, Russo, Albert & Prinz, 1984) this range includes
mild to almost severe. Albert et al. (1991) reported no performance deficits in the perception of affect that were not attributable to cognitive factors. From their reported DRS mean of 101 and standard deviation of 15, the range was approximately 86 - 116, again including mild to almost severe levels of impairment. While the two studies have a comparable mean and lower range, the upper range differs by 10 points, suggesting that the Albert et al. (1991) sample had more subjects in the moderate range.

The two studies used only one measure of cognitive functioning in common, the Boston Naming Test. The reported means and standard deviations were as follows: 37.8 and 16.4 (Allender & Kaszniak, 1989) and 19.1 and 6.5 (Albert et al. 1991). In the present study the means and standard deviations were 32.86, (14.6) and 13.66, (8.89) for the mild and moderate dementia groups respectively. A comparison of the means supports the speculation that the population sample used by Albert et al. (1991) likely had a greater number of subjects with moderate levels of dementia and that Allender & Kaszniak (1989) had a greater number of subjects with mild levels of dementia. It may be that for a simple two-group comparison of normal elderly to a group of persons with a moderate level of dementia, the observed deficits on emotion tasks may be more attributable to the cognitive differences that define the groups, but that this pattern of covariance may be less evident with a sample of persons with a mild dementia. This example further illustrates how the lack of clarity about severity level makes it difficult to compare different studies and possibly contributes to the disparate results evident in the literature.
The third hypothesis of the present study was that the decreased accuracy in the perception of emotion tasks would remain evident even after controlling for deficits in cognitive functioning. The hypothesis sought to address the debate in the literature about whether the deficits in the perception of affect represents a primary impairment that is characteristic of DAT (Allender & Kaszniak, 1989) or are secondary to deficits in cognitive functioning (Albert et al., 1990; Drexler, 1988). In the present study, all but one of the emotion tasks maintained significant severity groups differences even when the impact of differences in cognitive functioning were used as covariates. This suggests that cognitive functioning plays a minor role in the perception of affect.

To answer the question about the nature of observed deficits on emotion tasks it was also important to examine what is known about impairments that are characteristic of DAT. Some impairments, such as memory loss and word-finding difficulties, have been well documented and are often evident even in the early stages of the disease (Lezak, 1983). Extrapolating from what is known about these impairments, if disruptions in the perception of affect were also characteristic of DAT, it seems that three conditions should be satisfied. The rudiments of impaired emotion processing should be apparent in the early stages of the disease, these deficits should not be attributable solely to impairments in cognitive functioning, and finally, the deficits should reflect a progression with disease severity.

Applying these conditions to the results of the present study did not provide unequivocal support for either of the two possibilities to account for deficits in emotion perception. The results of the multiple comparisons indicated that the mild-dementia
group differed from the no-dementia group on only one of the emotion tasks, the ability to independently provide the correct name of a pictured emotion. This difference, however, was no longer evident when scores were adjusted for overall level of cognitive functioning. This would seem to rule out the possibility that the disruptions in emotion processing represent a primary impairment characteristic of DAT, yet, none of the cognitive measures used in the study exerted a significant enough impact to account for the variance evident between the dementia groups on the other emotion tasks. This, then, would also seem to rule out the possibility that deficits in the perception of affect were attributable solely to cognitive impairments. The factor analysis also demonstrated that the emotion tasks were relatively independent, with little of the variance shared with the cognitive or behavioral factors. As the present study used a cross-sectional approach, the final condition to be satisfied, namely that deficits should reflect a progression with disease severity, could not be addressed.

The lack of unequivocal support for either possibility to account for the deficits in emotion perception suggests that future research needs to continue the investigation of this question. Optimally, the research would use a sample population large enough to allow for representation of each of the severity levels and would use a longitudinal rather than a cross-sectional research method. Only a longitudinal approach would provide information about whether deficits in the perception of affect reflect a progressive deterioration (Yesavage & Brooks, 1991). This approach would also help clarify whether emotion perception and cognitive functioning are relatively independent or are interrelated phenomena.
Several exploratory issues were also examined in the present study. Previous research has demonstrated that it is often the level of behavioral functioning rather than the cognitive deficits that determines whether the individual with DAT will remain in the community or will require institutional care (Chenoweth & Spencer, 1986; Colerick & George, 1986; Moak & Fisher, 1990). In addition to cognitive and behavioral factors, the extent to which performance on perception of affect tasks was an important predictor of living situation was examined. The overall results were consistent with the previous research. While level of cognitive functioning was important, the degree of behavioral disturbance was consistently a more significant predictor. Also making more significant contributions to living outcome than did cognitive functioning were level of dementia severity and one of the affect tasks, emotion-identify (total). That the emotion task which measured the ability to correctly identify pictured facial expressions of emotion with/or without prompts was a consistent predictor highlights the importance of pursuing research that examines how emotion cueing may be helpful to persons with DAT in understanding and responding to their social and emotional environments. Greene et al. (1982) found that the stress of caregivers was not related to the demented individual’s level of cognitive functioning or capacity for independent self-care; rather, it was the behavioral manifestations of dementia and the accompanying disturbance of mood that caregivers were less able to tolerate. Although Greene and colleagues (1982) were addressing mood disturbance as related to depression, their work does raise the question of what impact deficits in the perception of affect have on caregivers. Many of our social exchanges rely on the recognition of emotion cues and it may be that caregivers find it
stressful when their emotion cues are not read or responded to correctly. The ongoing research that examines caregiver adjustment and coping skills needs to address not only the impact of behavioral disturbance but also deficits in the perception of affect that can alter the emotional bond between caregivers and their affected family member.

The final exploratory issue examined the relationships among behavior disturbance, overall cognitive functioning, and dementia severity. There are conflicting findings in the literature regarding the relationships among these variables. Some research has found that cognitive impairment, behavioral decline and dementia severity are strongly positively correlated (Baumgarten et al., 1990; Kurita, Blass, Nolan, Black & Thaler, 1993), while others studies have found these variables to be only moderately correlated (Skurla et al., 1988) or that behavioral disturbance is largely unrelated to cognitive ability (Teri et al., 1992). In the present study, the degree of behavioral disturbance, whether measured by the Revised Memory and Behavior Problems Checklist (RMBPC, Teri et al., 1992) or the Dementia Behavior Disturbance (DBD, Baumgarten et al., 1990) was not significantly related to level of cognitive functioning or level of dementia severity. These findings support the premise that behavioral disturbance can be a presenting problem at any stage of DAT and that disruptive behaviors are not a simple or direct product of intellectual deterioration (Swearer et al., 1988; Teri et al., 1992). Not surprisingly, there was a negative correlation between degree of cognitive functioning and dementia severity.

In terms of the two behavioral measures used in the present study, the RMBPC and the DBD, there was a significant but moderate correlation between the two scales. This suggests that while both assess the degree of behavioral disturbance present, there is only
a moderate degree of overlap with respect to the behaviors actually measured. This is consistent with the reported functions intended by the authors of the two measures discussed earlier and suggests that both provide some similar and some unique information about behavioral functioning. In the present study the only difference between the two measures was that the DBD emerged as a somewhat more consistent predictor of living arrangement than did the RMBPC. In an effort to understand why, a post-hoc correlational analysis was conducted using the emotion task of emotion-identify (total) which had emerged as a significant predictor of living outcome and the two behavioral measures. Evident was a negative correlation between the DBD and emotion-identify (total) of -.33 that just missed significance (p=.02). The correlation between the RMBPC and emotion-identify (total) was -.21, (p=.15), and was not significant. Although a weak correlation, it appears that the behaviors assessed on the DBD are somewhat related to deficits observed in emotion identification.

An examination of the DBD scale items did not reveal any specific items that would obviously be related to emotion elements, suggesting that it was the overall degree of behavioral disturbance that this scale assesses that was related to emotion perception. In other words, as the degree of behavioral disturbance increased, accuracy in the recognition of facial expressions decreased. Interestingly, the least significant correlation, -.11, (p=.507), was evident between the emotion task and the RMBPC subscale for depression problems. This subscale included items such as expressing feelings of hopelessness and sadness about the future, talking about feeling worthless or being a burden, and talking about feeling lonely. While these statements are affect-laden, they reflect depressive
ideation, and did not demonstrate a significant relationship with emotion perception. This supports the earlier observation that research on caregiver coping should address emotion perception as an important contributing factor separate from that of mood disturbance.

What emerges from the present study is that while behavioral functioning and emotion perception are relatively separate phenomena as the factor analysis demonstrated, the relationship between the two appears to be an important one for the quality of life that persons with DAT and their caregiver(s) experience. An important aspect of behavioral functioning is the ability to respond appropriately in social interactions and, among other factors, appropriate responding requires an accurate perception of the emotional context of the situation. As Kurucz and colleagues (1979) pointed out, persons with DAT may be impaired with respect to perceiving goodwill, anger, or disapproval on the faces of people around them. It may be speculated that some of the behavioral disturbances present in DAT are not the result of cognitive impairment as had been thought (Baumgarten et al., 1990; Kurita et al., 1993) but arise from confusion and frustration that persons with DAT may feel in social situations as they become progressively unable to understand and respond to the emotional context.

It may be that the relationship between behavior and emotion perception is a more significant and consistent relationship than that between behavior and cognitive functioning. This speculation warrants further exploration and has important pragmatic implications for the remediation of behavioral disturbances. In a survey of 142 nursing home facilities, researchers found that the most difficult behaviors to manage were
physical and verbal aggression, agitation, and depression (Fisher, Fink, & Loomis, 1993). This is consistent with the finding that of the dementia patients admitted to a state psychiatric hospital, 47.2% were admitted from nursing homes because of aggressive behaviors (Moak & Fisher, 1990). If these behavioral problems are linked primarily to cognitive impairment, as the level of cognitive impairment increases, there are limitations to the interventions possible. If, however, the behavioral problems are related to deficits in the perception of emotion, an intervention such as emotion cueing may be an important behavior management strategy. Future research needs to explore the relationship between behavioral disturbance and the perception of emotion, using tasks that are more ecologically valid than still pictures.

Limitations of the present study:

An important implication from the present study was that investigations of the performance deficits in the perception of emotion cannot treat DAT as a single, homogeneous variable. The very nature of DAT as a disorder of progressive decline suggests variability as the disease moves through its course from onset to the end-stages. Previous studies (Allender & Kaszniak, 1989; Albert et al., 1990) have, in this paper, been criticized for not having addressed the issue of the heterogeneity in DAT when they collapsed across severity levels. To an extent, however, the present study has also failed to fully address this issue.

This study hypothesized that the perception of emotion would reflect differences in performance abilities among the different levels of disease severity. To examine the
hypotheses, a cross-section of persons with varying levels of DAT were sampled. The findings demonstrated lower performance scores on emotion tasks were primarily related to disease severity. From an examination of the standard deviations of the severity groups on the different tasks, however, it was evident that the deficits did not follow a simple and linear model of disease progression. While appropriate statistical procedures were used to address the heterogeneity evident in the sample data, this also highlighted two related limitations of the study: the use of a cross-sectional approach and a linear progression model.

Increasingly, there is evidence emerging that suggests that not all persons with DAT show exactly the same pattern of deficits, that decline does not progresses at the same rate for all persons, and that decline does not progress evenly in all domains of functioning (Yesavage & Brooks, 1991; Lucca, Comelli, Tettamanti, Tiraboschi, & Spagnoli, 1993; Brooks, Kraemer, Tanke, & Yesavage, 1993). As a result, it is unlikely that a single pattern of decline could accurately portray the nature of the disease which likely comprises different subtypes (Brooks et al., 1993). The heterogeneity of variance in the present study suggested variations in abilities within the severity groups, but the important exploration of these variations in performance in relation to the progressive nature of the disease was not possible within a cross-sectional approach. The cross-sectional approach is not entirely without merit (Brooks et al., 1993) and is, in fact, a useful and cost-effective research method to investigate new aspects of functioning in DAT. In terms of emotion processing, however, our understanding of the nature of performance deficits and the heterogeneity of ability, between and within severity levels,
has progressed to the point where future research should address these questions within a longitudinal design.

With the emphasis on longitudinal research, alternatives to that of a linear model of decline are being presented. One example is the trilinear model by Brooks et al. (1993) which posits three periods during the course of DAT, reflecting a pattern of stability-decline-stability which can be determined for each ability measured. Using this model, it is possible to obtain an estimate of the average rate of change on an outcome measured as the disease progresses, estimates of the point at which decline begins and ends, and to investigate correlates of major clinical events (Brooks et al., 1993). There are two problems with this model that the researchers themselves point out. The period of decline in this model is assumed to approximate a linear course and, secondly, with any individual person there may be multiple periods of decline during the disease progression (Brooks et al., 1993). While this model has not as yet been used with actual clinical data and has the limitations noted above, it does reflect an important shift in emphasis within the research investigations of DAT away from a simple linear approach and towards a more complex representation of the course of DAT.

Another limitation of the present study concerns the artificiality of using still pictures to assess emotion processing. While such a procedure is simple, easy to administer, and does provide theoretical information, it is important that future research examine how persons with DAT process affective cues in contexts more representative of natural social interactions. Finally, the present study examined the relationship of behavior and emotion processing only from the standpoint of disruptive behaviors common to DAT. As became
evident, information is needed about social functioning and how persons with DAT respond to emotional cues in their environment. To develop effective management strategies it is important that we have knowledge not only of the level of behavioral disturbance but also of the adaptive behaviors that are maintained.
REFERENCES


APPENDIX A

Contact Letter, Information and Consent Forms
(Participants with DAT)

Information and Consent Forms
(Community-dwelling Elderly)
RECOGNITION OF FACIAL EXPRESSIONS OF EMOTION

Very little is known about awareness of emotions in relation to the process of Alzheimer's disease. The purpose of this study is to understand how the recognition of facial expression of emotion may change over the course of the disease.

Participation would involve completing 3 brief tasks which measures a variety of cognitive abilities and a series of 5 tasks designed to measure ability to recognize emotions depicted in photographs of human faces. The entire procedure would not take much more than 1 hour. Participation will be arranged at the most convenient location - at your home or at the Alzheimer's Clinic.

An additional focus of the study is to understand the relationship between emotion recognition and behavior. As a result, a caregiver will be asked to complete 2 brief measures of behavioral functioning. Completion of these measures should take no more than 30 minutes.

Please be assured that all information collected for the study will be kept confidential and any reports of the findings will not contain any identifying information. There is no monetary compensation for participation. You are free to refuse participation as well as free to withdraw at any time throughout the study without having to provide a reason. In no way will refusal to participate or withdrawal have an impact upon continuing care with the Alzheimer's Clinic.

I hope that this study interests you and that you will consider participating. If interested please contact the Alzheimer's Clinic at 822-7031 to leave your name and number. A follow-up call to this letter will be made to answer any questions about the study.

Thank you.

Cara Zaskow, M.A.
Holly Tuokko, Ph.D., Supervisor
STUDY TITLE: Recognition of facial expressions of emotion in persons with a dementia of the Alzheimer's type

INVESTIGATORS: Holly Tuokko, Ph.D.
Cara Zaskow, M.A.

INTRODUCTION: The purpose of this study is to understand how the recognition of facial expressions of emotion may change over the course of Alzheimer's disease.

PROCEDURE: You will be asked to complete a brief mental status examination, a measure of your ability to name objects, and a measure of your visual-organizational ability. You will also be asked to complete a series of five tasks designed to measure your ability to recognize emotions depicted in photographs of human faces. The entire procedure should not take more than one hour.

An additional focus of the study is to understand the relationship between emotion recognition and behavior. As a result, a partner/caregiver will be asked to complete two measures of behavioral functioning.

All information collected during the course of the study will be kept confidential and reports of the findings will not contain any identifying information.

There will be no monetary compensation for your participation. Should there be any questions or concerns related to the study, please contact Dr. Holly Tuokko or Cara Zaskow at the Alzheimer's Clinic at 228-7031.

You are free to refuse to participate as well as free to withdraw at any time throughout the study without providing a reason. Refusal to participate or withdrawal of participation will not have any impact upon your continuing care with the Alzheimer's Clinic.

Signature ___________________________ Date ___________________________

Witness ___________________________ Date ___________________________
INFORMED CONSENT FOR MINORS
AND CAPTIVE AND DEPENDENT POPULATIONS
BY PARENT, GUARDIAN AND/OR OTHER APPROPRIATE AUTHORITY

NOTE: The University and those conducting this project subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of subjects. This form and the information it contains are given to you to ensure your full understanding of the procedures, risks and benefits involved. Your signature on this form will signify that you have received the document described below regarding this project, that you have received an adequate opportunity to consider the information in the document, and that you voluntarily agree to allow the subject(s) for whom you are responsible to participate in the project.

As (partner/doctor/etc.) ___________________________

of (name of patient participating) ___________________________

I consent to the above-named individual engaging in the procedures specified in the document titled:

"Recognition of Facial Displays of Emotion"

to be carried out in the following place:

______________________________

at the following time: _________

in a research study conducted by Cara Zaskow of the Psychology Department, Simon Fraser University.

I certify that I understand the procedures to be used and have fully explained them to (name of the patient participant):

In particular, the participant knows the risks involved in taking part. The participant knows that he/she has the right to withdraw from the project at any time.
I understand that any complaints about the study may be brought to the attention of the chief investigator named above or to Dr. Roger Blackman, Chairman, Department of Psychology, Simon Fraser University.

I may obtain a copy of the results of this study, upon its completion, by contacting: Cara Zaskow, Department of Psychology, Simon Fraser University.

Name (please print): ________________________________________________

Address: ________________________________________________________

Signature: _______________ Witness: _______________

Date: ____________________
SFU RESEARCH ETHICS REVIEW COMMITTEE SUBJECT FEEDBACK FORM

Completion of this form is optional, and is not a requirement of participation in the project. However, if you have served as a subject in a project and would care to comment on the procedures involved, you may complete the following form and send it to the Chairman, University Research Ethics Review Committee. All information received will be treated in a strictly confidential manner.

Name of Principal Investigator: ________________________________

Title of Project: ____________________________ Department: ____________

Did you sign an Informed Consent Form before participating in the project? __________

Were you given a copy of the Consent form? _________________

Were there significant deviations from the originally stated procedures? ____________

I wish to comment on my involvement in the above project which took place: ____________________________

(Date) (Place) (Time)

Comments: ______________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

Completion of this section is optional

Your name: _______________________________________________________________________

Address: ______________________________ Telephone: ____________

This form should be sent to the Chairman, University Ethics Review Committee, c/o Vice-President, Research and Information Systems, Simon Fraser University, Burnaby, B.C.,
STUDY TITLE: Recognition of Facial Expression of Emotion in Primary Degenerative Dementia

INVESTIGATORS: K.L. McEwan, Ph.D.
               C.A. Zaskow, M.A.
               R.J. Ancill, M.D., F.R.C. (Psych.)

INTRODUCTION:

The purpose of the study is to determine whether differences exist between normal, community-dwelling individuals such as yourself and patients with memory disorders in the ability to recognize facial expressions of emotion.

PROCEDURE:

You will be asked to complete a brief mental status test in addition to a variety of tasks designed to measure your ability to recognize emotions depicted in photographs of human faces. The entire procedure should not take more than 30 minutes.

All information collected during the course of this study will be kept confidential and reports of the findings will not contain any identifying information.

There will be no monetary compensation for your participation. Should there be any questions or problems related to this study, Dr. McEwan or Cara Zaskow can be contacted at Riverview Hospital at 524-7689 or 524-7686.

You will be free to refuse to participate or withdraw from the study without having to give a reason and without jeopardy to your relationship to the community centre.

CONSENT FROM SUBJECT

I have been informed of the nature of the study. I understand that I will receive no monetary compensation for my participation, that I am free to refuse participation or to withdraw at any time without giving a reason or without jeopardy to my involvement at the community centre.

(Signature & Date)

(Investigator's Signature & Date)
APPENDIX B

Measures
Different
FACIAL EXPRESSIONS OF EMOTION

Fear

Sadness
FACIAL EXPRESSIONS OF EMOTION

Happiness

Surprise
FACIAL EXPRESSIONS OF EMOTION

Disgust

Angry
<table>
<thead>
<tr>
<th>Pict No.</th>
<th>Response</th>
<th>1 Credit Response</th>
<th>1/2 Credit Response</th>
<th>No Credit Response</th>
<th>Cr.</th>
</tr>
</thead>
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<td>1</td>
<td>Fish</td>
<td></td>
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<tr>
<td>2</td>
<td>Saw</td>
<td></td>
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<tr>
<td>3</td>
<td>Table, Bench</td>
<td></td>
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<tr>
<td>4</td>
<td>Airplane</td>
<td></td>
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<tr>
<td>5</td>
<td>Baseball, Round Ball</td>
<td>Football</td>
<td></td>
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<tr>
<td>6</td>
<td>Hammer</td>
<td></td>
<td>Hatchet</td>
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<tr>
<td>7</td>
<td>Dog, Sheep</td>
<td>Animal</td>
<td></td>
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<td>Truck</td>
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<tr>
<td>9</td>
<td>Cup</td>
<td></td>
<td>Vase, Jar</td>
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<tr>
<td>10</td>
<td>Hand</td>
<td></td>
<td>Glove</td>
<td>Fingers</td>
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</tr>
<tr>
<td>11</td>
<td>Apple, Peach, Etc.</td>
<td>Fruit</td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td>Basket</td>
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<td>Net</td>
<td></td>
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<tr>
<td>13</td>
<td>Scissors</td>
<td></td>
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<tr>
<td>14</td>
<td>Can, Hockey Stick</td>
<td>Pencil</td>
<td></td>
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<tr>
<td>15</td>
<td>Sailboat, Boat</td>
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<tr>
<td>16</td>
<td>Teakettle</td>
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<tr>
<td>17</td>
<td>Chair</td>
<td></td>
<td>Sofa</td>
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<td>18</td>
<td>Candle</td>
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<tr>
<td>19</td>
<td>Teapot, Cream Pitcher</td>
<td></td>
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<tr>
<td>20</td>
<td>Cat</td>
<td></td>
<td>Animal</td>
<td></td>
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<tr>
<td>21</td>
<td>Flower, Pansy, etc.</td>
<td>Tree, Isl.</td>
<td></td>
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<tr>
<td>22</td>
<td>Mouse, Guinea Pig, Etc.</td>
<td>Animal</td>
<td></td>
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<tr>
<td>23</td>
<td>Book</td>
<td></td>
<td></td>
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<tr>
<td>24</td>
<td>Rabbit</td>
<td></td>
<td>Animal</td>
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<td>Block</td>
<td></td>
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<tr>
<td>26</td>
<td>Lighthouse</td>
<td>Tower, Castle</td>
<td></td>
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<tr>
<td>27</td>
<td>Shoe</td>
<td></td>
<td>Iron</td>
<td></td>
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<td>Key</td>
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<tr>
<td>29</td>
<td>Ring</td>
<td></td>
<td>Lock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Broom</td>
<td></td>
<td>Mop</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MINI MENTAL STATE

Score

ORIENTATION
What is the (year) (season) (month) (dte) (day) (5 pts.)
Where are we? (country) (province) (city) (hospital) (floor) (5 pts.)

REGISTRATION
Name 3 objects: 1 second to say each. Then ask the patient to repeat all three after you have said them. 1pt. for each correct. Then repeat them until he learns them. Count trials and record _______. (3 pts.)

ATTENTION
Serial 7's. 1 point for each correct. Stop at 5 answers. Or spell "world" backwards. (# correct = letters before first mistake) (5 pts.)

RECALL
Ask for the objects above. 1 point for each correct. (3 pts.)

LANGUAGE TESTS
Name: pencil, watch (2 pts.)
Repeat: no ifs, and or buts (1 pt.)
Follow a 3 stage command: "Take the paper in your right hand, fold it in half, and put it on the floor". (3 pts.)
read and obey the following: (1 pt.)
Write a sentence spontaneously below. (1 pt.)
Copy design below (1 pt.)

Total (30 pts.)

Date: _______________ Examiner: ___
READ AND OBEY THE FOLLOWING:

CLOSE YOUR EYES

WRITE A SENTENCE BELOW:

COPY THIS DESIGN:
### BOSTON NAMING TEST

**PICTURE:**

<table>
<thead>
<tr>
<th></th>
<th>Correct Without Cue</th>
<th>Latency Secs</th>
<th>With Stimulus Cue</th>
<th>With Phonemic Cue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>bed (a piece of furniture)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>tree (something that grows outdoors)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>pencil (used for writing)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>house (a kind of building)</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>whistle (used for blowing)</td>
<td></td>
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<tr>
<td>6</td>
<td>scissors (used for cutting)</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>comb (used for fixing hair)</td>
<td></td>
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<tr>
<td>8</td>
<td>flower (grows in a garden)</td>
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<tr>
<td>9</td>
<td>saw (used by a carpenter)</td>
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<tr>
<td>10</td>
<td>toothbrush (used in the mouth)</td>
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<tr>
<td>11</td>
<td>helicopter (used for air travel)</td>
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<tr>
<td>12</td>
<td>broom (used for cleaning)</td>
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<tr>
<td>13</td>
<td>octopus (an ocean animal)</td>
<td></td>
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<tr>
<td>14</td>
<td>mushroom (something to eat)</td>
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<tr>
<td>15</td>
<td>hanger (found in a closet)</td>
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<tr>
<td>16</td>
<td>wheelchair (found in a hospital)</td>
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<tr>
<td>17</td>
<td>camel (an animal)</td>
<td></td>
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<tr>
<td>18</td>
<td>mask (part of a costume)</td>
<td></td>
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<tr>
<td>19</td>
<td>pretzel (something to eat)</td>
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<tr>
<td>20</td>
<td>bench (used for sitting)</td>
<td></td>
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<tr>
<td>21</td>
<td>racquet (used for sports)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>22</td>
<td>snail (an animal)</td>
<td></td>
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<tr>
<td>23</td>
<td>volcano (a kind of mountain)</td>
<td></td>
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<tr>
<td>24</td>
<td>seahorse (an ocean animal)</td>
<td></td>
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<tr>
<td>25</td>
<td>dart (you throw it)</td>
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<tr>
<td>26</td>
<td>canoe (used in the water)</td>
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<tr>
<td>27</td>
<td>globe (a kind of map)</td>
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<tr>
<td>28</td>
<td>wreath (an X-mas decoration)</td>
<td></td>
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<tr>
<td>29</td>
<td>beaver (an animal)</td>
<td></td>
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<tr>
<td>30</td>
<td>harmonica (musical instrument)</td>
<td></td>
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<tr>
<td>31</td>
<td>rhinoceros (an animal)</td>
<td></td>
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<tr>
<td>32</td>
<td>acorn (it comes from a tree)</td>
<td></td>
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<tr>
<td>33</td>
<td>igloo (type of house)</td>
<td></td>
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<tr>
<td>34</td>
<td>stilts (used to make you taller)</td>
<td></td>
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<tr>
<td>35.</td>
<td>dominoes (a game)</td>
<td></td>
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<tr>
<td>36.</td>
<td>cactus (something that grows)</td>
<td></td>
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<tr>
<td>37.</td>
<td>escalator (you go up on it)</td>
<td></td>
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<tr>
<td>38.</td>
<td>harp (a musical instrument)</td>
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<tr>
<td>39.</td>
<td>hammock (you lie on it)</td>
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<tr>
<td>40.</td>
<td>knocker (it's on a door)</td>
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<tr>
<td>41.</td>
<td>pelican (a bird)</td>
<td></td>
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<tr>
<td>42.</td>
<td>stethoscope (used by doctors and nurses)</td>
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<tr>
<td>43.</td>
<td>pyramid (found in Egypt)</td>
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<tr>
<td>44.</td>
<td>muzzle (used on dogs)</td>
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<tr>
<td>45.</td>
<td>unicorn (mythical animal)</td>
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<tr>
<td>46.</td>
<td>funnel (used for pouring)</td>
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<tr>
<td>47.</td>
<td>accordion (a musical instrument)</td>
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<tr>
<td>48.</td>
<td>noose (used for hanging)</td>
<td></td>
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<tr>
<td>49.</td>
<td>asparagus (something to eat)</td>
<td></td>
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<tr>
<td>50.</td>
<td>compass (for drawing)</td>
<td></td>
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<tr>
<td>51.</td>
<td>latch (part of a door)</td>
<td></td>
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<tr>
<td>52.</td>
<td>tripod (photographers or surveyors use it)</td>
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<tr>
<td>53.</td>
<td>scroll (a document)</td>
<td></td>
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<tr>
<td>54.</td>
<td>tongs (a utensil)</td>
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<tr>
<td>55.</td>
<td>sphinx (it's found in Egypt)</td>
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<tr>
<td>56.</td>
<td>yoke (used on farm animals)</td>
<td></td>
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<tr>
<td>57.</td>
<td>trellis (used in a garden)</td>
<td></td>
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<tr>
<td>58.</td>
<td>palette (artists use it)</td>
<td></td>
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<tr>
<td>59.</td>
<td>protractor (measures angles)</td>
<td></td>
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<tr>
<td>60.</td>
<td>abacus (it's used for counting)</td>
<td></td>
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</tr>
</tbody>
</table>

**SUMMARY OF SCORES**

1. Number of spontaneously given correct responses
2. Number of stimulus cues given
3. Number of correct responses following a stimulus cue
4. Number of phonemic cues
5. Number of correct responses following the phonemic cue

Total Number Correct (1 + 3)

First Item failed

Total Score: Allow credit for all items preceding first item failed and att "Total Number Correct"
<table>
<thead>
<tr>
<th>Impairment</th>
<th>None 0</th>
<th>Questionable 0.5</th>
<th>Mild 1</th>
<th>Moderate 2</th>
<th>Severe 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory</strong></td>
<td>No memory loss or slight inconstant forgetfulness</td>
<td>Consistent slight forgetfulness; partial recollection of events; &quot;benign&quot; forgetfulness</td>
<td>Moderate memory loss; more marked for recent events; defect interferes with everyday activities</td>
<td>Severe memory loss; only highly learned material retained; new material rapidly lost</td>
<td>Severe memory loss; only fragments remain</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Fully oriented</td>
<td>Fully oriented except for slight difficulty with time relationships</td>
<td>Moderate difficulty with time relationships; oriented for place at examination; may have geographic disorientation elsewhere</td>
<td>Severe difficulty with time relationships; usually disoriented in time, often to place</td>
<td>Oriented to person only</td>
</tr>
<tr>
<td><strong>Judgement &amp; Problem Solving</strong></td>
<td>Solves everyday problems well; judgement good in relation to past performance</td>
<td>Slight impairment in solving problems, similarities, differences</td>
<td>Moderate difficulty in handling problems, similarities, differences; social judgement usually maintained</td>
<td>Severe difficulty in handling problems, similarities, differences; social judgement usually impaired</td>
<td>Unable to make judgements or solve problems</td>
</tr>
<tr>
<td><strong>Community Affairs</strong></td>
<td>Independent function at usual level in job, shopping, business and financial affairs, volunteer and social groups</td>
<td>Slight impairment in these activities</td>
<td>Unable to function independently at these activities though may still be engaged in some; appears normal to casual inspection</td>
<td>No pretence of independent function outside home</td>
<td>No pretence of independent function outside home</td>
</tr>
<tr>
<td><strong>Home &amp; Hobbies</strong></td>
<td>Life at home, hobbies, intellectual interests well maintained</td>
<td>Life at home, hobbies, intellectual interests slightly impaired</td>
<td>Mild but definite impairment of function at home; more difficult chores abandoned; more complicated hobbies and interests abandoned</td>
<td>Only simple chores preserved; very restricted interests, poorly sustained</td>
<td>No significant function in home</td>
</tr>
<tr>
<td><strong>Personal Care</strong></td>
<td>Fully capable of self care</td>
<td>Needs prompting</td>
<td>Requires assistance in dressing, hygiene, keeping of personal effects</td>
<td>Requires much help with personal care; frequent incontinence</td>
<td></td>
</tr>
</tbody>
</table>
CLINICAL DEMENTIA RATING

Patient Name ___________________________ Hosp. No. ____________

Date Rated ___________________________ Ward ________________

Onset ____________________________________________
(a abrupt; insidious

Duration ______________________________________
(no. of months)

Course ________________________________________
(stable-no progression; gradual progressive deterioration; stepwise
progressive deterioration; fluctuating)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
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<td>JPS</td>
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<td>CA</td>
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<td>HH</td>
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<tr>
<td>PC</td>
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</tbody>
</table>

C.D.R. SCORE

(M = Memory; O = Orientation; JPS = Judgement and Problem Solving; C = Community Affairs; HH = Home and Hobbies; PC = Personal Care; See attached criteria for ratings).

Provisional Diagnosis ____________________________
DEMENTIA BEHAVIOR DISTURBANCE SCALE

I am going to read you a list of common problems. Please tell me if (subject) had this problem in the past week and, if so, how often it occurred.

[Scoring: 0 Never
1 Rarely
2 Sometimes
3 Frequently
4 All the time]

(Subject):

1. Shows lack of interest in daily activities.
3. Is verbally abusive, curses.
4. Empties drawers or closets.
5. Dresses inappropriately.
7. Screams for no reason.
8. Makes physical attacks (hits, bites, scratches, kicks, spits).
10. Paces up and down.
11. Moves arms or legs in a restless or agitated way.
12. Gets lost outside.
13. Is incontinent of urine (wets himself/herself).
15. Wakes up at night for no obvious reason.
16. Wanders in the house at night.
17. Sleeps excessively during the day.
18. Overeats.
19. Refuses to eat.
20. Cries or laughs inappropriately.
21. Refuses to be helped with personal care tasks, such as bathing, dressing, brushing teeth.
22. Throws food.
23. Wanders aimlessly outside or in the house during the day.
24. Hoards things for no obvious reason.
25. Destroys property or clothing, breaks things.
26. Loses, misplaces, or hides things.
27. Asks the same question over and over again.
28. Repeats the same action (e.g., wiping table) over and over again.

REFERENCE:
REVISED MEMORY AND BEHAVIOR PROBLEMS CHECKLIST

SUBJECT ID # ___________________________ DATE: ___/___/___

PATIENT'S NAME: ___________________________

NAME OF PERSON FILLING OUT FORM: ___________________________

INSTRUCTIONS

The following is a list of problems patients sometimes have. Please indicate if any of these problems have occurred during the past week. If so, how much has this bothered or upset you when it happened? Use the following scales for the frequency of the problem and your reaction to it. Please read the description of the ratings carefully.

FREQUENCY RATINGS: REACTION RATINGS:

0 = never occurred 0 = not at all
1 = not in the past week 1 = a little
2 = 1 to 2 times in the past week 2 = moderately
3 = 3 to 6 times in the past week 3 = very much
4 = daily or more often 4 = extremely
9 = don't know/not applicable 9 = don't know/not applicable

Please answer all the questions below. Please circle a number from 0-9 for both frequency and reaction.

<table>
<thead>
<tr>
<th>Question</th>
<th>Frequency</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asking the same question over and over.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>2. Trouble remembering recent events (e.g., items in the newspaper or on TV).</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>3. Trouble remembering significant past events.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>4. Losing or misplacing things.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>5. Forgetting what day it is.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>6. Starting, but not finishing, things.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>Question</td>
<td>Frequency</td>
<td>Reaction</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>7. Difficulty concentrating on a task.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>8. Destroying property.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>9. Doing things that embarrass you.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>10. Waking you or other family members up at night.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>11. Taking loudly and rapidly.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>12. Appears anxious or worried.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>13. Engaging in behavior that is potentially dangerous to self or others.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>14. Threats to hurt oneself.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>15. Threats to hurt others.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>16. Aggressive to others verbally.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>17. Appears sad or depressed.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>18. Expressing feelings of hopelessness or sadness about the future (e.g., &quot;Nothing worthwhile ever happens&quot;, &quot;I never do anything right&quot;).</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
<tr>
<td>19. Crying and tearfulness.</td>
<td>0 1 2 3 4 9</td>
<td>0 1 2 3 4 9</td>
</tr>
</tbody>
</table>
### FREQUENCY RATINGS:

- 0 = never occurred
- 1 = not in the past week
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- 3 = 3 to 6 times in the past week
- 4 = daily or more often
- 9 = don't know/not applicable

### REACTION RATINGS:

- 0 = not at all
- 1 = a little
- 2 = moderately
- 3 = very much
- 4 = extremely
- 9 = don't know/not applicable

Please answer all the questions below. Please circle a number from 0-9 for both frequency and reaction.

20. Commenting about death of self or others (e.g., "Life isn't worth living", "I'd be better off dead").
   - Frequency: 012349
   - Reaction: 012349

21. Talking about feeling lonely.
   - Frequency: 012349
   - Reaction: 012349

22. Comments about feeling worthless or being a burden to others.
   - Frequency: 012349
   - Reaction: 012349

23. Comments about feeling like a failure or about not having any worthwhile accomplishments in life.
   - Frequency: 012349
   - Reaction: 012349

24. Arguing, irritability, and/or complaining.
   - Frequency: 012349
   - Reaction: 012349

Reference: