DISCOURSE AND PRAGMATICS IN PRIMARY PROGRESSIVE APHASIA
AND ALZHEIMER’S DISEASE

by

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Abstract

Primary progressive aphasia (PPA) and Alzheimer’s disease (AD) are syndromes of progressive neurodegeneration presenting with language disturbances. The language impairments of PPA are often considered ‘isolated’, whereas in AD language deficits are one aspect of pervasive cognitive decline. Discourse and pragmatic deficits in AD have been well described. Conversely, little is known about the discourse and pragmatic abilities of individuals with non-fluent and fluent subtypes of PPA. The purpose of this investigation was to identify and describe patterns of discourse and pragmatics in PPA, AD, and normal subjects. Distinct patterns of deficits were revealed, particularly between non-fluent subjects (i.e., NF-PPA) and fluent subjects (i.e., F-PPA, AD, and controls). Results showed that PPA subjects presented with more linguistic (i.e., cohesion) disturbances, while AD subjects were more impaired in cognitive-communication (i.e., coherence) domains. These findings appear to correspond with neuropathological evidence.
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Introduction

Primary progressive aphasia (PPA) and Alzheimer’s disease (AD) are forms of progressive neurodegenerative disease presenting with language impairments. In PPA, progressive decline in language in the absence of obvious pathology (e.g., tumours, infections, etc.) or definitive time of onset are typically the first and only symptoms of an insidious disease process (Mesulam, 1982). In contrast, language impairments in AD are one symptom of more pervasive intellectual deterioration (Cummings & Benson, 1992). Memory deficit is an early and characteristic feature of AD (Molloy & Lubinski, 1991). Language dysfunction in AD has been described extensively in terms of performance on various standardized measures. In recent years, efforts have been made to extend the description of language impairment in AD beyond the level of linguistic performance. Communicative competence, which refers in part to the speaker’s ability to use language appropriately in context, has been examined in a number of recent discourse studies (Mentis, Whittaker, & Gramigna, 1995; Nicholas, Obler, Albert, & Helm-Estabrooks, 1985; Penn, Sonneberg, & Schnaier, 1988; Ripich & Terrell, 1988; Ulatowska, Allard, Reyes, Ford, & Chapman, 1992). A small but growing body of literature exists which characterizes diverse aspects of language dysfunction in AD. In contrast, language deficits in PPA have traditionally been measured and defined in terms of performance on neuropsychological tests measuring a few discrete aspects of language. These data advance our understanding of the selective nature of the disease process on highly specific aspects of language competence (e.g., object naming, fluency, etc.). The neuropsychological measures used thus far, however, have not adequately described the
impact of the pathology on functional, or everyday communication because of the
decontextualized manner in which these measures were obtained. Spontaneous language
is generated through complex, dynamic interactions between cognitive and linguistic
operations which are constantly modified in relation to social guidelines. With some
exceptions, very few researchers to date have extended their investigations of
communication deficits to patients with PPA

Relationship Between PPA and AD

Descriptions and classifications of neurodegenerative diseases have been
complicated by heterogeneity in clinical presentation and pathological evidence
(Kirshner, 1994; Schwartz, DeBleser, Poeck, and Weis, 1998; Tyrell, Warrington,
Frackowiak, & Rossor, 1990). Consequently, the precise nature and relations among
syndromes of cortical degeneration continue to be investigated. The relationship between
PPA and AD has been a matter of debate since the first subject to present with an isolated
deficit in language was described by Mesulam (1982). Both PPA and AD are forms of
cortical degeneration with undetermined etiology. PPA is often perceived as being
‘related’ to dementia in that it is a degenerative condition of presumed organic origin. It
does not, however, meet current diagnostic guidelines for dementia specified in the
Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric
Association, 1994) in that a progressive worsening of memory is not among the
prominent symptoms of the disease. A decline in memory may occur later in the course
of the disease but, by definition, is not present within two years of language symptom
onset (Mesulam, 1982). In contrast, AD is the most common type of dementia, with
memory impairment typically occurring as the primary early symptom.

Mesulam maintained that PPA is a distinct and selective impairment of language with a unique etiology (1982; 1987). Cases of purely selective language deterioration without progressive cognitive decline, however, have proven to be rare. As a result, several researchers have proposed that PPA is not a distinct clinical entity but represents either an earlier stage or atypical presentation of AD (Green, Morris, Sandson, McKeel, & Miller, 1990; Poeck & Luzzatti, 1988). Other investigators have proposed a common, non-Alzheimer etiology, with variable clinical manifestations based on site of lesion (Barber, Snowden, & Crawford, 1995; Cassel & Jack, 1992; Graff-Redford, Dames, Hyman, Hart, Tranel., Dames, Van Hoesen, & Rezai, 1990; Kempler, Metter, Riege, Jackson, Benson, & Hanson, 1990; Kertesz, Hudson, Mackenzie, & Munoz, 1994; Schwartz et al., 1998; Snowden, Neary, & Mann, 1996; Turner, Kenyon, Trojanowski, Gonatas, & Grossman, 1996; Tyrell, et al., 1990) There is abundant clinical, neuroimaging, and pathological evidence to support the latter hypothesis. Atypical presentations of PPA and AD, however, have been documented, which complicate their classification (Greene, Patterson, Xuereb, & Hodges, 1998).

Kertesz (1997) emphasized the pathological relatedness between syndromes of frontotemporal atrophy (of which PPA is an example) and Pick’s disease. The term "Pick Complex" was proposed to refer to PPA, frontal lobe dementia (FLD), and other manifestations of frontal lobe degeneration. Evidence of overlap in clinical and pathological presentations between FLD, PPA, motor neuron disease, and corticobasal degeneration provide additional support for a shared pathological mechanism (Kertesz &
Munoz, 1997; Neary, Snowden, & Mann, 1993). Etiologic issues aside, PPA and AD are viewed generally as distinct clinical entities presenting with language impairment.

**Primary Progressive Aphasia (PPA)**

PPA describes slowly progressive impairments of language in the presence of relatively preserved non-verbal cognitive, social, and right hemisphere functions (e.g., attention, spatial orientation, object recognition). PPA is associated with focal neural degeneration (Duffy & Peterson, 1988; Kirshner, 1994; Mesulam, 1987). Criteria for the diagnosis of PPA include (a) progressive and selective language decline over at least a 2 year period, (b) normal or near normal performance on tests of non-verbal cognitive functions, and (c) preserved ability to live and function independently (Weintraub, Rubin, & Mesulam, 1990). Symptoms typically appear before the age of 65, however, cases of senile onset have been documented (Sapin, Anderson, & Pulaski, 1989). PPA can occur in conjunction with syndromes of frontal and temporal lobe degeneration, including Pick's disease, frontal lobe dementia (FLD), Creutzfeldt-Jacob disease (CJD), and corticobasal degeneration, as well as with unspecified dementing processes (Kertesz, 1997; Turner et al., 1996). Neuroimaging evidence is variable, however, several studies have identified localized atrophy and reduced metabolism in focal regions of the frontal and temporal lobes (Cassel & Jack, 1992; Kempler et al., 1990; Turner et al., 1996). Cases in which language deficits are the prominent or isolated features have frequently been associated with an asymmetrical pattern of degeneration localized to the left hemisphere (Cassel & Jack, 1992; Kempler et al., 1990; Snowden et al., 1996; Turner et al., 1996). More advanced cases in which visuoperceptual problems or personality
deficits have been observed, in addition to language symptoms, showed signs of symmetrical (i.e., bilateral) atrophy (Kirshner, 1994). These findings suggest that PPA may originate in the language-dominant left hemisphere and progress over time to the frontal lobes of the right hemisphere.

Language impairment in PPA typically begins with mild-to-moderate word-finding difficulties and progresses towards mutism in the terminal stages of the disease. The anoma, along with agrammatism and reduced fluency, are the most characteristics deficits observed in PPA (Karbe, Kertesz, & Polk, 1993). Beyond this, the picture of language disturbance in PPA is characterized by extensive heterogeneity.

Interest in PPA began with Mesulam’s (1982) seminal description of five patients with a selective, non-fluent impairment of language in the absence of deteriorating non-verbal cognitive functions or changes in personality or social skills. Since that time, subjects with fluent, non-fluent, and mixed profiles have been described. A first type of PPA is characterized by impairments similar to those observed in patients with non-fluent aphasia, such as Broca’s. Reduced length and complexity of phrases, telegraphic and agrammatic language, and phonemic paraphasic errors in the context of relatively preserved comprehension are significant features (Beland & Ska, 1997; Thompson, Ballard, Tait, Weintraub, & Mesulam, 1997). A second type of PPA is characterized predominantly by fluent language with anomic deficits, circumlocutions, and variable comprehension deficits (Duffy & Peterson, 1992; Karbe et al., 1993; Kirshner, 1995; Turner et al., 1996). The existence of non-fluent and fluent subtypes of PPA is supported by neuroimaging data. Abe, Ukita, and Yanagihara (1997) found that PPA subjects with
non-fluent language symptoms presented with a distinct pathological profile versus subjects presenting with fluent symptoms. Using MRI and SPECT, these investigators found that non-fluent PPA subjects exhibit atrophy of the left frontal and perisylvian regions primarily, including the inferior motor cortex. In contrast, atrophy of the superior, middle, and inferior gyri of the left temporal lobe as well as the hippocampus and parahippocampal gyrus was found in subjects with fluent language symptoms. These results provide additional support for the association of non-fluent aphasias with more anterior, frontal lobe lesions involving the primary motor cortex, and fluent aphasias with more posterior, temporal lobe lesions.

**Alzheimer's Disease (AD)**

AD is a clinical neurobehavioural syndrome characterized by slowly progressive deterioration in aspects of intellectual functioning, personality, and other cortical functions (Osimani & Freeman, 1991). It is the most commonly diagnosed form of irreversible dementia, with prevalence rates estimated between 45% and 65% of all types of dementia (Cummings & Benson, 1992; Ripich, 1991). In contrast to PPA, AD is associated with diffuse, bilateral degeneration. Deficits have occasionally been described as 'global', and the result of a 'diffuse' neurodegeneration. This terminology is somewhat misleading in that it implies a randomness in the underlying pathological process and the resulting clinical symptomatology. Cummings and Benson (1992) maintain that few, if any, of the dementias are truly global in nature. Typically, not all intellectual processes are affected in AD, and AD may be distinguished from other neurogenic disorders on the
basis of specific patterns of preserved skills and deficits.

Severe, irreversible deficits in memory, in conjunction with deterioration of language, reasoning, visuospatial, and other cognitive functions are the primary clinical manifestations of AD (Molloy & Lubinski, 1991). These deficits are the result of diffuse, bilateral neuronal degeneration in specific regions of the frontal, temporal, and parietal cortices (Osimani & Freedman, 1991). The presence of a severe and progressive decline in memory is considered the hallmark of AD. Currently accepted criteria for a diagnosis of AD (McKinnon, Drachman, Folstein, Katzman, Price, Stadlan, 1984) include: (a) the presence of deficits in two or more areas of cognitive function, (b) progressive worsening of memory and other cognitive functions, (c) no loss of consciousness, (d) absence of other systemic disorders or brain diseases which may account for the memory and cognitive deficits, and (e) onset between the ages of 40 and 90, most often after age 65. Similarly, the DSM-IV (American Psychiatric Association, 1994) criteria for a diagnosis of probable AD stipulates the presence of memory impairment plus deficits in at least one cognitive domain. In contrast with PPA, intellectual deficits in AD are typically severe enough to interfere with activities of daily living.

There is ample evidence to suggest that AD and PPA are distinct pathological entities. PPA is associated with focal, asymmetrical cortical atrophy in highly circumscribed areas of the left frontotemporal cortex (Abe et al., 1997; Graf-Radford et al., 1990; Kempler et al., 1990; Poeck & Luzzatti, 1988; Schwartz et al., 1998; Turner et al., 1996). AD is associated with diffuse cortical atrophy (Cummings & Benson, 1992). The term "diffuse" may be misleading in that it suggests a randomness in underlying
pathological process and clinical manifestations. The changes which do occur in AD are widespread, but they occur in a systematic and predictable manner, affecting specific regions of cortex while leaving other areas intact. Affected regions include the associative areas of the frontal, temporal, and parietal lobes, hippocampus, and amygdala (Cummings & Benson, 1992; Osimani & Freeman, 1991). The primary motor cortex, primary somatosensory cortex, and occipital lobes are relatively spared (Cummings & Benson, 1992). Widespread involvement of the hippocampus is not observed in PPA as it is in AD, which may account for the relative preservation of memory in the presence of selective language deficits in PPA (Kertesz et al., 1994; Schwartz et al., 1998). There are no truly unique pathological symptoms which distinguish AD from other dementing conditions. Neurofibrillary tangles (NFT), neuritic plaques, and granuovacuolar degeneration aid in the differential diagnosis of AD, however, these specific changes are also found in other neurodegenerative conditions (e.g., Postencephalitic Parkinson’s disease; Guamanian ALS-Parkinsonism-dementia complex). These features, particularly neuritic plaques, also are found, albeit with less frequency, in the brains of non-demented, aging individuals (Cummings & Benson, 1992). PPA subjects often present with a different and heterogeneous pathological profile. Neuropathological features associated with Pick’s disease (PD), Creutzfeldt-Jacob disease (CJD), and non-specific spongiform changes have been found to occur in patients with PPA (Graff-Radford et al., 1990; Green et al., 1990; Kertesz et al., 1994; Schwartz et al., 1998). A confirmed diagnosis of AD requires: (a) the presence of the aforementioned pathological features in sufficient quantities, (b) the presence of these features in the associative regions of the frontal,
temporal, and partietal lobes, and the limbic system, and (c) the presence clinical
diagnostic characteristics (Cummings & Benson, 1992).

Language impairment is generally a universal symptom of AD, found in as many
as 100% of patients with AD (Appell, Kertesz, & Fisman, 1982; Cummings, Benson,
Hill, & Read, 1985; Murdoch, Chenery, Wilks, & Boyle, 1987). Several investigators
observed that the high prevalence of language dysfunction warrants its inclusion as an
essential diagnostic criterion (Cummings, Benson, Hill, & Read, 1985; Murdoch, et
al., 1987), however, no such stipulation is required currently. Language impairments in
AD parallel deficits in other aspects of mental activity in that they are selective and
dynamic. AD subjects typically present with fluent language, characterized by prominent
deficits in semantics (word-knowledge) and pragmatics (language use) with relatively
well preserved syntactic and phonologic abilities. Language production and
comprehension are both compromised. Language skills deteriorate with disease
progression, with progressive worsening of established symptoms, and an increase in the
number of deficits observed. The early, middle, and late stages of AD are associated with
specific profiles of language impairment which are observed fairly consistently across AD
subjects (Kempler, 1991). Subjects in the early phase of the disease may demonstrate
impairments consistent with anomic or transcortical sensory aphasias, while subjects in
the middle and later stages exhibit characteristics consistent with Wernicke’s aphasia
(Appell, Kertesz, & Fisman, 1982; Murdoch et al., 1987). In contrast to PPA,
agrammatic, non-fluent aphasias are extremely rare in AD and are considered atypical
presentations (see Green, Patterson, Xuero, & Hodges, 1996).
The spoken language of AD subjects has been described as fluent, yet semantically empty (Nicholas et al., 1985). Retained fluency and even verbosity have been documented in subjects in the earlier stages of the disease. Kertesz, Appell, and Fisman (1982) found preserved fluency in their early stage AD subjects, but a reduction in the amount of information conveyed. Similar results have been documented in a number of other studies. Preserved fluency is a characteristic feature of patients presenting with lesions of posterior regions of the temporal lobes and diffuse neurogenic disease, such as in AD (Glosser & Deser, 1990). Syntactic abilities tend to be relatively well retained, even into the late stages of the disease (Appell et al., 1982; Glosser & Deser, 1990; Hier, Hagenlocker, & Shindler, 1985). Word-finding deficits are typically the earliest to emerge and reflect a breakdown in the processes which rely on semantic memory (Bayles, Boone, Tomoeda, Slauson, & Kaszniak, 1989; Bayles & Kaszniak, 1987; Martin, Brouwers, Cox, & Fedio, 1985). AD patients consistently demonstrate difficulties on structured naming tasks (e.g., generative naming, confrontation naming) and in spontaneous language (Appell et al., 1982; Bayles et al., 1989; Glosser & Deser, 1990; Martin et al., 1985; Murdoch et al., 1987). The precise cause of anomic difficulties has not been determined, however, a number of theories have been suggested.

Visuoperceptual deficits, depletion of the mental lexicon, and retrieval, or accessing deficits, or combinations of the latter, have been posited as explanations for naming difficulties in AD (Bayles, 1982; Martin & Fedio, 1983; Melvold, Au, Obler, & Albert, 1994). Excessive use of indefinite, non-specific terms (e.g., thing, stuff, somewhere), circumlocutions, and paraphasias reflect word-finding deficits, and contribute to the
perception of "emptiness" in the spoken output of AD patients (Hier et al., 1985; Nicholas et al., 1985; Ripich & Terrell, 1988). One of the features many researchers believe distinguish AD from other conditions of linguistic impairment is the presence of semantic paraphasic errors and the virtual absence of phonemic paraphasias, which characterize the spoken output of PPA and especially non-fluent PPA subjects (Mesulam & Weintraub, 1992). AD subjects have been observed to substitute the intended word for the category to which the word belongs (e.g., "fruit" for "banana") or a semantically-related word (e.g., "apple" for "banana") (Bayles & Kaszniak, 1987; Melvold et al., 1994; Murdoch et al., 1987; Nicholas et al., 1985).

Reduced language comprehension can be an early feature in AD (Bayles et al., 1989; Kempler, 1991; Martin et al., 1985; Murdoch et al., 1987). AD subjects may initially have difficulty interpreting abstract, complex information and executing multi-step commands (Appell et al., 1982; Murdoch et al., 1987). Comprehension continues to decline, resulting in deficits at the single word level, and eventually result in a complete lack of comprehension for all verbal language (Melvold et al., 1994). Syntactic and phonologic abilities may remain relatively intact into the late stages of the disease progress (Appell et al., 1994; Kempler et al., 1987; Murdoch et al., 1987). The virtual absence of phonemic paraphasias and violations of phonotactic restraints reported consistently in the literature on language in AD provide evidence of preserved phonologic abilities.
Discourse and Pragmatics in PPA, AD, and Normal Older Adults

The nature of linguistic deficits in PPA and AD populations have been well described in terms of performance on standardized tests of language competence. These studies have revealed patterns of preserved skill and deficit which provide a necessary framework within which to understand the impact of the pathologic processes on linguistic operations. They have not, however, been able to capture the nature of communicative deficits in PPA and AD populations because of the highly decontextualized manner in which language impairments have been described.

Communicative competence includes, but is not confined to, knowledge of language form and content (Ulatowska & Chapman, 1991). It also includes pragmatic knowledge, which Paradis (1998) maintains consists of two main components. The first is knowledge of how to communicate in a socially appropriate manner. The degree to which a subject's verbal and nonverbal (as well as linguistic and extralinguistic) communication conforms with the expectations of the social context is evaluated as part of a speaker's pragmatic competence (Paradis, 1998; Penn, 1985). The second component is the ability to derive meaning from non-literal, contextual information. This involves using information from the context of the interaction (e.g., nonverbal cues, such as facial expression, body posture, and paralinguistic cues, such as intonation patterns) to identify a speaker's intended message, which may not be evident at the linguistic, or literal level of interpretation. The ability to identify non-literal meanings or intentions (often called the illocutionary force of an utterance) is essential for understanding jokes, sarcasm, and metaphoric language; all of which are essential to socially appropriate communication
Such abilities are frequently disturbed in neurogenically impaired populations.

Over the years a number of discourse studies in neurogenic populations have emerged which extended the investigation of language dysfunction to the study of language in various contexts. These studies have contributed significantly to our understanding of the complex interactions between cognition and language in neurogenic populations. There is growing evidence which supports the claim that discourse is an important tool in the differential diagnosis of neurologically impaired populations. Penn (1988a) evaluated the discourse of aphasic and demented populations and found discourse to be a "particularly sensitive indicator of social and cognitive competence" (p.66). This is because discourse analysis involves examining how information is organized and communicated across utterances (Duchan, 1994). Discourse analysis can yield information about the contributions of linguistic knowledge, social knowledge, and aspects of cognition in the production of connected language.

Chapman, Highley, and Thompson (1998) view discourse as the product of interactions between linguistic, pragmatic, and cognitive operations. These operations are highly interdependent and difficult to isolate. The authors, however, maintain that careful analysis of discourse in neurogenic populations along these parameters can identify areas of association and dissociation between subjects with different etiologies, despite similarities in presenting symptoms (e.g., AD and fluent aphasia of vasular onset).
Discourse in PPA

Descriptions of the cognitive and linguistic performances in subjects with PPA have been obtained mainly through formal tests of neuropsychological and language functions. Only a few studies have carried the investigation of language deficits beyond interpretation of traditional language and neuropsychological assessment scores.

Thompson et al. (1997) analyzed longitudinal narrative data and conversational data to compare aspects of grammatical and lexical performance in PPA subjects with those of Broca's aphasia subjects and non-impaired controls. Their analyses revealed two patterns of language decline in their PPA subjects. The first pattern, similar to that observed in Broca's aphasia, was characterized predominantly by reduced grammatical complexity. Subjects demonstrated impaired use of closed-class items (e.g., prepositions, conjunctions, pronouns, etc.) and reduced range of different types of verb morphology. The second pattern revealed relatively preserved grammatical competence (with the exception of reduced mean length of utterance and reduced phrase complexity, which were common in all PPA subjects), but progressive word-retrieval deficits. These findings suggest that the heterogeneity of characteristics observed in aphasias with vascular onset is reflected in populations of subjects with progressive aphasia.

Tyler, Moss, Patterson, and Hodges (1997) studied the deterioration of syntactic and semantic processing in the language comprehension skills of a subject with PPA. The subject's performances on word-monitoring and semantic priming tasks were observed over a four year period. Tyler et al. (1997) hypothesized that the subject's declining ability to comprehend semantic and syntactic information resulted from a
disturbance in combining semantic information and not from a loss of individual word meanings. The selective quality of language impairment which characterizes PPA was demonstrated by the fact that word meanings and the subject's access to them appeared to be intact while the processes required to link units of information together for decoding were impaired. Beland and Ska (1997) investigated the use of gestures to compensate for declining verbal proficiency in the procedural discourse of a single PPA subject. They found that although the subject increased the number of gestures that she used at the same time that her verbal skills declined, she was not as creative in her use of gestures as had been expected.

Orange, Kertesz, and Peacock (1998) were the first to document the discourse and pragmatic performances of PPA subjects in a systematic manner. Samples of spontaneous language from five non-fluent PPA, six fluent PPA, and three FLD subjects were elicited in a topic-directed interview. The samples were analyzed for a number of linguistic and discourse measures, including aspects of topic management. Mean scores across all measures were obtained for each group. Pragmatic performance was evaluated across six domains using the Profile of Communicative Appropriateness (PCA) (Penn, 1985). A total of forty-five behaviours were rated on a five-point scale of social appropriateness for each subject. A sixth point, "Could Not Evaluate", was scored when a specified behaviour was not elicited in the interview task or when it was clear that subjects were incapable of executing the behaviour. The number of behaviours for each domain of the rating scale were tallied. Two subtotals were obtained in each domain: (a) the total percentage score for the inappropriate and mostly inappropriate categories,
(b) the total percentage score for the somewhat appropriate, mostly appropriate, and appropriate categories. The percentages of "Could Not Evaluate" scores were reported separately. Areas of discrepant performance between groups were identified by substantial heterogeneity in the mean percentage scores.

Orange et al. (1998) found that non-fluent PPA subjects demonstrate poor performance in areas of topic maintenance and development, use of reference devices, and responding to their communication partner's requests for information. Fluent PPA subjects, in contrast, were rated as more appropriate in their responses to partners and display an awareness of their communication difficulties, which was not observed in the non-fluent PPA subjects. The influence of word-finding difficulties was reflected in measures of discourse performance for both PPA groups (e.g., % metastatements, % incomplete utterances, % overt statements concerning difficulty with task).

This preliminary investigation of spontaneous language in PPA by Orange et al. (1998) revealed areas of variable performance in discourse and pragmatic performances between non-fluent PPA and fluent PPA subjects. Their findings provide the background necessary for further in-depth descriptions and comparisons of language impairment in PPA with the discourse performance of individuals with AD.

**Discourse in AD**

The spoken output of AD subjects has been described in the literature as fluent and grammatically correct, but semantically deficient (Appell et al., 1982; Nicholas et al., 1985). Terms such as "confusing", "incoherent", and "empty" are frequently employed to characterize the discourse features of AD speakers (Appell et al., 1982; Nicholas et al.,
1985; Ripich & Terrell, 1988). Systematic investigations of the discourse performance of subjects with AD reveal disturbances in a variety of communication domains at each stage of the disease progression. Impairments may be relatively subtle in the earliest stages, with subjects appearing to be pragmatically intact. However, they tend to become more frequent and pronounced with disease progression (Kempler, 1991). The selective nature of deficits in other aspects of cognition also is paralleled in the discourse performance of AD subjects. Discourse deficits are assumed to result from disturbances in a variety of cognitive systems which influence linguistic operations (Ulatowska & Chapman, 1991). Richardson and Marquardt (1985) observed that "(AD) subjects' success on a given communication task depends on the degree of the match between the individual's capability and the task's demands for logical inference, linguistic precision, sustained attention, background information, memory, perspective taking, and visual-motor coordination" (p. 91).

Verbosity and informativeness. Disturbances in the quantity and quality of information are consistent findings in the literature on discourse in AD subjects. Verbosity tends to be a feature of early and middle stage AD, while reduced spoken output, or taciturnity, is a common feature of an advanced stage of AD. Tomoeda and Bayles (1993) found that subjects in the early stage of AD produce more words in a picture description task than normal control subjects. However, a marked reduction in spoken output occurs with increased severity of the disease. Verbosity in earlier stages and taciturnity in later stages have been documented in other discourse studies of AD subjects (Hier et al., 1985; Ripich, Vertes, Whitehouse, Fulton, & Ekelman, 1991).
Reduced information content is another consistent finding in the discourse of individuals with AD. AD subjects produce fewer essential units of information on a variety of discourse tasks, such as picture description (Gentry & Swindell, 1989; Hier, Hagenlocker, & Schindler, 1985; Nicholas & Brookshire, 1993; Tomoeda & Bayles, 1993).

Other features which contribute to reduced informativeness in AD subjects' discourse include frequent perseveration, semantic paraphasic errors (Nicholas et al., 1985) stereotyped phrases, and an increase in the number of unintelligible utterances with advancing disease (Ripich et al., 1991). Perseveration, or the "inappropriate, involuntary repetition of a verbal response" (Bayles et al., 1985, p. 102) is a widely identified characteristic of language production in AD. Perseveration has been associated with reduced informativeness (Bayles et al., 1985; Hier et al., 1985; Richardson & Marquardt, 1985). It also has been suggested that perseveration may result from an inability to change mental sets, possibly as a function of deficits in memory, attention, and/or semantic access problems (Bayles et al., 1985; DeSanti, Koenig, & Goldberger, 1994). DeSanti, et al. (1994) found perseveration was associated with increased word-finding deficits, and suggested that it may be used by AD subjects as a strategy for dealing with anomic difficulties.

Coherence and cohesion. Coherence and cohesion are distinct yet interrelated concepts that are essential to the production of meaningful, well-formed discourse (Glosser & Deser, 1990; Ripich & Terrell, 1988). Coherence is related to the conceptual organization of propositions within discourse (Ripich & Terrell, 1988). It is the cognitive
framework which supports the information speakers wish to convey in discourse. Coherence is related to the concept of predictability (Ripich & Terrell, 1988). When listeners are able to predict what type of information a speaker is about to provide next, discourse can be said to be coherent. Logically organized information is conveyed to listeners by means of linguistic structures which express the relationships between concepts (Duchan, 1994). The expression of meaning relationships through the use of linguistic devices, is referred to as cohesion (Ripich & Terrell, 1988). AD subjects demonstrate disturbances in both coherence and cohesion (Nicholas et al., 1985; Ripich & Terrell, 1988; Ulatowska & Chapman, 1991).

Control and maintenance of topic are aspects of coherence that are problematic for AD speakers. Mentis et al. (1995) analyzed several parameters of topic management in conversational interactions with 12 subjects with senile dementia and 12 normal elderly controls. Despite variability in the AD subjects' performance, clear deficits in topic introduction and maintenance were observed. The AD subjects demonstrated abrupt topic changes, fewer utterances with new information, and tangential and incoherent topic shifts. AD subjects also produced more utterances related to factors external to the topic of conversation ("condition-related" utterances), suggesting distractibility (i.e., attention deficits). A small percentage of their subjects produced confabulatory and contradictory statements. Several theories have been proposed to account for the difficulties observed in AD subjects' management of topic. Disturbances may arise from a central deficit of pragmatic knowledge, which impairs the speaker's ability to access the rules governing the exchange of information in conversation (Heller, Dobbs, & Rule, 1992). Memory
deficits could impair the AD speakers' ability to retain and manipulate information across conversational turns (Mentis et al., 1995). Confabulation or the provision of incorrect information is hypothesized to arise from deficits in reasoning, judgement and/or from psychiatric disturbances such as delusional states (Mentis et al., 1995). Mentis et al. (1995) noted that AD subjects exhibit appropriate topic shifting and maintenance behaviours but not as frequently as normal elderly control subjects. Garcia and Joanette (1997) also found that AD subjects were capable of making appropriate topic shifts, suggesting that some level of sophistication in manipulating information is retained.

Other factors contributing to the incoherence of discourse in AD subjects are a high prevalence of sentence fragments and frequent omissions of essential information within complete phrases (i.e., cohesion problems). Several studies have documented an increase in the number of incomplete phrases. These may contribute to a reduction in discourse coherence as speakers abandon one idea and continue with another idea that is remotely related or unrelated to the previous proposition (Hier et al., 1985; Richardson & Marquardt, 1985; Ripich & Terrell, 1988). A high prevalence of incomplete phrases may also be indicative of disturbances in grammatical structure, prompting suggestions that the syntactic systems of AD subjects may not be as intact as commonly believed (Hier, et al., 1985). Ripich and Terrell (1988) found that AD subjects frequently omit units of information, such as key words, which are essential to the correct interpretation of the speaker's utterance. According to Ripich and Terrell, these missing elements are the single largest factor contributing to reduced coherence in AD speakers' discourse.
AD subjects exhibit cohesion difficulties across a variety of discourse tasks. A number of studies have found that lexical reference is the most frequently used form of lexical-semantic cohesion in AD subjects discourse (Gentry & Swindell, 1989; Ripich & Terrell, 1988; DeSanti et al., 1994). Referencing disturbances, or the problematic use of pronouns, pro-forms, and lexical substitution to establish meaning relationships across utterances, are frequently disrupted in AD as well as other neurogenic populations. Absence of a clearly defined referent (i.e., exophoric reference) is a major factor in the reduced cohesion of AD subjects' discourse (Gentry & Swindell, 1989; Hier et al., 1985; Nicholas et al., 1985; Ripich & Terrell, 1988; Ulatowska & Chapman, 1991). However, referencing problems do not always distinguish AD subjects from normal elderly controls. Ripich and Terrell (1988) found that although their AD subjects produced pronouns without antecedents four times as often as normal elderly controls, this difference was not statistically significant.

Disturbances in lexical cohesion (e.g., missing elements, paraphasias) are also evident in the discourse of individuals with AD in conjunction with reduced information content. Several studies report that AD subjects substitute non-specific or generic terms for substantive terms (Glosser & Deser, 1990; Nicholas et al., 1985). This tendency also may be reflected in AD subjects’ increased use of personal and demonstrative pronouns relative to the overall number of words produced. However, further investigation into this claim is warranted. Nicholas et al. (1985) found that excessive reliance on pronominal forms was one of the sentence-level disturbances which contributed to the "empty" quality of AD subjects’ discourse.
Comprehension, awareness, and self-monitoring. Disturbances in language comprehension and self-monitoring also are apparent to some extent in the spoken discourse of AD subjects. These disturbances may result from disturbances in memory, attention or other aspects of cognitive dysfunction. Evidence of decreased comprehension is found in an increased number of requests by the AD subject for clarification of a speaker’s propositions, and more off-topic, or inaccurate responses to questions (Mentis et al., 1995; Richardson & Marquardt, 1985).

McNamara, Obler, Au, Durso, and Albert (1992) examined speech monitoring skills in AD, Parkinson’s disease (PD), and control subjects. They found that of the three groups, AD subjects produced the greatest number of uncorrected errors. AD patients were found to resemble patients Wernicke’s aphasia in that they demonstrated “fluent, error-ridden output, poor comprehension, and few repairs” (p. 49). These deficits were attributed to frontal lobe system dysfunction, which has been implicated in the regulation of self-monitoring skills.

Awareness of spoken deficits also has been examined in AD subjects. Evidence of some degree of preserved functioning has been documented. Ripich et al. (1991) stated that an increased number of requests for clarification observed in conversational interactions with early and middle stage AD subjects signaled a concerted effort on their part to compensate for their reduced comprehension. A high prevalence of statements which express uncertainty (e.g. “I think so”, “I suppose”, “It appears to be...”) also was taken as evidence of insight into deficits (Richardson & Marquardt, 1985).
Discourse in Normal Older Adults

One of the most consistent findings in the discourse of older normal adults is a progressive reduction in naming abilities, possibly resulting from disturbed accessing, or retrieval of semantic information (Albert, 1994). Anomia is most pronounced after the age of 70, however, it may begin in the fourth decade of life (Albert, 1994). Naming difficulties may be more pronounced on structured tasks, where the stimuli are provided by the examiner as they force the speaker to provide a specific label. Anomia may be less obvious in conversational discourse where speakers compensate for difficulties using circumlocution (Bayles & Kasziak, 1987). Retention, and even a possible increase in vocabulary items in the mental lexicon has been noted (Bayles & Kasziak, 1987).

Similar to patients in the early and middle stages of AD, Ulatowska and Chapman (1991) found that older adults demonstrate an increase in the amount of spoken output generated with a concomitant reduction in the amount of information conveyed. Subjects used more words and sentences to describe a picture but produced fewer propositions, or meaningful units of language. In contrast, Hutchinson and Jensen (1980) identified reduced elaboration in their normal elderly subjects, as defined as the production of fewer utterances per conversational turn.

Another common finding in the discourse of older adults is decreased production and comprehension of syntactic structures with advanced age (Bayles & Kasziak, 1987; Emery, 1986; Kynette & Kemper, 1986; Ulatowska & Chapman, 1991). In general, the more complex and abstract the syntactic information to be produced or understood, the more errors will occur as normal individuals age. Normal subjects between 60 and 70
years of age produce a greater number of semantic paraphasic errors than individuals in the 40 and 50 year range, possibly as a consequence of increased lexical accessing difficulties (Obler, Au, Kugler, Melvold, Tocco, & Albert, 1994).

Referencing disturbances also appear in the discourse of older normal adults. Ulatowska, Hayashi, Cannito, and Fleming (1986) found that disturbances in referential operations emerge in younger elderly subjects (64-76 years), and become more prominent with advanced age. Ambiguous reference, characterized by the use of pronouns without adequately established antecedents, was significantly more prevalent in elderly normal speakers than in middle aged subjects. Older adults also use more pronouns and fewer specific referents than younger adults (Ulatowska et al., 1986). Referencing disturbances occur in both procedural and narrative discourse genres, suggesting a “general impairment of reference” (p. 35) in subjects 60 years of age and older (Ulatowska et al., 1986). In contrast, Glosser and Deser (1992) found no evidence of disturbed reference between their middle aged and elderly subjects.

Glosser and Deser (1992) examined macrolinguistic and microlinguistic aspects of discourse production in middle aged (43-61 year old) and elderly (67-88 year old) subjects. They determined that advanced age is associated with a reduction in the ability to organize information logically and coherently (macrolinguistic aspect), while the ability to express meaning relationships through the use of linguistic devices (microlinguistic aspect) remains intact. They found that elderly speakers are less likely to produce discourse that is coherent and well-formed with respect to the organization of conceptual information, but display no deficits in the use of sentence level, cohesive
devices to convey meaning. The authors concluded that macrostructural deficits in the elderly result from a process of general decline in aspects of cognition which are bilaterally, and diffusely distributed in the brain, and which occur as a consequence of normal aging.

**Summary**

The literature on the effects of pathologic and normal aging processes on discourse performance describes deficits in the organization, integration, and expression of meaning relationships. However, there is much variability in the nature of the deficits and in the types of preserved skills. The language-specific deficits experienced by PPA subjects result in distinct profiles of discourse performance in non-fluent and fluent subtypes. Non-fluent PPA subjects exhibit difficulties in topic management, cohesion, informativeness, and insight into their deficits (Orange et al., 1998). Fluent-PPA subjects demonstrate awareness of their difficulties, but exhibit more subtle deficits across a number of aspects of discourse and pragmatic performance (Orange, et al., 1998). AD subjects' discourse is described as confusing, incoherent, and empty (Appell et al., 1982; Ripich & Terrell, 1988; Nicholas et al., 1985). Deficits occur in the organization of information across utterances, the expression of relations between units of information, and in the use of conventions governing social interaction (Glosser & Deser, 1992; Mentis et al., 1995; Ripich & Terrell, 1988). In general, the decline in discourse operations parallels the declines observed in other domains of cognition, and these deficits may result in disturbances at the suprasentential and sentential levels. Similarly, normal older adults experience a decline in language operations which parallel the decline
experienced in other domains of cognition, and deficits may result in disturbances in suprasentential and sentential level skills (Kynette & Kemper, 1986; Melvold et al., 1994)

**Objective**

The objective of this study was to describe and compare the discourse and pragmatic performances of non-fluent PPA (NF-PPA), fluent PPA (F-PPA), AD, and normal adult subjects. This investigation is a partial replication of the study by Orange et al. (1998), wherein the discourse and pragmatic performances of subjects with NF-PPA, F-PPA, and FLD were compared. The primary purpose of the study was to identify the profile of discourse and pragmatic performance of subjects in each diagnostic category (NF-PPA, F-PPA, AD, and normal older adults). The investigation addressed the following questions:

1. Do NF-PPA, F-PPA, AD, and normal control subjects differ on measures of discourse and pragmatics?

2. What are the discourse and pragmatic characteristics of NF-PPA, F-PPA, AD, and normal control subjects?

3. What are the primary discourse and pragmatic characteristics of PPA?
Method

Participants

A total of twenty-eight subjects presenting with diagnoses of NF-PPA (n=6), F-PPA (n=8), AD (n=9), and a control group of normal older subjects (n=5) participated in this study. Of the 6 NF-PPA subjects, 5 were drawn from the database of the Orange et al. (1998) study. Similarly, of the 8 F-PPA subjects, 5 were drawn from the same database. Subjects in the NF-PPA, F-PPA, and AD groups were between 54 and 81 years of age. Control subjects were between 48 and 65 years of age. All NF-PPA, F-PPA, and control subjects were right-handed. Information on handedness was not available for AD subjects. Demographic information for each subject is provided in Table 1.

NF-PPA and F-PPA subjects were recruited from the neurology practice of a cognitive neurologist at St. Joseph’s Health Centre in London, Ontario (Dr. Andrew Kertesz). Native English speakers with no previous history of complicating psychiatric, neurologic, and medical conditions and who met the current research criteria for PPA (Mesulam, 1982) were invited to participate in the study.

AD subjects were recruited from the Memory Disorders Clinic at Henderson General Hospital in Hamilton, Ontario. The AD subjects were native English speakers with no history of other complicating medical, neurological, or psychiatric conditions. The AD subjects met the diagnostic criteria for probable AD (McKhann et al., 1984)

Control subjects were recruited through the Motor Neuron Disease Clinic at the London Health Sciences Centre in London Ontario.
They were the spouses of patients with amyotrophic lateral sclerosis (ALS) who were participating in a concurrent study of discourse performance (see Aere, 1998). All subjects were native English speakers with no previous history of neurologic, psychiatric, or medical illness.
## Table 1

**Subject Demographic Information**

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Assessment of Cognition and Language

Comparison of performance on language tests versus tests of non-verbal cognition is an essential component of the diagnosis of PPA. Cognitive functions for the PPA subjects were assessed by an experienced research assistant using a variety of neuropsychological test instruments. The core battery consisted of the Mattis Dementia Rating Scale (MDRS) (Mattis, 1976); Raven’s Colored Progressive Matrices (Raven, 1947), Rey-Ostereith Complex Figures (Ostereith, 1944; Rey, 1941); Wechsler Adult Intelligence Scale - Revised (Wechsler, 1981), and the Wechsler Memory Scale - Revised (Wechsler, 1987). The Standardized Mini Mental State Examination (SMMSE) (Molloy, Alemayheu, and Roberts, 1991) was administered to provide an index of mental status in the AD subjects. No standardized language tests were administered to the AD subjects. Language performance was assessed in each NF-PPA and F-PPA subject using the Western Aphasia Battery (WAB) (Kertesz, 1982). Overall performance on the WAB was represented by the Aphasia Quotient (AQ) (see Table 1).

Control subjects underwent extensive cognitive and language assessment. Cognitive functions were assessed using a variety of standardized instruments which measured performance in the following domains: (a) executive systems (i.e., processes presumed to be regulated by regions of the prefrontal cortex, such as organizational abilities), (b) attention, (c) memory, (d) visual-spatial / visual-constructional skill, and (e) emotional/personality (see Aere, 1998). Language performance was measured using a comprehensive battery of formal and informal assessment measures. The core battery of linguistic measures consisted of The Peabody Picture Vocabulary Test -Revised
(PPVT-R) (Dunn & Dunn, 1981) and the Linguistic Expression and Linguistic Comprehension subtests of the Arizona Battery for Communication Disorders in Dementia (ABCD) (Bayles & Tomoeda, 1991).

**Discourse and Pragmatic Data Collection**

Discourse analysis involves observing the mechanics by which information is organized and expressed across utterances and exchanges, as in the context of the topic-directed interview (Duchan, 1994). Discourse analysis refers to an examination of the manner in which relations between ideas are expressed linguistically (Duchan, 1994). Procedures for the collection and analysis of discourse samples were similar to that outlined in Orange et al. (1998). Discourse samples for all subjects were obtained at the time of neuropsychological, mental status, or language assessments. Discourse samples were obtained using assessment tasks which have the potential to generate extended talk on a particular subject. These tasks included (a) topic-directed interviews, (b) questions from the Spontaneous Speech subtest of the WAB, and (c) questions pertaining to the nature of specific language and cognitive symptoms experienced by the subjects. The topic-directed interview and the WAB subtest were selected because the use of standard questions provides consistency in discourse topics across subjects and facilitates comparisons between groups.

The suitability of topic-directed interviews for generating extended samples of discourse in demented and other neurologically compromised populations has been documented in a number of studies (Garcia & Joanette, 1997; Mentis et al., 1995; Ripich & Terrell, 1988). The subjects in the present study were asked to provide information on
at least 3 out of 5 specific, pre-determined topics introduced by a single, trained examiner. Information on each topic was elicited through an open-ended request, such as "Tell me all about your family". The five topics on which participants were invited to speak were: (a) your family, (b) your health right now, (c) what you do each day, (d) where were you born and raised, and (e) the jobs you had or the work that you did.

Interviews were conducted in a quiet, distraction free room. Participants included the subject and a single trained examiner. Subjects were permitted to speak, uninterrupted, on each topic for as long as they desired. The examiner elicited further talk on a subject with the request, "Tell me more about your ______". A new topic was introduced when the speaker indicated that he/she did not intend to continue speaking on a particular subject. Such indications included verbal comments indicating that the speaker had concluded speaking on a specific topic, and other non-verbal behaviours. Examples of non-verbal behaviours include pauses exceeding fifteen seconds with no concomitant signs of word-finding behaviours (e.g., 'fillers such as "um", "uh"; upward or downward eye gazing, etc.), and downward intonation at the end of the speaker's last utterance. Establishment of eye contact with the examiner was another indication that the speaker had finished speaking.

Information elicited through the use of the questions on the Spontaneous Speech subtest of the WAB (Kertesz, 1982) also was obtained in the context of an interview between the same trained examiner who completed the assessment of cognition. The PPA subjects were asked to provide information on the following questions: (a) your name, (b) your address, (c) your occupation, (d) Have you been here before?
(e) Why you are being tested today? Similar to the protocol for the topic-directed interview, a new question was introduced after the patient indicated through verbal and non-verbal signs, that he/she had no further information to add on a given question.

Questions pertaining to the nature of the specific deficits a subject was experiencing were often elicited by the examiner in addition to the WAB or topic-directed interview questions for the PPA subjects. This information was often obtained through probe questions introduced by the examiner to obtain information which would assist with the differential diagnosis. These questions were often open-ended and had the potential to generate extended talk. An example would be “Have you noticed any changes in your memory?”.

**Measures**

The basic unit of analysis was the utterance, or series of propositionally-related utterances. All samples were transcribed orthographically and segmented into utterances in accordance with criteria specified in the *Shewan Spontaneous Language Analysis* system (Shewan, 1988). Syntactic, semantic, and prosodic criteria were used to identify utterances.

The measures used to investigate the discourse and pragmatics characteristics of the PPA, AD, and normal control subjects fall into three broad categories which correspond closely with Chapman et al.’s (1998) model of discourse production: (a) discourse measures, (b) cognitive-communication measures, and (c) pragmatic measures. Discourse measures in this study correspond essentially with Chapman et al.’s (1998) measures of “linguistic facility” (58). These measures reflect aspects of lexical and
syntactic competence. Discourse measures were broken down further into measures of:
(a) quantity of spoken output, (b) quality of spoken output, (c) word-finding, and (d) cohesion. Cognitive-comunication measures reflect the influence of cognitive functions (e.g., attention, memory, etc.) on the organization of information in discourse production.

The aspects of pragmatic competence investigated in this study diverge to some extent from those examined by Chapman et al., however, the investigation of paralinguistic phenomena is common to both. In this investigation, pragmatic competence was measured in terms of socially appropriate behaviour across six distinct, yet interrelated domains of communicative competence on the PCA. Chapman et al. examined elements of pragmatic knowledge (i.e., the ability to correctly interpret communicative intentions, draw inferences, and provide an adequate amount of information relative to the amount of language output) which were more adequately studied in the interpretive discourse tasks they selected to evaluate. In contrast with Chapman et al., measures which examine the "language/information balance" in connected language are grouped under "discourse" measures in this study, instead of "pragmatic". The author agrees with Chapman et al.'s rationale for including these in pragmatic measures. They were grouped with discourse measures for practical reasons, to keep them distinct from the PCA measures, which were the measures of pragmatic competence used in this study.

The transcripts were segmented into utterances. Each sample was coded for discourse and pragmatic measures using the Codes for the Human Analysis of Transcripts (CHAT) from the CHILDES Project (MacWhinney, 1995).
Discourse and pragmatic performances in this study were defined in terms of subjects’ performances on measures of discourse production, topic management, and socially appropriate communication (see Tables 2, 3, and 4). Operational definitions for each of the measures are listed in Appendix A.

Pragmatic performance was measured using the Profile of Communicative Appropriateness (PCA), a measure designed to describe and predict pragmatic characteristics of specific populations (Penn, 1985) (see Appendix B). Communicative performance for each subject was evaluated across six domains (i.e., Response to Interlocutor, Control of Semantic Content, Cohesion, Fluency, Sociolinguistic Sensitivity, and Nonverbal Communication). A single rater (the author) evaluated one domain of performance at a time by observing the videotaped interview and reviewing the transcript of the interaction, and then evaluated the subject’s performance on each of the behaviours identified on the PCA. The sequence continued until all of the behaviours in the six domains of the PCA had been evaluated for each subject. Subject performance on the PCA was scored in terms of social appropriateness. Communicative behaviours were rated on a five-point scale ranging from 1 to 5, and corresponding with behaviours that were entirely inappropriate to entirely appropriate (i.e., Inappropriate = 1, Mostly Inappropriate = 2, Some Appropriate = 3, Mostly Appropriate = 4, Appropriate = 5). Behaviours not observed to occur, or situations where there was an opportunity for the behaviour to occur but did not because the subject was incapable of producing the behaviour (as a result of physical impairment, etc.), were scored as “Could Not Evaluate”. A value of 0 was assigned to “Could Not Evaluate” scores. Scores on the PCA are
reported as percentages of subjects' scores falling in each of the PCA rating categories (Inappropriate to Could Not Evaluate), such that for each domain the percentage of scores that were Inappropriate, Mostly Inappropriate, etc., are presented for each of the diagnostic categories.

The measures are presented in discrete categories for theoretical and practical reasons. The organization of measures into distinct groupings provides a systematic framework within which to analyze the discourse and pragmatic data, and facilitates comparison across the subject groups. It is important to state, however, that the discourse, cognitive, and pragmatic categories do not represent mutually exclusive domains of discourse production. A single measure may reflect aspects of performance across discourse, pragmatic, and cognitive domains. Results are interpreted with these considerations in mind.
Table 2

**Discourse Measures**

<table>
<thead>
<tr>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity and quality measures</strong></td>
</tr>
<tr>
<td>Number of words (# words)</td>
</tr>
<tr>
<td>Number of words per minute (# wpm)</td>
</tr>
<tr>
<td>Number of utterances (# utterances)</td>
</tr>
<tr>
<td>Percentage of incomplete utterances (% incomplete)</td>
</tr>
<tr>
<td>Percentage of utterances with stereotypes (% stereo)</td>
</tr>
<tr>
<td>Mean length of utterance (MLU)</td>
</tr>
<tr>
<td>Percentage of content information units (% CIU)</td>
</tr>
<tr>
<td><strong>Anomia Measures</strong></td>
</tr>
<tr>
<td>Percentage of overt utterances regarding anomia (% overt)</td>
</tr>
<tr>
<td>Number of self-corrections per utterance (# self / utt)</td>
</tr>
<tr>
<td>Number of repetitions per utterance (# reps / utt)</td>
</tr>
<tr>
<td><strong>Cohesion Measures</strong></td>
</tr>
<tr>
<td>Percentage of pronouns (% pronoun)</td>
</tr>
<tr>
<td>Percentage of pronouns without antecedents (% pwa)</td>
</tr>
<tr>
<td>Percentage of demonstrative pronouns (% demo)</td>
</tr>
<tr>
<td>Percentage of utterances with missing elements (% missing)</td>
</tr>
<tr>
<td>Percentage of non-specific terms (% non-specific)</td>
</tr>
</tbody>
</table>
Table 3

Cognitive-Communication Measures

<table>
<thead>
<tr>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of utterances per topic (# utts / topic)</td>
</tr>
<tr>
<td>Percentage of utterances in side sequences (% side seq)</td>
</tr>
<tr>
<td>Percentage of comment about topic utterances (% CAT)</td>
</tr>
<tr>
<td>Percentage of comment about performance utterances (% CAP)</td>
</tr>
<tr>
<td>Percentage of external side sequences (% external)</td>
</tr>
<tr>
<td>Percentage of off-topic utterances (% off)</td>
</tr>
<tr>
<td>Percentage of irrelevant responses (% irrelev)</td>
</tr>
<tr>
<td>Percentage of utterances in subject-introduced topics (% subject)</td>
</tr>
<tr>
<td>Percentage of intrusive utterances (% intrusive)</td>
</tr>
<tr>
<td>Percentage of perseverative utterances (% perseverative)</td>
</tr>
<tr>
<td>Number of repetitions per utterance (# reps / utt)</td>
</tr>
<tr>
<td>Pragmatic Measures (PCA Domains)</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Response to Interlocutor</td>
</tr>
<tr>
<td>Control of Semantic Content</td>
</tr>
<tr>
<td>Cohesion</td>
</tr>
<tr>
<td>Fluency</td>
</tr>
<tr>
<td>Sociolinguistic Sensitivity</td>
</tr>
<tr>
<td>Non-verbal Behaviour</td>
</tr>
</tbody>
</table>
Data Analysis

Each subject’s coded transcript was evaluated in terms of the discourse, cognitive-communication, and pragmatic measures described above. The mean scores and standard deviations for each of the diagnostic categories (NF-PPA, F-PPA, AD, and controls) on each measure were calculated (see Tables 5, 6, and 7).

The PCA is a comprehensive and integrated checklist of features reflecting components of pragmatics which includes all aspects of discourse performance measured with discourse and topic measures. It also provides additional information not evaluated with these measure (e.g., non-verbal communication). The PCA provides a more global, and perhaps a more functional perspective on the communicative competence in each of the diagnostic categories under investigation than the discourse and topic analyses.

Scores on each behaviour of the PCA were tallied, and total scores for each of the six domains were obtained (i.e., Response to Interlocutor, Control of Semantic Content, Cohesion, Fluency, Sociolinguistic Sensitivity, and Non-verbal domains). Subjects’ total scores in each domain were then divided by the maximum score possible for each domain (e.g., with 7 behaviours in the Cohesion domain, the maximum possible score a subject could achieve in this domain is 7 x 5, or 35) to obtain a percentage score. Statistical analyses were performed only on the percentage scores for each of the six domains. Comparison of each subject on all of the 34 behaviours evaluated on the PCA was deemed unwise as the high number of comparisons required would have significantly inflated the Type I error rate and increased the possibility of finding statistically significant results. Subjects’ performances on the PCA are thus reported in terms of
performance in each domain, rather than on each behaviour.

The research design selected to address the research questions posed in this analysis was selected based on careful consideration of the data, the research objectives, and the characteristics of various statistical methods. It was determined through examination of kurtosis and skewness values that scores on several measures were not normally distributed. Raw scores were subsequently transformed to Z-scores to more closely approximate the normal distribution. Z-scores were used for all subsequent analyses. A One-Way Analysis of Variance (ANOVA) design was selected to address the research questions which guide this exploratory investigation of discourse performance in PPA, AD and normal populations. It should be noted that although ANOVA was originally intended to analyze differences between experimentally manipulated sample populations, it is a common and acceptable analysis for comparing naturally occurring groups, such as the impaired and normal subjects in this study.

The exploratory nature of this investigation warranted the use of a liberal alpha value, however, adjustments were made to control for the number of comparisons made (Kirk, 1982). Three sets of comparisons were required to address the research questions which guided this investigation. All 28 subjects were compared on linguistic, cognitive-communicative, and pragmatic measures (i.e., the PCA). An alpha value of 0.10 was selected. To control for type I errors a family-wise alpha rate was calculated by dividing the alpha value by the number of comparisons made per analysis (Kirk, 1982).
**Agreement Studies**

Inter-rater agreement was determined for utterance segmentation and the coding of language measures, discourse measures, measures of topic management, and PCA ratings. The primary investigator (a graduate student in speech-language pathology) segmented the transcripts, and scored and rated the discourse and topic measures. A trained rater (a different graduate student in speech-language pathology) then evaluated 10% of the study subject data (3 transcripts) on randomly selected subjects. The investigator’s scores on the segmentation and coding of each discourse and topic measure were compared with scores obtained by the second rater. Agreement was calculated on a point-by-point comparison basis. The raters achieved a mean of 93% agreement on utterance segmentation, with a range between 90% and 97% agreement. A mean of 94% agreement was achieved by the raters on measures of discourse performance and topic management, with a range between 92% and 97% agreement.

Two other graduate students in speech-language pathology were recruited to evaluate study subjects on the PCA. The raters attended an initial training session lasting approximately 2 hours. The raters then practiced using the PCA categories by rating a subject who was not included in the study. The raters, who were blinded to the diagnostic categories of the subjects, then evaluated two study subjects each, for a total of 4 transcripts (or approximately 14% of the data base). Agreement was calculated on a point-by-point comparison basis. The investigator’s scores on the PCA were compared with scores obtained by the two raters (graduate students in speech-language pathology). The raters achieved between 69% and 97% agreement, with a mean of 83% agreement, on the scoring of the PCA.
Results

Significant differences were found for 5 out of 15 discourse measures, 2 out of 10 cognitive-communication measures, and 4 out of 6 domains on the PCA (see Table 8). An additional cognitive measure and one PCA measure approached significance. In addition to the statistically significant differences, unique patterns were found based on comparisons of means for the diagnostic groups (see Tables 5, 6, and 7).

Discourse Measures

There were significant F-ratios for 4 measures of quantity and quality of information and 1 measure of cohesion (see Table 5). Post-hoc analyses using Tukey’s Honestly Significant Difference test (HSD) revealed several significant differences for the number of words, words per minute, number of utterances, MLU and percent CIU (see Table 5). No other significant differences were found among the diagnostic groups on any of the other discourse measure.

NF-PPA subjects produced significantly fewer words than normal control subjects (see Table 5). They also produced significantly fewer words per minute than F-PPA subjects, AD subjects, and control subjects (see Table 5). NF-PPA subjects exhibited significantly fewer utterances than F-PPA, AD, and normal control subjects (see Table 5). NF-PPA subjects’ MLU scores were significantly lower than F-PPA, AD, and normal control subjects. They also obtained significantly lower percent CIU scores than F-PPA and AD subjects. F-PPA subjects produced significantly more demonstrative pronouns than normal control subjects.
No other significant pair-wise comparisons were found among the diagnostic groups for percent incomplete utterances, percent non-specific terms, percent overt statements regarding anomia, percent pronouns, percent pronouns without antecedents, number of repetitions per utterance, or number of self-corrections per utterance (see Table 5).

Several patterns, albeit non-significant, were found. NF-PPA subjects produced a higher mean number of repetitions than F-PPA, AD, and normal control subjects (see Table 5). NF-PPA subjects also exhibited a higher mean number of self-corrections per utterance than F-PPA, AD, and normal control subjects (see Table 5).

NF-PPA subjects obtained a lower mean score on the number of pronouns than the F-PPA, AD, and normal control subjects (see Table 5). Additionally, NF-PPA subjects demonstrated a higher mean score for the percentage of pronouns without antecedents than F-PPA, AD, and the control subjects. Normal control subjects exhibited lower mean scores than NF-PPA, F-PPA, AD subjects on the percentage of demonstrative pronouns measure (see Table 5). These differences between these diagnostic groups was not statistically significant.

Minimal differences were found between F-PPA subjects and AD subjects's scores on the percentage of utterances with missing elements measure (see Table 5). The mean number of perseverative utterances produced by F-PPA subjects was not significantly higher than the mean scores obtained by NF-PPA, AD, and normal control subjects (see Table 5).
The mean scores obtained by subjects in each of the diagnostic groups for the percentage of overt statements regarding anomia were not significantly different. Normal control subjects, however, demonstrated lower mean scores than NF-PPA, F-PPA, and AD subjects on the percentage of overt statements regarding anomia (see Table 5).

AD subjects produced fewer stereotyped utterances than normal control subjects, as revealed in the mean scores for both groups on this measure (see Table 5). Normal control subjects produced fewer stereotyped utterances than NF-PPA and F-PPA, though these differences were not significant (see Table 5).

**Cognitive-communication Measures**

Significant F-values were found for the number of utterances per topic unit and the percentage of intrusive utterances (see Table 6). A third measure, percentage of external side sequences approached significance (see Table 6).

NF-PPA subjects produced significantly fewer utterances per topic unit than F-PPA and normal control subjects (see Table 6). AD subjects produced significantly more intrusive utterances than F-PPA subjects and normal control subjects (see Table 6).

Differences between NF-PPA, F-PPA, AD, and normal control subjects on the percentage of external side sequences measures approached significance (see Table 6). NF-PPA subjects produced significantly more external side sequences than F-PPA, AD, and normal control subjects (see Table 6).

No significant differences were identified among the diagnostic groups on the percentage of side sequences, comments about performance, comments about topic, off-topic utterances, irrelevant responses, utterances in subject-introduced topics, or
percentage of perseverative utterances (see Table 6).

Although not statistically significant, several different profiles of cognitive-communication measures were observed among the diagnostic groups. AD subjects produced more off-topic responses, as reflected in a higher mean score on this measure than F-PPA subjects (see Table 6). They also demonstrated a higher mean score on comments about the topic measure than F-PPA subjects (see Table 6). AD subjects also produced more percentage of utterances in subject-introduced topics than F-PPA subjects. AD subjects produced more of these utterances than F-PPA subjects (see Table 6).

Pragmatic Measures

The normal control subjects who participated in this study were rated on the PCA, but their scores were not included in the statistical ANOVA’s as their scores were too homogenous. Their mean scores were consistently high (i.e., ratings of appropriate, mostly appropriate, and somewhat appropriate) (see Table 7).

Significant F-ratios were found for the Response to Interlocutor, Control of Semantic Content, Cohesion, and Fluency domains of the PCA (see Table 7). A fifth domain, Sociolinguistic Sensitivity, approached significance (see Table 7). No significant differences were found for Non-verbal domain scores (see Table 7).

NF-PPA subjects’ scores in the Response to Interlocutor domain were significantly lower (i.e., inappropriate and mostly inappropriate ratings) than the scores for the F-PPA subjects and the scores for the AD subjects (see Table 7). F-PPA subjects were rated as significantly more appropriate than AD subjects on this domain (see Table 7).
NF-PPA subjects’ scores in the Control of Semantic Content domain were significantly lower (i.e., inappropriate and mostly inappropriate ratings) than the scores for the F-PPA subjects and the scores for the AD subjects (see Table 7). No significant differences were identified between F-PPA subjects and AD subjects in this domain.

NF-PPA subjects received significantly lower scores (i.e., inappropriate and mostly inappropriate ratings) in the Cohesion domain than F-PPA subjects and AD subjects (see Table 7). F-PPA subjects did not differ significantly from AD subjects on this domain score (see Table 7).

NF-PPA subjects’ scores in the Fluency domain were significantly lower (i.e., inappropriate and mostly inappropriate ratings) than the scores for the F-PPA and the scores for the AD subjects (see Table 7). No significant differences were found between F-PPA subjects and AD subjects in this domain (see Table 7).

Differences between the diagnostic groups mean scores in the Sociolinguistic Sensitivity domain approached significance (see Table 7). Tukey’s HSD Post-hoc analysis revealed that the relevant difference was between the NF-PPA and the AD subjects groups. NF-PPA subjects were rated as less appropriate than AD subjects in this domain (see Table 7).
Table 5

Discourse Measures for NF-PPA, F-PPA, AD, and Control Subjects

Subject Data

| Discourse Measures | NF-PPA | | | | F-PPA | | | | | | AD | | | | | | Control | | | |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                  | M      | SD     | Min    | Max    | M      | SD     | Min    | Max    | M      | SD     | Min    | Max    | M      | SD     | Min    | Max    | df     | F      | p      |
| Quantity and     |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Quality          |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| # words          | 110.8  | 70.0   | 17.0   | 216.0  | 1094.5 | 558.1  | 472.0  | 190.3  | 995.7  | 659.1  | 346.0  | 2013.0 | 1693.8 | 1170.4 | 810.0  | 3688.6 | (3,24) | 5.2   | .01   |
| # wpm            | 44.5   | 26.7   | 11.0   | 86.0   | 92.3   | 13.6   | 77.0   | 120.0  | 100.4  | 30.1   | 53.0   | 144.0  | 139.2  | 24.0   | 121.0  | 180.0  | (3,24) | 14.0  | .01   |
| # utts           | 24.5   | 13.2   | 11.0   | 48.0   | 143.4  | 63.5   | 72.0   | 252.0  | 133.9  | 72.35  | 70.0   | 244.0  | 170.2  | 102.8  | 87.0   | 346.0  | (3,24) | 5.2   | .01   |
| %incorrect       | 17.4   | 11.3   | 0      | 30.8   | 17.0   | 7.5    | 8.0    | 27.5   | 17.5   | 14.3   | 2.9    | 47.7   | 19     | 14     | 0      | 3.5    | (3,24) | 2.9   | 1     |
| % stereo         | 8.8    | 15.6   | 0      | 38.5   | 11.9   | 11.8   | 0      | 35.0   | 5.6    | 3.0    | 1.7    | 9.4    | 8.3    | 12.3   | 0      | 29.2   | (3,24) | 2.7   | 7     |
| ML/I             | 3.7    | 1.8    | 1.3    | 6.3    | 8.5    | 2.1    | 5.2    | 12.0   | 7.7    | 1.3    | 4.9    | 9.6    | 10.8   | 0      | 10.2   | 11.4   | (3,24) | 19.8  | .01   |
| % C/IH           | 37.9   | 17.8   | 12.5   | 58.3   | 67.3   | 16.3   | 46.0   | 87.9   | 45.7   | 7.2    | 36.3   | 60.6   | 85.6   | 7.6    | 72.4   | 91.0   | (3,24) | 16.2  | .01   |
| Anomia           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| % overt          | 2.4    | 4.2    | 0      | 10.4   | 2.5    | 2.5    | 0      | 7.5    | 2.7    | 3.6    | 0      | 11.3   | 0      | 0      | 0      | 1      | (3,24) | 9.4   | 4     |
| # self /utt.     | .6     | .9     | 1      | 2.4    | 3      | 1      | 2      | 5      | 2      | 1      | 1      | 5      | 2      | 1      | 1      | 2      | (3,24) | 15.2  | 2     |
| # reps/utt.      | .9     | 1.0    | .4     | 2.9    | 4      | 1      | 2      | 6      | 3      | 3      | 1      | 9      | 1      | 1      | 0      | 3      | (3,24) | 27.1  | 1     |

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Table 5 (Continued)
Discourse Measures for NF-PPA, F-PPA, AD, and Control Subjects

<table>
<thead>
<tr>
<th>Discourse Measures</th>
<th>NF-PPA</th>
<th>F-PPA</th>
<th>AD</th>
<th>Control</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
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<tr>
<td>Cohesion</td>
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<td>% pronoun</td>
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<tr>
<td>% pwa</td>
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<tr>
<td>% demo</td>
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<td>8.7</td>
<td>0</td>
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<tr>
<td>% missing</td>
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<td>0</td>
<td>0</td>
<td>1.6</td>
</tr>
<tr>
<td>% non-specific</td>
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<td>2.2</td>
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</table>
Table 6
Cognitive-communicative Measures for NF-PPA, F-PPA, AD, and Control Subjects

<table>
<thead>
<tr>
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<th>Subject Data</th>
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<tr>
<td></td>
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<td></td>
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<td>#utts/topic</td>
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<tr>
<td>% sidescq</td>
<td>19.2</td>
</tr>
<tr>
<td>% CAT</td>
<td>7.0</td>
</tr>
<tr>
<td>% CAP</td>
<td>5.4</td>
</tr>
<tr>
<td>% external</td>
<td>6.4</td>
</tr>
<tr>
<td>% off</td>
<td>17.0</td>
</tr>
<tr>
<td>% irrelev</td>
<td>8.9</td>
</tr>
<tr>
<td>% subject</td>
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<tr>
<td>% intrusive</td>
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</tr>
<tr>
<td>% persever</td>
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Table 7

Pragmatic Measures for NF-PPA, F-PPA, AD, and Control Subjects

<table>
<thead>
<tr>
<th>PCA Domains</th>
<th>NF-PPA</th>
<th>F-PPA</th>
<th>AD</th>
<th>Control</th>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Response to Interlocutor</td>
<td>35.0</td>
<td>15.0</td>
<td>20.0</td>
<td>55.0</td>
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<tr>
<td>Control of Semantic Content</td>
<td>42.0</td>
<td>16.0</td>
<td>20.0</td>
<td>60.0</td>
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<tr>
<td>Cohesion</td>
<td>50.0</td>
<td>29.0</td>
<td>20.0</td>
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<tr>
<td>Fluency</td>
<td>27.0</td>
<td>8.0</td>
<td>20.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Socioling. Sensitivity</td>
<td>49.0</td>
<td>20.0</td>
<td>20.0</td>
<td>73.0</td>
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<tr>
<td>Non-verbal Behaviour</td>
<td>78.0</td>
<td>11.0</td>
<td>69.0</td>
<td>95.0</td>
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Table 8

Summary Table of Significant Differences

<table>
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<th>Measures</th>
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<tr>
<td>Discourse Measures</td>
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<td>Quantity and quality</td>
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<tr>
<td># words</td>
<td>NF-PPA &lt; Control *</td>
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<tr>
<td># wpm</td>
<td>NF-PPA &lt; F-PPA *</td>
</tr>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
<td># utterances</td>
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<tr>
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<td>NF-PPA &lt; AD *</td>
</tr>
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<td></td>
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<tr>
<td>% CIU</td>
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</tr>
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<td></td>
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</tr>
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<td></td>
</tr>
<tr>
<td>% demonstrative</td>
<td>F-PPA &gt; Control *</td>
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<tr>
<td>Cognitive-Communication</td>
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</tr>
<tr>
<td># utts/ topic</td>
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</tr>
<tr>
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</tr>
<tr>
<td>% intrusive</td>
<td>AD &gt; F-PPA *</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
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<tr>
<td>Response to Interlocutor</td>
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</tr>
<tr>
<td></td>
<td>NF-PPA &lt; AD **</td>
</tr>
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<td>F-PPA &gt; AD **</td>
</tr>
<tr>
<td>Control of Semantic Content</td>
<td>NF-PPA &lt; F-PPA **</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Cohesion</td>
<td>NF-PPA &lt; F-PPA**</td>
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<tr>
<td>Fluency</td>
<td>NF-PPA &lt; F-PPA**</td>
</tr>
<tr>
<td></td>
<td>NF-PPA &lt; AD **</td>
</tr>
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</table>

*p < .01.  **p < .02.
Discussion

The current investigation into the discourse, cognitive-communication, and pragmatic characteristics of subjects with NF-PPA, F-PPA, AD, and normal control subjects revealed variable performance between diagnostic groups. Distinct discourse and pragmatic profiles for subjects with NF-PPA were identified. The AD and F-PPA subjects with fluent language symptoms were very similar in their discourse and pragmatic performance, and were not easily distinguished on the measures examined in this study. Normal control subjects were found to be more similar to F-PPA and AD subjects than NF-PPA, however, areas of dissociation were observed across several measures.

**Discourse and Pragmatic Characteristics of NF-PPA Subjects**

NF-PPA subjects were the most significantly impaired compared to subjects in the four diagnostic groups. Despite within-subject heterogeneity across most measures, NF-PPA subjects as a group performed substantially worse than F-PPA, AD, and normal subjects on the majority of measures. The variability in performance may reflect varying severity levels across NF-PPA subjects. This heterogeneity could also reflect the presence of different subgroups of NF-PPA subjects, who may perform in qualitatively and quantitatively different ways on specific measures (see Thompson et al., 1997). As a group, NF-PPA subjects showed more pronounced deficits on cohesion (linguistic) measures than coherence (cognitive-communication) measures.

NF-PPA subjects performed significantly worse than F-PPA, AD, and control subjects on linguistic measures associated with fluency. Specifically, NF-PPA subjects
demonstrated the fewest number of words, number of words per minute, number of utterances, and the lowest MLU values, on average. AD subjects produced the next fewest number of words, followed by F-PPA, and normal control subjects (see Table 5). NF-PPA subjects, on average, produced at least 15 times fewer words than normal control subjects, and approximately one third the number of words per minute of normal control subjects. The second lowest MLU values were obtained by AD subjects, F-PPA, and normal control subjects (see Table 5). The mean MLU for NF-PPA subjects was approximately one-third of the mean MLU value for normal control subjects. NF-PPA subjects also exhibited the slowest speech rate, measured by the number of words per minute (see Table 5). F-PPA subjects demonstrated the second slowest rate of spoken language, followed by AD subjects, and normal control subjects. NF-PPA subjects also exhibited the fewest number of utterances of all subject groups, followed by AD, F-PPA, and normal control subjects. These results are consistent with previous reports of reduced quantity, rate, and syntactic complexity in NF-PPA subjects' spoken output (Green et al., 1990; Karbe et al., 1993; Orange et al., 1998; Thompson et al., 1997; Weintraub et al., 1990). Diminished and agrammatic language are typically associated with lesions of the frontal lobes (e.g., inferior frontal gyrus and the inferior motor cortex). Evidence of reduced verbal output in NF-PPA lends additional support for the association of NF-PPA with lesions of the left frontal and anterior perisylvian regions (Abe et al., 1997; Mesulam, 1982).

NF-PPA subjects were also the least informative diagnostic group, producing significantly fewer CIU's (i.e., relevant units of information), followed by AD, F-PPA,
and normal control subjects. Reduced informativeness in NF-PPA was observed by Karbe et al. (1993). These researchers found that NF-PPA subjects obtained the lowest information content scores on the Spontaneous Speech subtest of the Western Aphasia Battery (WAB) (Kertesz, 1982) compared to subjects with PPA, probable AD, and aphasia of vascular onset. In the current investigation, the presence of paraphasic errors, stereotyped utterances, sound, syllable and word repetitions, revisions, abandoned thoughts, and comments about word-finding difficulties all contributed to reduced informativeness in NF-PPA subjects’ discourse. The following examples illustrates this finding of reduced informativeness in NF-PPA subjects:

Examiner: tell me your full name.
Subject: fu full full mane?
Examiner: tell me your name.
Subject: mane mane like me?
Examiner: tell me your first name
Subject: that that things like that.

NF-PPA subjects also produced significantly fewer utterances per topic unit than subjects in all other diagnostic groups, followed by F-PPA, AD, and normal control subjects. The finding of fewer utterances per topic unit in NF-PPA subjects is consistent with results reported by Orange et al. (1998). Scores on this measure may suggest that NF-PPA subjects are more limited in their ability to elaborate or expand on information related to a particular topic than are F-PPA, AD, and normal control subjects. Reduced elaboration is typical of patients with bilateral frontal lobe disturbance, and reflects a reduction in mental efficiency on tasks which require conscious and prolonged talk and sequential organization of concepts (Orange et al, 1998; Snowden et al., 1996). Patients
with bilateral frontal lobe involvement are restricted in their ability to generate novel information, which is reflected in fewer utterances per topic unit than subjects without frontal lobe injury. Reduced elaboration in spoken language is thought to result from disturbances in executive functions, which are presumed to be localized bilaterally to the frontal and prefrontal cortices (Snowden et al., 1996). An alternative explanation for this finding is that the production of fewer utterances reflects reduced linguistic fluency rather than reduced mental efficiency in generating new information.

NF-PPA subjects received the lowest ratings on the PCA of all the subjects in the diagnostic groups evaluated. Scores on the various domains of the PCA appear to correspond well with scores obtained by NF-PPA subjects on the measures of fluency and informativeness previously described. In particular, NF-PPA subjects received the lowest ratings of all subjects in the Response to Interlocutor, Control of Semantic Content, Cohesion, and Fluency domains of the PCA. Deficits in the quantity and quality of subjects' responses to the examiner's requests for information contributed to the ratings of reduced appropriateness. Poor performance in these domains reflected poor scores obtained by NF-PPA subjects on measures of quantity, such as the number of words, speech rate, number of utterances, and MLU scores and on measures of quality, including the percent CIU measure. The presence of paraphasic errors (literal, verbal, and neologisms), stereotyped utterances, repetitions, and revisions also reduced the quality of NF-PPA subjects' discourse. Not surprisingly, the lowest score obtained by NF-PPA subjects on the PCA was the in the Fluency domain. NF-PPA subjects were rated as more inappropriate in their use of repetitions, self-corrections, pauses, and incomplete
phrases. Word-finding deficits also contributed to poor scores in the Fluency domain in the form of overt statements regarding word-finding difficulty. NF-PPA subjects' responses to the examiner were rated as frequently off-topic, however, not significantly more so than the responses of subjects in the other diagnostic groups. This was especially true for two NF-PPA subjects in particular who consistently failed to provide the requested information, but spoke about subjects unrelated to the topic of discussion.

The following is an example of an off-topic response by a NF-PPA subject:

Examiner: Tell me, how is your memory?
Subject: We were down down there a way over here.
Subject: And she came over and gave came with you
Subject: And that's good because nice place to play or to do it.

The prevalence of comments about word-finding difficulties also reduced NF-PPA subjects' scores in the Response to Interlocutor domain. The following example illustrates this finding in a NF-PPA subject:

Examiner: (tell me your) address?
Subject: It's uh or...
Subject: No, wait a minute
Subject: It's um...
Subject: No, that's not right um today
Subject: It's in Clinton
Subject: And it's uh uh four...no
Subject: Oh dear, let's see, Clinton, um
Subject: My uh address is uh...oh gosh.

Differences between NF-PPA subjects and the F-PPA, AD, and normal control subjects approached significance on another aspect of cognitive-communication competence, that is the production of external side sequences. External side sequences reflect the degree to which the on-going topic of discussion is interrupted by the subject
to address situations external to the topic. Examples include comments about the physical environment, comments about matters external to the assessment environment, and requests by the subjects for the examiner to repeat the interview question. This measure of external side sequences was included to reflect, in part, a subject’s ability to remain attentive to the discourse task without being distracted by extraneous stimuli. Thus, this measure was used to identify subjects, particularly those with frontal lobe deficits, who experience deficits in attention. The relatively high frequency of external side sequences produced by NF-PPA subjects may or may not reflect the occurrence of distractions. A review of the transcripts shows that these external side sequences were mainly requests for the examiner to repeat the question (e.g., “huh?”, “pardon”) rather than comments about issues external to the interaction. Such requests could indicate the subject’s failure to hear or understand the examiner’s question, however they may also suggest failure to attend to the question. It is not possible to identify the precise nature of the breakdown which lead to the requests for repetition on the basis of a single word response. Consequently it is uncertain whether NF-PPA subjects demonstrate attention deficits, or whether the higher prevalence of external side sequences, relative to the other diagnostic groups, reflects deficits in auditory comprehension.

The difference between the mean scores of NF-PPA subjects and AD subjects on the Sociolinguistic Sensitivity domain of the PCA approached significance. This finding suggests that individuals with NF-PPA demonstrate less awareness of the implicit guidelines governing the exchange of information and socially appropriate communication in social interactions than non-impaired subjects. One aspect of this
pragmatic knowledge, which may be deficient at some level in individuals with NF-PPA, is awareness of the need to adjust output to meet the demands of the communication context. Part of this awareness involves the ability to take the listener's perspective when providing information. The ability to determine what information the speaker must provide, in order to effectively communicate the desired message, is essential for the construction of coherent, socially relevant discourse. The ability to express this information linguistically also is an aspect of sociolinguistic sensitivity. Low ratings in this domain suggest that individuals with NF-PPA demonstrate either reduced awareness of their communication deficits, or preserved awareness, but an inability to correct their communication deficits. The NF-PPA subjects in this investigation demonstrated variable awareness into their communication deficits. One subject with severely deficient verbal output indicated to the examiner that she was aware of her communication deficits, and appeared upset when she was not able to convey her message to the examiner. Another NF-PPA subject whose spoken output was characterized by relatively fluent, but severely paraphasic output, appeared not to be aware that she was not making herself understood to the examiner. These findings support Thompson et al's (1997) identification of different subgroups of NF-PPA subjects. It appears from this investigation that level of awareness and insight into communication deficits (i.e., level of sociolinguistic sensitivity), may be one dimension on which subgroups of NF-PPA subjects may differ.

A review of the NF-PPA subjects' mean scores on measures of discourse performance that were not significant also provides insight into the nature of their
discourse performance. Of particular interest are two specific measures associated with
word-finding deficits. Although the difference was not statistically significant, NF-PPA
subjects were found to produce the greatest number of repetitions and self-correction per
utterance of all the diagnostic groups. These phenomena have been associated with
word-finding deficits in neurogenically-impaired populations (DeSanti et al., 1994).
However, the presence of repetitions and self-corrections in the discourse of normal
control subjects and the lack of statistically significant differences between NF-PPA and
normal control subjects on these measures raises suspicions as to whether these
phenomena reflect word-finding problems. An alternative interpretation was offered by
Illes (1989), who stated that the presence of whole word repetitions and self-corrections
indicated awareness of language production deficits in neurogenically impaired
individuals. These discourse features may reflect NF-PPA speakers’ ability to identify
their production errors and their attempts to correct them. Preserved awareness of deficits
in NF-PPA patients has been documented (Snowden et al., 1996), and is supported in the
current investigation. The presence of word-finding deficits in NF-PPA subjects’ spoken
output is consistent with previous reports of anomic disturbances in NF-PPA subjects
(Karbe et al., 1983; Mesulam, 1982). Lexical retrieval deficits, in addition to deficits in
the planning and execution of spoken language, also may contribute to reduced verbal
output in NF-PPA subjects (Thompson et al., 1997). Thompson et al. (1997) found that
NF-PPA subjects had difficulty retrieving substantive words, such as verbs and nouns,
and also elements occurring with them in noun and verb phrases. Such word-retrieval
deficits were observed to contribute to the low MLU values obtained by NF-PPA
subjects. Word-finding deficits have also been implicated in the occurrence of a greater number of incomplete utterances, which may also be reflected in poorer fluency scores (Thompson et al., 1997). NF-PPA subjects participating in this investigation produced substantially more incomplete utterances on average than normal control subjects, however this difference was not significant.

A review of mean scores on measures of discourse cohesion revealed some unique patterns in the discourse productions of NF-PPA subjects. NF-PPA subjects used the fewest pronouns, however, they produced the highest percentage of pronouns without antecedents of all subject groups. NF-PPA subjects used these particular cohesive devices less frequently than any other subject group, and demonstrated a greater tendency than other subjects to use them inappropriately. These findings suggest, albeit indirectly, that referencing may be more deficient in NF-PPA subjects than in subjects with F-PPA, AD, or normal controls. No significant differences were found among the NF-PPA, F-PPA, AD, and normal control subjects on this or any other measure of referencing. Impaired referencing is most commonly perceived as resulting from deficits at a linguistic level (Glosser & Deser, 1990; Ripich & Terrell, 1988). Glosser and Deser (1990) evaluated aspects of microlinguistic (cohesion) and macrolinguistic (coherence) competence in three groups of neurogenically impaired subjects. Analyses of their data showed that inadequate referencing (referred to as "incomplete cohesion") is strongly related to aspects of microlinguistic (i.e. within sentence) ability than macrolinguistic (i.e., across sentence) ability. A factor analysis showed that disturbed referencing was associated specifically with aspects of impaired word-finding (i.e., the production of verbal
word-finding (i.e., the production of verbal paraphasias and the use of non-specific terms). It is reasonable to suggest, therefore, that impaired linguistic ability is a potential source of disturbed referencing in NF-PPA subjects. Glosser and Deser (1990) suggest that microlinguistic competence, such as appropriate referencing, results from preserved integrity of the left temporal lobe. Findings of disturbed linguistic processing in association with circumscribed lesions of the left frontotemporal cortex, which are typical of PPA subjects, provide additional support for this claim (Abe et al., 1997; Mesulam, 1982). The coexistence of deficits in pragmatic ability is an interesting matter of speculation, but is unlikely in view of the evidence of this and previous studies of neurogenically impaired subjects. Hier et al. (1985) suggest that another measure which reflects impaired word-finding (i.e., aposiopesis, or incomplete utterances) may actually reflect disturbances in the ability to take the listener's perspective, which is an aspect of pragmatic competence. Similarly, subjects who exhibit disrupted referencing may not be aware of the listener's need for specific information and may fail to adequately specify the entities to which they are referring.

In summary, significant deficits in the quantity and quality of output was observed in the discourse of subjects with NF-PPA. Low scores on measures associated with fluency and informativeness were observed and are consistent with findings of other researchers (Karbe et al., 1983; Orange et al., 1998; Thompson et al., 1997). Not surprisingly, NF-PPA subjects' poor ratings on the Response to Interlocutor, Control of Semantic Content, Cohesion, and Fluency domains of the PCA mirror scores obtained on the discourse measures evaluated. Overall, NF-PPA subjects demonstrated awareness of
their deficits, however, the precise aspects of discourse production (linguistic competence versus pragmatic/cognitive-communication) for which they demonstrate retained insight requires further investigation. NF-PPA subjects showed reduced performance on a measure of cognitive-communication competence sensitive to aspects of frontal lobe dysfunction (i.e., reduced elaboration on a topic). Deficits in cohesion, or linguistic production, however, predominated.

**Discourse and Pragmatic Characteristics of F-PPA Subjects**

F-PPA subjects were substantially less impaired than NF-PPA subjects across a wide range of discourse and pragmatic behaviours. Areas of divergent performance between F-PPA, AD, and normal control subjects were difficult to detect using the measures selected for this investigation. Statistically significant differences were identified on only a few aspects of discourse production.

F-PPA subjects produced significantly more (i.e., 3 times as many) demonstrative pronouns than normal subjects. Demonstrative pronouns are lexical devices which establish cohesion in discourse. These findings suggest that F-PPA subjects have retained knowledge of the use of such devices in establishing relations between elements across a spoken text (De Santi et al., 1994; Ripich & Terrell, 1988). However, extensive use of demonstrative pronouns may reduce the specificity, or overall coherence of spoken output. The listener is required to recall the specific referent for which the pronoun is replacing across utterances. Frequent use of such elements may lead to perceptions of the speaker’s discourse as incoherent by listeners.
The presence of an increased percentage of demonstrative pronouns in F-PPA subjects versus normal control subjects is not surprising. Extensive production of demonstrative pronouns is considered an indication of word-finding problems. A high percentage of demonstrative pronouns is not expected in normal subjects. Using many demonstrative pronouns suggests that the speaker is less able to retrieve the name of an intended target and so must substitute it with a generic term (Glosser & Deser, 1990).

A comparison of mean scores of demonstrative pronouns shows that all diagnostic groups produced a greater percentage of demonstrative pronouns than normal control subjects. This finding is not surprising, as anomia is prominent characteristic of NF-PPA, F-PPA, and AD, and higher than normal values on the measure are a priori expectations. The variability observed in the mean scores between these groups, however, was not anticipated. AD subjects produced fewer demonstrative pronouns, but the magnitude of the difference between the mean scores of these groups is relatively small in comparison with the size of the difference between F-PPA subjects’ scores and NF-PPA subjects’ scores. NF-PPA subjects produced less than half the percentage of demonstrative pronouns as F-PPA subjects. One possible explanation for the discrepancy between mean scores for F-PPA and NF-PPA subjects on a measure associated with word-finding deficits is that NF-PPA and F-PPA subjects differ in the extent of their word-finding impairments. Anomia is a major feature of the language disorder in F-PPA, but it may be less prominent in subjects with NF-PPA. Thompson et al. (1997) identified a small group of NF-PPA subjects who exhibited less impairment in word-finding and more grammatical errors than the other NF-PPA subjects who showed greater naming deficits.
The data obtained for this study may be reflective of a group of subjects who present with more errors in grammar and language production and a relatively less prominent deficit in naming.

The lack of significant differences in the percentage of pronouns and pronouns without antecedents between F-PPA and normal control subjects suggests that F-PPA subjects reference information appropriately the majority of the time. The F-PPA subjects as a group produced more of these elements associated with word-finding than the normal control subjects, as indicated by higher mean scores. Given the prominence of anoma in F-PPA, it is reasonable to infer that higher scores on these measures likely correspond with a higher degree of word-finding difficulties evidenced by F-PPA subjects than non-impaired subjects. Future studies which replicate this investigation on larger samples of subjects may find distinct patterns of performances with respect to referencing performance in subjects with PPA and non-impaired subjects.

The similarity in the mean percentage of utterances with missing elements scores between F-PPA subjects and AD subjects is of interest because it indicates that F-PPA subjects omit essential units of information within complete utterances with relatively similar frequency to AD subjects. Ripich and Terrell (1988) categorized missing elements as one aspect of disrupted cohesion related to disturbances in ellipsis. They found that missing elements were the single most important factor which contributed the most to reduced coherence in AD subjects’ discourse. The identification of missing elements in the discourse of subjects with PPA is of interest as these phenomena have not been studied in any systematic manner in PPA subjects. Disturbed ellipsis, in the form of
missing elements, also contributed to reduced coherence in F-PPA subjects’ discourse.

In the following example of disturbed ellipsis in the discourse of F-PPA subjects, the missing element is highlighted:

Subject:  I I I couldn't get up to through uh the fifth uh [grade] in uh at school.
Subject:  So uh I did a few things that uh you know very you know trying to do things.

The missing element (the word “grade”) is easily recoverable on the basis of context (i.e., the discussion about school) in this particular segment of discourse, thus the effect of the omission on the overall coherence of the segment is not overly apparent. None of the F-PPA subjects in this study omitted information that was not recoverable from the context of the discussion.

Ripich and Terrell (1988) attribute the presence of missing elements within an utterance as a manifestation of a deficit in pragmatic knowledge. The authors maintain that disturbed ellipsis results from a speaker’s inability to take the listener’s perspective. The omission of information suggests that the speaker has failed to recognize the listener’s need for the omitted information. The omission of substantive words, it could be argued, may be another manifestation of word-finding deficits. Thompson et al. (1997) found that several of the F-PPA subjects they evaluated demonstrated word-finding deficits for open and closed class words, with no difference in the occurrence of difficulties for nouns or verbs. The failure to provide the missing information in the above example may stem from a deficit in lexical retrieval. The failure to provide the information suggests a lack of awareness that an error has occurred. This finding supports Ripich and Terrell’s hypothesis of a pragmatic disturbance related to reduced
awareness of errors, and an inability to take the listener's perspective. It also is interesting that missing elements were present in both impaired subject groups presenting with fluent language symptoms (F-PPA and AD), but were absent from the discourse of NF-PPA subjects. Reduced awareness is commonly associated with posterior lesions of the temporal lobe, and fluent language symptoms, as in the case of subjects with Wernicke’s aphasia. The presence of missing elements in F-PPA and AD and their absence in NF-PPA subjects’ discourse suggests that these phenomena may be associated with posterior temporal lobe lesions. These findings represent observations of interest at this point. Further investigation may result in more definitive conclusions regarding a neuroanatomical explanation for such occurrences.

F-PPA subjects were the only subjects in the study to exhibit perseverative utterances. Perseveration for the purposes of this investigation was defined as the repetition of words, phrases, or ideas following the introduction of a new topic for discussion. Consequently, perseveration occurred at topic boundaries when a subject continued with some aspect of the previous topic, regardless of the fact that the examiner had introduced a new topic for discussion. Perseveration may result from an inability to change mental sets, and is often seen in patients with frontal lobe impairment, or diffuse cognitive impairment, such as AD. F-PPA subjects tended not to perseverate on an idea, but repeated a word or phrase, typically a stereotyped expression. One particular F-PPA subject exhibited such perseverations, and is responsible for most of the occurrences of perseveration observed in this subject group. An example to illustrate this finding follows:
Examiner: Can you tell me about your health right now?
Subject: well it was very good
Examiner: Tell me what you do each day
Subject: well I was very good

Ideational perseveration, or the repetition of an idea, is a common feature of AD subjects' discourse. Bayles et al. (1985) found that ideational repetition was the most commonly observed form of perseverations in AD subjects. Bayles and colleagues hypothesize a relation exists between ideational perseveration and reduced informativeness. They suggest that an inability to generate novel ideas may occur as a result of disturbances in aspects of cognitive processing. Conversely, perseverations produced by F-PPA subjects consist exclusively of involuntary repetitions of non-propositional words and phrases (e.g., "you know", "things like that") across topic boundaries. Hier et al. (1985) suggested a different pathological mechanism for the type of perseveration observed in F-PPA subjects. Perseveration of a phrase was proposed to result from word-retrieval deficits, and consequently reflect deficits in linguistic processing. The fact that the repeated elements in the discourse of F-PPA subjects are qualitatively different from those which occur in AD subjects' discourse implies two distinct origins for the phenomenon of perseveration observed in both of these populations.

**Discourse and Pragmatic Characteristics of AD subjects**

AD subjects were most similar to subjects with F-PPA and normal control subjects in their discourse and pragmatic performances. These subject groups were not easily distinguished on the measures investigated in this study. Qualitative analyses of
AD subjects' discourse reveal patterns of association and dissociation between AD subjects and subjects in the other diagnostic categories.

AD subjects produced significantly more intrusive utterances than F-PPA and normal control subjects. Intrusive utterances were not observed in the discourse of non-impaired control subjects, however, they were produced by F-PPA subjects. A comparison of mean scores on this measure shows that AD subjects produced intrusive utterances five times more often than F-PPA subjects. Intrusive utterances are one specific form of ideational perseveration, defined for the purposes of this investigation, as utterances which interrupt the interaction by re-introducing a previous topic or idea into the current topic of discussion. Mentis et al. (1989) found that the repetition of old information in the discourse of AD subjects contributed to the "dependent and passive style of topic management" (p. 1063). The pathological mechanism of this form of ideational perseveration has not been identified and may be the result of deficits in several cognitive systems (Bayles et al., 1985; Snowden et al., 1996). Theories proposed to account for intrusions include deficits in cognitive processing associated with the generation of new ideas, attention disturbances, reduced self-monitoring, and memory impairments, among others (Bayles et al., 1985; Ulatowska & Chapman, 1991).

A review of AD subjects’ transcript data revealed unique patterns with respect to the occurrence of intrusive utterances. Most intrusive utterances occurred after episodes of memory failure, failure to comprehend the examiner’s question, and distractions, however, breakdowns did not always occur following one of these incidences. An example which illustrates the two former situations in the discourse of an AD subject is
presented below. In this excerpt, the subject has just completed her discussion about her family, and the examiner has introduced the next topic for discussion, the subject’s current health status:

Examiner: Could you tell me about your health right now?
Subject: my health?
Examiner: yes.
Subject: yes, it’s pretty good.
Subject: yeah.
Examiner: could you tell me more about your health?
Subject: um well um we do things together, a lot of things together.
Subject: and we have a fellow that stays in our house.
Subject: um it’s my daughter’s boyfriend.

The example illustrates the fact that this AD subject is able to switch mental sets to move from discussing her family to discussing her health, even though she fails to elaborate on this topic. The intrusive utterances relating to the topic of her family occurred following a request by the examiner for additional information. The subject was observed to pause slightly before answering the question, and did not appear confused as to the requirements of the task (i.e., providing additional information on the new topic of health). However, she did respond to this request with the provision of irrelevant information which related to the previous topic of discussion. This may be interpreted as evidence of comprehension failure. This excerpt also demonstrates an example of memory failure. The short pause between the examiner’s request and the subject’s intrusive response may have been of sufficient duration for the subject to forget the examiner’s question and to lose her train of thought. Whatever the origin, this interruption resulted in the subject’s reversion to a recent topic of discussion. The following is an example of intrusive utterances following an external distraction and after
an overt statement of memory difficulty in another AD subject’s discourse. The subject had previously described the house her parents had lived in when she was growing up. She was relaying the story of where she went to school following the death of her mother when she was distracted by the examiner’s inattentive behaviour:

Subject: I didn’t like the idea of being away from home, and in particular because by that time with my mother go my mother dead...

Subject: It’s a long story.

Subject: You’re bored.

Subject: You’re not allowed to be bored

Subject: You’re being paid for this by somebody

Subject: Anyway, so uh...

Subject: I’ve got to gather my thoughts for two minutes.

Subject: So, after she persuaded him to move into the old family house and then we moved next door.

The example shows that the distraction caused by the examiner’s inattentive behaviour caused the AD subject to lose her train of thought, and consequently to reiterate the story she had relayed several minutes previously. Several similar episodes also were observed in other AD subjects’ discourse. AD subjects, as a group, continued with their intrusive utterances for several turns, and seemed unaware that they were failing to respond with the requested information. The results of this investigation suggest that intrusive utterances in AD may arise from disturbances in memory and attention. The relative preservation of memory and other cognitive processes in PPA, in conjunction with findings of significantly fewer intrusive utterances in these populations, provides supports the theory of a cognitive-memory origin for these redundant utterances. The presence of some intrusive utterances in PPA subjects’ implies that memory and other cognitive functions are not entirely unimpaired in PPA subjects. This hypothesis also is
supported in part by neuropathological evidence of limited pathological changes in areas of the limbic system (i.e., the hippocampus) observed in the brains of some subjects with PPA (Kertesz et al., 1994). Conversely, widespread involvement of limbic system structures in subjects with AD is implicated in some of the memory disturbances (e.g., rapid forgetting of information) which characterize the deficits experienced by subjects in AD (Osimani & Freedman, 1991). Thus, it is reasonable to suggest that such impairments also influence aspects of cognitive-communication abilities associated with discourse coherence (e.g., topic management).

Statistically significant differences between AD subjects and F-PPA subjects were identified on a single measure, the Response to the Interlocutor domain of the PCA. Low mean scores in this domain indicate that AD subjects are more significantly impaired in the planning and execution of their responses to a partner than are F-PPA subjects. These findings provide support for the claims of several researchers that the primary communication deficit in AD is a pragmatic deficit (Laine, Laakso, Vuorinen, & Rinne, 1998; Mentis et al., 1989; Ripich, 1991). The significantly poor ratings obtained by AD subjects in this domain versus ratings obtained by F-PPA subjects imply that AD subjects are less able to access and use the knowledge of the implicit guidelines which govern the exchange of information in interactions than are F-PPA subjects. Mean scores obtained by AD subjects and those obtained by F-PPA subjects on a number of coherence and cohesion measures were impaired. It was found that raters' perceptions of reduced quality of AD subjects' responses corresponded with low mean scores on a number of the discourse measures evaluated, particularly on measures associated with discourse
coherence. Three such comparisons in particular will be discussed.

Though not significant, the difference between AD and F-PPA subjects’ scores on the percentage of off-topic utterances measure was sufficiently large to warrant investigation. AD subjects produced more than twice the number of off-topic responses of F-PPA subjects. These results support other research findings of disturbed topic management and reduced coherence in AD subjects’ discourse (Glosser & Deser, 1990; Laine et al., 1998; Mentis et al., 1989; Ripich & Terrell, 1988). The majority of off-topic utterances produced by AD speakers were intrusive utterances, utterances in subject-introduced topics, and irrelevant responses. A higher prevalence of intrusive utterances in AD subjects is thought to be related to episodes of memory failure, comprehension failure, or distractions. The implication is that deficits in memory and attention contributed significantly to AD subjects’ difficulties in managing topic relative to F-PPA subjects, who demonstrate relative preservation of memory and other cognitive processes.

AD subjects mean scores on the comment about topic measure were higher than F-PPA subjects’ scores, however, the difference was not significant. Comments about the topic were defined as meta-statements which remark on some aspect of the topic for discussion. The majority of comments about topic produced by AD speakers were requests for clarification of the topic under discussion. More requests for clarification of the topic by AD subjects resulted in greater perceptions of decreased informativeness of AD subjects’ responses. The development of the topic was hampered by the AD subjects frequent ‘checks’ on their understanding of the questions to which they were asked to respond. Despite the disruption these comments represented, a high prevalence of these
comments in AD subjects’ spoken output suggests that they may be more aware of their deficits than F-PPA subjects. This investigation supports Ripich’s (1991) claim that requests for clarification are strategies which AD subjects use to monitor their comprehension and maintain coherence in their responses. The fact that F-PPA subjects produced fewer meta-statements suggests that they are less effective in the use of strategies to maintain coherence.

A final point of interest is the observation that the quality of AD subjects’ responses to the examiner were reduced by a substantially higher number of utterances in subject-introduced topics relative to F-PPA subjects. In general, AD subjects produced more digressive utterances related to topics on which they wished to speak than F-PPA subjects. A pragmatic basis for the tangentiality disturbance demonstrated by AD subjects suggests that AD subjects frequently violate Grice’s conversational maxims governing the appropriate quality and quantity of subjects’ responses (Grice, 1975). Such violations are thought to reflect deficits in pragmatic knowledge. AD subjects are believed to experience reduced awareness and use of the implicit, socially constructed rules guiding communicative interactions. Consequently AD subjects may fail to perceive that they are providing too much information, and continue to digress. F-PPA subjects did digress, however, they did so less often than AD subjects, suggesting that their ability to access pragmatic knowledge may be less impaired than AD subjects.

In summary, significantly poorer ratings obtained by AD subjects than F-PPA subjects in the Response to Interlocutor domain suggests that AD subjects may experience a greater deficit in their access to and use of pragmatic information than
F-PPA subjects. A differential impairment in pragmatic knowledge in AD and F-PPA subjects is hypothesized to account for the significantly poorer scores obtained by AD subjects on the Response to Interlocutor domain. If this hypothesis were eventually confirmed, it would suggest that the Response to Interlocutor measure of the PCA is highly sensitive to aspects of pragmatic competence involved in the production of coherent discourse.

**Discourse and Pragmatic Characteristics of Normal Control Subjects**

Control subjects consistently achieved the best scores of all subject groups across the majority of discourse and performance measures assessed. The majority of statistically significant differences identified in this study were between normal control subjects and NF-PPA subjects, particularly.

Normal control subjects produced the greatest amount of verbal output of all subject groups. Significant differences were found between normal control subjects and NF-PPA subjects on the number of words, words per minute, number of utterances, and MLU measures. These findings emphasize the significant deficits in the quantity of verbal output experienced by NF-PPA subjects. Significant differences between normal control subjects, F-PPA and AD subjects also were revealed on the same measures, with normal control subjects producing the greatest number of words per minute, number of utterances, and the longest MLU of these three diagnostic groups. Normal control subjects also were rated as significantly more informative than control subjects and F-PPA subjects. These findings were expected given that reduced informativeness is identified as a characteristic of neurologically impaired populations (Glosser & Deser, 1990).
Normal control subjects also produced significantly more utterances per topic unit than either NF-PPA or AD subjects. These findings are of interest because they emphasise the role of disturbed cognition in the ability to elaborate on information. Normal subjects are assumed to have the potential to generate an appropriate amount of novel information. Individuals with diffuse or circumscribed pathology, as characterized by the AD and NF-PPA subjects respectively, may exhibit disturbances in the cognitive systems involved in the generation of new information, and thus exhibit reduced elaboration, as these results show.

No intrusive utterances were produced by the normal control subjects in this investigation, which represents a significant contrast between non-impaired control subjects and subjects with AD. These findings indicate that the production of redundant information is unique to impaired populations, but specifically to subjects with AD.

Normal control subjects were rated consistently as appropriate or mostly appropriate on the PCA concerning their pragmatic behaviours. Scores on the six domains of the PCA across the normal control subjects were very homogeneous. This suggests that the PCA may be a very useful measure of pragmatic impairment as it can indicate how much an individual deviates from what is considered normal.

A review of mean scores on measures not found to be significant revealed some unique patterns which, when contrasted with mean scores obtained by the PPA and AD subjects, provide even greater insight into the nature of the deficits experienced by the subjects in the diagnostic groups evaluated.
Perhaps the most surprising outcome of this investigation was the finding of no significant differences between the normal subjects and the PPA and AD subjects on measures of word-finding. Anomia is typically a central language disturbance found in both PPA subgroups and AD subjects. PPA and AD subjects produced on average two and a half times more explicit statements of word-finding difficulty as control subjects, yet this difference was not significant. Similarly, substantially fewer repetitions and self-corrections were observed in the discourse of normal control subjects. There are a number of possible explanations for this finding. First, the lack of significant differences between normal subjects and NF-PPA, F-PPA, and AD subjects may be an artifact of low statistical power, caused by the relatively small sample size and numerous comparisons made in this investigation. Second, these results suggest that the PPA and AD subjects presented with relatively mild naming deficits overall, which made them harder to distinguish from normal control subjects. Third, word-finding problems are a common feature of neurologically impaired and normal populations. Normal speakers experience the “tip-of-the-tongue” phenomenon occasionally, which would show up on measures sensitive to word-finding difficulty. Finally, declining word-finding is been associated with advanced age in normal individuals, with difficulties beginning as early as the fourth decade of life (Albert, 1994, Bayles & Kasniak, 1987; Emery, 1990). Control subjects ranged between 48 and 65 years of age in this study. When compared with middle aged speakers, the deficits in naming experienced by impaired subjects may not be as significant as they would be if these subjects were compared with younger normal adults.
Another surprising finding was that normal control subjects did not produce the fewest number of stereotyped utterances of all groups. For example, normal control subjects produced more stereotyped utterances than AD subjects. Stereotyped utterances are commonly found in neurogenically impaired populations, and were expected to occur with significantly less frequency in the normal control group. These expectations were not confirmed. Although PPA subjects produced more stereotyped utterances than control subjects on average, the differences between mean scores were small and not significant. Despite the lack of quantitatively significant difference between groups, examination of the transcript data revealed some interesting qualitative differences. The types of stereotyped phrases used were considered typical of normal speakers (e.g., frequent use of the term "you know"). PPA and AD subjects used the same phrases, but considerably, but not statistically more often than normal subjects. Phrases considered to be atypical of normal speakers (e.g., such as the constant appearance of the phrase "very good" at inappropriate intervals seen in one F-PPA subject) were never observed in the discourse of normal speakers.

In summary, normal control subjects performed consistently better than PPA and AD subjects. These findings were expected, as normal subjects are assumed to demonstrate intact linguistic, cognitive-communication, and pragmatic competence. The comparison of normal control subjects with the neurogenically impaired subjects evaluated in this study served to highlight areas of important quantitative and qualitative divergence and association between the diagnostic groups. Such comparisons facilitate greater understanding of the nature of communication deficits in subjects with varying
degrees and characteristics of neurologic dysfunction. Comparing normal control
subjects and neurogenically impaired subjects on qualitative, as well as on quantitative
parameters, provided better descriptive power in characterizing differences between
diagnostic groups.

Primary Characteristics of Discourse and Pragmatics in PPA

Comparisons of discourse and pragmatic performance in PPA and AD subjects
provide an excellent opportunity to observe interactions between brain pathology and
communication behaviour. One of the objectives of this study was to determine whether
PPA subjects present with more deficits in linguistic aspects of discourse production, or
whether their performance could be characterized primarily by deficits in cognitive-
communication aspects of discourse. Speculation that linguistic deficits would emerge as
the most prominent disturbances experienced by individuals with PPA were motivated by
the findings of several discourse studies. Several studies have shown that subjects with
varying sites and types of cortical lesions demonstrate variable patterns of discourse
performance (Glosser & Deser, 1990; Iles, 1989; Laine et al., 1998). For example,
Glosser and Deser (1990) found that subjects with fluent aphasia resulting from focal
lesions of the left temporal lobe demonstrate impairments in lexical and syntactic
performance primarily, with relatively preserved coherence. In contrast, subjects with
AD, who typically present with diffuse bilateral lesions, are impaired in aspects of
cognitive-linguistic communication, such as the production of coherent discourse, but
demonstrate preserved linguistic abilities. Coherent discourse depends on the integrity of
certain cognitive processes which are assumed to be widely distributed throughout the
cerebral cortex. Deficits at a cognitive-communication level observed in AD subjects reflect the influence of diffuse pathological processes on such aspects of cognition as memory and attention (Bayles & Kaszniak, 1987; Glosser & Deser, 1990; Ulatowska and Chapman, 1991).

The results of the study of discourse and pragmatics in PPA by Orange et al. (1998) showed that NF-PPA subjects demonstrate significant impairments in language functions, and in some aspects of cognitive-communication performance related to the management of topic. The association of NF-PPA with frontotemporal lesions results in language which is significantly diminished along a number of parameters. Similar findings emerged in the current study.

F-PPA subjects demonstrated relatively subtle disturbances in cognitive-communication abilities, in conjunction with disturbances in aspects of discourse cohesion. It was anticipated that F-PPA subjects would exhibit a mixed profile of preserved and deficient discourse skills. F-PPA has been associated with focal lesions of the left temporal lobe, which suggests prominent disturbances in language. However, PPA often precedes a general decline in other cognitive functions, which is presumed to result from the progressive and pervasive pathological disturbance. It is reasonable to expect evidence of deficits in linguistic and cognitive-communication.

Results of this study show that NF-PPA subjects, as a group, show more deficits in linguistic performance than in cognitive-communication performance. F-PPA subjects present with a mixed profile of linguistic and cognitive level deficits. It must be emphasized that NF-PPA subjects were not impaired exclusively on language measures.
Reduced scores relative to normal control subjects were obtained by all PPA and AD subjects on almost all measures investigated.

NF-PPA subjects exhibited significantly impaired performance relative to all groups of subjects on measures of quantity of output (# words, # utterances), speaking rate (# wpm), and syntactic complexity (MLU). They also obtained the lowest scores by far on the Cohesion and Fluency subgroups of the PCA, which evaluate aspects of linguistic competence primarily. A review of mean scores shows that they produced the greatest number of repetitions, self-corrections, and non-specific terms of all subject groups, which are all considered linguistic phenomena. There is little doubt, based on this evidence, that NF-PPA subjects experience substantial deficits in language function.

NF-PPA subjects’ performance on measures associated with cognitive function is more difficult to characterize on the basis of observed scores. A cursory examination of the data suggest that NF-PPA subjects demonstrate substantial difficulty in aspects of cognitive-linguistic operations (e.g., topic management). The reasons for this appear to be related more to linguistic deficits than cognitive-communication problems. NF-PPA subjects’ data were analyzed to determine why they were coded as off-topic so frequently. The presence of extensive paraphasic errors (e.g., neologisms and literal paraphasias), stereotyped phrases, and auditory comprehension deficits contributed substantially to the number of off-topic utterances identified.

F-PPA subjects are considerably more difficult to distinguish from AD subjects. There are, however, points of dissociation which suggest different profiles of discourse performance.
F-PPA subjects demonstrated reduced performance in several domains of linguistic performance, however differences in mean performance were statistically significant on only one measure. F-PPA subjects used considerably more demonstrative pronouns than normal control subjects, but not significantly more than AD subjects. This represents a cohesion level disturbance in one specific aspect of referencing. An analysis of mean scores shows that F-PPA subjects produced the greatest number of behaviours associated with disturbed referencing of all subject groups (demonstrative pronouns, pronouns, and pronouns without antecedents). F-PPA subjects also received lower ratings in Fluency and Cohesion domains than AD subjects, however these differences were not statistically significant.

Deficits in behaviours associated with cognitive functions were observed in F-PPA subjects, however they were less impaired on these dimensions than AD subjects. F-PPA subjects were significantly more appropriate in their responses to the examiner than AD subjects. This suggests that their responses were generally more coherent and that they provided an appropriate amount of information more often than AD subjects. Close examination of the transcript data, however, reveals extensive variability in both subject groups. This variability may be related to the severity, with subjects at a more advanced stage of disease process demonstrating more pronounced deficits across a wide range of discourse behaviours. A review of mean scores on measures related to topic management show that F-PPA subjects produced more than half the number of off-topic responses of AD subjects, however, these differences were not statistically significant. F-PPA subjects had better mean scores on measures related to attention and memory.
(percentage of intrusive utterances, utterances in subject-introduced topics, and utterances in external side sequences). The finding of perseverative utterances exclusively used by F-PPA appears to refute this position. However, close examination of subject transcript data shows that perseveration was related more to linguistic deficits than cognitive. F-PPA subjects’ perseveration consisted entirely of repetitions of stereotyped phrases (e.g., “very good”) with no propositional content. This contrasts with AD subjects, who perseverated on ideas in the form of intrusions of a previous topic into the on-going topic of discussion.

In summary, the primary communication deficits in subjects with NF-PPA are more linguistic than cognitive-communicative. Deficits in NF-PPA subjects are qualitatively different from those observed in AD subjects. Disturbances were found to result more from linguistic deficits than cognitive deficits in this population, which contrasts with findings for AD subjects. The primary deficit in F-PPA is not as easily delineated because these subjects present with a mix of linguistic and cognitive level impairments in their discourse and pragmatic behaviours. It may be more informative to distinguish F-PPA subjects from AD subjects on the basis of quantity and not quality of deficits. F-PPA subjects and AD subjects both exhibit linguistic deficits, however, in general, F-PPA subjects showed less overall cognitive impairment in their discourse than AD subjects. This was reflected in higher scores on aspects of topic-management, and on pragmatic measures relating to the appropriateness of communication behaviours. The results of this study suggest that the PPA and AD subjects may be placed on a continuum of cognitive impairment in discourse production. NF-PPA subjects reside at the lower
extreme of the continuum, demonstrating more linguistic deficits in their discourse and pragmatic behaviours than cognitive problems. F-PPA subjects fall somewhere in the middle, with evidence of both linguistic and cognitive impairments in discourse and pragmatic behaviours. AD subjects reside at the other extreme of the scale, exhibiting the greatest degree of cognitive impairment in discourse production and pragmatic behaviours.

Caveats

These findings must be interpreted with respect to several considerations. Firstly, it is often difficult to separate discourse measures into 'linguistic' and 'cognitive' categories as discourse is the product of interactions between both. Several of the cohesion measures evaluated also contribute significantly to the overall coherence, or conceptual organization of the discourse. A discourse measure identified as 'linguistic' by one researcher may be considered to be more representative of 'cognitive' ability by another. As previously stated, the division of measures in this study into their respective categories was guided by theory, and based on findings in previous discourse studies of neurogenic populations. Secondly, this investigation was conducted on a relatively small number of subjects, and as with all small sample studies, results must be interpreted with caution. Thirdly, as in most neurogenic populations, there is a significant amount of variability in subjects' performances, which complicate the analysis of distinct clinical populations. Finally, conclusions were not based on those measures which were found to be statistically significant exclusively. All data, including descriptive statistics and raw transcript data were analyzed descriptively to obtain the most detailed picture of discourse performance in PPA, AD, and normal control subjects.
Future Directions

This study represents the first attempt at comparing NF-PPA, F-PPA, AD, and normal subjects on a wide range of discourse and pragmatic measures. Consequently, the results of this study provide a starting point for other investigations. It is strongly recommended that future studies of discourse and pragmatics in these populations be conducted on larger samples of subjects. Results of this investigation must be interpreted with caution as conclusions drawn were based on the discourse and pragmatic performances of relatively few subjects. Heterogeneity in clinical symptoms may be a legitimate feature of these syndromes, however, it is possible that much of the observed variability could be reduced by controlling for the effects of severity. Studies which compare subjects at similar points in the progression of the disease may result in more systematic and accurate descriptions of discourse and pragmatic performance in these populations. This study looked at discourse and pragmatic performance on one particular task, the topic-directed interview. Subjects in these populations should be evaluated across a wide range of discourse tasks, as particular tasks may reveal specific patterns of strength and weakness. The progressive nature of these syndromes warrants detailed analysis of discourse and pragmatic performance over time. Longitudinal studies which chart the progression of communication deficits in PPA over time, and compare with deficits in AD, would have significant theoretical and clinical relevance. Future studies comparing subjects with clinically similar characteristics, yet different pathological profiles, would provide further insight into the nature of brain-behaviour relationships. For example, it would be interesting to compare subjects with Broca’s aphasia of vascular
onset with NF-PPA subjects. Additionally, F-PPA subjects, who typically present with posterior lesions of the temporal lobe, could be compared with subjects with Wernicke's aphasia or other syndromes associated with posterior lesions. Comparisons between AD subjects and those with frontotemporal involvement, such as individuals with FLD or would also be informative. Finally, studies which examine correlations between discourse, neuropsychological, and imaging data would provide further insight into the nature of brain-behaviour relationships in syndromes of diffuse and focal cortical atrophy.
Appendix A  
Definitions for Measures

I. Discourse Measures

Quantity and Quality Measures

Word

Words were identified according to Nicholas and Brookshire’s (1993) definitions and guidelines. According to their definition, words are “intelligible in context to someone who knows the ...topic being discussed”. They “do not have to be accurate, relevant, or informative relative to the ...topic being discussed (p.348).

Utterance

An utterance, as defined by Shewan (1988) is a “complete thought, usually expressed in a connected grouping of words, which is separated from other utterances on the basis of content, intonation contour, and/or pausing” (p.124). Utterances may also be expressed a nonverbal actions.

Incomplete utterance

Incomplete utterances were identified following the definitions and guidelines of the Childes Project (MacWhinney, 1991). According to this definition, incomplete utterances are “incomplete but not interrupted” utterances in which the speaker “trails off” without completing the thought (p. 43).

e.g., Subject: The doctor here was in touch with him and told him...
   Subject: Oh the B-12 shot was something that I got for a long time.

Stereotype utterance

A stereotype utterance contains an idiosyncratic, non-propositional phrase or phrases, such as “you know”, “very good”, “okay now”, etc.

e.g., Subject: I was very good.
   Examiner: Tell me about all the jobs that you’ve had.
   Subject: I was very good um...

Mean Length of Utterance

The average number of morphemes per utterance (Retherford,1993, p. 272).
Content Information Unit

Content information units (CIU’s) were defined by Nicholas and Brookshire (1993) as words that are “accurate, relevant, or informative about the...topic being discussed (p.348). Guidelines for the scoring of CIU’s are outlined in Nicholas and Brookshire (1993). The percentage of CIU’s to the total number of words produced provides an indication of the informativeness of speaker’s discourse.

Anomia Measures

Overt statements regarding anomia

Overt statements regarding anomia refer to comments made by the speaker which indicate that he/she is experiencing difficulty recalling an intended word.

e.g., Subject: Yesterday with doctor, or professor...
Subject: I am thinking of his name.
Subject: I can’t seem to recall it.

Self correction

Self corrections refer to all instances of “retracing with correction" as defined and described in the Chilides Project (MacWhinney, 1991). Self corrections refer to instances where "a speaker starts to say something, stops, repeats the basic phrase, changes the syntax but maintains the same idea" (p.52).

e.g., Subject: It just it was just terrible to try and do it.

Repetitions

Repetitions refer to all instances of “retracing without correction” described in the Chilides Project guidelines and definitions (MacWhinney, 1991). Repetitions refer to instances where "a speaker begins to say something, stops and then repeats the earlier material without change” (p.51). Repetitions may occur on sounds, syllables, words or phrases.

e.g., Subject: I think I think those pills helped me.

Cohesion Measures

Pronoun without antecedent

A pronoun without antecedent includes a referent which was not clearly established in the preceding discourse and thus is unknown or ambiguous to the conversational partner.
Demonstrative Pronoun

A pronoun that points out that which it modifies (e.g., this, that, those, these) (Retherford, 1993, p. 272). The pro-forms here and there, which designate location are also included in this category.

e.g., Subject: I think those sleeping pills helped me.
e.g., Subject: I’ve never been here before.

Missing Elements

Missing elements were defined by Ripich and Terrell (1988) as “elements absent from the text that provides the relationship between preceeding text and that which follows". For the purposes of this investigation, the missing element was always a nominal element (e.g., noun or noun phrase) which occurred in the context of a complete utterance.

e.g., “I I I couldn’t get up to through uh the fifth 0 at school”

Non-specific Terms

The definition of a non-specific term is based on Glosser and Deser’s (1990) definition of “indefinite terms". For the purposes of this investigation, non-specific terms are nouns which denote an ambiguous or general referent. Terms such as “something", “thing", and “stuff" are examples of non-specific terms.

e.g., “I used to work in an office and did all that stuff"

II Topic Analysis

Topic Unit

A topic unit is defined as a sequence of utterances that address the same topic and/or an utterance that addresses a unique topic. The concept of topic unit was drawn from and based on Keenan and Schieffelin’s (1976) definition of topic. Several aspects of a given topic may be discussed within the scope of a single topic unit. In a topic-directed interview format topic unit boundaries typically coincided with each new question asked by the examiner, however this was not always the case.

e.g., Topic unit #1
Examiner: Tell me all about your family.
Subject: I’ve got an older son and he’s home right now.
Subject: My youngest son’s up in Guelph studying veterinarian medicine.
Topic unit #2

Examiner: Tell me about your health right now.
Subject: Well it’s not too bad.

Side Sequence

A side sequence refers to an utterance or a series of utterances which temporarily suspend the on-going topic of discussion to address matters which arise during the course of the discussion. The definition was based on the working definition of Jefferson (1972). Three distinct types of side sequence were identified: comments about the topic, comments about performance, and external side sequences.

Comment about Topic

A comment about the topic statement is a specific type of side sequence in which the speaker suspends the on-going conversation to comment on some aspect of the topic being discussed. Requests for clarification of the examiner’s question are frequent encountered examples of comment about topic utterances. Comment about topic utterances reflect meta-awareness, or the ability to use examiner’s question as a topic of discussion and comment. Comments about performance statements may occur as a single utterance or a series of utterances within the boundaries of a topic unit.

e.g., Examiner: So tell me all about your family.
Subject: Do you mean my personal family or my parents and stuff?

Comment about Performance

A comment about performance is a statement produced by the speaker about some aspect of his/her performance in discussing the immediate topic. Statements related to word-finding difficulty or loss of memory are examples of comment about performance side sequences.

e.g., Subject: The doctor told me that I had...
Subject: uh... what’s it?
Subject: it starts with a P...
Subject: I’ve forgotten the name of it.

External Side Sequence

An external side sequence is an utterance or series of utterances which interrupt the on-going topic of conversation to address matters in the immediate environment or other matters which are unrelated to the immediate topic of conversation.
Examples of external side sequences include:

Comments about an event which arises in the interview environment during discussion of a given topic.

e.g., Subject: I started to read one of those things from a to z and it took me an hour.
        Subject: Is that a computer on your desk?

Comments about matters external to the interview situation.

e.g., Subject: He had a store but that wasn’t in Owen Sound it was later.
        Subject: We have to go home soon.
        Examiner: That’s okay we only have a little while longer to go.

Off-Topic Utterance.

An off-topic utterance is defined as an utterance that does not contribute to the advancement or maintenance of the on-going topic of discussion and appears inappropriate within the context of the immediate topic. Off-topic utterances include:

a. those which demonstrate no apparent or appropriate relation to the on-going topic of discussion,
b. those which do not appear to be functioning to permit the continuation of an on-going topic,
c. those which convey false or incorrect information with respect to the topic of discussion,
d. are identified as external side sequences.
e. perseverative utterances,
f. intrusive utterances.

Irrelevant Response

An irrelevant response is one specific type of off-topic utterance in which the speaker provides incorrect information in response to the examiner’s question. These are termed “irrelevant” as the information the speaker provides bears no obvious relation to the information which was requested. Thus the speaker’s response is not relevant to the topic introduced. Irrelevant responses may indicate a failure to comprehend the examiner’s question.

e.g., Examiner: Tell me, how is your memory?
        Subject: w we were down down there a down there over here and she came over here.
Subject - Introduced utterance

A subject-introduced utterance is one that provides information about a topic which the speaker, and not the examiner, initiated for discussion. Requests for information from the examiner are also examples of subject-introduced utterances.

Intrusive Utterance

An intrusive utterance is one in which the speaker refers to a previously discussed topic of conversation and it is inappropriate within the context of the current topic of discussion.

Perseverative Utterance

A perseverative utterance is one which continues the preceding topic of conversation despite the introduction of a new topic by the conversational partner. It also includes exact repetition of utterances or repetition of utterances with the same propositional or non-propositional meaning.

Could Not Evaluate Utterance

Could not evaluate utterances include those which could not be analyzed for topic measures as they lacked intelligible content. Responses identified as could not evaluate include:

a. completely unintelligible utterances with no identifiable semantic content.
b. utterances consisting solely of non-meaningful filler words (e.g., um, uh) or sound repetitions.
NOTE TO USERS

Page(s) missing in number only; text follows. Filmed as received.

UMI
Appendix B
The Profile of Communicative Appropriateness (Penn, 1985)

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<th>Response to Interlocutor</th>
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