Language Loss in Bilingual Speakers with Alzheimer's Disease

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ABSTRACT

This study investigated the changes in language and cognition in five bilingual speakers with Alzheimer's Disease over a period of twelve months. The pattern and rate of loss in English was compared to that of Afrikaans. The bilingual behaviour of language mixing was also investigated, as was the interaction between deteriorating cognitive skills and language functions. Data was collected at three time points (0 - 6 - 12 months) employing a battery of neuropsychological and language tests, and conversation analysis.

It was predicted that where both languages were automatised to a similar extent, a similar pattern, severity and rate of loss would be evident across languages. This hypothesis was supported by results. It was also predicted that in cases where one language was less automatised than the other, the less automatised language (i.e. the language learnt later in life (L2) and/or the less proficient language) would be more severely impaired and would deteriorate at a faster rate than the fully automatised language (L1). Results revealed that while L2 was more impaired than L1 for some speakers, for others, languages were similarly impaired/spared. These discrepancies were attributed to the fact that tests were not sensitive to inter-language differences near floor or ceiling. Results did not strongly support the second prediction that L2 would deteriorate at a faster rate. Ambiguous findings could be artefacts of the time window of examination, insensitive assessment tasks, and the heterogeneous nature of the population.

With regards to language mixing behaviour, code switching mainly affected L2 interactions even though the extent of switching varied across speakers. The amount of language mixing increased for two participants over the year. With regards to a possible interaction between language and cognition, complex language tasks appeared to be more compromised by deteriorating neuropsychological support than less complex tasks, but the extent of this interaction varied across languages and across speakers. Finally, the overall profile of results suggested that a language learnt later in life will never become fully automatised, even if high levels of L2 proficiency had been attained in adulthood.

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INTRODUCTION

The psycholinguistic and neurolinguistic organisation of two languages in one brain has fuelled intensive investigation for many years now. Researchers have delved into issues such as which aspects of language functioning are language universal, and which are language specific; whether there are two separate language systems or one larger system; whether languages are localised in the same area of the brain or are diffusely represented; how different ages of language acquisition may affect the organisation of languages; and the relationship between language and cognition. Various population groups such as healthy bilingual speakers and bilingual speakers with aphasia have been studied to answer these questions, and, in the case of pathology, to provide an indication of what the most effective intervention methods might be.

It is only recently that researchers have begun to investigate the effect that dementia has on a bilingual speaker's two languages. The progressive nature of deterioration with dementia facilitates a longitudinal investigation into language attrition. By tracking the long term progressive dissolution of language skills, we can find out what aspects are most vulnerable, and by comparing attrition in one language to the other, we can begin to infer how they might have been organised in the first place. Such insights into the organisation of two languages in one brain is precluded from the study of aphasia, which results from a sudden, focal lesion. In addition, since dementia also involves cognitive decline, it affords an opportunity to closely examine the relationship between language *and cognition. However, only a handful of studies* have been reported on bilingual speakers with dementia thus far, all of which can be criticised on a number of accounts, including use of ambiguous and conflicting terminology, and abundant methodological concerns.

The aim of this work was to begin a systematic investigation into the area of bilingual dementia. Since there are many types of dementia (for instance multi-infarct dementia, Lewy Body Disease, Alzheimer's Disease) - all unlikely to exercise the same influence on language -

the present work restricts itself to speakers with Alzheimer's Disease (AD). There is scant data available as to what impairments occur in the languages of a bilingual person with AD. Most studies to date are restricted to aspects of discourse, and involve a single assessment period only. However there is as yet no detailed account available describing what actually happens to the two languages over time, in terms of the pattern of impairment exhibited or the rate of decline observed. Thus the first strand of this work is to simply describe what happens to the bilingual speaker's languages with the progression of AD. For instance, whether language decline in this population follows the same pattern seen in monolingual speakers with dementia, and whether there are differences in the pattern and rate of dissolution for each language. If differences exist, why should this be, given that the two languages are represented in the same brain and used by the same person? However, if on the other hand differences are not evident, how can this be explained, given the diversity of language structures and multiplicity of uses?

This leads us into the second strand of the study, namely addressing various theoretical issues. Only once data concerning language attrition over time is available can existing theories on the organisation of languages in the brain be confirmed or refuted, or new theories be constructed stemming from the detailed descriptions obtained. A theory is only tenable if evidence can be found to support it. In this way the two strands of the study are linked.

There is a third strand which grows out of the previous two. Bilingual speakers with dementia are primarily people, people with problems in communication as well as difficulties in many other areas. However, our current knowledge base on what happens in bilingual AD is considerably limited. At this stage we therefore cannot provide firm, theoretically-grounded advice regarding management and intervention issues for speakers and their families. The findings from this research study will be a first step towards establishing which factors may be important for prognosis regarding language decline, which behaviours associated with using two languages are normal, and which may be indicators of pathology. The clinical implications of the work will be an important initial contribution to the field of Speech-

Language Pathology in so far as providing clinicians with sound strategies for intervention is concerned.

The structure of the work

The term 'bilingualism' is not universally defined, and is open to several readings. Chapter 1 discusses the potential ambiguity that surrounds the term, and the difficulties associated with assessing the two languages of a bilingual speaker. To determine what implications can be drawn for the present study from other bilingual populations, including bilingual aphasia and healthy bilingual speakers, this chapter also presents findings from recent studies in terms of patterns of loss exhibited and reasons accounting for these patterns. In addition, several areas of academic and practical interest strongly indicated to have an impact on the possible pattern of attrition are discussed, including age of acquisition of the two languages, method of acquisition, pattern of language usage over the lifespan, and relative level of proficiencies.

Chapter 2 provides an overview of the pathology of AD, focusing on the changes in language that occur in monolingual speakers with AD. In order to compare whether language loss in bilingual AD is similar to patterns and rates seen in monolingual speakers, and in order to formulate predictions regarding pattern and rate of decline, pertinent cross-sectional and longitudinal studies on changes in language in monolingual AD are reviewed. Since the present work is the first study to holistically investigate language loss over time in bilingual AD, methodological considerations of data collection in the AD population are also discussed in order to guide the selection of tests used for the present study.

In order to derive methodological pointers, and to compile a body of data against which findings from the present study can be compared, Chapter 3 critically reviews the few studies reported on bilingual speakers with AD, drawing out implications and concerns for the present work. A new approach to assessing language separation abilities at the level of conversational discourse is also discussed as a potential tool to overcome difficulties associated with previous approaches. The final section of the chapter outlines the main questions of the study and hypotheses proposed.

Chapter 4 details the methodology employed. The first part of the chapter contains a description of the participants in the study and how they were selected. The second part of the chapter details the formal tests selected and method of conversation analysis. The third part lists the statistical tests employed, and the final section reports the findings from the pilot study.

Each of the 5 single case studies are reported separately in Chapters 5 through to 9. For each case study, the chapter commences with a set of predictions of what language profiles are expected. This is followed by a Results section where the results are reported. The final section of each chapter concludes with a discussion of the findings obtained.

Chapter 10 draws the findings from the single case studies together in order to answer the main questions of the thesis. Each finding is discussed in reference to the predictions made and is compared to results reported in the literature where available. The final section of this chapter presents a schema of language profiles in bilingual AD, as derived from the findings from the present study. However, since this work is only a preliminary investigation into a vast and heterogeneous field, further research is required to confirm the findings. Several challenges for future studies are therefore also proposed.

The final chapter, Chapter 11, investigates methodological and clinical implications arising from the study. Limitations of the study are discussed first, and clinical implications are explored in the second part, divided into assessment and intervention issues. The chapter concludes with a General Conclusion, which summarises the aims, methods and findings of the work.

Chapter 1
BILINGUALISM:
ISSUES OF ASSESSMENT, PATHOLOGY, AND PREDICTIONS

Introduction

There has been very little research with bilingual speakers with dementia from which to derive methodology or theory for the present study. Nevertheless, there is abundant research in related fields that might be of importance for current concerns. The aim of this chapter is to explore pertinent controversial issues surrounding the assessment of bilingual speakers, as well as describing changes that result from pathology (in this case stroke), and language attrition in healthy elderly bilingual individuals. Each area is analysed in terms of what lessons we can learn for the present study, and how past findings can be adapted to predict overall patterns of language attrition in the bilingual AD population.

1.1 What is bilingualism?

Bilingualism is more the rule than the exception around the world (Harris and McGhee Nelson, 1992). However, to define bilingualism is to enter an area fraught with controversy. Grosjean (1992: 51) offers a broad definition: "Bilingualism is the regular use of two (or more) languages, and bilinguals are those people who need and use two (or more) languages in their everyday lives." Other definitions have included "the alternate use of two languages", to "the ability to produce complete and meaningful utterances in the second language" (Edwards, 1994: 56). The last definition would include individuals with a sparse knowledge of foreign phrases. Edwards concludes that bilingualism is a matter of degree and varies along a continuum.

Grosjean (1989, 1992) contends that for too long, many researchers have adopted the view that a bilingual speaker should be two monolinguals in one person. In other words, a bilingual individual should have two discrete language competencies, each on a par with a monolingual speaker of that language. This fractional view of bilingualism has resulted in bilingual speakers being judged according to the balance they have in their languages. A person was deemed a 'true' or 'balanced' bilingual only if he or she was equally fluent in both languages. This however is not descriptive of the vast majority of bilingual people. Therefore, an increasing number of researchers are currently advocating a holistic view of bilingualism (e.g. Grosjean, 1992; Roger, 1998). Proponents of this view assert that bilingual speakers cannot be dismantled into two separate (monolingual) parts, but rather, they have sufficient competence in both languages so as to meet personal and/or societal needs. The two languages are used together or separately depending on the listener or context. These authors acknowledge that the levels of proficiency in either language depend on the needs or functions of that language. Proficiency may differ drastically within each separate language's domains: reading, writing, speaking and listening, and may fluctuate throughout the life span (Baker, 1993; Harris and McGhee Nelson, 1992).

However, the *assessment* of the relative proficiencies of both languages is extremely problematic. To what degree do bilingual speakers have to master their L2 before they are considered proficient? Does this apply to all aspects of language (e.g. comprehension, sentence construction, naming)? Ardila (1998) accurately notes that levels of understanding and production may fluctuate across topics. What then are our criterion levels? Roberts (1998) remarks that self-rating scales have been used to place speakers along the monolingual-bilingual continuum, but these scales are themselves problematic. For instance, while some scales explore the ability to understand and speak, they do not include parameters such as speed or perceived effort. Furthermore, some speakers may not be reliable reporters, especially those who have suffered severe strokes, or who are dementing, and their relatives often only have a subjective view of the person's relative fluencies (Paradis, 1977; Roberts, 1998).

Grosjean (1997: 228) discusses how bilingual speakers can be operating on a continuum ranging from monolingual mode to bilingual mode. On the one end of the continuum, bilingual speakers will adopt the language that their monolingual interlocutor is using and deactivate the other language as far as possible. However, the non-selected language is not always totally deactivated, as is evidenced by language slips and interference (Green, 1986, 1995; Grosjean, 1997; Westwood, 1997). When assessing individuals, the mode in which they are operating must be taken into consideration. For instance, it is unreasonable to expect speakers to keep their two languages separate when speaking to another bilingual speaker with whom they habitually code switch.

In summary, the above comments urge an individualised, holistic assessment of each speaker, detailing case history factors (e.g. pattern of use), and sampling a wide range of linguistic behaviour representative of how *that* particular speaker used his/her two languages.

1.2 Bilingual Aphasia

Aphasia may be defined as an impairment in language resulting from focal organic damage to the brain, such as stroke/cerebro-vascular accidents (CVA) (Chapey, 1986). When a bilingual individual becomes aphasic, various patterns of impairment and recovery have been reported. These patterns have been used to support hypotheses concerning the effects of variables such as language proficiency and age of acquisition on the patterns of impairment observed. An abundance of (often contradictory) data has so far been collected concerning the storage and processing of two or more languages in one brain. Some of these findings from bilingual aphasia research will now be reviewed, in as far as they may provide some insight into predicting patterns of language attrition in bilingual speakers with dementia.

1.2.1 Patterns of recovery

In surveying the literature, Paradis (1977, 1997) describes several main patterns of recovery in aphasia. The first and most common is parallel recovery (Junque, Vendrell, Vendrelli-Brucet et al, 1989). This is when languages are both impaired to a similar degree and recover in parallel with each other. With the second pattern, differential recovery, the same symptoms are evident in both languages, but to different degrees. Antagonistic recovery occurs when one language regresses while the other progresses. With successive recovery, one language does not begin to reappear until the other has been restored. A fifth pattern, selective recovery, occurs when there is no improvement in one or more of the languages. Finally, mixed recovery occurs when the individual's two or more languages are intermingled. Another behaviour termed alternate antagonism was identified by Paradis, Goldblum and Abidi (1982). This was characterised by the alternating availability for speaking in one language (L1) with the second language (L2) becoming simultaneously inaccessible for given periods of time.

Other patterns of recovery have also been discussed. These include paradoxical and compulsive translation. In the former, the patient is able to translate into a language he cannot presently use productively, but cannot translate from that language (with intact comprehension, impaired expression) into the language he is using productively. With compulsive translation, the patient cannot restrain himself from translating what is said to him, or what he wishes to say. Various combinations of recovery patterns have also been reported in the literature. For instance, patient AS, a trilingual speaker, demonstrated alternating antagonism between two languages, and successive recovery of the third (Nilipour and Ashayeri, 1989).

1.2.2 Factors influencing recovery patterns

Certain factors and laws governing the patterns of recovery following aphasia have been postulated in the literature. Ribot's rule from 1882 states that languages acquired in childhood are more resistant to impairment irrespective of the degree of fluency when the injury occurred. A second rule was advanced by Pitres in 1895, stating that the most familiar language at the time of insult recovered first. A last rule was offered by Minkowski in 1928: the language of greater psychosocial importance recovers first (all cited in Paradis, 1977).

However, these laws do not account for all the patterns of recovery observed, and the laws are themselves contradictory in many circumstances. For instance, a person's mothertongue may not be the language of greater psychosocial importance at the time of insult. Therefore, other factors have been cited in the literature in an attempt to explain non-parallel recovery. These include:

(a) **Site of Lesion:**

An ideographic orthography (Chinese) may be more or less affected than a more phonetically written language depending on the site of lesion (temporal as opposed to occipito-parietal sites). Similarly, a language that can be written may recover before a language that can only be spoken, especially if the areas in the brain for reading and writing are intact (Paradis and Lecours, 1983).

(b) **Proficiency:**

Premorbid degree of fluency of each language may contribute to non-parallel recovery. Studies of healthy bilingual speakers have shown that the degree of L2 proficiency does influence language production. For instance, Meuter (1994) investigated the cost involved when switching from one language to another, using digits as stimuli. She found that it was quicker to translate from L2 to L1 than L1 to L2 especially when there was an imbalance between the two languages. Her explanation of this phenomenon was that, for non-balanced speakers, a greater amount of control is needed to select the appropriate lemma in L2 while inhibiting strong L1 lemma links to the semantic form, therefore taking longer to translate into the *non-dominant* language (p.64).

Poulisse (1997: 205) contends that a less-proficient L2 indicates that L2 knowledge is not complete. Because speakers have fewer words available to them in their L2, they may make use of compensatory strategies such as circumlocutions. L2 talk is more hesitant, with more corrections, repetitions and filled pauses than talk in L1. Poulisse maintains that in a weaker L2, the semantic, syntactic and phonological information associated with the learned L2 lexical items is not always completely established. This lack of automaticity results in a slower, more effortful L2 production, sapping many resources to maintain the process.

Evidence supporting Poulisse's observations comes from a study by Poulisse and Bongaerts (1994). These authors studied 45 Dutch learners at 3 different proficiency levels. They noted 771 instances of language switches from a 140 000 word corpus. The amount of language switches evident correlated with the degree of proficiency; the more language switches, the less proficient the speaker in L2. An analysis of the unintentional language switches revealed that, with the two least proficient groups of speakers, function words (e.g. prepositions, determiners, pronouns) were switched two to three times more frequently than content words (e.g. nouns, verbs, adjectives). This finding is consistent with Giesbers (1989) who also found that many of the switches in his corpus involved function words. Giesbers accounted for this phenomenon by claiming that speakers pay more attention to the content they are trying to convey in their L2 than the formal aspects of their message. In addition, the L1 function words were also high frequency words, requiring less activation to be accessed, and therefore could be selected faster than less frequent words.

Poulisse and Bongaerts agree with this explanation, adding that if a single storage network of lexical items is assumed, language switch errors can be compared to semantic substitution errors such as 'right' for 'wrong'. With spreading activation, the most frequent words are activated first. When starting to learn a second language, the L2 function words are of a lower frequency than the corresponding L1 function words. Therefore the chances are higher that the word with a lower threshold of activation (L1 function words) will be activated quicker than a less frequent word with a higher threshold of activation (L2 function words). As the speaker becomes more proficient in the L2, so the L2 words will require less activation to be accessed.

Further support for the influence of language proficiency as a variable comes from a study by Perani, Paulesu and Galles (1998). Using functional imaging techniques (fMRI), they found that listening to stories in L1 yielded very different patterns of cortical activity compared to listening to stories in a far less-proficient L2. In comparison, no major differences in cortical activity were found between L1 and L2 for speakers with very high L2 proficiency. The authors concluded that the level of L2 proficiency determines cortical representation of L2 to a far greater degree than does age of acquisition (but see (g) below).

However it must be remembered that, as discussed in 1.1, ascertaining the degree of proficiency a speaker has in either language remains extremely difficult, and can differ from researcher to researcher.

(c) **Pattern of Use:**

If one of a bilingual person's languages was not used for a number of years pre-morbidly, then it is plausible that it would be more vulnerable to brain injury (it had been used less and therefore elements of that language have a high activation threshold see 1.2.2[b]). In addition, it is likely that using each language for a different purpose may also influence the pattern of loss (for instance, using one language for work purposes, and the other for socialising). In their study of 156 bilingual patients demonstrating L1 attrition following stroke, Obler and Mahecha (1991) also stressed that the extent to which individuals used their L1 pre-morbidly may be a relevant factor in contributing to the pattern of loss post-stroke. However, this factor could not be ascertained as the study was a retrospective one and this variable had not been recorded.

(d) **Order of Acquisition:**

Compound bilingualism refers to those individuals who acquired both languages simultaneously in the same context before the age of 5 years. Co-ordinate bilingualism refers to those who learnt their second language in a separate environment the first one, and after the age of 5 years (Romaine, 1995; Obler and Mahecha, 1991). The order of learning two languages has also been referred to as simultaneous versus successive (Stobbart, 1992). It has been theorised that the order of acquisition results in structural differences in how two languages are organised in the brain, even in cases where L2 acquisition begins as soon as two years after L1 acquisition commenced (De Houwer, 1995). However, in their review of 156 stroke patients, Obler and Mahecha (1991) concluded that the order of L2 acquisition did not appear to influence pattern of loss. Romaine (1995) too in her review of the literature reports that the compound/co-ordinate distinction remains inconclusive, and Paradis (1997) states that the distinction (based on age or context of acquisition) is a poor predictor of recovery patterns.

(e) **Age of L2 Acquisition: the Critical/Sensitive Period Hypothesis:**

The controversial hypothesis of there being a critical period in which language acquisition must take place in order to reach maximum competence in a language was originally proposed by Lenneberg (1967, cited in Johnson and Newport, 1989). He emphasised maturation as playing an essential role in language acquisition, and that the critical period terminated with the onset of puberty. Studies over the past years have yielded contradictory results, with some refuting the notion of a critical period, and some providing evidence for it.

Using a comprehensive test of English grammar, Johnson and Newport (1989) assessed the level of English proficiency of 46 Korean or Chinese who had immigrated to America between the ages of 3-39 years. At the time of testing, all participants had been living in the USA between 3 and 26 years. Results revealed a linear relationship between test performance and age of arrival in America up to puberty. However, after puberty, no such relationship was found. The authors concluded that their results supported the hypothesis of a critical period for second language acquisition.

Likewise, findings from other studies have shown a general trend where younger learners obtain a higher proficiency in their L2 than older learners (e.g. Johnson, 1992; Patkowski, 1980). However, the actual age range of this critical period varies from study to study, with some researchers claiming that it ends at puberty (e.g. Johnson and Newport, 1989; Patkowski, 1980), while others adopt the age of 7 years as a cut-off point (e.g. Hyltenstam, 1992). In comparison, there have been studies showing that speakers learning their L2 for the first time in adulthood can achieve a near native-like mastery of the L2 (e.g. Birdsong, 1992; White and Genesee, 1996). However, Birdsong (1992) concedes that these individuals may not be representative of the norm as they may have exceptional talent for learning languages.

In a review of past research on the area, Harley and Wang (1997: 44) summarised the empirical findings regarding L2 acquisition as follows:

(a) mature learners acquire morphosyntactic and lexical aspects of L2 at a faster rate initially than young learners.

(b) the older the age of L2 acquisition onset, the less pronunciation and morphosyntax are perfected. This pattern begins from as young as 6 years old.

(c) there is a lack of convincing support that the critical period ends at puberty. Some adults achieve a near-native mastery of their L2, while some children have more difficulty than others.

(d) there remains a lack of convincing evidence that there are maturational effects on the process of language acquisition.

Harley and Wang conclude that the extensive range of findings cannot be accounted for by one single variation of the critical period hypothesis. They also raise the point that different results from studies may reflect the different methodologies used, such as the tests employed (e.g. written versus auditory tests; grammar versus pronunciation), and the criteria used to judge whether native-like proficiency has been obtained. In addition, they question the validity of using a yardstick of native-like competence for bilingual speakers when, as maintained by Grosjean (1989, 1992), a bilingual speaker is not two monolinguals in one person (see 1.1).

(f) **Method of Acquisition:**

A distinction has been drawn between implicit and explicit learning. Ellis (1994) describes the former as the automatic acquisition of knowledge of a language by taking part in natural and meaningful communication. Explicit instruction is not needed, and this knowledge cannot be described consciously. This is the method in which a first language is acquired. In contrast, the latter refers to a more conscious, formal learning of a language, for instance when learning a second language in school.

Paradis (1994) maintains explicit and implicit memory are involved differently, depending on the method in which the L2 is acquired. Using evidence from amnesia and aphasia, he demonstrates that declarative memory (subserving the conscious, formal learning of a second language; resulting in explicit knowledge) is neurofunctionally - and anatomically - different to procedural memory (subserving the automatic acquisition of a language in a conversational setting; resulting in implicit competence). With regards to learning an L2 at school, Paradis (1997) reasons that even if the L2 became automatised, it may remain a translation equivalent of the speaker's L1. He cites as evidence Matsumi's (1994) experiment which demonstrated that speakers learning an L2 formally did not develop links between the L2 and the non-linguistic imagery system.

Paradis (1994) further argues that metalinguistic knowledge does not become integrated for automatic use. Therefore, he claims that it is plausible to expect explicit metalinguistic knowledge to remain available when implicit knowledge of a language is affected by brain injury (e.g. stroke). Hence, depending on the site of lesion, declarative memory may remain intact and the patient may therefore rely on explicit knowledge as a compensatory strategy in communication.

However, the difficulty with the implicit/explicit distinction is that it may be a continuum rather than a dichotomy. For instance, some knowledge learnt explicitly may become implicit with time and practice. There is no decisive point when knowledge stops being explicit and starts being implicit. Similarly, much metalinguistic knowledge we have of our L1 comes from formal learning. While situations exist where the distinction can apply unambiguously (e.g. when first starting to learn an L2 at school), grey areas remain where the label explicit/implicit is difficult to apply with any certainty.

(g) **Regression Hypothesis:**

This hypothesis as advanced by Jakobson (1968, cited in Obler, 1993) states that what is acquired first is lost last, and what is learnt last, is lost first. It implies a gradual and fixed order of acquisition and loss of lexical items, morphological markers, syntactic structures and so forth (De Bot and Weltens, 1991). Relating the hypothesis to bilingualism, an L2 learnt *after* L1 was acquired would therefore be more vulnerable post-insult. However, the regression hypothesis has not been conclusively supported in recent literature. For instance, in her review on childhood and (monolingual) adult aphasia, Berko Gleason (1993) summarises that aphasic adults do not lose their language in the opposite way to which children acquired the language structures. However, some specific linguistic structures may be affected in this pattern. For instance, Olshtain (1986) found that irregular verb morphology was vulnerable to attrition in Hebrew speakers with English as a second language. However, the lexicon itself was not affected in a first-in last-out pattern. In response to this conclusion, Obler (1993) argues that later-learnt items are used less and therefore appear to have been forgotten first.

De Bot and Weltens (1991) maintain that it is not surprising that the regression hypothesis remains basically untenable with the aphasic population. Firstly, focal brain injury affects specific parts of the linguistic system only. Secondly, in most cases, deterioration is immediate and may even recover to some extent. Instead, they propose that the hypothesis may be more valid for the dementing population (involving a global deterioration of language). However, they note two major obstacles in this regard: there is a lack of specific data collected thus far in the area of dementia, and there exist no objective criteria as to *when* an item is considered acquired or lost (although see Morrison, Chappell and Ellis, 1997).

Related to research on the regression hypothesis are studies investigating age of acquisition (AOA) of a lexical item and naming ability. These studies, especially those involving language breakdown in adult aphasia, have been fuelled by "the suggestion that early experiences play a special role in organising our knowledge about words and their referents" (Hirsh, 1993: 225). Earlier research into naming abilities in aphasia and normal speakers attempted to correlate word frequency effects with ability to name that item, but many failed to control for age of acquisition effects. In contrast, by controlling for frequency as well as age of acquisition effects, recent studies have demonstrated that only the latter was an extremely strong predictor of naming ability (e.g. Hirsh, 1993; Hirsh and Ellis, 1994; Morrison and Ellis, 1995).

Hodgson and Ellis (1998) investigated AOA and naming abilities in the elderly (ages 71-86). They found that AOA and name agreement (i.e. how many plausible names there are for an object) predicted naming accuracy at both 5- and 15-second response deadlines, while word frequency did not appear to influence naming ability. The authors contend that these findings refute claims that less frequent words are more susceptible to aging than words used more frequently in adulthood. Considered together, all these studies strongly indicate that age of acquisition effects have a powerful influence on language attrition later in life. To extrapolate these findings to the bilingual population, it is plausible that lexical L2 items learnt after L1 is acquired may be more vulnerable to the aging process than the L1 equivalents, irrespective of frequency of use.

In conclusion, Paradis (1987) surmises that no single factor exists that absolutely influences patterns of attrition or governs recovery. Rather, a multidimensional explanation encompassing a combination of factors is necessitated.

1.2.3 Theories underlying patterns of recovery

While 1.2.2 above discussed various factors influencing patterns of recovery post-CVA, theories regarding a common mechanism underlying these influences have been postulated. Since it is not within the scope of this thesis to critically discuss these theories, they will only be outlined briefly.

The first theory is the Activation Threshold Hypothesis (Paradis, 1997). In this theory, comprehension and production are seen as being (partly) subserved by the same neural substrate. Each trace has its own activation threshold (i.e. propensity to be activated). This threshold level is a function of frequency of activation and time elapsed since last activation. With every activation, the threshold is lowered, and therefore easier to activate the next time. Competing targets (e.g. synonyms, items sharing similar features, homophones) are simultaneously inhibited i.e. their activation thresholds are raised. According to this theory, different patterns of recovery are seen to result from difficulties with activation/inhibition. For instance, in selective recovery, one language is permanently inhibited. Which of the two languages is affected depends on factors such as psychosocial issues, age of acquisition, and so forth.

A second (complementary) theory is put forward by Green (1986, 1993, 1995, 1997, 1998). This theory builds on the Activation Threshold Hypothesis as discussed by Paradis (1997) by adding the dimensions of resources, and control of these resources. Three main features are fundamental to Green's framework: control, activation, and resources. As opposed to an on-off switch, the Inhibitory Control Model (Green, 1998) supposes that two languages are kept separate by regulating their levels of activation. This is achieved through multiple levels of control, both external (input e.g. hearing a word in one language) and internal (e.g. inhibition of competitors at the lemma level). As explained in his earlier papers, lapses of control, even in healthy speakers, result in errors such as blending two words together from different languages. Any act of control (activating one language, inhibiting the other) consumes resources. Green likens these resources to the fuel a car needs to operate, thereby conceptually differentiating the capacity of a system and the resources required to activate the system. Performance can therefore be seen as "a joint function of the capacity of a subsystem, and the availability of resources to regulate it" (1995: 8). If the resources diminish with use, then a 'resource generator' must exist to replenish the supply, at the appropriate rate. The nature of this generator remains unspecified, and Green does not offer any further description. Stress, fatigue and/or brain damage may sap available resources, resulting in impaired speech/language.

In Green's view, resources become depleted following a CVA and therefore fewer are available to control (bilingual) speech production. Different recovery patterns thus result from resources being temporarily (or permanently) allocated away from one language and to another (for psychosocial reasons, differences in proficiency and so forth).

However, resource theories are not unanimously accepted. For instance, Allport (1980) strongly criticises what he terms the concept of a general-purpose limited-capacity central processor (GPLCCP), a term which implies that resources are limited and that they are undifferentiated. He maintains that this fundamental assumption of one single resource is arbitrary, and that a GPLCCP is so general and broad that it accounts for too much. However, even though resource theories still require further refinement, the metaphor of resources as a (depletable and fluctuating) energy source remains a viable approach to understanding the patterns of deficit observed in language after brain injury.

1.2.4 Applicability to bilingual AD

Numerous factors (1.2.2) have been offered as attempts to explain patterns of language loss resulting from a CVA. The question now is what predictive power do they wield for accounting for changes in language after the onset of AD? Studies of bilingual speakers with AD have yet to systematically analyse such factors (See Chapter 3). However, it is plausible that most of these factors could have an impact on patterns of language loss in bilingual AD. Varying levels of proficiency as influenced by pattern of language use, age, order and method of acquisition are all sound theories that have the potential to predict and explain patterns of attrition in bilingual speakers with AD, and influence allocation of remaining resources. These factors therefore cannot be discarded *a priori*. The only possible exception is site of lesion, for in AD there is a global deterioration as opposed to a focal lesion in aphasia. However, in AD the spread of atrophy is not uniform, resulting in a quasi-localised picture.

1.3 Cross-Linguistic Studies of Aphasia

Comparative aphasiology (or cross-linguistic studies comparing breakdown across different languages) is a relatively new area of research. Results have highlighted an extremely problematic concern that has tainted much research with aphasic bilingual individuals: aphasiology has been dominated by researchers and patients who are both English speaking. This has resulted in confusion between what is language specific and what constitutes language universals. Furthermore, theories of aphasia reveal the exceedingly heavy influence of English language facts; they have been derived based solely on what is observed in English speaking patients (Bates and Wulfeck, 1989; Bates, Wulfeck and MacWhinney, 1991; Niemi and Laine, 1989).

Differences across languages may not only be evident when comparing the broad areas of expressive versus receptive language, but also when comparing the different structures of a language such as the determiner system. In one language, the determiner system may be relatively intact while in the other language it appears to be impaired. However, while these differences in languages may be evident when examining the surface structure, there may be an underlying neurolinguistic deficit to both languages: the trade-off between the cost of a structure in terms of resources sapped and the importance of the structure in that particular language. This concept of cue validity versus cue cost is a significant contribution of cross-linguistic research. Bates et al (1991) explain cue validity as referring to how significant a particular feature is to the language (phonological, semantic, morphological or syntactic cues). The more valid the feature, the more resistant it may be to damage. Cue cost refers to the amount of capacity or energy required to activate or process a specific linguistic feature. The higher the cost of the feature, the more likely it may be impaired following brain damage. However, if the feature has a very high cue validity, it may remain necessary to devote the required amount of energy to activate it. Items of high cost and low validity are universally vulnerable with aphasia. Which items these are, however, depends on the individual language structure (language specific information).

For instance, word order (SVO) is a highly valid cue in English, and is retained - even over-used - in aphasia. In comparison, word order is of low validity in languages like Russian, where the morphological markers attached to words dictate who did what to whom, and the actual order of words in the sentence is far less important. Discrepancies in the patterns of impairment in a bilingual speaker's two languages may therefore be reflecting the different cue costs and validities a feature has for each language. In other words, language specific variations may contribute to the different patterns of impairment across languages.

Findings from cross-linguistic research have implications for studies on bilingual dementia. In particular, the over-generalisations of what have been discovered to be only language-specific findings, and the cue cost/validity trade-off provide warnings for research into any bilingual population. However, the language pair used in the present study (English-Afrikaans) are structurally very similar languages. Both hold word order as a valid cue, and generally use SVO word order in present tense. Their morphological systems are similar too. For instance, verbs are marked for tense, and nouns are marked for number but not gender. An overview of the structure of Afrikaans can be found in Appendix 1.

1.4 Language Attrition in Healthy Bilingual Speakers

The above sections discussed how the two languages of a bilingual speaker may be differentially affected following a CVA, and how certain factors such as age and method of acquisition may influence the observed patterns of loss. However, language attrition does not only result from pathology, but may also occur with normal aging. Juncos-Rabadan (1994) examined the effects of aging in 60 Spanish-Galician bilingual speakers, ranging from 30 to 90 years old, using the Bilingual Aphasia Battery (BAT; Paradis, 1987). Results showed that all were more proficient in Spanish, which is consistent with the sociolinguistic variable of Spanish being the more dominant and socially prestigious language in the region. Elderly participants showed a deterioration in language performance in both their languages, as demonstrated by total scores obtained, suggesting a generalised decline associated with aging. Furthermore, the degree of deterioration on different subtests was also similar between languages, with no one task proving more sensitive to inter-language changes over time. The author concluded that changes in language performance seen with increasing age are due to deteriorating attentional and working memory capacities. However, it is of note that no formal investigation of these neuropsychological functions was undertaken. A factor possibly contributing to the similar pattern of decline between the two languages is their structural proximity. Languages that are closely linked may be organised in the brain in a different way to languages which are structurally very different, such as English-Chinese (Luderus, 1995; Paradis, 1997).

In another study, Clyne (1981) investigated second language attrition and first language reversion in a large group of Dutch immigrants in Australia. These individuals spoke Dutch as their L1, and English (their L2) only after they arrived in Australia (the youngest at age 3; the oldest aged 45). Evidence was found for both L2 attrition and reversion to L1 in elderly speakers (based on self-perceived changes in proficiency and conversational language samples). Explanations were offered as to why some individuals demonstrated such a pattern while others did not. These included social reasons (e.g. retirement, therefore less exposure to and use of L2), and acquisitional reasons (whereby those acquiring their two languages at an early age maintained both languages equally well in later life - see 1.2.2).

Forty of the original subjects were followed up over a decade later (De Bot and Clyne, 1989). Only one clear case of reversion to L1 was noted (i.e. increased use of L1 with a concomitant decrease in use of L2), and three examples of improvement in L2 proficiencies occurred. Other patterns reported included no change in proficiency of either language; and one language improving/regressing while the other remained unchanged. The authors concluded that lack of contact was the most crucial variable in determining language attrition (for *both* L1 and L2) - even more important than time elapsed since emigration. They refer to Neisser's (1984) critical threshold hypothesis to account for their data. This hypothesis claims that linguistic knowledge which reaches this critical threshold is highly resistant to attrition over time, while knowledge below this level disintegrates rapidly. As support for this theory, De Bot and Clyne (1989) note that some of their informants who reported L2 attrition had a very low proficiency in English from the start.

This idea of a critical threshold offers a further dimension to the notion of proficiency (see 1.1 and 1.2.2). However, what remains unclear is exactly what level is considered to be the 'critical threshold', and whether this threshold differs from person to person, and/or domain to domain (e.g. writing a business letter versus having a conversation in a pub).

1.5 Summary

Several main points can be drawn from this review:

1. A bilingual speaker is not two monolingual individuals rolled into one, and therefore assessments should be as detailed and as individualised as possible.
2. Many factors combine to influence patterns of impairment and recovery in bilingual aphasia. With a few exceptions, these same factors may also be important variables impacting

on the patterns of language loss in bilingual AD. In particular, L1 versus L2 proficiency plays a role in that a less-proficient L2 is more effortful to produce. Additionally, AOA variables determine which lexical items are more or less resistant to the aging process. However, in general there appears to be no single factor that overrides all the others in determining patterns of loss.

3. Cue cost and cue validity issues specific to each language may contribute to different patterns of impairment in bilingual AD.

4. From studies on healthy bilingual speakers, it appears that the aging process affects both languages in a similar manner. Additionally, lack of contact appears to determine language attrition, especially when a critical threshold of language proficiency has not been reached. These factors may therefore also contribute to language attrition patterns in bilingual AD.

Chapter 2
CHANGES IN LANGUAGE IN MONOLINGUAL SPEAKERS WITH AD

Introduction

The aim of this chapter is firstly to provide a background to the nature and symptomotology of AD, and secondly to critically review longitudinal studies of linguistic and cognitive changes in monolingual speakers with AD. Since only one study on bilingual speakers with AD has adopted a longitudinal sample (see 3.1.6), longitudinal studies of AD in monolingual speakers will be particularly valuable in terms of what lessons may be drawn from any methodological difficulties inherent in these studies, and how these limitations can be overcome for the present study. Furthermore, a main question of the thesis asks whether the changes observed in bilingual speakers with AD mirror changes seen in their monolingual counterparts. Therefore, a review of pertinent studies in the monolingual AD literature is important in sketching a picture of language changes against which findings from the present study can be compared.

First, a brief description of the nature and symptomotology of AD and issues in diagnosis are discussed. Next, a brief overview of the general order of fragility of language components in AD is provided. Thirdly, the two main study designs (cross-sectional versus longitudinal) are reviewed using pertinent studies to illustrate advantages and disadvantages of each design. Fourthly, reasons contributing to the great variation of results reported thus far are discussed. Fifthly, various themes arising from studies on monolingual AD are listed. Finally, drawing from the review, methodological implications for the present study are considered.

2.1 Alzheimer's Disease

The prevalence of mild to moderate dementia is conservatively estimated to be 8% in individuals over the age of 65 years (Swihart and Pirozzolo, 1988). This percentage climbs to 25% with individuals over 85 years of age (Stuart-Hamilton, 1994). Of all the dementia types, AD is the most common form, accounting for approximately half of the reported cases (Bayles, 1994; Cummings 1988). The onset of AD is between the 40-90 years, but most often over 65 years of age (McKhann, Drachman, Folstein et al, 1984). The course of the disease ranges from one and a half years to fifteen years (Walton, 1994). The longer the time course of the disease process, the longer the stages of the dementia (mild, moderate, severe) are likely to be (Lezak, 1995). However, the time course and duration of stages of the disease may vary erratically.

2.1.1 Diagnostic criteria

The diagnosis of Alzheimer's Disease can only be confirmed on autopsy, but criteria for the diagnosis of probable AD have been set out in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R; American Psychiatric Association, 1987). These include:

- Demonstrable evidence of short and long term memory impairments severe enough to interfere significantly with social or occupational functioning
- At least one of the following:
    - -impaired abstract thinking
    - -impaired judgement
    - -other disturbances of higher cortical function e.g. aphasia, apraxia, agnosia
    - -personality change
- No disturbance of consciousness
- Insidious onset with progressive deteriorating course

- Exclusion of other specific causes of dementia by case history, physical examination, and laboratory tests

2.1.2 Neuropathology

Characteristic degenerative changes include senile neuritic plaques (found dotted over the cortex and hippocampus), neurofibrillary tangles (webs of neurofilaments within the nerve cells), and granuvacuolar degeneration (especially affecting the hippocampus). Neuronal loss affects all four lobes (frontal, temporal, parietal and occipital), but cerebral atrophy is most marked in the frontal and temporal lobes. Medial temporal structures are first affected, followed by the neo-cortex with the temporal-parietal association cortex being more implicated than frontal association regions. In particular, the pathway between the cortex and the hippocampus (responsible for memory) is affected, thereby functionally isolating the hippocampus. The olfactory, primary sensory and motor cortices are spared until the late stages of the disease process (Henderson, 1996; Lezak, 1995; Osimani and Freedman, 1995).

The pathogenesis of these changes is as yet unknown, although cholinergic abnormalities have been implicated.

2.1.3 Clinical features

The earliest symptoms to appear are memory impairments. Swihart and Pirozzolo (1988) outline three phases of the progressive disease. The first is the *forgetfulness phase*, characterised by subtle memory problems (e.g. misplacing objects), a decrease in spontaneity, and anxiety resulting from an insight into their difficulties. The second phase is the confusional phase, where memory impairments worsen, disorientation to time and place occurs, and difficulties with judgement, language and praxis are noted. The final phase is the dementia phase, where marked disorientation, memory problems, and decreases in general intellectual abilities occur. Individuals in this stage of dementia may eventually become echolalic or mute. However, as observed by Lezak (1995: 209), marked variability exists between individuals. Patterns of deterioration differ, as do rates of decline. Both intra-speaker variation (i.e. differences between functions within the same speaker) and inter-speaker variations (i.e. differences between speakers) are apparent. However, a downwards trend is evident, and the end point of the disease is the same for every individual: a complete loss of all functions.

The next section provides an overview of changes in language and cognition in monolingual speakers with AD.

2.2 Overview

Cognitive Changes

The earliest symptoms of AD are memory impairments. While memory deficits do occur in normal aging, aspects of memory usually resistant to the aging process are impaired in AD. In particular, two types of memory are frequently discussed in the literature on AD: semantic and episodic. The former refers to ones encyclopaedic knowledge about the world, and is evaluated by tasks such as confrontation naming, and concept definition. The latter includes an individual's autobiographical experiences, and is involved in new learning. It is usually tested with list recall and recognition tasks (Bayles and Kaszniak, 1987; Becker, Lopez and Butters, 1996; Nebes, 1989; Salmon, Heindel and Butters, 1995). Although episodic memory is impaired to a far greater extent in AD than in normal aging, semantic memory deficits evident in AD are not observed in the normal elderly (Nebes, 1989; Patel and Satz, 1994). Bayles and Kaszniak (1987) contend that semantic memory impairments constitute the primary linguistic problem in AD.

As reviewed by Lezak (1995), deficits in working memory affect new learning even in the early stages of the disease. With regards to free recall, individuals perform poorly on both story recall and list learning tasks, showing a marked recency effect (i.e. items first in the list are less likely to be remembered). Both encoding of information into memory and retrieval from the memory store are thought to be compromised. In addition, decay of memory traces further compromises new learning as is evident from a rapid rate of forgetting.

After memory impairments appear, the neuropsychological abilities of attention, information processing (especially when speed-dependent), and abstract thinking begin to deteriorate (Lezak, 1995). The earliest signs of impaired attention are evident from tasks tapping divided attention (Parasuraman and Haxby, 1993). Disorientation to person and place may or may not occur in the early stages of the disease. Visuo-spatial deficits, visuo-perceptual deficits and dyspraxia appear as the disease progresses.

Language Changes

In general, there emerges a pattern of language resilience/fragility with the progression of AD. The most vulnerable areas are semantics and pragmatics, while syntax and phonology remain relatively intact until the late stages of the disease process.

Table 1 provides a general overview of some auditory-verbal aspects of language functioning that become impaired as AD progresses. This table was difficult to compile as different authors use different methods and scales to rate the stage of dementia. For example, what one author may consider to comprise a 'mild AD' category may incorporate the end of the continuum that another author considers 'moderate AD'. The stages used in Table 1 are therefore imposed somewhat arbitrarily.

Stage dementia	Difficulties	Authors
Very mild	Superordinate naming Co-ordinate naming Verbal fluency Discourse: -decreased coherence, verbose, less concise	Bayles, Tomoeda and Trosset (1993) Bayles and Kaszniak (1987); Bayles et al (1993); Kempler (1995); Leikin and Peretz (1998); Nicholas, Obler, Au et al (1996) Bond Chapman, Ulatowska, King et al (1995); Tomoeda and Bayles (1993)
Mild	Confrontation naming Concept definition	Bayles and Kaszniak (1987); Bayles et al (1993); Faber-Langendoen, Morris, Knesevich et al (1988); Leikin and Peretz (1998); Bayles et al (1993)
Mild - Moderate	Discourse: empty words (e.g. 'stuff'), circumlocutions, digressions, ambiguous references, semantic paraphasias, generally lacking in amount of information conveyed, irrelevant and incorrect information, fewer total words, increasingly less concise	Nebes (1989); Nicholas, Obler, Albert et al (1985); Orange Lubinski and Higginbotham (1996); Tomoeda and Bayles (1993); Ulatowska and Bond Chapman (1995); Ulatowska, Allard, Donnel et al (1988)
Moderate	Auditory comprehension	Bayles et al (1993)
Severe	Phonology Syntactic production of sentences	Appell et al (1982); Bayles (1982); Bayles and Kaszniak (1987); Emery (1996); Patal and Satz (1994)

Table 1: Difficulties on different language tests at different stages of dementia

The above table is meant only as a rough guide and does not reflect the numerous controversies associated with investigating longitudinal changes in monolingual dementia. Not every researcher agrees with the reported pattern of fragility. For instance, Bates, Harris, Marchman et al (1995) showed that, when assessed in tightly controlled conditions, syntactic production is impaired as early as the mild stages of AD. Others however maintain that syntax is preserved until the later stages of AD (e.g. Appell, Kertesz and Fishman, 1982; Blanken, Dittman, Haas et al, 1987). Another example of controversial findings is whether confrontation naming difficulties do in fact present as one of the earliest impaired naming skills, as asserted by Bayles (1982) and Nicholas, Obler, Au et al (1996) among others. In contrast, Bayles and Trosset (1992) found that in 102 patients with AD, dementia severity only accounted for a third of naming difficulties. They concluded that confrontation naming impairments are not always hallmarks of language deficits in AD. Instead their study succinctly showed that "some AD patients may be moderately demented and name well, whereas others may be mildly demented and name poorly" (p.201). Yet another example comes from a retrospective study on 66 AD patients (mild to moderately involved) by Della Sala, Lorenzi, Spinnler and Zuffi (1993). They found that only 45.5% of participants fell below the cut-off point on the Token Test (De Renzi and Faglioni, 1978), indicating that not all individuals have a difficulty with sentence comprehension.

Discrepant findings are not only limited to performance on formal tests, but are also evident from studies of conversational discourse abilities. For instance, some researchers have found that individuals in the middle stages of AD frequently do not repair trouble spots/errors in their talk and rarely request clarification from their interlocutors (e.g. Bayles and Kaszniak, 1987; Stevens, 1985). In comparison, other studies have shown that many aspects of conversational discourse are preserved even in speakers in the moderate stages of dementia (e.g. Hamilton, 1994; Orange, Lubinski and Higginbotham, 1996; Perkins, Whitworth and Lesser, 1998). In particular they do respond to a need for repair as revealed by abilities to initiate self-repair. From her study of speakers with dementia, Shakespeare (1998: 216) concludes that "the presence of a confused speaker does not mean the absence of a coherent conversation".

The underlying pathology of language symptoms in AD is also hotly debated. Some theories postulate that symptoms arise from a difficulty accessing an (intact) semantic memory (e.g. Hartman, 1991; Ober and Shenaut, 1998). Other theories view the pathology as involving a degradation of the language system itself, with links between lexical items slowly degrading over time (e.g. Chertkow, Bub, Bergman et al, 1994). Ober and Shenaut (1995) conclude that in some cases, both difficulties with access and degraded memory stores contribute to the observed deficits in AD.

These abundant conflicting results regarding language impairments reflect differences in methods of staging severity of AD, methodological frameworks employed (e.g. top-down discourse analysis versus conversation analysis - see 3.3), task stimuli selected (e.g. categories used for generative naming), and the heterogeneous nature of the AD population. The purpose of the present study however is not to address all these discrepancies or to arrive at a firm claim as to the underlying nature and cause of each and every symptom in AD. Instead, it is more helpful to focus this review on studies that have attempted to describe longitudinal changes in language and cognition in a manner similar to that used in this study. This discussion will therefore restrict itself to studies with a broader scope of investigation, not highly specific, task-fragmented designs.

The next sections explore various approaches to assessing broad changes in language subsequent to the onset of AD. Before commencing the review however, a brief discussion is required about what is meant by 'pattern' and 'rate' of decline - two recurrent terms in many studies of AD.

2.3 Pattern versus Rate

Previous studies have reported patterns of language decline and rate of deterioration over a period of time. However these terms are not used consistently across studies. Each term is now explored to highlight the different ways in which the same terms have been interpreted.

2.3.1 What is meant by Pattern?

In the literature describing patterns of decline in AD, several interpretations of the word 'pattern' can be discerned. It may refer to an overall, global measure of the stages passed, such as the Clinical Dementia Rating scale (CDR; Hughes, Berg, Danziger et al, 1982); it may refer to the relative preservation/impairment of broad cognitive or physical categories, such as language versus praxis versus memory, or within these areas to relative patterns of sparing of (presumed) subcomponents such as episodic versus procedural memory, or morphology versus semantics. Still finer distirictions are sometimes drawn in contrasting patterns of decline within subcomponents, e.g. noun versus action naming subcomponents of the semantic system.

In addition, "patterns" of decline have been determined according to differing parameters of measurement, scoring, and interpretation of results obtained. Each approach has its strengths and weaknesses.

(a) Measurement:- Two extremes regarding measurement can be distinguished. The one uses a global scale such as the Global Deterioration Scale (GDS; Reisberg, Ferris, de Leon et al, 1982) or Western Aphasia Battery (WAB; Kertesz, 1980). These measures collate results from different subtests, yielding a final score that relates to a severity category. They can be criticised for forfeiting a richness of interpretation in favour of a neat overall rating or profile. A pattern of decline is determined by changes in the overall score; for instance, the individual's overall performance on the test fell within the 'mild' impairment category, but six months later, a different pattern of impairment was observed, placing the person in the 'moderate' impairment category.

In comparison, the other extreme does not attempt to summarise performance across a range of tasks with one final score. Rather, such tests (e.g. self-devised tasks assessing highly specific areas such as attribute knowledge) investigate various sub-components with increasing detail. While these tests afford an in-depth investigation into numerous areas, they do not easily generate an overall generalisation of the pattern of impairment.

(b) Scoring individual responses:- When scoring test behaviour, one can mark the response as correct or incorrect. Alternatively, one can qualitatively describe the nature of the response (e.g. the answer provided was semantically related to the target). Accordingly, different patterns of impairment may be identified from these two ways of scoring. For instance, the quantitative binary yes/no method may show that the same number of items were generated in fruit versus transport category naming tasks. However, a qualitative method may show that the speaker made use of both semantic and phonemic strategies to aid recall in the first task, while there was no evidence of such strategies to aid the second task. Both the qualitative and the quantitative approaches however can be complementary. The first describes the process; the latter offers a numerical score that can be statistically analysed.

(c) Interpretation -What constitutes decline? Is it indicated only by increasingly poor performance on formal tests? If so, then even at this level there are different aspects to consider, such as quantitative changes in scores versus qualitative changes. For instance, on a confrontation naming task, the total score may remain unchanged while increases in the variety of errors produced are observed (e.g. semantic versus phonological versus unrelated). In addition, some researchers contend that there has to be a concurrent impairment in a more ecologically valid measure such as conversation analysis in order for a diagnosis of deterioration to be made. However, difficulties with interpretation also affect communicative discourse. For instance, what aspects should be considered to reflect decline? Increases in pauses and hesitancies? Evidence of increasingly complex repair trajectories? Other issues of interpretation are raised even within a quantitative framework. Can a loss only be proved by achieving statistically significant results? What happens then in cases where numbers are too small to reach statistical significance, yet a definite trend downwards can be discerned? Depending on which view is adopted, different patterns of impairments may result. The lack of a uniform approach to interpretation of results coupled with researchers omitting to specify which approach they used renders many past studies difficult to interpret.

Thus we see that a discussion of 'pattern of loss' can be in terms of global scales and/or subcomponents of larger areas; qualitative measures and/or quantitative measures; and many other variables mentioned above. It is important to establish which perspective a writer is using because different levels of comparison may yield different results

2.3.2 What is meant by Rate?

As with 'pattern', there is no straightforward definition of 'rate' of decline. Variables involved in trying to establish what one means by 'rate' include:

(a) Great variability from person to person, not only from year to year, but also from day to day: AD is characterised by such fluctuations. Therefore, on testing, decreases in scores on that day may not be a true indication of language attrition per se, but rather may be reflecting a downwards cycle in daily fluctuation. There is no absolute scale against which rate can be measured.

(b) Units of measurement: As discussed with patterns of loss, a drop in one subcomponent of a system may occur, but not in others. However, if a global measurement scale is used, this scale may be insensitive to changes in subcomponents of the language system, and the overall score will not reflect any decline. The broader versus more detailed levels of assessment may reveal different rates of decline depending on their sensitivity and breadth of analysis.

(c) Use of statistics to determine loss: Statistically significant differences do not necessarily mean functionally or clinically significant differences - and vice versa. Hence there is a need for both qualitative and quantitative perspectives for determining rate of loss.

(d) Starting point of measurement: Different rates of loss may be identified using different starting points. For instance, changes in language may be slower in the first 6 months after a person has been diagnosed as having AD as compared to more rapid declines that are noted in the moderate stages of the disease process. Furthermore, measuring change against an external criterion (such as norms for age matched healthy speakers) versus using the speaker's starting point as its own control may also yield different pictures of rate of decline.

How the present study defines and measures pattern and rate of decline is discussed in 2.7. The next section reviews the various approaches to assessing broad changes in language over time in AD.

2.4 Methodological approaches

Methodologies employed to identify and track broad changes in language and cognition in AD include cross-sectional versus longitudinal and group versus single case study approaches. Each methodological approach however can yield different results. They will now be discussed critically in order to highlight advantages and disadvantages inherent in each.

2.4.1 Cross-sectional investigation

Studies using this approach compare performance on tests for groups of different severity levels. Individuals are assessed once only, and are not followed up longitudinally. An order of skill resistance/vulnerability to AD is discerned by comparing test performance across putative groups.

An example of such a study is one by Appell, Kertesz and Fishman (1982). They assessed 25 individuals with AD (mild to moderate in severity), using the WAB. Results indicated that non-verbal tests (e.g. praxis and constructional tasks) were more affected than oral language tasks (e.g. naming, verbal fluency and repetition). The latter tests only become compromised as the disease severity worsens.

Studies such as this can however be criticised on two important points. Firstly, AD is a heterogeneous disease, and studies tracking longitudinal changes in several individuals reveal large variations in the rate and pattern of decline (see 2.4.2). Gray and Della Sala (1996) criticise cross-sectional studies as giving a misleading picture of the course of deterioration. By only offering a single snap-shot of language abilities for each participant, the results from studies such as Appell et al contribute little to our understanding of individual rates and patterns of decline over time. Even within the same severity grouping, marked variations can be observed. Difficulties demonstrated by one participant who is moderately demented do not always parallel deficits in another participant of similar severity, as shown by Maxim and Bryan (1994) (see 2.4.4). How then can we compare with confidence findings from one group in the mild stages of AD to a separate group in the moderate stages? The second point of criticism is that the actual staging of disease severity is very problematic. Where does the mild stage end and the moderate stage begin? How many stages can dementia be divided up into? This point is discussed in more detail in 2.5.1.

2.4.2 Longitudinal studies

Such studies track changes in language in the same individuals over a fixed time period (e.g. one year; several years). An example is the study by Ripich, Petrill and Whitehouse (1995). These researchers used a language battery consisting of Boston Naming Test (BNT; Kaplan, Goodglass and Weintraub, 1983), vocabulary, word fluency and the Token Test. There were 60 participants; 58 were mildly impaired and 2 were moderately demented, as assessed on the CDR. Participants were tested every 6 months over a year and a half. Results showed statistically significant differences in test scores at each of the 6 month intervals, suggesting a steady, linear decrease in language abilities.

Studies such as Ripich et al's however can be criticised on the range of tasks used for assessments. For instance, changes in cognition were frequently not reported, and the language test battery was sparse. To date there have only been two published studies comprehensively detailing longitudinal changes in numerous aspects of both language and cognition in a large group of participants. Since these studies are of considerable importance in so far as methodology and results are concerned for the purposes of this present study, both will now be reviewed in some detail.

Study 1: Faber-Langendoen, Morris, Knesevich et al (1988)

Introduction

The first comprehensive longitudinal study is the Washington University Memory and Aging Project. Preliminary results have been published as they emerged over a period of years (e.g. Berg, Hughes, Coben et al, 1982; Berg, Danzinger, Storandt et al, 1984; Botwinick, Storandt and Berg, 1986). However, it is the report by Faber-Langendoen et al (1988) that will be discussed in detail, as this comments on the results from the original study, as well as the expanded study that stemmed from it.

Aims of study

1) to determine the prevalence of aphasia in AD (defined as "the presence of prominent language difficulties" (p 365))
2) to determine what clinical aphasic symptoms are manifested
3) to determine whether language disturbances exist as a separate entity to global cognitive impairment, or whether they are secondary to cognitive decline.

Methods

1) The study sample consisted of participants (a) from the original 1982 longitudinal study (Berg et al, 1982), where 16 had questionable AD, and 44 had mild AD (as assessed on the CDR) on entrance, and 58 healthy elderly control subjects; (b) from a replica longitudinal

study: 26 questionably demented and 22 mildly demented participants, and 25 healthy control subjects; and (c) from a cross-sectional study: 25 moderately and 17 severely demented speakers. A total of 83 healthy control subjects and 150 participants with AD were therefore involved. At the start of the study, 42 of the AD group had questionable AD, 66 were mildly demented, 25 moderately, and 17 severely demented. Mean age was 73.5 years.

2) Participants from the original 1982 study were assessed four times: at entry; 15 months; 33 months; and 50 months. All other speakers were only assessed once.

3) The test battery included:

(a) CDR

(b) An Aphasia Battery (AB) comprising the following subtests of the Boston Diagnostic Aphasia Battery (BDAE; Goodglass and Kaplan, 1983): expressive speech from descriptions of the Cookie Theft card, oral naming, word discrimination, written naming, reading comprehension, auditory comprehension, and body part identification. A maximum score of 35 is possible. 3 or more errors was considered indicative of aphasia.

(c) Psychometric tests including BNT, word fluency, a sentence repetition test, Token Test, memory tests, and Trail Making.

Results

(a) Prevalence of aphasia:

Healthy control subjects did not make more than 2 errors on the AB, and showed very little or no deterioration on psychometric testing. Of the participants with AD, 36% with mild AD were aphasic, as opposed to 100% of the severely demented group. The proportion of participants considered aphasic therefore increased with the severity of dementia.

(b) Clinical aphasic symptoms:

A pattern of impairment was observed. Deficits in reading comprehension and written language were common early on in the disease, even more so than naming abilities. Naming, auditory comprehension and expressive language tended to parallel deterioration of AB scores. Word discrimination and body part identification were most resistant to AD.

(c) Nature of the language disturbance:

Two psychometric language tests (sentence repetition and Token Test) yielded different results for aphasic versus non-aphasic AD participants. For the latter, performance on these tests remained relatively constant, while for the former, performance worsened with increasing severity of dementia. From this observation, the authors concluded that aphasia in AD is "a language-specific impairment, rather than general cognitive decline" (p. 369). In comparison, verbal fluency results deteriorated with increasing dementia severity for all AD participants. The authors contend that this task taps other cognitive skills (such as short term memory, and organisation of processing), and poor performance on this task reflects increasing cognitive impairment as opposed to language impairment per se.

(d) Rate of decline

[i] Those participants with aphasic symptoms occurring early on in the disease process deteriorated at a more rapid rate than their non-aphasic AD counterparts. According to the authors, such a pattern suggests that aphasic symptoms represent a subtype of AD.

[ii] Results reported by Berg et al (1984) revealed different rates of decline among participants. Half of the CDR 1 (mild) individuals progressed to moderate or severe dementia over a year, while the other half remained mildly demented (as assessed on the CDR). The Botwinick et al (1986) report also noted different rates of decline. For instance, over the four year period, of the original CDR 1 participants, 5 remained CDR 1, 3 progressed to a CDR 2 (moderate), and 11 to a CDR 3 (severe).

Several hypotheses were offered by the authors as to why the 5 individuals remained mildly demented over that length of time:

1) all individuals progressed at more or less the same rate, but entered the study at different time points on the continuum of 'mild dementia' (CDR 1). According to the authors, this hypothesis is most likely given the range of test results.

2) the five participants had milder cases of AD.

3) The disease process may have started later in these 5 individuals. However, as noted by Bayles et al (1993), it is usually extremely difficult to accurately pinpoint onset of AD.

4) These 5 constitute a subtype of AD: 'slow or non-progressive'.

Note: The use of the term 'aphasia' is highly controversial. As Bayles et al (1993) contend, 'aphasia' denotes a very specific difficulty with linguistic processing (as opposed to general cognitive processing). The term traditionally refers to a syndrome where impairments in linguistic communication far outweigh global cognitive impairments. However in AD, linguistic deficits are proportional to global cognitive impairments (Bayles et al, 1993). The use of the term 'aphasia' is therefore not neutral, and presupposes that language disturbances in AD are primary deficits.

Study 2: Bayles, Tomoeda and Trosset (1993); Tomoeda and Bayles (1993)

Introduction

These articles are two of many detailing results from a 5 year longitudinal study carried out at the University of Arizona. The Tomoeda and Bayles (1993) article is the first published report of longitudinal changes in discourse production, tracking each individual over time.

Aims of study included:

1) to describe longitudinal changes in language and global dementia severity

2) to investigate the relationship between change in language and increasing dementia severity.

Methods

1) 53 normal controls and 94 individuals with AD were involved. Of the AD participants, 26 completed all 5 years of testing, and 32 were still active participants when the study terminated, having been recruited over the 5 year period. All participants were tested every year for a five year period. They ranged from a GDS of 3 (mild AD) to 7 (severely impaired).

2) The test battery included 11 subtests (e.g. confrontation naming, auditory comprehension, concept definition, co-ordinate naming) and a narrative discourse sample. The GDS was also administered to obtain an indication of global cognitive impairment.

3) To extend the study, 3 participants (initially diagnosed as being mildly demented) were also given a picture description task. Discourse analysis of performance involved measures such as:

- total words
- number information units (defined as relevant, truthful, non-redundant facts)
- conciseness (worked out by dividing number information units by total number words)
- circumlocutions, revisions and aborted phrases.

Results

a) Changes in dementia severity:

There was extreme variation in the rate of decline among participants. The 'typical' individual took about 6 years to deteriorate from normal to non-functional performance.

b) Changes in language with increasing severity of dementia:

-Deterioration in linguistic performance was strongly correlated with increasing severity of dementia. However different abilities deteriorated at different stages of the disease. It appeared that task difficulty determined the order of deterioration. For example, participants at GDS stage 3 showed the greatest decline in superordinate and co-ordinate naming over the following 12 month period, while those at stage 4 deteriorated on pantomime expression and recognition (tasks of intermediate difficulty according to the authors). Easy tasks (see 2.5.2) such as oral reading were not affected in the early stages, while more difficult tasks (such as superordinate naming) were.

-Participants with AD only began to deteriorate on tasks in the second 12 month period after the study began. In comparison, those with moderate AD deteriorated substantially during the first 12 month period. This suggests that a GDS of 5 is a crucial stage for decline in linguistic abilities.

-Discourse: in the mild stages, participants were more verbose than normal controls. However, as the disease progressed, so the total number of words dropped markedly. Number of information units and conciseness dropped with increasing severity of dementia. Circumlocutions were rare, but that may be due to the nature of the task (picture description as opposed to conversational discourse). Revisions were infrequent, and occurred at a similar rate as for the normal controls.

Reasons contributing to the differences in results from these two studies are discussed in 2.5.

2.4.3 Group studies

Such studies collect data from many individuals and statistically analyse findings to determine trends seen across the group. An important general criticism of group studies such as Bayles et al (1993) is that with such a design, the means of scores obtained are reported and very little attention is paid to the ranges and standard deviations. Instead, statistical analyses average out extremes, thereby forfeiting vital information, and may indeed result in misrepresentative data analysis.

2.4.4 Single case studies

Such studies track the changes in language and cognition in individual cases. The very strong rationale for such a methodology is that language symptoms in AD are largely heterogeneous. As Maxim and Bryan (1994) assert, specific impairments and dissociations between deficits are highlighted using such a detailed methodology. These authors investigated 3 speakers with AD, using a detailed language and cognitive test battery (similar to that of Bayles et al, 1993). Maxim and Bryan (1994) remark that the profiles of three longitudinal case studies show marked variation among participants with regards to the relationship between language and cognitive decline, areas spared versus affected, and course of decline on individual subtests. If data had been averaged out, such important variations would not have been noted, and findings from the study would have been substantially weakened. As claimed by Bates, McDonald, MacWhinney et al (1991), summary statistics hide extreme scores - and it is precisely these extremes that may yield invaluable insights into our understanding of the disease.

Single case studies have however been criticised as not being generalisable to the rest of the population (as discussed by Caramazza, 1986). However, in studies such as the present one where the first detailed examination of a speaker type is being undertaken, the methodology employed must facilitate an indepth exploration of each speaker, with no variations being discarded from analysis. Furthermore, the rationale behind group studies where they are used to overcome the problem of individual variation (Pring, 1986) is inappropriate, as it is these very variations that reveal the full picture of the effects of AD. As noted by Funnell (1996) group studies assume patient homogeneity, but the AD population is certainly heterogeneous. These arguments motivate for a single case study methodology when assessing speakers with AD.

2.4.5 Summary

This section has demonstrated that cross-sectional approaches to data collection do not facilitate an insight into changes in pattern and rate of language loss over time in each individual. It has also shown that group studies average out extremes in performances thereby curtailing insights into the disease process that these extremes may yield. In comparison, it was maintained that a longitudinal approach to tracking changes in language in individual speakers (i.e. a single case study methodology) is most appropriate for facilitating a sensitive and indepth understanding of how and the extent to which AD affects language. This approach is particularly suited for the extremely heterogeneous AD population, where no two speakers may present with the same profiles over time (Lezak, 1995).

2.5 Reasons for variations in results

What is strikingly evident from all these studies, both cross-sectional and longitudinal, is the variation in patterns and rates of decline. Three main reasons may account for these variations.

2.5.1 Different sensitivities of test batteries and rating scales

Various authors identify different rates of decline, but these differences in rates may be reflecting the sensitivity of the measurement tool used (Gray and Della Sala, 1996). For instance Berg et al (1984) concede that an analysis of language and psychometric scores reveal that the 50% of participants who progressed to a more severe dementia rating on the CDR had poorer results on these tests than the other 50% who remained mildly demented. In other words, a single rating category may encompass a large continuum of decline as identified by more sensitive tasks. However the authors still uphold the utility of using global rating scales to stage overall cognitive decline. Another difficulty however arises in that not all global scales have the same amount of subcategories. For instance, the CDR has 5, while the GDS (as used by Bayles et al, 1993) has 7. A comparison of different results regarding rate of loss is therefore complicated by the fact that different stage ratings were used by different authors.

Selection of the language test battery too is problematic. For instance, the tasks constituting the AB in the Faber-Langendoen et al study were taken from an existing aphasia test. However these tests may not be sensitive enough to pick up subtle changes in language, especially in the early stages of AD. 54% of individuals with mild AD in the study were not considered aphasic, but this percentage may be misleading as it may reflect the insensitivity of the test battery, rather than presence/absence of difficulties in language processing. In addition, other language tests such as verbal fluency were excluded from the AB. Had they been included, the proportion of presence of aphasia in the early stages of AD may have been quite different.

Scoring of test performance may also lead to different conclusions. For example, the cut-off point of 3 or more errors on the AB makes the labelling of participants as aphasic/non-aphasic rather arbitrary; one additional error may place the individual in a completely different category of 'aphasic', and strong conclusions are drawn using this label. As Bayles et al (1993) note, 'non-aphasic' may only be one end of the continuum, thereby rendering the discussion of subtypes of AD artificial. Furthermore, use of the gross score gives no insight into where the impairments lay (e.g. mainly on the comprehension subtest, or spread over across all subtests).

In summary, the tests included in the test battery, and the use of global versus task-specific scores, all combine drastically to influence which results are yielded.

2.5.2 Task Complexity

Bayles, Tomoeda and Trosset (1990: 508) claim that "Alzheimer's Disease would be expected to impair complex processes more rapidly than simple ones". In other words, the more complex the task, the more likely it will be affected in AD. However, analysing what makes a task more or less complex is controversial.

Bayles et al (1993) define difficult tests as those which challenge healthy subjects, but do not elaborate what exactly makes a task more or less challenging. In another paper, Bayles et al (1990) explain their finding that naming ability was less impaired than category recall and recognition as a function of task complexity. Naming involves identification of the item, while categorisation involves recall of the category as well as identification of the stimulus. In other words, by comprising an extra sub-component, the categorisation task is a more complex process, and therefore is more impaired in AD. Similarly, in their study of 152 AD patients, Bayles, Tomoeda and Trosset (1992) note that co-ordinate and superordinate naming are most vulnerable to mild dementia. The authors describe these tasks as being generative and requiring recall of conceptual and linguistic information. Presumably, the two sub-components render the task itself more difficult and complex. Such a presumption can stem from either of two (mutually inclusive) theoretical reasons (as discussed by Nebes, 1989):

(i) These two tasks are heavily attention dependent and therefore are most impaired (c.f. the Automaticity Hypothesis)

(ii) Self-initiated tasks (e.g. generative naming) are more difficult to carry out than ones where the actual task itself provides a cue to retrieval (such as a confrontation naming task).

A complementary explanation comes from Tesak (1994): the more cognitive demands a task makes, the more difficult it is thought to be. For instance, grammatically complex sentences are more demanding than simple sentences, and they have been shown to rely heavily on working memory as well as language comprehension modules (Gathercole and Baddeley, 1993). However, Bates et al (1995) state that to fully determine what makes some structures more difficult than others requires an enormous amount of research into grammatical and lexical norms for frequency, age of acquisition and so forth - information that is as yet severely lacking, especially with regards to grammatical forms (see 1.3 for discussion on cue cost/validity).

Another idea put forward is that different tasks sap differing amount of resources (e.g. Waters, Caplan and Rochon, 1995). However, there is no independent way in which one can gauge the amount of resources a task taps (Styles, 1997), nor has the actual nature of these resources been specified (Allport, 1980). Furthermore, different tasks may be more/less complex for different people. Premorbid styles and abilities are important in this regard. For instance, a mathematician will find mathematical tasks considerably less demanding than an artist may. In addition, motivation plays a role in determining how much effort an individual will put into completing a task (Clark and Robin, 1995). In this light, task complexity is not uniform for all people at all times.

2.5.3 Different anatomical correlates

A source of heterogeneity may stem from the fact that plaques and neurofibrillary tangles may affect different parts of the brain in different people at different stages of the disease (Henderson, 1996). In this manner, depending on where and when the plaques arise, individual variations in rate and pattern of decline can be expected.

2.6 Issues arising from studies on AD

Several issues occur as recurrent themes in the literature on monolingual AD that are pertinent for this study.

2.6.1 The relationship between language and cognition

Several authors (e.g. Faber-Langendoen et al, 1988; Leikin and Peretz, 1998) contend that aphasic symptoms indicate a specific problem with language that is not merely a reflection of impaired cognition. However others argue that on closer scrutiny, those language problems can indeed be considered secondary to diffuse cognitive involvement, and that a strong interplay between cognitive skills and language skills exists (e.g. Bayles et al, 1993; Ober and Shenaut, 1998; Perkins et al, 1998). For instance, on a procedural discourse task, recall and organisation of information from long-term memory stores are involved (Ulatowska et al, 1988). The authors suggest that attentional deficits result in a failure to include all relevant information, rather than an inability to retrieve the necessary components. Similarly it has been demonstrated that an impairment in working memory leads to a difficulty understanding sentences. The more propositions in a sentence, the more difficulty speakers with dementia have in holding the information in working memory (Waters, Rochon and Caplan, 1998). As a final example, Perkins et al (1998) have demonstrated how memory deficits and slowed information processing abilities may compromise conversational discourse skills in speakers with AD.

The interplay between language and cognition appears to be crucial. Hartman (1991) notes that, because of the diffuse neuropathology associated with AD, many cognitive deficits can occur simultaneously, and adversely affect performance across different tasks. For example, confrontation naming may be compromised by visuo-perceptual impairments. Hartman argues that it is therefore imperative to scrutinise links between different domains in order to determine how different deficits impact on task performance.

2.6.2 Institutionalisation

The influence of social factors on cognitive decline in AD has been questioned. However, it appears that when carefully scrutinised, decline in AD is more likely to be determined by neuro-pathological changes in the brain as opposed to social factors (Gray and Della Sala, 1996; Katzman, Brown, Thal et al, 1988).

2.6.3 Normal aging

The question which changes seen in language in AD are due to the pathology and which are due to normal aging has been asked, especially in the mild stage of dementia. Nicholas, Barth, Obler et al (1997) summarise that although changes in language do occur with normal aging, the problems seen in AD are more severe and different in nature to those seen in elderly control subjects. For instance, individuals with AD are less able to make use of cues to aid naming ability, and make more errors that are off-target. Emerging very strongly from longitudinal studies using matched controls (e.g. Bayles et al, 1993) are findings that the normal control subjects did not show any deterioration as opposed to participants with AD who demonstrated significant progressive deterioration over time.

2.6.4 Difficulties assessing individuals with AD

Due to impaired attention and concentration spans, and fluctuations in compliance, the AD population is a difficult population to assess (Lezak, 1995). Therefore assessments should cater for these fluctuations by keeping data collection brief, or at least have the option of dividing up the test battery into shorter sub-sessions to be administered at another time, should the individual not be able to participate any longer.

2.7 Implications for the present study

2.7.1 Defining 'pattern' and 'rate'

While the present study makes use of a global rating scale to stage the dementing process (mild, moderate severe), the battery of language and neuropsychological tests was compiled by including both subtests from existing test batteries as well as self-devised tasks. There thus is no global rating to be calculated from the test battery. Rather, a discussion of patterns of impairment considers each separate component assessed (i.e. naming versus comprehension versus discourse versus memory), describing patterns qualitatively and by using statistical analyses where appropriate.

Furthermore, a distinction is made in the study between pattern versus severity of impairment. When analysing results, whether a different pattern of impairment between languages exists is determined according to whether the same tasks across languages are spared or impaired. The *degree* to which they are impaired is discussed separately. The rationale for making the distinction between pattern and severity is that a similar pattern of impairment can exist between languages in that (for instance) memory tasks are impaired while naming tasks fall within normal limits. However in L1, memory tasks may be less affected than their L2 counterparts. The pattern is the same; the degree of deficit varies.

With regards to rate of attrition, this is signified both by statistically significant drops in formal test results, and by qualitative differences, for example in conversational ability, as revealed by a conversation analysis. (For further details, see Chapter 4).

2.7.2 Methodology

Since the present study is a longitudinal one, it was decided to adopt a single case study design. Very little is known about changes in language in bilingual speakers with dementia.

Therefore, before any generalisations can be made, detailed and complete assessments are required to begin to compile a picture of what happens to the two languages over time. It is not helpful to average out any variations in the data obtained, as happens in group studies. These variations may facilitate crucial insights into the rate and pattern of loss over time - insights which as yet remain largely untapped.

In order to gain a fuller understanding of what happens to a speaker's two languages, an eclectic test battery was selected. The battery drew on findings from the monolingual literature, incorporating tasks shown to be sensitive to the mild to moderate stages of AD. Since participants in the study fell into the mild to moderate impairment categories, tasks sensitive to changes in the late stages of AD (such as phonology) were omitted. In addition, since the role of cognitive decline has been heavily implicated in determining linguistic decline, cognitive tasks were also included in the test battery. Finally, a method of assessing functional communication was included as functional decline does not necessarily mirror impairments identified on formal test (Frattali, 1992; Scherzer, 1992). The choice of methodology to assess functional communication is discussed in 3.3.4. For further details on the test battery, the reader is also referred to Chapter 4.

2.8 Summary

This chapter provided an overview of changes in language and cognition subsequent to the onset of AD in monolingual speakers. Pertinent studies were reviewed and reasons for why variation in results occurred were discussed. One main conclusion was that different methodologies result in different findings. Therefore, in order to ensure as accurate an assessment as possible, this chapter is convincing in presenting motivation for using an eclectic approach when compiling a test battery. The battery should include both global scales to allow broad comparisons across time and speakers, as well as specific tests of sufficient sensitivity to pick up even slight variations in language and cognition. A longitudinal single case study design is most appropriate for identifying and tracking changes in each individual over time in a thorough and detailed manner. It overcomes difficulties associated with cross-sectional studies and group study designs, thereby facilitating a highly sensitive exploration of a highly variable disease. The final section of the chapter discussed several implications for the present study arising from the literature review. These included the need to explicitly define terms such as pattern and rate; the advantage of a longitudinal approach especially for a study taking a first detailed look at a speaker type; and the need for an eclectic yet complete test battery.

Chapter 3
REVIEW OF PREVIOUS REPORTS OF BILINGUAL SPEAKERS WITH DEMENTIA

Introduction

This chapter sets out to review the few published studies on bilingual dementia. The aim of the section is to describe each of the studies, detailing the methodology employed and results obtained. The strengths and weaknesses of each approach will be reviewed in order to draw methodological implications for the present study, and in order to compile an overview of results against which findings from the present study can be compared.

Each study will be discussed separately, concentrating on formal language and cognitive tests administered, and language mixing difficulties observed. Thereafter, issues of concern common to all of them will be highlighted. Finally, ways in which the present thesis overcomes the identified problems from previous studies will be flagged. In particular, a new approach to the analysis of language mixing at the level of conversational discourse will be discussed, one which has the potential to overcome the controversial language choice/separation dichotomy that confounds recent studies on bilingual dementia.

The final section of this chapter reports the main questions of the study and the hypotheses proposed.

3.1 Case Studies

Introduction

Using one or two languages depending on the context and interlocutor is a skill healthy bilingual speakers manage with ease. They are able to select the appropriate language to speak for a particular occasion, even when that choice depends on a complex interaction of topic, setting, participants and so forth. They are also able, when needed, to maintain strict separation between their languages - as for instance when speaking to a monolingual speaker of their language. In many bilingual communities apparently random switching between languages and mixing them together is a common occurrence. However, despite its apparent randomness, the types and degree of mixing and switching tolerated are highly structured (Grosjean, 1982). Still, in the same speakers, when needs be, they can suppress this behaviour and speak as 'monolinguals'. However, anecdotal and preliminary studies have suggested that bilingual speakers with AD, even in the early stages of deterioration, can have problems selecting the appropriate language, and maintaining conversations in that language once appropriately chosen.

Two mechanisms underlying inappropriate language use in bilingual AD speakers have been postulated to account for such behaviour. The first is a language choice problem, whereby the speaker fails to make use of situational cues (e.g. interlocutor is monolingual), and therefore selects the incorrect language in which to converse. The second mechanism is termed a language separation problem, where the individual has difficulty inhibiting the non-selected language when speaking in a monolingual situation i.e. keeping the two languages separate during production. At the same time however, the speaker remains aware which language should be used.

Using the above distinction of a language choice versus a language separation problem, most of the few studies on bilingual AD have investigated discourse management along those parameters. Researchers set out to answer questions such as whether problems with language choice and/or separation occur in every bilingual speaker with AD; whether these difficulties relate to severity of dementia; whether conversations in one language are more prone to choice and/or separation problems than others; and whether the less dominant language is more prone to language interference.

Several studies investigating language mixing at the level of conversational discourse also included a more formal analysis of language skills, using subtests of existing language tests such as the BDAE. However, formal investigations of cognitive skills such as memory and attention were comparatively sparse. Where provided in the published article, these details will be included in the review below.

3.1.1 Dronkers, Koss, Friedland et al (1986)

These researchers studied a multilingual demented woman whose mother tongue (L1) was Dutch. She learnt French at the age of 14, and English at 31, after moving to England. At the time of onset of AD, she was reportedly fluent in Dutch and English, and moderately fluent in French. She would use Dutch primarily, but mixed her languages when speaking to other multilingual speakers, or when fatigued. However, with the progression of AD, she progressively used less English, and spoke more Dutch, even to non-Dutch speakers. Linguistic assessments (details not provided) revealed that both English and Dutch were equally affected. They maintain that the speaker's tendency to use her L1 as opposed to English reflected the typical short-term memory impairment seen in AD, as opposed to a differential impairment of the two languages. However, it is unclear whether or not they had formally assessed memory skills.

3.1.2 De Vreese, Motta and Toschi (1988)

The authors discuss NT, a 65 year old male, in the advanced stages of dementia. He spoke three languages which he used professionally and personally until his retirement. Italian was his home language; French was learnt at school at the age of 13; English was learnt formally at the age of 28.

Methodology

- Administered the Mini-Mental State Examination (MMSE; Folstein, Folstein and McHugh, 1975), and the Dementia Scale (Gottfries, Brane and Steen, 1982)
- Administered the International Aphasia test Battery (Prevedi, 1975), but in Italian only.
- Multilingual examination involved eliciting a conversational speech sample, repetition (words, non-words and sentences), reciting a series (days and numbers), visual object recognition, and oral and written comprehension of commands. Most tasks were taken from the Bilingual Aphasia Test (BAT, Paradis, 1987). A translation task was devised, comprising of 5 sentences relating to aspects NT's personal life. He was required to translate the sentences from one language into the other, and vice versa. Each sentence was read aloud and repeated as many times as was necessary before he managed to translate the full sentence.
- Each language was assessed on separate days.

Findings

- Conversational speech in Italian was better than French which was better than English. The last was virtually non-existent. Similar patterns were found for the formal linguistic tests. However, repetition and automatic speech were preserved in all languages. In Italian, the following were observed: word retrieval deficits, perseveration, empty speech with decreased internal coherence, and incomplete, telegraphic sentences. These difficulties were merely listed in the article, and the criteria according to which they were judged or measured were not detailed.
- Language mixing: NT often responded in a different language to the one used by the examiner. Mixing was worst when he was not requested to speak a specific language. Lexical mixing was limited to the spoken modality.
- Repetition and automatic speech were preserved in all languages.

- Table 2 provides raw scores for other formal tests administered. As evident from the table, scores for NT's most proficient language (Italian) were the highest.

	Italian	French	English
Visual Object Recognition (Max=10)	7	5	4
Auditory Comprehension (Max=10)	10	8	3
Written Comprehension (Max=10)	5	1	0

Table 2: De Vreese et al: Formal Test Results

- Translation: a paradoxical translation pattern was evident. NT could not translate from Italian to English on command, but was better in translating from English to Italian. Translation from Italian to French was good. However, NT had great difficulty translating from French to Italian. The authors propose three hypotheses to account for this paradoxical translation pattern:

  i) NT had a premorbid preference for translating from Italian to French. However, this cannot be verified.

  ii) The direct non-cognitive route from Italian to French was used (i.e. the translation equivalent was activated). Evidence from automatic translation supports this theory.

  iii) There is an imbalance in inhibitory resources (c.f. Green - see 1.2.3). However, this theory does not explain why translation from Italian to French was successful, but not from Italian to English. It is plausible that pre-morbid proficiency contributed to the observed pattern: proficiency in English was too low to be able to perform the required task.

The authors conclude that these findings are similar to those from polyglot aphasia (see 1.2). However, they claim that the underlying cause of the problem differs: In dementia, inappropriate language mixing results from decreased attention and self-monitoring, difficulties with changing set, and memory impairments.

Comment

The authors emphasise the influence cognitive decline has on language and communication, and even draw their main conclusion from this assumption. However, even though a brief cognitive assessment was carried out (MMSE), there was not sufficient data yielded from that assessment to facilitate an in-depth analysis of the effect cognitive decline has on language. A more extensive assessment would therefore be required than they conducted before firm conclusions can be drawn.

The authors (like others reviewed for this study) adopt Green's theory regarding inhibition of languages as an explanation for observed phenomena. Many factors must also combine to influence inhibition, such as relative proficiencies of the languages (see 1.2.2). However, the effects of variables such as different proficiencies among languages, and the influence of age of L2 (and L3) acquisition on the patterns of impairments were not considered in this study.

3.1.3 Hyltenstam and Stroud (1989)

These authors studied two bilingual speakers with AD. The first was GM whose home language was German. He acquired Swedish (his L2) at work only later in life. The other speaker, KL, spoke Swedish as her first language, but acquired Finnish at a very early age socially outside the home. She had only spoken Finnish infrequently over the last 35 years before the study. Both were at the advanced stages of dementia (rating scale used not mentioned).

Methodology

- Two separate assessments were carried out on different days; the first in L1 and the second in L2. Each assessment was kept as monolingual as possible.

- Data collected included conversations (involving 9 predetermined topics such as family history), picture description (from the BDAE), the Action Naming Test (ACT; Obler and Albert, 1979), and automatic sequences (e.g. days of the week). Finally, situation-contextualised interactions were recorded (walking around the ward talking about immediately observable activities and objects).
- Language choice was defined as "a process whereby a bilingual speaker, in taking account of situational cues, selects the appropriate language" (p. 208). Language separation referred to "the bilingual speaker's ability to keep two languages apart *in production* when speaking in monolingual mode" (p. 209; their italics). Finally, code switching referred to "a bilingual speaker's alternate use of two languages within the same discourse" (citing Poplack, 1980: 209).

Findings

GM:

- Automatic speech was intact in L1, but GM refused to attempt the task in L2.
- No raw scores were provided for the Action Naming Task (ANT); however, the authors comment that responses were more on-target in L1 than L2.
- When speaking L1, no interference from L2 was noted. However, when speaking L2, language mixing was evident, with GM reverting to L1 when constructing long turns. Code switches were interpreted as appropriate according to criteria suggested by Poplack (1980). Automatic speech was intact in L1, but could not be elicited in L2.
- Language choice and separation: certain topics favoured the choice of L1 over L2. GM appeared to speak about memories from postulated long term stores in the language in which they were first encoded (i.e. L1). This finding is similar to Dronkers et al (see 3.1.1). In the L2 monolingual interaction, GM generally responded in the appropriate language initially. However, this was followed by a mixed utterance (both languages), and then an

expanded utterance in L1. He was apparently better at keeping to L2 when much contextual support was available (e.g. walking around the ward).

The authors interpret this behaviour as being a language separation problem, while language choice appears relatively intact. They contend that language choice and separation abilities depend on two different pragmatic abilities. The former depends on the ability to take the speech situation into account, while the latter depends on the ability to inhibit the unwanted language. GM appears to have difficulty inhibiting his L1 when speaking in a monolingual L2 situation.

- GM appears to be more successful in an L1 interaction than an L2 situation. Evidence for this is that automatic speech is intact in L1. Furthermore, a large amount of L1 was mixed into the L2 interaction. An increase in focused topic treatment with a concurrent decrease in available turns was evident only in the L1 situation.

The authors explain this behaviour using a resource allocation theory within a model that assumes a limited capacity of resource availability. They suggest that his L1 (his mother tongue) is more available to him, and therefore more cognitive resources are available for processing the content/topic, monitoring the output, and selecting lexical items. In contrast, aspects of processing that are fairly automatic in L1 require controlled processing in L2. More resources are utilised in L2 when processing syntactic structures (for example) and therefore fewer resources are available for the afore-mentioned activities such as monitoring output. In addition, the authors contend that resources are deployed for inhibiting a dominant L1 when speaking in L2. However, when speaking L1, the L2 is not activated and therefore does not need to be inhibited; inhibition is unidirectional. Thus, when speaking in L2, resources are also required to inhibit the L1, and therefore fewer resources are available to process the more effortful L2.

KL:

- Very little language was produced in both interactions. Her utterances were generally unrelated to the topic in both situations, and no automatic speech could be elicited. No raw scores are provided for the ANT, but the authors comment that responses were vague and off-target.
- No difference was noted between L1 and L2. This is surprising as she only used L2 infrequently over the past 35 years.
- Language choice and separation: KL spoke the appropriate language in each interaction. However, reports from her family indicated that she frequently used the inappropriate language, for instance speaking L2 to an interlocutor who only spoke L1. According to the authors, this suggests a language choice problem. The fact that she could keep her two languages separate in production however indicates that there was no language separation problem.

Comment

Although the notions of language choice and separation abilities were upheld as crucial in the study of bilingual dementia, the authors offer no detailed explanation of what factors constitute these abilities. The terms are vague and the criteria for differentiating the problems are ambiguous. The authors claim GM did not have a language choice problem. However, they do not stipulate how such a problem would present. Luderus (1995) observes that GM's problem of language separation could just as easily be classified as a language choice problem based on the following evidence:

- In the L2 interaction, the appropriate language was only used in 10/76 utterances. The remaining talk pertained to his childhood and early adulthood. The topic may therefore have influenced his language choice.

- In the situation-contextualised interaction, only four utterances were in the inappropriate language (L1). This indicates that he can separate his language and inhibit L1.

The bulk of the assessment focused on the level of discourse. Discourse however is dependent on the integration of multiple abilities, such as short term memory, attention, pragmatic abilities such as topic maintenance, as well as specific linguistic skills such as word retrieval. If one wants to describe and account for language difficulties at the discourse level, such skills also have to be assessed in order to account for all contributing parameters. The authors maintain that language choice ability is a pragmatic skill whereby the speaker must take the interlocutor and context into account. However they did not carry out an extensive assessment of all relevant parameters that would provide a justification for classifying behaviour as either a choice or separation difficulty.

Following from the above comment, the author's use of a resource allocation theory as a post-hoc explanation for language separation difficulties is problematic. They offer no other data to support their retrospective analysis of depleting cognitive resources. For instance, they did not formally assess cognition, and therefore could not demonstrate deteriorating cognitive skills as identified on formal test (working memory, information processing, attention etc.). They use the resource allocation theory to account for a language separation problem in one speaker, but presumed that resources were sufficient to meet all language separation demands in the other participant. There is no proof for this beyond mere speculation and retrospective assumptions.

3.1.4 Hyltenstam and Stroud (1993) (also Hyltenstam, 1995)

The aim of this study was to examine language choice and separation when speakers were required to use their L2. Six females were studied. Two were in the early stages of dementia; two were in the early middle phase; and the last two were in the late middle stage (based on

Obler and Albert, 1984). All had Finnish as their L1 and Swedish as their L2. L2 was acquired later on in adulthood and was used regularly by all subjects prior to the onset of AD.

Methodology

- Both monolingual and bilingual interactions were recorded (but only the monolingual situations are discussed in the write up). Each language was assessed on a different day.
- Data collected included spontaneous conversations, and formal tests of object and action naming, repetition (sentences of increasing length and decreasing frequency of lexical content), automatic sequences, translation, and metalinguistic tasks. Unfortunately no description of these last tasks was provided. For the naming tasks, speakers received a point for naming a noun correctly, no matter what language they used. A language history questionnaire was completed by relatives.

Findings

- Table 3 provides the raw scores obtained on two of the tests administered in L2. It appears that a correlation between stage of dementia and successful task performance exists.

	MA	JE	VH	AKJ	RA	KJ
Naming (Max = 26)	13	25	19	9	0	4
Repetition (Max = 44)	25.5	Not administered	5.5	2.5	4.5	Not administered

Table 3: Hyltenstam and Stroud: Naming and Repetition Results Participants are ordered according to stage of dementia from least impaired (MA) to most impaired (KJ).

- Language choice and separation: there was a vast range in speakers' ability in language choice, ranging from mostly appropriate to inappropriate. Many appeared unaware that they were not using the same language as the examiner. All showed a difficulty with language separation productively, but their comprehension was reportedly intact. All participants except two frequently lapsed into their L1 during an L2 conversation. RA demonstrated minimal language mixing, while MA was more successful in speaking in her L2.

- The level of language regression did not correlate with increased problems with language choice and separation. This is contrary to De Santi, Obler, Sabo-Abramson et al's (1990) contention (see 3.1.5). Hyltenstam and Stroud suggest that premorbid L2 proficiency must interact with the severity of dementia. The greater the proficiency in L2 premorbidly, the more preserved the language separation and choice abilities remain until later in dementia.

- Code switching generally followed the grammatical constraints adhered to by healthy bilingual speakers. However, much variation was evident among subjects. As Hyltenstam (1995) stresses, one cannot presume that the subject selected the examiner's language as their base language. One must first determine which is the matrix language and which is the embedded language before attempting to analyse code switching behaviour.

The authors explain language mixing patterns in terms of Green's theory: speakers lack the resources to successfully inhibit their L1. They extend this theory, maintaining that the availability of a language also is influenced by frequency and recency of use. L2 may be less available as it has a lower degree of automatisation, and a less appropriate structuring of the L2 language system. It therefore relies more on controlled processing, and more processing resources are required when using L2. This extra utilisation of available resources leaves fewer resources available to successfully clamp down L1 in a monolingual L2 situation.

Comment

Unlike their 1989 article, in this study, the authors make no attempt to separately analyse language choice and separation problems. Rather, they discuss language mixing under the joint umbrella term 'language choice/separation' with reference to Green's theory.

Luderus (1995) takes issue with the proposed theory that L1 (one's first-acquired language) is more difficult to inhibit than L2. She asserts that this theory is negated by the fact that MA did not use L1 at all in the L2 situation. In comparison, MA showed considerable mixing of L2 in the L1 interaction. According to Luderus, this suggests rather that the *order* of language acquisition is a relevant factor. However, this may be a misinterpretation of Hyltenstam and Stroud's argument. They maintain that the success of L1 inhibition depends on the degree of proficiency in L2 rather than the order of acquisition as such. So therefore, if L2 has become increasingly automatised, more resources will be available for inhibiting L1. Furthermore, with regard to MA's mixing of languages in the L1 (Finnish) situation, the authors explain that this interaction may in fact be viewed as a bilingual one, as the examiner also spoke Swedish. MA's code switching may therefore be appropriate, considering that she was one of the two least impaired subjects.

A final criticism of this study is that some of the participants may not actually be bilingual. On a scale of L2 proficiency ranging from 1 (very limited proficiency) to 5 (near-native proficiency), one speaker (VH) scored a rating of 1, while JE and KJ scored a rating of two. Furthermore, in L2 conversations, these three speakers could only produce between 5-15% of their utterances in the appropriate language L2. The rest of the talk was in L1. No information was given regarding past or current pattern of language use. How then can any conclusions be drawn regarding interactions between level of proficiency and stage of dementia when in the first place these speakers may not actually have been bilingual?

3.1.5 De Santi, Obler, Sabo-Abramson et al (1990) (also Obler, De Santi and Goldberger, 1995)

Four Yiddish-English bilingual speakers were included in this study. All spoke Yiddish (L1) at home and English at work. Only one however worked until retirement. 3 of the subjects spoke more than 2 languages, but the other languages were not tested. Speaker B was in the mild to moderate stage of dementia (based on Obler and Albert, 1984); C was in the mid to late stages; D in the moderately impaired stage; and E was moderately to severely impaired.

Methodology

- Speakers were interviewed on 2 separate occasions on separate days; firstly with a monolingual English speaker, and secondly a bilingual examiner. The interaction in the latter tended to be Yiddish. When the participant used English, the examiner repeated the utterance in Yiddish, and continued speaking Yiddish.
- A formal language assessment was carried out in both languages. This included subtests from the BDAE (monolingual spontaneous speech sample, automatic speech, repetition, reading, and writing), as well as the BNT and the ACT. No information was provided regarding the translation of the relevant BDAE subtests into Yiddish, nor on the validity and statistical reliability involved.

Findings

- General language behaviour included word retrieval problems, verbal and literal paraphasias, neologisms, perseveration of words and ideas, repetition, unreferenced pronouns, and topic loss. Speakers C and E had naming problems, paraphasic errors, and neologisms in both languages, while D only demonstrated these difficulties in the English assessment. Speaker E showed naming problems and paraphasic errors in English only. English was more impaired with speakers B, D and E. With speaker C (the most demented of the group), both languages were equally affected. According to Obler et al (1995), differential language breakdown could reflect differences in language use, proficiency and age of acquisition, rather than stage of dementia. With regards to the individual formal tests administered, raw scores were unfortunately only provided for the English results, thereby precluding any comparison between the two languages.

- Certain aspects specific to bilingualism were impaired in these speakers with dementia. The participants lost the distinction between talking to bilingual and monolingual interlocutors, and so chose the wrong base language. They also code switched with both examiners (monolingual and bilingual). However, some sophisticated behaviours were maintained, including translation and correction of the examiner's speech. These require both linguistic and pragmatic skills.

- Language choice: Speaker D maintained the appropriate language choice in both interactions. She was the only participant born in America and who had learnt both languages simultaneously at a younger age than the others. The authors suggest that her appropriate language choice could be a consequence of increased practice in bilingual language choice during her life. Speaker B chose the appropriate language in the monolingual situation, but not in the bilingual interaction (presumably the Yiddish interaction, although the authors do not stipulate this). The opposite was true for speaker E. Speaker C chose the incorrect language in both interactions. Obler at al (1995) disagree with Dronkers et al's (1986) contention that language choice problems arise from memory problems. Rather, they claim that impaired language choice results from impaired pragmatic monitoring.

- Code switching: This was linguistically correct for all participants. However the pragmatic aspect of code switching appeared impaired in the speakers who mixed their two languages even though their interlocutor was monolingual.

<u>Comment</u>

Yet again, the authors do not stipulate exactly what errors they consider to constitute a language choice problem as opposed to code switching problems. Luderus (1995) contends that the use of the term 'code switching problem' in this study in fact refers to two different problems. The first is *inadequate* code switching, i.e.: not according to the constraints on normal code switching. Luderus maintains that such a problem seems to occur when the speaker is talking to the bilingual examiner in the L1 situation, where their bilingual children are also present. In these circumstances, code switching may be appropriate, as the speaker knows her child can understand English too. Speakers B and C may therefore not really have a language choice problem. The second problem is *inappropriate* code switching, where code switching occurs when the interlocutor is monolingual. This may be the same problem that other researchers term a 'language separation problem'. Once again, the issue of confusing terminology is highlighted.

A serious flaw in their methodology is that by involving a *bilingual* speaker in the Yiddish interactions, it is unreasonable to expect the participant to be operating in monolingual mode. If they are aware that the interlocutor is bilingual, then any language mixing in such a situation cannot be considered inappropriate.

The authors claim that language choice results from impaired pragmatic monitoring. However, surely pragmatic skills rely on memory too? As with Hyltenstam and Stroud's (1989) study, there is a need to explore more fully the parameters of pragmatics before any firm conclusions can be drawn. A full language and cognitive assessment is required.

3.1.6 Luderus (1995)

This is the only study that has to date involved a systematic, longitudinal investigation of language choice and language separation abilities in dementia. The aim of the study was, firstly, to investigate the extent to which inappropriate use of language results from a language choice or a language separation problem. Secondly, the possible causes underlying a language choice/separation problem were also explored. Changes in language performance were tracked over a period of one year.

Three German-Dutch bilingual speakers with AD were studied. At the first assessment period (T1), all three were moderately impaired (as rated by the CDR). After 6 months (T2), EZ was severely impaired. By the end of the year's period (T3), all three were severely impaired. All participants spoke German as their L1. They left Germany after school to work as housekeepers in the Netherlands. All married Dutch-speaking men. No information is provided regarding the method of L2 (Dutch) acquisition, the pattern of usage throughout their lives, or pre-morbid proficiency in L2.

According to the author, a language choice problem is distinguished from a language separation problem according to directionality and consistency. *Directionality* refers to the direction of language interference, e.g. whether L1 intrudes in a supposedly monolingual L2 conversation only (unidirectional), or whether language interference happens in both L1 and L2 interactions (bi-directional). *Consistency* refers to whether or not a language choice/separation problem will become increasingly more severe over time (in this case, over the year period studied). For Luderus' study, a language choice problem is considered bi-directional (i.e. can occur in a monolingual interaction in either language, not only in an L2 situation). A choice problem is also inconsistent. That is, there is more than a 50% increase in the use of the inappropriate language over the year. This 50% marker was chosen arbitrarily by the author. In comparison, a language separation problem was hypothesised to be uni-directional (i.e. only evident in a non-dominant L2 interaction), as it resulted from an premorbid non-balance between L1 and L2 proficiency. A language separation problem is also considered to be consistent, i.e. there is less than a 50% increase in the use of the inappropriate language over the year.

Luderus used the De Bot (1992) model of bilingual language production to theoretically pinpoint where difficulties of language choice and separation arise. This model (with later modifications and additions by De Bot and Schreuder, 1993) was adapted from Levelt's (1989) 'Speaking' Model describing how language is produced in monolingual speakers.

The various sub-components of De Bot's model include:

(a) Knowledge component - containing information pertaining to general world knowledge and the current interactional setting. While not considered to be language specific, it plays a role in the choice of language to be used (information perhaps gleaned from the discourse model).

(b) Conceptualiser - relevant information is selected and sequenced and a preverbal message is formed. Two stages are involved:

(a) macroplanning - Relevant information necessary to realise communicative intentions is retrieved. Macroplanning remains language independent, but plays a further role in determining language choice based on information fed in from the discourse model.

(b) microplanning - the information is then focused by defining topics and so forth. Language specific encoding occurs at this stage.

(c) Formulator - the preverbal message is converted into a speech plan. Semantics, syntax and morpho-phonological encoding are worked out. Information from the conceptualiser activates the appropriate language-specific formulator.

(d) Articulator - the speech plan is converted into speech itself. It comprises all phonemes and intonation patterns of both L1 and L2.

According to this model, Luderus contends that a difficulty with language choice can be isolated to the Knowledge Component and the Conceptualiser, while a difficulty with language separation happens at the level of the Formulator lower down.

Methodology

- Assessments of L1 and L2 were carried out on separate days. The setting was monolingual, but the examiner did not feign ignorance of the other language during testing. There were 3 test periods, each six months apart.

- Materials used included subtests from the BDAE (conversational speech, confrontation naming, picture description), CDR and MMSE. In addition, a 15-20 minute speech sample was obtained, where pre-determined questions pertaining to the speaker's personal history were randomly introduced.
- Data was analysed firstly according to the presence of a problem. In the L2 (Dutch) interaction, a minimum of 5% of the total number of utterances should be in L1 (German) for a problem to exist. In the L1 interaction, a minimum of 10% of utterances should be in L2 to be regarded as a problem. These percentages were chosen arbitrarily. Data was then analysed according to whether a language choice or separation problem was evident, using the parameters discussed above (directionality and consistency). Finally, intentionality of code switching was analysed (c.f. Giesbers, 1989).

Findings from individual speakers

AS: This speaker showed a language choice problem at T3, where she used the inappropriate language (L1) as the base language in L2 interactions. Luderus explains this behaviour as resulting from disorientation to person. Evidence for this comes from the fact that topics no longer related to the present situation, and instead of using the polite form 'U' in L2, she used the familiar form 'du' in L1.

EZ: EZ showed a language separation problem in the L1 interaction only, throughout the year period. She had a problem inhibiting the dominant language Dutch (in this case her L2) when trying to hold a monolingual conversation in her L1. There was a 42% increase in the use of the inappropriate language over time, very near to the arbitrary 50% cut-off mark. However, since a problem activating L1 was already present at T1, but to a lesser extent at T2 and T3, Luderus suggests that a language separation problem is not always caused by dementia per se.

DH did not demonstrate either a language choice or separation problem, and therefore no further analysis was undertaken.

General Findings

- The three speakers differed in terms of the presence, extent and nature of the inappropriate language use. This is consistent with the findings of other studies (Hyltenstam and Stroud, 1989; De Santi et al, 1990; Hyltenstam and Stroud, 1993). Both inter and intraspeaker variation occurred. The latter refers to changes within one speaker's performance over time.

- Case history factors (e.g. age and context of L2 acquisition) and decreases in processing capacity cannot account for differences between participants, as, according to the author, all three had similar case histories and demonstrated impaired processing capacity over time (as assessed by the MMSE). Rather, Luderus maintains that the occurrence and nature of a language choice/separation problem resulting in inappropriate language usage is determined by the degree of pre-morbid non-balance between languages. If language proficiency is balanced, language separation problems will not occur early on in the disease process, but a language choice problem may. This would depend on the presence and extent of disorientation. If the languages were premorbidly non-balanced (i.e. L1 more dominant than L2), then a unidirectional language separation problem will manifest itself with dementia, depending on the amount of processing capacity available. According to Luderus, a language choice problem will be excluded as the speaker loses their ability to 'choose' the non-dominant language.

Comment

This is the first published study that attempts not only to define a language choice/separation problem, but also to provide parameters to assess in order to ascertain whether the problem is one of choice or separation. However, there are major weakness in the study.

The first weakness is the arbitrary nature by which cut-off points for language choice versus separation problems were selected. Luderus acknowledges the percentages she chose for detecting the presence of a problem, as well as consistency of inappropriate language use were arbitrary. Her interpretation of the data was therefore based on too loose a methodology, but all the analyses hinged critically on those figures. For instance, with EZ, inappropriate language use increased by 42% over time. Luderus randomly chose 50% as a cut-off mark to determine whether inappropriate language use was consistent or not. If she had settled for 40% for argument's sake, her interpretation of EZ's problem would be drastically altered. EZ's inappropriate language use would then be inconsistent, and contrary to results from directionality and unintentional code switching, would indicate a language choice problem.

To apply rigid cut-off scores with confidence, norms need to be established. We need to know what is 'normal' before we can make judgements about the presence and extent of abnormality. However, these norms are difficult to obtain, as the extent of language mixing will differ from healthy bilingual speaker to healthy bilingual speaker, based on the situation, topic, conversational partner and so forth. It therefore appears that this is an unrealistic goal. Some other means of investigating language mixing in AD therefore needs to be developed.

A second weakness of the study is that even though case history factors such as age of L2 acquisition were alluded to, no formal investigation into premorbid language proficiency or pattern of language use was reported. This is a glaring omission, especially since the author asserts that the balance between an individual's two languages premorbidly will determine the nature of the problem (choice/separation) in dementia. Furthermore, Luderus argues that a language separation problem is not necessarily caused by dementia, because EZ showed language mixing behaviour at T1, the initial period of data collection. However, EZ was already in the moderate stages of dementia at that first assessment period. No mention is made of language mixing behaviours when she was in the mild stages of AD, nor even what her pre-morbid style of language mixing may have entailed. It is therefore highly problematic to claim with any certainty the effects AD may or may not have in causing a language separation problem.

A third weakness is that Luderus chose to omit the analysis of results from formal language assessment in this report. Those results would have facilitated a greater insight into the relative balance/non-balance between each speaker's two languages. As with other studies reviewed here, a detailed linguistic (and cognitive) assessment was neglected, thereby significantly weakening any interpretation of the observed deficits.

3.1.7 Cooper (1995)

Cooper's study differs from the others reported in this chapter in that it is a small group study concentrating on sub-areas of semantics only. Six French-English bilingual speakers were studied. Three were in the early stages of dementia, and the other three were in the middle stages (according to the MMSE). All learnt their L2 (English) at school, and used their two languages interchangeably. Six matched control subjects also participated.

Methodology

- Data was collected for each language on two separate days.
- The Confrontation Naming and Verbal Fluency subtests of the BAT were administered in both languages, as was a two minute topic-directed interview (work experience). The discourse sample was analysed for evidence of word finding difficulties which included

phonemic, semantic and neologistic paraphasias, and overt comments indicating word retrieval problems.

Findings

Table 4 tabulates the raw scores obtained, where similar results were found for each speaker's two languages.

Speaker	Confrontation Naming (Max = 17)	Verbal Fluency (animals named in one minute)	Discourse: Word retrieval difficulties
EDAT 1	L1: 17 L2: 12	L1: 8 L2: 5	L1: 1 in 18 utterances L2: 4 in 10 utterances
EDAT 2	L1: 16 L2: 13	L1: 11 L2: 7	L1: 0 in 33 utterances L2: 10 in 26 utterances
EDAT 3	L1: 17 L2: 17	L1: 8 L2: 5	L1: 1 in 19 utterances L2: 0 in 14 utterances
MDAT 1	L1: 13 L2: 16	L1: 7 L2: 6	L1: 1 in 19 utterances L2: 2 in 14 utterances
MDAT 2	L1: 13 L2: 5	L1: 0 L2: 2	L1: 3 in 12 utterances L2: 1 in 12 utterances
MDAT 3	L1: 11 L2: 7	L1: 1 L2: 2	L1: 2 in 8 utterances L2: 2 in 16 utterances

Table 4: Cooper: Test Results EDAT = Early stage of Dementia of the Alzheimer's Type. MDAT = Mid stage of Dementia of the Alzheimer's Type.

- Speakers with AD had greater word retrieval problems than the controls subjects.
- No statistically significant differences were evident between EDAT and MDAT results, nor between L1 and L2 scores, for any test. However, qualitative differences were evident on L1 versus L2 performance. For instance, on the Confrontation Naming task, speakers gave a more variable pattern of error responses (e.g. semantically related versus visually related).
- Cooper attributed the lack of statistically significant results to the small sample size and the heterogeneity of responses among speakers.

Comment

Cooper's study can be viewed as a small pilot study in that only 6 speakers participated, and each task was only administered once. Results therefore must be interpreted with caution.

3.1.8 Summary of Findings from Previous Studies

It is difficult to draw generalisations from studies to date. Of the few case studies published, individuals have differed in terms of stage of dementia, age of second language (L2) acquisition, pattern of language use over time, degree of proficiency in either language, and structural differences between languages (e.g. English-Yiddish versus Dutch-German) - all of which may be surmised to affect performance (Paradis, 1997; see 1.2.2). Such parameters were not even fully reported in some papers, thereby rendering comparisons even more difficult. Furthermore, the types of assessments carried out differed from study to study. Some included full language and neuropsychological batteries, while others only reported relatively superficial discourse analyses. However, some conclusions can be drawn.

Table 5 summarises the participants' details and findings of the studies reviewed (excluding Cooper). Findings indicate that not every bilingual individual with AD demonstrates inappropriate language use (e.g. DH). There is large variability in extent of inappropriate language use, with some individuals showing more language mixing than others. Generally, there does not appear to be a relationship between AD severity and an absence/presence of language mixing problems. For example, DH (moderately to severely impaired) had no difficulty keeping two languages apart, while B (mild to moderately impaired) demonstrated a difficulty in this regard when conversing in L2. For many speakers, their L2 was more affected than their L1 with the onset and progression of AD. However, there were exceptions, namely MA and EZ who were better in their L2, and DH and KL, whose languages were equally affected. Most speakers showing a language mixing problem had difficulty with inhibiting the dominant language (L1) when speaking in the less-dominant language (L2).

Authors	Speaker	Age	Stage dementia	Languages	Age L2 Acquisition	Findings
Hyltenstam & Stroud, 1989	GM	89	Advanced	L1 German L2 Swedish	Adulthood	Language mixing in L2 interactions only.
	KL	83	Advanced	L1 Swedish L2 Finnish	Very early age	L1 = L2
Hyltenstam & Stroud, 1993	MA	73-94	Early	All: L1 Finnish L2 Swedish	All: Adulthood	L2 better
	JE		Early			L1 better
	VH		Early-mid			L1 better
	AKJ		Early-mid			L1 better
	RA		Mid-late			Minimal language mixing problems
	KJ		Mid-late			L1 better
De Santi et al, 1990; Obler et al, 1995	B	96	Mild-mod	L1 Yiddish L2 English	18 yrs	Language mixing in L2 interactions only.
	C	96	Severe	L1 Yiddish L2 English	16 years	Language mixing affecting both languages.
	D	89	Mod	L1 English L2 Yiddish	0 yrs	Language mixing in L2 interactions only.
	E	87	Mod-sev	L1 Yiddish L2 English	19 yrs	Language mixing affecting both languages.
De Vreese et al, 1988	NT	65	Advanced	L1 Italian L2 French L3 English	L2 at school L3 adult-hood	L1 > L2 > L3 reflected in both formal tests and conversation.
Dronkers et al, 1986	A	76	Mod-sev	L1 French L2 English	31 years	On formal tests L1 = L2. In conversations, language mixing affecting L2 interactions.
Luderus, 1995	AS	88	Mod-sev	All: L1 German L2 Dutch	All: After school	Language mixing in L2 interactions only.
	EZ	82	Mod-sev			Language mixing in L1 interactions only.
	DH	86	Mod-sev			No language mixing occurred.

Table 5: Subject Description (from previous studies) L1 = first language acquired; L2 = second language acquired. Mod = moderate; Sev = severe

3.2 General Issues

The studies reviewed above attempted to explore the issue of inappropriate language mixing in bilingual speakers with AD. Most studies screened cognitive skills, and used the idea of depleting cognitive resources to explain the patterns of language mixing observed. A secondary concern was performance on formal language tests and how they mirrored conversational discourse performance. However, many difficulties with these studies were noted. In this section, the glaring difficulties with terminology and methodology common to all the studies reviewed are discussed, and in the following section, methods to overcome these difficulties for the present study will be presented.

3.2.1 Terminology

Most of the articles reviewed use the term 'language choice' and 'language separation'. However, the various authors provide different definitions for these terms. For instance 'language choice' is defined as "a bilingual speaker's choice of one of his/her languages, with or without in-mixing of the other, for a specific discourse" by Hyltenstam (1995: 306). De Santi et al (1990: 224) adopt a briefer but broader definition: when speakers "choose to speak any one of their languages". Luderus (1995: 64) however offers a more specific definition of a language choice problem: it is the use of the inappropriate language whereby speakers "incorrectly specify the conceptual structure of utterances as to the language in which they should be produced". These three definitions vary in their scope of focus, from broad to more specific.

Likewise, there is a range of different definitions provided for 'language separation'. Hyltenstam and Stroud (1989: 209) define it as "the bilingual speaker's ability to keep the two languages apart in production when speaking in monolingual mode". Luderus' (1995: 65) definition offers an account of the cause underlying a language separation problem: "the dominant language is not inhibited to a sufficient extent, when they [speakers with dementia] attempt to produce the non-dominant language". In contrast, De Santi et al (1990: 224) do not refer to the term 'language separation'. Instead, they refer to a 'code switching problem', which they define as mixing "words or phrases of one language into the other". However, they speak of both code switching and language choice. It remains ambiguous as to whether they regard the same phenomena they label a 'code switching problem' to be the same phenomena others have termed a 'language separation problem'.

Thus, not only do the same terms refer to different phenomena, but different terms may in fact be referring to the same phenomena (for example De Santi et al's 'code switching' and Luderus' 'language separation'). The concepts of language choice and separation have not been neatly defined nor unambiguously described in the literature. More importantly, with the exception of Luderus (1995), definitions offered do not indicate *how* the presence of a language separation/choice problem is established, nor objective criteria for how to distinguish between them.

For instance, if a person is addressed in English and starts to reply in French, does this indicate a problem with choosing the right language in the first place, or rather that the speaker knows what language they should be speaking, but are unable to inhibit the other language? Models of bilingual language choice and switching have been proposed (e.g. De Bot, 1992) which permit a definition of where in language production breakdowns leading to a choice or separation problem might be located. However, these models have not been systematically exploited to answer the choice/separation issue in bilingual ongoing conversational interactions, or, where definitions have been derived from such models, they have been applied without regard to the methodological problems posed in fitting actual surface language behaviour to any other claimed category of breakdown. Consequently, while it may be possible to offer theoretical definitions of choice versus separation, in practice they have failed to lead to a clear-cut distinction. The result is that the application of and distinction between these labels has thus far been largely arbitrary. This point is particularly illustrated in Hyltenstam and Stroud's (1989) study, where they interpret GM's behaviour to be indicative of a language separation problem, while Luderus (1995) suggests it can just as easily be interpreted as a language choice problem. Furthermore, the conceivable possibility that an individual may have both a language separation and a language choice problem has also been ignored. The presence of both problems in one individual may therefore have confounded data analysis to an even greater degree.

In conclusion, while it is feasible to derive theoretical definitions of language choice and separation, when actually presented with data from conversations, what becomes immediately apparent is the huge gap between neat theoretical distinctions and conversational behaviour one has just transcribed. The distinction between language separation and language choice so easily defined on paper is confusingly blurred. When a healthy bilingual speaker chooses which language to speak, this choice is influenced by the situation, topic, interlocutor, and many other factors (Grosjean, 1982). In AD, a number of problems such as disorientation, lapses in attention, and so on, may result in inappropriate language mixing. Since it is impossible to determine without doubt what the underlying cause of inappropriate language mixing is, the application of the choice/separation label remains a fundamentally arbitrary decision.

3.2.2 Methodology

- As the terminology used in the reviewed articles is conflicting, researchers may choose different assessments to investigate what they regard as a language choice/separation problem. For instance Luderus (1995) suggests that a decrease in processing capacity underlies a language separation problem. She therefore includes a cognitive screening test (MMSE). In contrast, De Santi et al (1990) do not assess cognition formally at all.

- Different methodologies will yield different conclusions. Even in studies on monolingual dementia, the order of language decline is dictated by what type of assessments were carried out. For instance, if comprehension was not assessed when investigating the language of an individual with mild dementia, the researchers would obviously not include comprehension deficits as part of the symptomatology at that stage.

- None of the reviewed articles gives a rationale for inclusion/exclusion of certain language and/or cognitive tests. For instance, De Santi et al (1990) choose several sections of the BDAE, as well as the BNT and Action Naming test. However, they did not report why these tests were selected, nor why cognitive testing was omitted. Hyltenstam and Stroud (1989) administered fewer language tests but also do not account for their choice in selecting/omitting the different parameters they assess. They also tested naming ability, but their scoring system (a point for each correct label irrespective of the language used) did not allow for language specific comparisons to be drawn. De Vreese et al (1988) strongly acknowledged the role of cognition in influencing the language disorders seen in dementia, but did not assess cognitive parameters in detail apart from an MMSE screening.

- Leading on from the above point, most articles reached strong conclusions as to whether a subject had a language choice or separation problem. However, the assessment batteries themselves was randomly chosen and incomplete. For instance, De Vreese at al (1988) emphasised the influence of cognitive decline on communication. However, it is felt that their screening of cognition (MMSE) cannot yield enough data to facilitate an in-depth analysis of the effect cognition and cognitive decline has on language. Luderus (1995) claims that the relative balance/non-balance between languages will determine whether a language separation or choice problem will occur in dementia. However, not only is the formal assessment of the participants' language sparse, but she does not even report the findings of that assessment battery in her book. A detailed linguistic and cognitive assessment was not undertaken, and therefore her interpretation of observed communication deficits was significantly weakened. In another example, Obler at al (1995) disagree with Dronkers at al (1986) who claim that a language choice problem occurs because of memory problems. However, Obler et al do not even screen memory abilities and it is therefore unclear how they can refute Dronkers et al's hypothesis without the relevant data.

- All the reviewed articles utilised an ad-hoc discourse analysis. These analysis were relatively informal and incomplete. One cannot reach a generalised conclusion about the nature and extent of inappropriate language use without fully exploring as many aspects influencing language use as possible (for instance, memory and attention). Furthermore, whenever the reviewed researchers did assess some language skills formally, no attempt was made to interrelate those formal investigations with problems encountered at the level of conversational discourse and inappropriate language use.

- Interlocutors themselves were sometimes bilingual (such as in the De Santi (1990) study), and language mixing on behalf of the subject can therefore be considered to be pragmatically *appropriate* in such cases.

- The cut-off scores used to distinguish between language choice and language separation problems in the Luderus study were chosen at random, and were not based on the individual's pre-morbid code switching behaviour, nor on any patterns observed in healthy bilingual speakers, or indeed in any other bilingual population.

In light of the terminological and methodological concerns, many of the case studies reported thus far in the literature can be considered misleading in describing language choice and separation behaviour in the bilingual AD population. There is therefore a pressing need to tackle the issues of inappropriate language mixing in a more structured and less subjective manner.

3.3 Overcoming the problems encountered by previous studies on bilingual AD

3.3.1 Complete test batteries

Past studies on bilingual speakers with dementia have mainly concentrated on discourse (with or without a cursory formal screening of cognitive and language skills). When formal language and cognitive tests were included, these were not always administered in both languages. Furthermore, no one study has investigated all those parameters in any of their speakers (discourse, formal language tasks, and cognitive skills) for both their languages. However, in order to draw an informed conclusion about the impact cognitive deterioration may or may not have on language abilities, as such researchers have tended to do, an investigation of cognitive abilities is surely necessitated. The present study overcomes these shortcomings by including a wide ranging, detailed test battery, targeting both formal language and cognitive tests, and an ecologically-valid analysis of conversational interaction (discussed more fully in 3.3.4).

3.3.2 Bilingual versus Monolingual Mode

When investigating inappropriate language mixing, some studies (e.g. De Santi et al, 1990; Obler et al, 1995) failed to ensure that the participants were operating in monolingual mode, so that any language mixing in such a mode would be considered inappropriate. The present study aims to solve that difficulty by ensuring that each language is assessed separately, on different days. Interactions recorded for the conversation analysis will be with a monolingual speaker of the relevant language, thereby ensuring that the participants are in monolingual mode.

3.3.3 Speakers as their Own Control

To overcome the difficulty of setting cut-off scores that differentiate between 'normal' versus 'inappropriate' language mixing behaviour, the present study uses each speaker as their own control. Changes in language mixing performance over time are compared to the original baseline measures obtained on the initial assessment.

3.3.4 Conversation Analysis

The existing analyses of conversations in bilingual speakers with AD can be criticised as being theoretically ambiguous and incomplete in that (with the exception of Luderus) no systematic analysis of behaviour was undertaken. Rather, analysis of discourse was seemingly post-hoc and was not driven by any theoretical model nor even with recourse to published protocols of discourse analysis (e.g. Prutting and Kirchner, 1987). Therefore, there is a pressing need for a theoretically sound yet comprehensive methodological tool with which conversational discourse can be investigated. Furthermore, as has been discussed in detail, the issues of language choice versus language separation are problematic at best, and practically useless at worst. A new approach to the language choice/separation controversy is thus necessitated, and a strong candidate with the potential to overcome these difficulties is CA.

Background Introduction

Two broad approaches to analysing the use of language in conversations can be differentiated from the literature: top-down/theory driven and bottom-up/data driven (Perkins, 1993; Perkins and Lesser, 1993).

Top-down procedures involve approaching the data with previously compiled theories and organisational principles. This approach attempts to deduce what is happening in the data according to those preconceived parameters. An example is the Profile of Communicative

Appropriateness (PCA; Penn, 1988). This assessment protocol consists of a checklist of various parameters of pragmatics according to which the data is analysed.

In contrast, bottom-up approaches avoid proposing such a set of analytic principles. Rather, they desrribe the conversational behaviour as it happens and reach generalisations on the basis of patterns observed, constructing theories only after a thorough analysis of the material has been undertaken (Levinson, 1993). An example of this method is Conversation Analysis (CA).

Principles of CA

CA developed over the past fifteen years from the field of sociology (Heritage, 1989; Lesser and Milroy, 1993). As the name implies, CA is a method of analysing a conversation between two or more interlocutors. It involves detailing how that interaction is sequentially constructed by observing each speaker's contribution, including components such as responses to the previous utterances. It examines, inter-alia, the parameters of turn-taking and repair of breakdowns in communication. No aspect of the interaction is disregarded as unimportant; even pauses are viewed to have communicative relevance.

According to Heritage (1989: 22), CA embraces four basic assumptions. Firstly, interaction is structurally organised and does not develop in a random manner. Secondly, contributions to this interaction are simultaneously context-shaped and context-renewing. The former refers to the principle that an interlocutor's contribution to an ongoing sequence of actions can only be understood in terms of the context in which it occurs. The latter implies that each new utterance will itself form the immediate context to which the subsequent utterance must refer. Following on from these two assumptions, the third supposition is that one cannot dismiss any details from the interaction as irrelevant. The fourth assumption is that conversational interaction is best studied through analysing naturally occurring data, as opposed to role play or other idealised interactions.

Taylor and Cameron (1987) explain that interlocutors are aware of rules they are expected to follow in conversation. Each participant appreciates that the other is also aware of these rules, and will judge and respond to him according to how he does or does not conform to the rule. Interlocutors therefore take into cognisance the accountability of their behaviour, and are aware of the consequences of breaking the rules. Levinson (1983) elaborates that conversation provides an explicit insight into how the participants understand the ongoing events. As the second speaker responds to the previous speaker's turn, (s)he displays the analysis (s)he made of that turn. This analysis is not only provided by the interlocutors for each other, but for the researcher too. Thus the researcher does not rely on intuition to explain the data, but rather can observe how each participant evaluated and understood the previous turn by their subsequent response to that utterance.

According to Lesser and Milroy (1993), CA has greater real-life validity than top-down procedures which apply preconceived theories of interaction to the isolated utterances of one speaker. CA acknowledges that conversation is a collaboratively achieved interaction and that the context is dynamic. Hopper (1989) too contends that top-down methods filter the data though numerous simplifying processes, thereby distorting and stripping the material of its inherent complexity. Furthermore, CA rejects the subjectivity of an appropriacy judgement by a third party. An utterance can only be deemed inappropriate if the actual interlocutor demonstrated difficulty with it. The analyst's interpretation of communication success or failure can only be derived from evidence provided by the observable behaviours of participants (Lesser and Milroy, 1993; Perkins, 1993).

Criticism however has been levelled at the CA approach (e.g. Coulthard and Brazil, 1979, cited in Levinson, 1983; Taylor and Cameron, 1987). Claims have been made that the focus on minute segments of conversation such as pauses provide too fragmentary an insight into the interaction for generalisation to be possible. In defence, Lesser and Milroy (1993) maintain that these fragments are placed together like a jigsaw, thereby revealing the organised multi-level structure of conversation.

In addition to the criticism cited in the literature, the validity of the assumption that CA avoids preconceived categories must also be questioned. Surely by selecting to investigate turn-taking or repair in conversation, these constitute pre-determined categories in themselves? It is felt that a difference between CA and top-down methods is not whether or not categories are applied, but rather the manner in which the category can be interpreted and analysed. CA facilitates a flexible, dynamic interpretation of data that is not constrained by a fixed range of categories and sub-components to be considered. The data will determine which categories will assume greater relevance to that conversation. It is therefore an appropriate method for analysing the unpredictable progression of a collaboratively achieved interaction.

Use of CA in Language Pathology

Existing assessment approaches of conversational discourse have been criticised on a number of aspects. Strauss Hough and Pierce (1994) claim that existing approaches do not investigate the underlying cause of pragmatic deficits: they describe the deficit rather than explain why it occurs. Lesser and Milroy (1993) contend that to judge a parameter as being appropriate or inappropriate is subjective and problematic, while Perkins (1993) criticises most existing methods as failing to take cognisance of the fact that a conversation is collaboratively constructed by at least two interlocutors. It is therefore artificial to examine only one speaker's contribution in isolation.

The field of language pathology has only recently adopted CA as an approach for studying the use of language in conversational discourse (e.g. Lesser and Milroy, 1993; Perkins, 1993). Although still in its infancy, it appears to be a valid and reliable assessment method, countering many shortcomings of existing approaches mentioned above. Over the past couple of years, a few studies have also emerged using a CA methodology to study conversational interactions in monolingual speakers with AD (e.g. Orange et al, 1996; Perkins et al, 1998;

Shakespeare, 1998). However, to the writer's knowledge, CA has not been used before to investigate language use in bilingual speakers with AD, and certainly not with regards to the controversial language choice/separation dichotomy.

Why CA?

CA has been shown to offer numerous advantages over existing top-down methods of studying conversational discourse. In addition, it has the potential to overcome the difficulties inherent in investigating language choice versus language separation problems. With fixed definitions, one is forced to classify behaviour as either a language choice or separation problem. However, as demonstrated above, this leads to relatively arbitrary labelling of language mixing behaviour - labels which different researchers may apply *differently* to the same behaviour. While the terms language choice and separation are theoretically important, they raise more problems than solutions where data analysis is concerned.

The present study proposes removing the temptation of classifying behaviour as either a separation or choice problem, and overcoming the difficulty of matching data to theoretical terms by discarding these *a priori* categories, and instead approaching talk from a bottom-up, data-driven perspective, as afforded by CA. In this manner, analysis is not bound by dichotomous yes/no answers as to whether language mixing occurs, nor does it involve subjective labelling of behaviour as a choice or separation problem. Rather, CA could facilitate an investigation into bilingual language problems through examining the contextual predeterminants and unfolding of any switching and mixing behaviour, and the turn by turn manifestation of the behaviour in ongoing conversation in each particular instance. For example, what contexts trigger inappropriate language use? How is it shown in structural and interactional terms? How, if at all, does it affect the quality of conversation? From the ways in which participants manage repair, what insights might be gained regarding the locus(i) of breakdowns?

In addition, CA principles emphasise that language is used for communication. Hence, any difficulty with keeping two languages separate is potentially a trouble spot. Even if infrequent (for instance below Luderus' 10% limit), mixing two languages when the interlocutor is monolingual may have communicative consequences. Furthermore, going by the interlocutors' response to language mixing may provide more insight into the severity of language mixing problems than an arbitrary cut-off percentage point. It also circumvents the problem of a lack of normative data regarding language mixing in an individual speaker or their language community. Any language mixing that presents a problem for the interlocutor for *that* conversation is then indeed a code switching problem.

A further advantage of using a CA methodology is that AD is not a dementia where each person has the same symptoms. Rather, it is a heterogeneous disorder. Different people progress at different rates, and present with differing symptomotologies. Therefore, each individual demands an indepth investigation into his or her particular presentation of deficits. CA can facilitate such a sensitive and individualised exploration of language use.

3.4 Summary

This chapter reviewed previous research on bilingual speakers with AD. These studies concentrated primarily on difficulties with language mixing at the level of conversational discourse, but some authors did include a (sparse) battery of formal tests. Methodologies employed were criticised on a numerous issues including ambiguous use of terminology, incomplete test batteries, and ad-hoc discourse analyses. For the present study, Conversation Analysis was explored as a potential tool to overcome the shortcomings highlighted in previous studies, and to provide a novel approach to investigating language behaviour.

3.5 Research Questions

From studies reviewed in Chapters 1 and 2, and from the findings from previous research on bilingual AD described in this chapter, several pertinent and as yet unanswered questions were formulated to focus the present investigation.

The main questions of the dissertation are:

1. Is the pattern of dissolution seen in the languages of bilingual speakers similar to that of monolingual speakers of those languages with AD, in terms of the hierarchy of task vulnerability to dementia?
2. Is there a similar *pattern* of decline seen in the speaker's different languages?
3. Is there a similar *rate* of decline in the speaker's two languages?
4. Do problems arise with specifically bilingual behaviours such as code switching?
5. Does language decline appear to be linked with a decline in neuropsychological functions?
6. How might possible differences in pattern and rate be associated with differences in

    i] age of L2 acquisition

    ii] method of L2 acquisition

    iii] level of L1 versus L2 proficiency

    iv] pattern of L1 and L2 usage

3.6 Hypotheses

On the basis of reviews in Chapters 1 and 2, it is predicted that:

1a) If all factors are equal (age and method of acquisition, proficiency levels, pattern of usage), then a similar pattern and rate of decline will be observed in a speaker's two languages.

b) If there are any differences in pattern or rate of decline between languages, these will be attributable to one or a combination of the above-mentioned factors.

2a) Where the neuropsychological abilities of sustained attention, working memory, sequencing and/or information processing deteriorate, then in cases where all factors all equal, a speaker's two languages will be similarly affected in terms of task performance and discourse management.

b) In scenarios where there is a dominant (more automatised) and non-dominant (less automatised) language, a decline in the above-mentioned neuropsychological skills will affect the weaker language more in terms of deteriorating at a faster rate, and appearing to be more severely impaired than the dominant language.

Chapter 4
METHODOLOGY

Introduction

Methodological advantages and limitations of various designs have been discussed in Chapters 2 and 3, where the relevance of each of these methodological issues to the present study has been explored. This chapter details information on the study design, subject selection and description, the test battery selected, the method by which data was analysed, and the pilot study carried out.

4.1 Research Design

This research involved five single case studies investigated in parallel, *with a longitudinal* design. As discussed in 2.4, the single case study design was adopted for a number of reasons including:

(a) heterogeneity in this population group (AD) precludes generalisations across participants.
(b) this is one of the first detailed studies of language decline in bilingual speakers with AD. Since the field of enquiry is so new, averaging of data as is done with group studies may forfeit vital insights. It is the extremes in variations that will afford a more complete description of the symptoms displayed and the nature of the pathology involved.
(c) one of the main methodologies employed (CA - see 3.3.4) emphasises the intricate, detailed analysis of conversation, demanding a context-specific analysis of each conversation. This renders the use of data averaging and generalisation across participants inappropriate (Perkins, 1993).

A longitudinal approach was selected for the following reasons:

(a) As Gray and Della Sala (1996: 26) observe: "In the field of AD research, the great problem with cross-sectional studies is that the statistics they yield often give rise to highly misleading expectations about the course of deterioration in the individual patient. Even among those carefully diagnosed as AD patients, a marked heterogeneity of cognitive deficits can be found." To counter the difficulties of comparing individuals of different stages of dementia (as discussed in 2.4.1), a longitudinal design tracking each participant over period of time was chosen to investigate changes in language and cognition in bilingual speakers with AD.

(b) A time span of a year is considered sufficient to detect changes in language in this population, as maintained by various researchers (e.g. Botwinick et al, 1986; Ripoch, Petrill, Whitehouse et al, 1995).

4.2 Subject Selection

The Alzheimer's and Related Disorders Association (ARDA) and Old Age Homes in the Gauteng area with a facility for caring for people with AD were contacted. A letter detailing the aims and procedures of the proposed study was given to the relevant matrons or group leaders, who reported whether there were any potential participants willing to take part in the study. The family members of each potential participant was contacted, and with their consent and the speaker's consent, the individuals were screened in order to determine whether they met the subject criteria necessary for the study (outlined below). The screening included asking the individual to name the first 10 pictures from the Confrontation Naming test of the Arizona Battery of Communication Disorders (ABCD; Bayles and Tomoeda, 1993) in both English and Afrikaans, and holding 5 to 10 minute conversations in first their one language, and then their other.

27 individuals were screened, but only 8 met the required criteria. Many of those who did not meet the criteria were in the severe stages of AD and so could not complete any of the

screening tasks. Other individuals were rejected because they did not have a high enough proficiency in their L2 to manage a conversation or name the items on the Confrontation Naming task in their L2, although they could in their L1.

Participants were asked to sign a consent form (Appendix 2), and this was witnessed by a family member where possible, or in cases where families did not live in Gauteng, the matron of the home. It was stressed that speakers may drop out of the study at any time, with no reasons required, and no penalties incurred.

However, even though 8 speakers were involved in the start of the study, subject attrition occurred over the year, and eventually only 5 speakers completed the study. Of those who did not, one speaker developed temporal lobe epilepsy and was placed on heavy medication. The second speaker decided to stop participating in the study as her husband passed away a short while after the first assessment period. As for the third participant, a history of alcohol abuse was only discovered once all the data collections were completed. She therefore also had to be excluded from the study as it is likely that her profile of results reflected the influence of alcohol-induced dementia in addition to Alzheimer's Disease. The effects caused by these two different pathologies could not be distinguished with any degree of confidence.

The participants who did complete the study met the following criteria:

(a) diagnosis of probable AD by a member of the medical faculty. Diagnosis is made according to careful case history and elimination of other causes of dementia, such as alcoholism.

(b) were in the early to mid stages of the disease progress at the start of the study, or had a Clinical Dementia Rating (CDR; Hughes et al, 1982) of 1 (Appendix 3).

(c) exhibited some difficulty with the use/comprehension of language as observed by the spouse/caregiver/doctor/relevant other.

(d) considered themselves (or be considered by their family members and friends) to be proficient English and Afrikaans speakers (see 1.1 and 1.2.2[b]). In addition, all participants met Grosjean's (1997) criteria of being bilingual in that they were no longer acquiring one of their two languages, and used these two languages separately or together in everyday life.

(e) did not have any concomitant or previous pathologies such as head-injuries, strokes, or any other degenerative diseases.

(f) had a school-leaving certificate, as pen and pencil tasks are included in the test battery.

(g) had corrected vision falling within normal limits, as assessed by an optometrist within a year before the study commenced, and passed a hearing screening test when the study commenced (500hz, 1000hz and 2000hz at 40dBHL, as recommended by Weinstein, 1995).

(h) were willing volunteers for the study.

4.3 Subject Description

Five bilingual speakers (English and Afrikaans) participated in the study, all female, aged 75-89 years. All lived in residential homes. Stage of dementia was rated according to the CDR (see Table 6). All speakers passed English and Afrikaans examinations in order to obtain their school leaving certificate, and used both languages extensively throughout adulthood. The individual language background for each participant follows below.

JB acquired both her languages simultaneously at an early age (from around two months old), and used them to an equal extent throughout her life: at home, at work and socially. She was a journalist and actress by profession, and was the only participant to commence tertiary education. She finished her undergraduate degree (a BA) at an Afrikaans medium university, and her postgraduate MA at an English medium university. Her husband and two children were all highly proficient bilingual speakers of English and Afrikaans. JB was diagnosed as having probable AD six months before this study commenced, and moved into a residential home around that time. While residents at the Home were mainly English-speaking, JB still spoke Afrikaans to her friends and family on a daily basis, and to some staff members. Results from the language background questionnaire indicate that JB was equally proficient in both her languages, as she stated she could read, write, speak and understand both to an equal extent, and was equally comfortable conversing in either language (Question 40 of the questionnaire).

EB learnt her second language (L2) (Afrikaans) formally at school from the age of 12 years. She married an Afrikaans-speaking man, and brought her children up to be bilingual. She used both languages at home, for work, and socially. EB obtained a school-leaving certificate, but did not commence any tertiary education. She worked in a chemist shop for most of her married life. She was diagnosed as having probable AD 9 months before this study. She moved into a bilingual residential home 6 months after the diagnosis was made. Results from the Language Background questionnaire indicate that English was EB's more dominant language, as she noted she could not speak Afrikaans as well as she could when her husband was alive, and was more comfortable conversing in English.

BL learnt her second language (L2) (Afrikaans) formally at school from the age of 12 years. She obtained a school-leaving certificate, but did not commence any tertiary education. BL married a bilingual man, and moved to a predominantly Afrikaans-speaking town after marrying. Although English was spoken at home, she used her L2 daily for work purposes (she was a dressmaker) and socially. She was diagnosed as having probable AD 2 years before the study, and moved into a residential home 14 months after that. Residents of the Home were mainly English-speaking, but BL continued to speak Afrikaans with visiting friends and staff. Results from the Language Background questionnaire indicate that English was BL's more dominant language. Of all the participants, she had the widest gap in proficiency levels between her two languages, as she claimed she could not speak Afrikaans now as well as she could when she was living in the community, and even then felt better able to express herself in English. Premorbidly BL preferred to read newspapers in English, and when given the choice would prefer to converse in English.

JS also learnt her second language (L2) (English) formally at school from the age of 12 years. After obtaining her school-leaving certificate, she married a bilingual man, and worked for an English firm as a bookkeeper. Although they spoke mainly Afrikaans at home, she brought up her three children as bilingual Afrikaans-English speakers. Both languages were used for social purposes. Her pattern of language use over her adult lifespan suggests that JS attained extremely high proficiency levels in both languages, being able to meet all the occupational and social demands in the relevant languages. However, on the Language Background questionnaire, she reported that she is more comfortable speaking Afrikaans, although she could still express herself in English as well as she did pre-onset of AD. She was diagnosed as having probable AD 4 years before this study, and moved into a bilingual residential home 9 months afterwards. Most of her friends there speak Afrikaans.

AR learnt her second language (L2) (English) formally at school from the age of 12 years. However, she was exposed to English from an early age as her parents had English speaking friends. After obtaining her school-leaving certificate, she married a bilingual man, and helped him in running his various businesses. Both English and Afrikaans were spoken at home, at work, and socially. Their one child was also brought up bilingual although AR mainly speaks Afrikaans to her. AR was diagnosed as having probable AD two and a half years before the study, and moved into a bilingual residential home one year after that, where she has equal exposure to both English and Afrikaans on a daily basis. As revealed from the language background questionnaire, AR appeared to be equally proficient in both languages, being able to read, write, speak and understand both languages to the same extent, both pre- and post-onset of AD.

All participants spoke their two languages separately in situations such as when speaking to monolingual speakers of that language (both premorbidly and once living in the Home). However, code switching did occur, especially when conversing with another bilingual speaker. Table 6 provides a summary of the participants' background details.

Participant	JB	EB	BL	JS	AR
Age	77 yrs	76 years	89 years	80 years	75 years
CDR Score (start of study)	1 (mild)	1 (mild)	1 (mild-mod)	2 (mod)	2 (mod)
L1	Eng/Afri	Eng	Eng	Afri	Afri
L2	Eng/Afri	Afri	Afri	Eng	Eng
Age L2 acquisition	2 months old	12 years	12 years	12 years	12 years
Perceived Language Proficiency	Balanced	English more dominant	English more dominant	Afrikaans is the preferred language	Balanced
Educational Qualifications	Master's Degree	School-leaving certificate	School-leaving certificate	School-leaving certificate	School-leaving certificate
Profession	Journalist and actress	Sales-person in chemist shop	Dress-maker	Book-keeper	Business woman
Time since diagnosis of AD to start of study	6 months	9 months	2 years	4 years	2 years, 6 months
Time living in Residence	6 months	3 months	10 months	3 years, 3 months	one year, six months

Table 6: Subject description Mod = moderate. L1 = first language. L2 = second language. Eng = English. Afri = Afrikaans.

4.4 Control Subjects

The aim of the study was to track the relative decline of two languages in one individual, as a result of AD. Since a bilingual person is not two monolingual speakers rolled into one (Grosjean, 1989; 1992), proficiencies between languages and between the sub-components of languages (e.g. reading versus speaking) may differ according to occupational, private and social needs. It is therefore problematic to develop standard norms for language use in healthy bilingual speakers, or to find control subjects that are appropriately matched in terms of pattern of language use, age of L2 acquisition, and the numerous other variables discussed in Chapter 1. To circumvent this difficulty, each subject acted as their own control, with the first assessment at time period 1 serving as the baseline (see Procedures 4.5.2). Changes identified in the subsequent assessment periods were compared to the initial baseline. In this manner, decline was measured relative to the individual's baseline performance, and not according to an external criterion. While norms provided by some formal tests augmented the interpretation of test scores, it was the changes in functioning relative to the initial baseline measure that were analysed.

4.5 Methods

4.5.1 Test and Materials

The methodology involved 4 main methods of data collection: (1) language background questionnaire, (2) dementia rating scale, (3) formal test assessments (neuropsychological and language), and (4) conversation analysis. Essentially, both global scales and specific investigations were included in order to compile as complete a picture as feasible of the pattern of linguistic and cognitive attrition. Table 7 presents the tests administered; each test is discussed in detail in the body of the text.

GROUP OF TESTS	NAME OF TEST	LANGUAGES ADMINISTERED
***Measures of dementia and* orientation**	*CDR*	N/A
	Mental Status	Speaker's L1
Non-verbal neuropsychological tests	AMIPB Information Processing subtest	N/A
	Trail Making A and B	N/A
Verbal neuropsychological tests	Digit Repetition	Language in which speaker counts
	ABCD Story Recall	L1 and L2
	Memory Recognition	L1 and L2
	AMIPB List Learning	L1 and L2
Non-verbal language tests	Pyramids and Palm Trees	N/A
Verbal language tests	Concept Definition	L1 and L2
	Confrontation Naming	L1 and L2
	Generative Naming	L1 and L2
	Token Test	L1 and L2
	Superordinate Naming	L1 and L2
	Co-ordinate Naming	L1 and L2
	Procedural Discourse	L1 and L2
Other	Conversation Analysis	L1 and L2
	Sentence Translation	L1 → L2; L2 → L1
	Language Background Questionnaire	N/A

Table 7: Tests administered N/A = not applicable. Tests are detailed in text below.

Language and memory tasks were adapted into Afrikaans. A difficulty was encountered in that word frequency lists are not available in Afrikaans. As maintained by Sanfeliu and Fernandez (1996), normative data cannot be taken from one language and applied to another directly as objects that are common in one may not be common in the other. Similar findings have been shown by Goggin, Estrada and Villarreal (1994) where geographical location (e.g. cold versus warm climate) and different cultures influenced cross-linguistic naming ability. However, participants in the present study spoke English and Afrikaans in the same geographical location, and the test items selected were of similar familiarity for each culture. These factors should contribute to stimuli being comparable across languages. In addition, when adapting the tests into Afrikaans, native speaker intuition regarding word frequency was relied upon. The tasks were first translated by a bilingual English-Afrikaans speaking linguist, who attempted to match perceived frequency, imageability, and length of lexical items. Efforts were made not forfeit length or complexity of sentences in favour of idiomatic meaning. The tasks were then given to two other bilingual speakers who were asked to confirm the perceived match of word frequency, syntactic complexity, and idiomatic phrasing between the languages. All language tests, including memory tasks, were administered in both English and Afrikaans (See Procedures 4.5.2).

4.5.1.1 Background Information

Language Background Questionnaire

Aim: To detail the pattern of pre-morbid and current language use.

Description: The questionnaire was adapted from the Bilingual Aphasia Test (BAT; Paradis, 1987) where the participant and family member are required to answer a set of verbal questions (both yes/no and open-ended). The original questionnaire was modified in the following manner:

(a) Questions 28, 40 and 46 ("Did you take any subjects in another language [at school]?") of the original questionnaire were omitted, as in South Africa, both English and Afrikaans were compulsory subjects at school.
(b) Five questions were added to the questionnaire. Questions 11-14 investigated age, method and pattern of L1 and L2 acquisition. Question 15 was included to find out whether the individual lived in a bilingual community, from which it can be inferred that there were opportunities to speak in bilingual mode (c.f. Grosjean, 1997).
(c) Several new subsections were included, namely: Further Education; Occupation History; Marital Status, and Current Language Status. Investigation into these areas yielded further information about the pattern of L1 versus L2 language use in adulthood.

A copy of the questionnaire is found in Appendix 4.

Rationale: Information on the pattern of bilingualism over the life span was necessary to answer Question 6 of the study's aims (see 3.5). In addition, it formed a background against which a more accurate analysis of test data could be made.

Scoring/Analysis: The information provided was purely qualitative.

4.5.1.2 Staging Dementia and Orientation

Clinical Dementia Rating (CDR; Hughes et al, 1982)

Aim: To assess the severity of dementia.

Description: Memory, orientation, judgement and problem solving, community affairs, home hobbies, and personal care, were assessed by the examiner along a five point rating scale. Information required to complete the scale was derived from relatives, friends and others (e.g. hospital staff). A copy of the scale and administration procedures can be found in Appendix 3.

Rationale: This published rating scale has been shown to be reliable and valid, yielding a standard judgement of the severity of dementia over time. Linguistic functions are not assessed: the severity of dementia is therefore not influenced by verbal functioning (Faber-Langendoen et al, 1988). This is an advantage as it is precisely those language skills this study investigated in detail. In addition, a global rating scale was selected in order that the stage of dementia could be comparable across participants.

Scoring/Analysis: Each of the six categories are independently rated. However, when calculating the CDR, memory is the most crucial category. For full scoring procedures, see Appendix 3.

Mental Status (Subtest of Arizona Battery of Communication Disorders (ABCD); Bayles and Tomoeda, 1993)

Aim: To assess orientation to person, place and time.

Description: Participants were required to answer 13 questions covering orientation to person, place and time. Several modifications were made in order to make the subtest culturally relevant: (1) the capital and president of the "United States" (questions 5 and 9) was changed to "South Africa", and (2) "Independence Day" (question 8) was changed to "Christmas Day".

Rationale: The test offered an insight into the person's present state of orientation, against which a more accurate analysis of test results, conversational behaviour and language mixing could be made.

Scoring/Analysis: In addition to providing a qualitative indication of the participant's orientation to person, place and time, the ABCD provides norms for normal elderly, mild AD, and moderate AD. A maximum score of 13 is possible.

4.5.1.3 Neuropsychological Tests

Non-Verbal Neuropsychological Tests

Trail Making Test (TMT) A and B (Army Individual Test Battery, 1947, described in Lezak, 1995)

Aim: To assess ability to mentally follow a sequence and deal with more than one stimulus at a time.

Description: This timed test is a paper and pencil task.
(i) Task A: The person is required to connect numbers scattered around the page in numerical sequence.
(ii) Task B: The person is required to connect alternating numbers and letters (e.g. 1-A, 2-B).

Rationale: TMT integrates complex visual scanning, motor speed, attention and conceptual tracking (Lezak, 1995). These skills are all vulnerable to AD, and Task B is particularly sensitive to mild AD. Mentally following a sequence and managing with more than one stimulus at a time are skills frequently tapped in everyday life, and are adversely affected by AD, thereby warranting a formal investigation.

Scoring/Analysis: Norms for the elderly on TMT A (in seconds) are provided by Wiederholt, Cahn, Butters et al (1993), and norms for TMT B (in seconds) are provided by Heun, Papassotoripoulous and Jennssen (1998).

Information Processing (Subtest from the Adult Memory and Information Processing Battery (AMIPB); Coughlan and Hollows, 1985)

Aim: To assess speed and accuracy of information processing ability.

Description: This is a paper and pencil task, involving marking off the second highest number of a random sequence. The aim is to complete as many lines as possible within a 4 minute time limit. A second subtest assesses motor speed. Participants are required to cross out as many parallel lines as possible in 20 seconds. An information processing score adjusted for any motoric slowing is provided in the test manual.

Rationale: This test is a language-free tool to measure concentration and speed of information processing. By giving a quantitative score, it tracks any decline in speed of information processing over time - an ability markedly vulnerable in AD. Information processing is involved in almost every task, particularly where new information is being provided, such as in a conversation, or learning a new task.

Scoring/Analysis: One point awarded for every correct answer. Norms are provided for raw scores, and adjusted for any motor slowing that occurred. However, the upper age limits of the norms provided only reach 75 years. Furthermore, the authors note that percentile markers and cut-off scores become less stringent with advancing age (p. 55). The norms were therefore used only as a very rough guideline to distinguish normal from impaired performance for this study, and were interpreted with caution.

Verbal Neuropsychological Tests

Randomised Digit List for Span Test (Lezak, 1995)

Aim: To assess immediate and working memory skills.

Description:
(a) Digit Span (DS) Forwards: participants are required to repeat an ever-increasing list of digits read out to them, starting from a sequence of three random digits.

(b) Digit Span (DS) Backwards: participants are required to repeat an ever-increasing list of digits in the opposite order to which they are read out, starting from a list of 2 random digits.

DS forwards and backwards were assessed in one language only. The speaker was asked in which language they counted, and it was digits in that language that were used.

Rationale:

(a) Memory is intricately implicated in AD, and the different parts of the memory system (immediate, working, short-term, long-term) require detailed investigation (as with this test and the 3 memory tests described below). Many other abilities hinge on an intact memory system, including language comprehension, and following a conversation. It is therefore an essential parameter to investigate.

(b) DS Forwards is a test of immediate memory and efficiency of attention. DS Backwards assesses the ability to hold bits of data while mentally juggling them around (Lezak, 1995). It is therefore an important test of the integrity of the working memory system, invariably compromised in AD (Bayles and Kaszniak, 1987; Morris, 1996).

(c) This list was only administered in one language. Digits are highly frequent, highly familiar, and practised materials that do not place high demands on the semantic decoding system. The aim of the task is not to determine whether participants could process the information semantically, but to gauge how many auditory bits of highly familiar data they could hold in memory for a brief period of time. Since digits in both English and Afrikaans are monosyllabic (except for 'seven' and its Afrikaans equivalent 'sewe' - both bisyllabic), using digits from one language only should not present either an advantage or disadvantage in terms of articulatory time constraints or processing loads.

Scoring/Analysis: 1 point awarded for each correct trial. Norms for raw scores are provided by Lezak (1995).

Story Recall (Subtest of ABCD)

Aim: To assess ability to recall a short narrative immediately after hearing it, and after a 30 minute delay.

Description: A short story (17 information units) is read out once. Participants are then required to repeat whatever they remember from the story. After a half hour gap with intervening tasks (detailed in 4.5.2), the participants again recall what they can, without receiving any prompts from the examiner. In English, "wallet" was changed to "purse"; and "purse" was changed to "handbag", in keeping with vocabulary terms in South African English.

Rationale:
Story Recall performance is a "linguistically oriented episodic memory test" (ABCD manual, p. 42). It yields information about semantic encoding and the contribution of meaning to recall, working memory and sequencing abilities, as well as how much of that originally encoded information was resistant to decay over time (Lezak, 1995).

Scoring/Analysis:
One point for each information unit recalled (as outlined in the test manual), for comparison with norms (normal elderly, mild AD, moderate AD).

Memory Recognition Task (Pavlou, 1996)

Aim: To assess memory recognition for verbal material.

Description: Single printed words were used as stimuli. Starting with a page on which only one word was printed, the aim for the person was to identify each new word added to the page, until a total of 15 words was reached (See Appendix 5 for full task instructions).

Rationale:

(a) By comparing performance on memory recognition and recall tasks, a difficulty with encoding and/or retrieval could be discriminated.

(b) By administering the test in both languages, language-specific difficulties with word surface forms could be identified.

Scoring/Analysis: One point awarded for every correct answer, for comparison to norms.

List Learning (Subtest of AMIPB)

Aim: To assess episodic memory, ability to learn from repetition, and susceptibility of memory traces to interference.

Description: Participants repeat after the examiner a list of 15 words. This same list is repeated over 5 trial periods (Task A 1-5). A second list is then read out and repeated by the participant (Task B). Finally, particpants were required to recite the original list, without it being read out again (Task A6).

Rationale:

(a) Deficits in episodic memory is an early sign of AD (Becker, Lopez, and Butters, 1996). List Learning should therefore be sensitive to changes in functioning even in the early stages of the disease process.

(b) This test offers an insight into working memory, learning curves, and susceptibility of memory traces to interference.

Scoring/Analysis:

(a) Quantitative: One point for every item recalled. Raw scores are converted to percentiles, and are available for Task A 1-5 totals and Task A6. The upper age limits of the norms provided only reach 75 years. The norms were therefore used only as a very rough guideline to distinguish normal from impaired performance for this study, and were interpreted with caution.

(b) Qualitative: Primacy effects (better recall for words at the beginning of the list), recency effects (better recall for words at the end of the list)and learning curves were noted.

4.5.1.4 Language Tests

Formal Language Tests

Pyramids and Palm Trees - Picture to Picture Version (Howard and Patterson, 1992)

Aim: To assess access to semantic memory using a non-verbal route.

Description: This test contains 52 items (pictured stimuli). Participants are required to identify which of two pictures best fits a third (e.g. bus/car to ticket); one of the two pictures is a semantic distracter.

Rationale: This non-verbal test is designed to assess access to the semantic system in a manner that is not language dependent. It therefore differs from the other language tests used in the battery, which require a language specific (English/Afrikaans) verbal response. The Pyramids and Palm Trees test also involves evaluative thinking and judgement, and has been shown to be sensitive to the early stages of AD (Howard and Patterson, 1992).

Scoring/Analysis: Cut-off score of three incorrect items. Any score worse than 49/52 indicates an impairment in the semantic system and/or impaired evaluative thinking.

Confrontational Naming (Subtest of ABCD)

Aim: To assess ability to name pictured items on confrontation (tapping semantic memory).

Description: Participants verbally name 20 pictured items. One modification to the original test was made by changing 'porcupine' to 'camel' - a more familiar animal for the participants in this study.

Rationale:

(a) It has been shown that a test with as few as 13 pictured items is sensitive enough to changes in naming ability over time in AD (Bayles and Trosset, 1992). This test contained 20 pictured stimulus items, and could therefore be considered sufficiently sensitive to naming disorders.

(b) Since L1 and L2 are spoken in the same geographical location in culturally similar contexts, the same picture could be used for both L1 and L2 testing.

Scoring/Analysis:

(a) Quantitative: a maximum score of 20 is possible. Norms are provided in the manual for normal elderly, mild AD and moderate AD, which can be used as a guideline for comparison.

(b) Qualitative: whether responses were

(i) on target

(ii) descriptions of the item's features/function

(iii) semantically related to the target

(iv) visually related to the target

(v) completely unrelated to the target.

(c) If a speaker gave the label in the incorrect language, they were asked if they could say it in the target language. If they could, one point was credited. If not, no points were given.

Category (Generative) Naming (Subtest of ABCD)

Aim: To assess word fluency - a test of lexical semantic access.

Description: Participant are required to generate as many names of (a) animals and (b) transport as possible in one minute.

Rationale:

(a) This is a test of the semantic system involving a divergent thinking task, as well as other cognitive processes such as attention and working memory (Binetti, Magni, Cappa et al, 1995; Emery, 1996). It has a linguistic component to it, where the linguistic integrity of the stored categories is assessed, as well as a fluency component, assessing speed and efficiency of the search (Binetti et al, 1995; Lezak, 1995). This one test therefore facilitates an investigation into more than one neuropsychological or linguistic parameter.

(b) Verbal fluency is particularly vulnerable to brain damage, and is sensitive to AD even in the mild stage of the disease (Bayles and Kaszniak, 1987; Kempler, 1995).

Scoring/Analysis:

(a) For both generative naming tasks, a global score was obtained by adding up the number of legal responses. These include items that belong to the category of animals/transport, as outlined in the ABCD test manual. If an item was named *more than once, no additional points* were given.

(b) Raw scores were compared to norms. Norms for transport generative naming are provided by the ABCD manual for normal elderly, mild AD, and moderate AD. However normative data is not provided for animal generative naming on the ABCD, so norms provided by Binetti et al (1995) were used for comparison.

(c) A qualitative analysis was undertaken, where the strategies used (semantic/phonemic) were noted.

(d) If a speaker gave the label in the incorrect language, they were asked if they could say it in the target language. If they could, one point was credited. If not, no points were given.

Concept Definition (Subtest of ABCD)

Aim: To assess ability to verbally define a concept.

Description: Participants are required to define and explain an item taken from the confrontation naming task as fully as possible. The original number of items in the subtest was reduced from 20 to 5, sampling a range of item frequency, from 'camel' with a frequency of 1.39 (Celex Lexical Database; Centre for Lexical Information, 1993) to domino with a frequency of 0 (Celex Lexical Database).

Rationale:

(a) Concept definition has been shown to be vulnerable in AD, even in the mild stages of the disease (Bayles and Kaszniak, 1987).

(b) The original subtest was shortened from 20 to 5 items because, as revealed by findings of the pilot study (4.5.4) the full subtest was too time consuming to administer. For the purpose of the present study, it was thought that the scope of results obtained would not justify the amount of time spent on this task. Although a longer test would reveal influences of fatigue and lapses in concentration, such revelations were not the aim of this task. If participants could not successfully define a concept over 5 trials, it is highly unlikely that they would improve on successive trials. The test was therefor shortened to obtain a balance between number of trials attempted versus the effect of lapses in concentration and fatigue on task performance. Because of the complex 3-point scoring system, five trials were considered sufficient to identify differences between L1 and L2 performance.

Scoring/Analysis: The three point scoring system from the ABCD manual was used (See Appendix 6).

Superordinate, Subordinate and Co-ordinate Naming

Aim: To assess ability to provide the superordinate category (e.g. 'sport'), and subordinate (e.g. 'tennis') and co-ordinate (e.g. 'netball' 'golf') members of that category.

Description:

(a) Superordinate naming: Three items belonging to a category were read out, and participants were asked to provide the category name to which the items belonged.

(b) Subordinate naming: Using the same categories as in (a), the category name was read out and participants were asked to give a subordinate member of that category. For instance: musical instruments → flute.

(c) Co-ordinate naming: Following on immediately from task (b), participants were then requested to give 4 co-ordinates. For instance, with the "flute" example, co-ordinates could include violin, piano, guitar and so on.

Appendix 7 lists the selected categories and stimulus items.

Rationale:

(a) Superordinate and co-ordinate naming have been shown to be vulnerable to AD and sensitive to the mild stages of the disease (Bayles et al, 1993).

(b) These tasks differed from generative naming as only 5 items for each category were required, as opposed to the generative naming tasks where there is no upper limit to the amount of exemplars generated. In addition, unlike generative naming, there was no time limit imposed. These two differences render co-ordinate naming a less demanding task.

(c) The sub/co-ordinate naming task was carried out at the end of the session to avoid a situation where the speaker merely repeats the same stimuli heard a few minutes before in the superordinate naming task (see 4.5.2). The same categories were used for co- and superordinate naming in order to keep the perceived ease/difficulty of items constant across tasks. Categories selected covered a range of familiarity, from beverages to musical instruments.

Scoring/Analysis:

(a) One point for each correct answer. A maximum score of 5 was possible on the superordinate task; a maximum of 25 was possible on the co-ordinate naming task. The score for the latter combined both the subordinate and the co-ordinate items named.

(b) If a speaker gave the label in the incorrect language, they were asked if they could say it in the target language. If they could, one point was credited. If not, no points were given.

Token Test (shortened version) (De Renzi and Faglioni, 1978)

Aim: To assess auditory verbal comprehension.

Description: Commands of increasing length and syntactic complexity are read out (e.g. from "show me the red token" to "after x, do y"). Participants follow these instructions by manipulating coloured tokens.

Rationale: This test facilitates an exploration of auditory comprehension deficits according to parameters of stress on working memory load, and difficulty understanding complex syntactic structures. It yields an insight into auditory comprehension deficits that may occur during conversational discourse, and has been shown to be sensitive to dementia (Lezak, 1995).

Scoring/Analysis:

(a) Quantitative: total commands correct.

(b) Qualitative: at which subtest breakdown occurs (e.g. one-staged or two-staged commands).

Other Language Tasks

Translation of Sentences

Aim: To determine how successfully a participant can translate familiar material from one language to another without intra-sentential code switching occurring.

Description: Similar to De Vreese et al (1988), 5 oral sentences were constructed using highly familiar vocabulary and sentence structures that one might use in everyday speech. Content pertained to everyday activities. Participants were required to translate each sentence from L1 to L2, and at a later point in the day, to translate the same sentences from L2 to L1. Since the aim of the task was to assess translation ability and not memory, the sentence was read out as many times as was necessary until the speaker completed the translation.

Sentences used in this task are found in Appendix 8.

Rationale: As opposed to conversational discourse, for this task, there was controlled input: the examiner had an exact expectation of what the appropriate response should be. Since the intention is explicit, any deviation from the expected response could be systematically analysed.

Scoring/Analysis: Code switching behaviour was analysed according to the following: (1) direct translations. These include literal translation from one language to the next, as evidenced by inappropriate idiomatic turn of phrase for the target language, or by literal translations of lexical items, e.g. 'roosterbrood' → 'roast bread', instead of 'toast', (2) whole sentence in inappropriate language, (3) whole phrase in inappropriate language, and (4) lexical item in inappropriate language. Performance in the direction of L1 to L2 was compared to L2 to L1 in terms of number and type of code switching carried out.

Procedural Discourse

Aim: To assess ability to plan, sequence and verbally encode a routine procedure.

Description: Two procedural discourse tasks were devised. The first required the participant to relate in sequence all necessary steps in making a sandwich. The second task was less familiar, requiring an explanation of how to post an expensive glass vase to someone in a foreign country.

Rationale: This task has both a linguistic and cognitive component to it (Ulatowska et al, 1988). It taps planning and sequencing skills, where steps have to be correctly sequenced, all essential steps included, and any additional steps needed to be relevant.

Scoring/Analysis: Qualitative analysis was in terms of essential steps included, and sequence of steps.

4.5.1.5 Conversation Analysis (CA) (See 3.3.4)

Aim: To provide a detailed analysis of functional communication abilities, including aspects of topic management and language mixing behaviour.

Description: CA is a method of analysing a conversation between two or more interlocutors. A ten minute conversation is tape-recorded, transcribed, and analysed according to CA principles (see scoring below). No aspect of the interaction is discarded as unimportant - even pauses are deemed to have communicative relevance (Perkins et al, 1998). For this study, two conversations were recorded on separate days, one in English and the other in Afrikaans. Interlocutors were monolingual speakers of that language, and therefore the participant was required to converse in the monolingual mode (c.f. Grosjean, 1997).

Rationale:

(a) CA involves analysing communication beyond the sentence level and has excellent ecological value. It overcomes many of the disadvantages of other discourse models (see 3.3.4 for full discussion). In addition, it facilitates an analysis of how problems identified on formal testing manifest themselves in everyday communication.

(b) Analyses at the level of discourse reveal how cognitive impairments affect linguistic functioning, and therefore communicative competence (Ulatowska and Bond Chapman, 1995: 115).

Scoring/Analysis:

(a) Parameters of conversation management:

The following aspects of conversation served as starting points for the analyses, as they represent variables that cross the whole of the conversation and in turn are likely to set the context for more micro-level behaviours (Lesser and Milroy, 1993; Perkins, 1993).

[i] Repair:

This can be divided into *self* and *other* repair (Schegloff, Jefferson and Sacks, 1977). The former refers to the speaker correcting an error he/she has produced. The latter refers to repair initiated or made by the other interlocutor. A distinction is made between repair initiation and repair outcome. The person who makes the repair is not necessarily the one who initiated the repair (hence: self-initiated self-repair versus self-initiated other-repair). Collaborative repair refers to when both partners assume active roles and together repair a trouble source (Milroy and Perkins, 1991). A *repair trajectory* is the span from initiation to solution of a repair. Self-repair is often initiated in the same turn as the trouble source/spot, while other repairs can extend over multiple turns. As Perkins et al (1998: 40) note, the term 'trouble source' is preferable to 'error', as there is not always a direct relationship between the two.

[ii] Turn Taking

A person's turn can be referred to as a Turn Constructional Unit (TCU). The recognisable end of a TCU is termed a Transition Relevance Place (TRP) (Sacks, Schegloff and Jefferson, 1974). Whenever turn taking occurs, two rules guide the process whereby the next speaker is selected (Levinson, 1983):

Rule 1: Occurs at the first TRP of any turn.

(a) If the speaker (x) selects interlocutor (y), then x must stop talking and y must speak at the first TRP.

(b) If x does not select anyone to speak, then any interlocutor can self-select. The first person to do so gains rights to the next turn.

(c) If x does not select anyone, and nobody self-selects, then the original speaker (x) can claim the right to a further TCU. This will give rise to an extended turn.

Rule 2: Occurs at all subsequent TRPs.

When Rule 1 (c) applies, then Rules 1 (a) to (c) apply again at the next TRP and so forth, until there is a change of speaker.

-Silences:

An attributable silence is a silence that occurs after a turn before the next selected speaker starts talking (i.e. after Rule 1 (a)). This is differentiated from a lapse which is a silence that occurs after a turn when no-one starts to talk again (i.e. non-application of the rules) (Perkins, 1993; Sacks et al, 1974).

-Minimal Turns:

These consist of tokens such as 'mm' and 'ja'. Their interactional significance depends on their occurrence in the talk sequence. In other words, where they occur determines the meaning they convey (Heritage, 1989).

[iv] Topic Management:

This includes topic maintenance (keeping to a subject), initiation (introducing a new subject), shift (changing from one subject to another), and bias (demonstrating a preference for a particular topic).

(b) Language Mixing:

Although CA is an inherently qualitative approach, and each conversation is essentially unique, there was a need in this study to provide quantitative data in order to analyse the presence and extent of language mixing difficulties. This underlying deficit manifests itself across different interlocutors and different conversations, and it is the occurrence of this psycho-linguistic deficit that the study aimed to explore. Quantitative data was required to answer questions such as how much language mixing occurs, in which direction (L1 to L2; L2 to L1), and how often it does/does not affect the quality of conversation. In addition, since the study was a longitudinal one, some method of comparison across time periods and across languages was necessitated. It is acknowledged that quantification strips the data of its complexity, but such an analysis is crucial to the investigation of language mixing across time and languages. Ultimately it is the combination of both qualitative and quantitative data that will yield a wider insight into the issues explored.

In order to determine the presence and extent of code switching, the percentage of utterances that were code switched in each ten minute conversation was calculated. The term 'code switching' is used here to refer to "the alternate use of two languages within the same discourse" (Poplack, 1980; cited in Hyltenstam, 1995: 307). It is used interchangeably with the term 'language mixing'. 'Utterance' refers to a "stretch of speech preceded and followed by silence or a change of speaker" (Crystal, 1991: 367). The end of an utterance is marked by a silence or stopping fall in intonation (as indicated by a full-stop in CA transcript notations - see Appendix 9).

As the conversation was a monolingual interaction, any language mixing was considered inappropriate, unless explicitly flagged (e.g. by a metalinguistic comment such as 'I don't know the word in Afrikaans' or 'As they say in English'). The following parameters were analysed in order to gain an insight into the extent and nature of language mixing behaviour:

-The number of intra- versus intersentential code switches were counted. The former refers to the mixing of two languages within one sentence; the latter refers to the insertion of a complete sentence from the inappropriate language into the talk (Luderus, 1995). This was done to determine the nature of the code switching behaviour. Similar to analyses carried out by Poulisse and Bongaerts (1994) and Giesbers (1989), lexical items code switched (i.e. intrasentential code switches) were further divided up according to function versus content words. This was done in order to determine whether the degree of L2 proficiency correlated with the ratio of content:function words code switched (1.2.2[b]).

-To investigate trouble spots and how they were managed, the number of different repair types carried out subsequent to inappropriate language mixing was calculated. Repair types were divided into self-initiated self-repair; self-initiated other-repair; other-initiated self-repair; other-initiated but repair abandoned; other-initiated other-repair; and collaborative repair. These categories represent the range of repair evidenced in conversations. It could therefore be determined for which interlocutor code switching was a problem, and who assumed responsibility for carrying out repair.

-Repair trajectories arising from language mixing were analysed according to their length:

(i) completed within the same turn as repair initiation

(ii) in the turn immediately after repair was requested

(iii) over several turns.

Trouble spots and repair trajectories were analysed in order to determine the reasons for why language mixing occurred, and how successful the speakers were in repairing trouble spots arising from code switching. These insights would facilitate a deeper understanding of the nature of the language separation difficulty.

-The number and types of repair arising from trouble spots *other* than language mixing (e.g. word retrieval difficulties, ambiguous use of pronouns, sudden topic shift) were calculated and compared to repairs following inappropriate language use. This was done in order to establish whether language mixing behaviour affected the quality of interaction in a quantitatively and/or qualitatively different manner to intra-language trouble spots.

4.5.2. Procedures

Participants were assessed three times at six month intervals over a one year period (0-6-12 months). The language background questionnaire was completed with help from family members at the start of the study, and any changes were updated at subsequent assessments. The CDR was also updated at each assessment period.

Each assessment period was spread over three days. Testing took place in the morning when participants were most able to cooperate, and was carried out in a private room. On the first day, non-verbal and language-independent tests were administered (such as Mental Status, TMT, Pyramids and Palm Trees). In addition, the sentence translation task was carried out, as strict language separation was not an issue on that day.

On the second day, all remaining tests were administered in English, and a ten minute conversation with the English-speaking researcher was audio-recorded. The conversations were not driven by pre-determined topics, but rather were naturally occurring ones. Once each recording was completed, participants were asked whether they wanted to listen to the tape or edit out any of the talk. None took up this option. The exchanges were then transcribed in standard orthography, and analysed according to CA principles. On the third day, the full procedure was repeated in Afrikaans. This was done in order to keep the two languages as separate as possible. The interlocutors were either health-care workers or other residential members in the Home. Attempts were made to control for constancy and familiarity of interlocutor. However, this could not always be managed. For instance with JS, the fellow resident involved in the first data gathering left the residential home before the second conversations were tape-recorded. Afrikaans conversations were transcribed by the researcher after which the transcriptions were checked by a native Afrikaans-speaker.

With some participants, administration of the test battery had to be split over several days due to fatigue and lack of concentration. However, the time of day, setting, and language was held constant in such cases. All formal tests were administered by the researcher.

The order in which tests were administered was thus:

<u>Day 1</u>: Mental Status
Sentence translation from English to Afrikaans
AMIPB Information Processing
Trail Making Tests
Digit Repetition
Pyramids and Palm Trees
Sentence translation from Afrikaans into English

Day 2/3: Story Recall Immediate
Superordinate Naming
Memory Recognition
Confrontation Naming
Generative Naming
Token Test
List Learning
Story Recall Delayed
Co-ordinate Naming
Concept Definition
Procedural Discourse

4.5.3 Data Processing

4.5.3.1 Analysis of Formal Tests and CA Results

(i) In order to examine the relative patterns and severity of L1 versus L2 impairment in each speaker, the results from individual formal tests were compared between languages, as were findings from the CA. This was done by:
-statistically analysing quantitative results to determine whether differences between scores of L1 versus L2 reached statistical significance (i.e. inter-language differences). The statistical tests employed are reported in 4.5.3.2.
-examining trends in scores. Trends may be evident where scores from one language are consistently higher than their counterparts in the other language, even if these inter-language differences are not statistically significant.
-comparing findings from qualitative analyses across languages.

An analysis of trends and qualitative results were included because statistical analyses are not always sensitive to differences in scores near floor or near ceiling, nor to tasks of a small n (Gray and Della Sala, 1996). In addition, some aspects of functional communication are not always amenable to quantification.

(ii) In order to explore changes in the rate of attrition, statistically significant scores, downwards trends and qualitative results were examined, as identified on formal tests and CA. Intra- and inter-language comparisons were carried out. The former refers to changes within a language over time; the latter refers to differences between languages, for example where naming deteriorates in L2 over the year but not in L1.

(iii) In order to examine specific bilingual behaviours, intra-language patterns of code switching were analysed, viz. the presence and extent of code switching on formal tests, sentence translation and CA results. The manner in which code switching in conversational discourse was analysed is detailed in 4.5.1.5. Language mixing behaviour in one language was then compared to that in the other to examine any inter-language differences observed.

(iv) Possible links between neuropsychological decline and deterioration in language were examined. Those language tasks heavily dependent on the neuropsychological abilities of attention, working memory, sequencing and information processing (i.e. Story Recall, List Learning, Memory Recognition, Token Test, Generative Naming, procedural discourse) were examined to determine whether deterioration evident on neuropsychological tasks would be reflected in these afore-mentioned language tasks. Likewise, parameters from the CA were scrutinised, viz. topic maintenance and shift, and attributable silences. Following this investigation, L1 performance on formal language tasks and CA was compared to the L2 equivalents to determine if one language appeared more affected by decreasing neuropsychological support than the other.

(v) In order to determine the effect the variables (age and method of L2 acquisition, pattern of language use, and relative proficiency levels) on the observed patterns and rates of L1 versus L2 attrition, the possible effect of each variable was systematically inferred from findings of both formal tests and CA.

4.5.3.2 Statistical Analysis

Table 8 lists the statistical tests used, and the tests they were used for.

Statistical Test	Used For	Used On	Time Periods
Wilcoxon Signed Rank Test (Or: Matched Pairs Test)	-rankable outcomes -related scores from 2 conditions	1) List Learning 2) Concept Definition	Intra-lang: -T1 vs T2 -T2 vs T3 Inter-lang: -T1; T2; T3
Page's L Test	-related, rankable scores -3 or more conditions	1) List Learning 2) Concept Definition	Intra-lang: -T1 through to T3
McNemar's Test	-binomial outcomes (i.e. dichotomous right/wrong answers) -related scores from 2 conditions	1) AMIPB errors 2) Mental Status 3) Pyramids and Palm Trees 4) Story Recall 5) Confrontation Naming 6) Superordinate Naming 7) Co-ordinate Naming 8) Token Test	Intra-lang: -T1 vs T2 -T2 vs T3 Inter-lang: -T1; T2; T3
Marascuilo and McSweeney Test	-related binomial scores -3 or more ordered conditions	1) AMIPB errors 2) Mental Status 3) Pyramids and Palm Trees 4) Story Recall 5) Confrontation Naming 6) Superordinate Naming 7) Co-ordinate Naming 8) Token Test	Intra-lang: -T1 through to T3
Chi Squared (df=1)	-independent scores where the minimum expected value is above 5	1) Utterances code switched in conversation	Intra-lang: -T1 vs T2 -T2 vs T3 Inter-lang: -T1; T2; T3
Fisher's Exact	-independent scores -two conditions -Minimum expected value is below 5	1) Utterances code switched in conversation	Intra-lang: -T1 vs T2 -T2 vs T3 Inter-lang: -T1; T2; T3
Jonckheere Trend Test	-ordered conditions -ordered outcomes -independent scores	1) Utterances code switched in conversation	Intra-lang: -T1 through to T3

<u>**Table 8: Statistical tests employed**</u> Intra-lang = examining changes in scores within the same language over time. Inter-lang = comparing differences between English and Afrikaans results on the same test.

Tests with no ceiling (i.e. Generative Naming tasks) were not amenable to statistical analysis as the number of trials of test administration were too few. As there were no repeated observations, an idea regarding the spread of scores could not be gained, and so statistical analyses could not be performed.

One-tail p is reported as there was a directional hypothesis i.e. a deterioration in test scores will occur.

4.5.4 Pilot Study

Before contacting ARDA and the Residential Homes in Gauteng, the original test battery was administered to two individuals as a small pilot study.

(a) Aims:

-To determine how long administration of tests would take, and whether speakers could manage to sustain attention for that period of time.

-To determine whether any modifications of the proposed test battery would be necessary, for instance, exclusion of redundant tasks; inclusion of tasks more sensitive to the effect of AD; changes in the order of task presentation.

(b) Participants:

Two participants were involved in the pilot study. The first was a Dutch-English bilingual male with vascular dementia. The second was a German-English bilingual female with suspected AD. Both were being seen by Speech Therapy Services in Leicester, England.

(c) Procedure:

The proposed test battery was administered. This differed from the current one used in the study in that only one procedural discourse task was included, and the full Concept Definition subtest was attempted.

(d) Results:

Findings indicated that a more difficult, less familiar procedural discourse task was needed, as the original was too easy, and therefore may not be sensitive to changes in the early stages of AD. In addition, the language-free neuropsychological tests (e.g. TMT, AMIPB Information Processing) were administered on the same day as some of the language tests. This was not advantageous as participants tired before the session was completed, and subsequently performance on the last few tests carried out reflected the effects of fatigue more than a difficulty doing the actual task. Fatigue was particularly evident on the Concept Definition task, where performance began to decline from item 8, until the very low scores of 0 and 1 were being awarded. Since items administered were not ordered according to difficulty (e.g. more frequent to less frequent items), the poor performance towards the end of the task can be attributed to fatigue and/or lack of motivation to complete the task.

(e) Subsequent Modifications to the Test Battery:

- A less familiar procedural discourse task was included (posting a glass vase overseas). The original procedure of making a sandwich was nevertheless still included in the test battery, as some of the more impaired speakers in the study may have difficulty with the easier procedure too. A range of difficulty on this task could thus be discerned.
- The Pyramids and Palm tress test was included to assess semantic memory via a non-verbal route.
- The number of items in Concept Definition was cut from 20 to 5 (see previous discussion 4.5.1.4).
- Data collection was spread over three days to limit the effect of fatigue on test performance.

4.6 Summary

The first section of this chapter described the design of the study: five longitudinal single case studies, involving English/Afrikaans bilingual speakers who varied according to age of L2 acquisition, levels of L2 proficiency, and stage of dementia. The second part of the chapter described how tests were adapted from English to Afrikaans, after which the aims, descriptions and scoring procedures of the selected neuropsychological (non-verbal and verbal) and language tests (formal tests and Conversation Analysis) were detailed. The third section of the chapter described the procedures of the study. There were three assessment periods, separated by six month intervals. At each assessment, non-verbal and language-independent tasks were administered on the first day; English formal language tasks and CA were administered on the second; and Afrikaans tasks and CA on the third. The order of test presentation was also described. The fourth section discussed how the data was analysed and pulled together, and the statistical tests that were employed. Data analysis involved statistical analysis of raw scores as well as examination of trends and qualitative results. Intra-language changes across time were examined in this manner, as were inter-language differences between the same tasks in English and Afrikaans. The final section of the chapter described the small pilot study carried out and what changes were needed to be made to the original test battery.

The next five chapters report the findings from each individual speaker, while Chapter 10 draws together the general findings of the study.

INTRODUCTION TO THE FOLLOWING 5 CHAPTERS

The next five sections present the results obtained for each participant, and an ensuing discussion relating to each speaker individually.

The format of each chapter is as follows:

(a) Hypotheses

From the general hypotheses postulated in Chapter 3 (see 3.6), predictions for participants were formulated based on each particular speaker's circumstances as revealed by the Language Background Questionnaire.

(b) Results

Results are reported according to the following order:

A. Formal language and neuropsychological test results, including both quantitative scores and qualitative analyses.

B. Conversation Analysis.

English and Afrikaans results are reported separately. Parameters analysed are turn distribution, topic maintenance, turn-taking, and trouble spots. Analyses cover qualitative features in keeping with CA principles. Additionally, quantitative scores are provided to achieve a means of comparison between languages and across time. Language mixing behaviour in the conversations is reported in Section C iii.

C. Language mixing

(i) on formal tests

(ii) on sentence translation

(iii) in conversations.

For language mixing occurring in conversational discourse, there is further analysis to ascertain:

(a) whether it gave rise to a trouble spot

(b) how these trouble spots were managed

(c) how language mixing affected the quality of interaction as compared to intra-language breakdowns (e.g. word retrieval problems; ambiguous referencing)

(c) Discussion

The Discussion section addresses the hypotheses postulated for each participant, determining whether the predictions have been borne out by the results obtained. The more general discussion in Chapter 10 draws out the implications of the overall findings.

Chapter 5
SPEAKER AR

Table 9 summarises AR's personal details and language background as discussed in section 4.3. She has used her L1 since birth, speaking it daily for both social and vocational purposes, and at home. The pattern of L1 use has not changed over the lifespan.

Age	**Time since diagnosis of AD to start of study**	**L1**	**L2**	**Age of L2 acquisition**	**Method of L2 acquisition**	**Past pattern of L2 use**	**Current pattern of L2 use**	**Current L1 versus L2 level of proficiency**
75 yrs	2 yrs 6 months	Afri	Eng	12 years	Formally at school	Daily: home; work; social	Daily: home; social	Similar levels of proficiency

Table 9: AR: Summary of background details L1 = first language. L2 = second language. Afri = Afrikaans. Eng = English.

5.1 Hypotheses

Based on the general hypotheses proposed (see 3.6) and on AR's personal circumstances (Table 9), the following predictions were made:

[i] PREDICTION: There will be a similar pattern of impairment between L1 and L2. That is, aspects of language (naming, auditory comprehension, discourse) that are impaired in one language will also be impaired in the other (but not necessarily to the same extent - see [ii]). REASON: AR used her languages in a similar pattern in adulthood, activating the expressive and receptive domains of each language to a similar extent. Furthermore, since English and Afrikaans are structurally similar languages, tasks considered more/less complex in one language would also be considered more/less complex in the other, and the hierarchy of sensitivity to AD (as claimed in the monolingual AD literature - see Chapter 2) will be similarly evident across languages.

[ii] PREDICTION: L2 will be more severely impaired than L1.

REASON: As shown in the literature (see Chapter 1), a language acquired later in life is more vulnerable to the aging process, and may never become fully automatised. A less automatised language will require more resources to be activated. However in AD, resources availability diminishes. Therefore, if it is true that L2 has a lower level of automatisation because it was acquired after L1, it will be more affected with the progression of AD.

[iii] PREDICTION: L2 will deteriorate at a more rapid rate than L1.

REASON: As in [ii].

[iv] PREDICTION: Inappropriate language mixing will affect L2 interactions, with language interference occurring in the direction of L1 into L2 talk.

REASON: Previous studies (Chapter 3) have claimed that an imbalance in languages will result in language interference: With decreasing resources there is a problem inhibiting the dominant language. While AR does not have a dominant language in terms of proficiency, she does have an imbalance between languages in terms of age of acquisition and subsequent differences in levels of L1/L2 automatisation.

[v] PREDICTION:

(a) With decreasing neuropsychological abilities, complex language tasks heavily dependent on sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Memory Recognition, Token Test, Procedural Discourse) will show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) L2 will be more affected than the L1.

REASON: The literature has shown an interplay between language and cognition (see Chapter 2). L2 complex tasks will be more vulnerable to decreasing neuropsychological support as it is less automatised, thereby requiring more controlled processing. Controlled processing in turn relies more heavily on cognitive skills to draw upon the necessary explicit metalinguistic knowledge and residual language competence.

5.2 Results

Results are reported in three sub-sections: (a) formal test results (b) Conversation Analysis and (c) language mixing behaviour. An interpretation of the results follows in the Discussion (5.3).

(a) Formal Test Results

This section looks at formal test results, and examines scores for possible differences across languages and across time. Table 10 reports the raw scores across time for neuropsychological testing as well as the English and Afrikaans test batteries. T1 refers to the first assessment period (at entry); T2 refers to the assessments carried out 6 months later; T3 refers to final assessment period 12 months after entry. Where possible, the corresponding dementia severity rating as provided by the ABCD is given in brackets after the raw score. For the Generative Naming (animals) task, norms from Binetti et al (1995) are used to give an indication of the stage of dementia reflected by the raw score, as this test is not included in the ABCD. The full names and details of tests used are cited in Chapter 4.

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
CDR	3	2 (mod)		2		2	
Mental Status	13	5 (mod)		6 (mod)		2 (mod)	
AMIPB -Task A Total	-	-	-	-	-	-	-
-Error %	-	-	-	-	-	-	-
-Speed	-	-	-	-	-	-	-
-Adjusted	-	-	-	-	-	-	-
AMIPB -Lists A1-5	-	-	-	-	-	-	-
-A6	-	-	-	-	-	-	-
Trails A	-	-	-	-	-	-	-
Trails B	-	-	-	-	-	-	-
Digit Fwds	Cut-Off: 5	5		5		4	
Digit Bwds	Cut-Off: 4	2		0		0	
Memory Recognition	-	-	-	-	-	-	-
Story Recall (Immediate)	17	3 (mod)	3 (mod)	2 (mod)	6 (mod)	1 (mod)	2 (mod)
Story Recall (Delay)	17	0 (mod)	0	0	0	0	0
Pyramid & Palm Trees	-	-	-	-	-	-	-
Confront. Naming	20	7 (mod)	6 (mod)	2 (mod)	4 (mod)	2	1 (mod-severe)
Generative Naming -animals	8	5 (mod)	2 (mod-severe)	2	2	1 (mod-severe)	0 (mod-severe)
-transport	8	3 (mod)	2 (mod)	1 (mod)	3	1	1
Super-ordinate Naming	5	2	2	1	3	1	2
Co-ordinate Naming	25	12	12	12	12	13	11
Concept Definition	15	5	5	3	4	3	3
Token Test	36	16	17	11	17	11	11
Procedural Discourse -sandwich		I	√	√	√	√	√
-post		I	I	∅	∅	∅	∅

Table 10: AR: Results Mod = moderate. Below Cut-Off = abnormal. - = not administered/attempted. √ = sequence correct, all essential steps included; I = incomplete/incorrect sequence; ∅ = no evidence of a procedure.

Table 10 reveals a test profile consistent with moderate dementia, with scores approximating the lower end of the moderate scale as the year progressed. Many tasks, especially neuropsychological tests, could not be administered even at the first assessment period due to advanced dementia.

Analyses were carried out to determine firstly whether the differences between the tests in English versus Afrikaans were statistically significant (i.e. inter-language differences), and secondly whether the changes in test scores across time were statistically significant for each language (i.e. intra-language changes). Results are reported in Tables 11a and 11b respectively, along with the statistical test used in each case.

T1	T2	T3
-	Token (McNemar, p=0.0461)	-

Table 11a: AR: Statistically significant inter-language differences at different time points

	T1-T2	T2-T3	T1→T3
English Tests	Confrontation Naming (McNemar, p=0.0313)	-	1) Token (M and M, p=0.0385) 2) Confrontation Naming (M and M, p=0.0228)
Afrikaans Tests	-	Token (McNemar, p=0.0461)	1) Token (M and M, p=0.0416) 2) Confrontation Naming (M and M, p=0.0412)
Other Tests	-	-	Mental Status (M and M, p=0.0502)

Table 11b: AR: Statistically significant changes in scores across time T1→3 = changes that occurred over the year, analysing results across all time periods (i.e. 3 ordered conditions). M and M = Marascuilo and McSweeney Test.

Table 11a shows differences between English and Afrikaans tasks at T2, on the Token Test only. Of the intra-language tests showing changes over time (Table 11b), the Token Test and the Confrontation Naming task deteriorated to a significant extent for both languages, although at different time points.

Qualitative analyses of test performance were carried out to see if patterns of impairment not apparent from raw test scores could be discerned. On the Token Test no differences in performance were noted for English and Afrikaans in so far as level of breakdown was concerned. For both languages, performance broke down on level 2 at T1; at level 1 at T2; and at level 2 at T3. For items involving two propositions, or containing 3 information markers (e.g. colour + shape + size), AR would either carry out the first part only, or would randomly move a token. On the Generative Naming tasks, she did not make use of semantic or phonemic strategies to aid recall for either language at any time period. On Concept Definition, she had difficulty providing an adequate definition for all items, scoring an average score of 1 for each. This finding was similar for both languages.

Table 12 provides an error-analysis of incorrect answers on the Confrontation Naming task. As evident from the table, the most frequent response when naming items was "I don't know" (No Response).

ERROR	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Semantic			1			
Visual	1				1	
Describe feature/ function	1	6	1		4	4
Not related			6		2	1
No response	11	8	10	16	11	14
Total correct	7	6	2	4	2	1

Table 12: AR: Error types from the Confrontation Naming task

Figure 1 gives an indication of how many individual items AR was consistent in not being able to name at any of the assessment periods in either language.

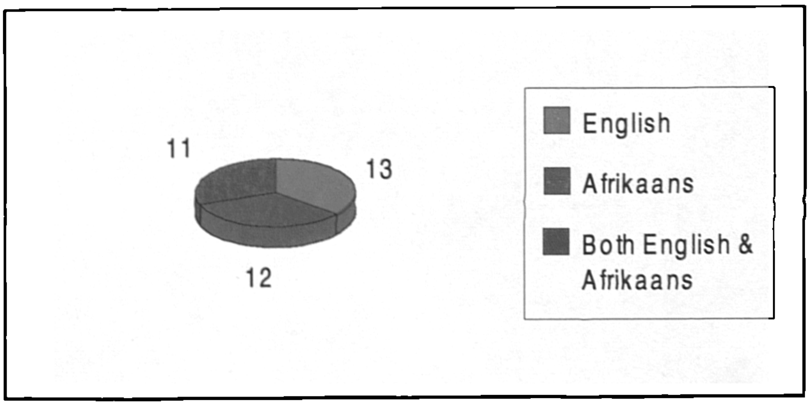


Figure 1: AR: Number of items not named on Confrontation Naming task

From Figure 1, it is evident that she could not name the same 13 items in English on each assessment. In Afrikaans, the same 12 items could not be named on every assessment. Of these, 11 items could not be named in either English or Afrikaans, at any time point.

(b) Conversation Analysis

English versus Afrikaans results are discussed separately, divided up into an overview of general discourse management, extra-linguistic parameters (topic maintenance and turn taking), and linguistic expression of propositions. To avoid repetition, results at T1 are discussed in detail while only those findings from T2 and T3 that are different to the initial analyses are noted. Appendix 9 contains a glossary of terms used in Conversation Analysis.

(i) English

T1:

General

The interlocutor was the researcher, who participated in conversations at all three time points. AR assumed an active role in the conversation, showing strong evidence of understanding and agreement by paraphrasing what the interlocutor was saying, and introducing new topics. Topics spoken about in the ten minute conversation included childhood, the Residential Home, and travel. Turn distribution was balanced with both interlocutors constructing major turns of similar length (approximately 2 utterances). However, the interlocutor assumed a more passive role in as far as introducing new information into the conversation was concerned. Instead of contributing new information, the interlocutor tended to ask questions to request information, elaboration or clarification, and gave feedback to show agreement and confirmation (Wootton, 1989).

Appendix 10 contains an extract from AR's conversation, where examples are included of how turn distribution was calculated and active versus passive roles decided.

Extra-linguistic parameters

(a) Topic maintenance:

AR demonstrated a decreased (but not completely impaired) ability to maintain a topic over several turns. In addition she tended to introduce a new topic abruptly without signalling a topic shift explicitly. This caused a trouble spot for the interlocutor, as is apparent from the example below:

[I = interlocutor]

1. **AR:**	I miss the farm
2.	(1.1)
3.	Because it's open
4.	(1.2)
5.	And and you can make jokes and (0.5) laugh and so on you know
6. **I:**	So you're saying it's much more carefree? Less stressful than living in the city?
	[ ] [ ]
7. **AR:**	Yes Yes
8.	(0.6) a city is uh:
9.	(1.0) A city you must be very careful you know
10. **I:**	Yes a city is quite dangerous isn't it?
11. **AR:**	Dangerous, it is.
12.	(1.5)
13.	And uh::
14.	(1.9)
15.	I was the baby.
16.	(0.8)
17. **I:**	You were the baby?
18. **AR:**	Yes I was the baby
19. **I:**	Of the <u>family</u>? So did you have older brothers or sisters?
	[ ]
20. **AR:**	Yes
21. **AR:**	Uh
22.	(1.4)
23.	I had only one sister

In the extract above, AR and her interlocutor were talking about living on a farm, and comparing the advantages of farm-life to living in a city. In line 15, AR introduced a new subject: her family. However because she did not make the topic shift explicit by closing the previous topic or by marking the shift as a new subject, the shift presented a trouble spot for the interlocutor. Before this instance, the interlocutor had been taking her turn promptly. However the silence in line 16 suggests that she had difficulty understanding AR's sudden topic shift. Indeed, in line 17, the interlocutor asked for confirmation that she was understanding AR correctly by repeating AR's statement in a question form. In line 18, AR provided strong confirmation by repeating her statement. In line 19 the interlocutor asked for further confirmation that the talk has progressed to AR's family. AR obliged (line 20), and continued to elaborate on the subject (line 23).

(b) Turn *taking:*

Turn-taking skills were generally intact, with AR taking up her turns promptly at the relevant TRP. However, of 18 questions asked by the interlocutor, 8 were greeted by an attributable silence, indicating a delay in taking her turn. By tolerating attributable silences, the interlocutor gave AR time to process the question and formulate an answer, allowing her to maintain her active role in the conversation. Findings from Perkins et al (1998) and Sabat (1991) indicate that tolerance of such silences usually improves interactional success. This was confirmed by the fact that AR (eventually) answered all questions appropriately, except for a single example:

[I = interlocutor]

1. **I:** So do you prefer living (.) on the farm or in the city?
2. (0.9)
3. **AR:** Y-yes i-i-it it is very good. (0.4) But in certain you know you get tired later on.
4. (etc.)

Linguistic expression

Even though many extra-linguistic parameters of the interaction appeared preserved, the quality of interaction was compromised by word retrieval difficulties, circumlocutions and tangential speech, abandoned phrases, ambiguous use of pronouns, and poor referencing. These all caused trouble spots for the interaction. Table 16 (column 3) provides a detailed breakdown of the type of repair that followed these trouble spots.

T2:

As with T1. Topics covered included family, weight, the Residential Home, and the weather. Of 14 questions, 7 were followed by attributable silences, and there was only one instance where AR did not provide a relevant response to the question. Word retrieval difficulties continued to be a major cause of trouble spots. There was one instance where AR initiated other-repair, asking the interlocutor to repeat her last comment.

T3:

In this interaction, both interlocutors played active roles, with the interlocutor also contributing new information to the conversation. Turn distribution was equal, with both partners constructing short turns (no more than three utterances). Both made use of minimal turns and tokens for feedback, and gave up their turns smoothly. Of the 24 questions posed to AR, 18 were greeted by attributable silences. Topics covered included going out for tea, family, and cooking.

(ii) Afrikaans

T1

General

The interlocutor was an Afrikaans-speaking female nurse who worked in the Residential Home. AR assumed a dominant role in this interaction. She constructed many extended turns, resulting in an uneven distribution of turns. In comparison, the interlocutor played a minor role, asking questions, paraphrasing AR's talk, or giving feedback using minimal turns and tokens to show understanding, agreement, or as continuers. Both interlocutors introduced new topics, by way of a question from the interlocutor, or a topic shift from AR. Topics spoken about in the conversation were holidays, friends, shopping, the Residential Home, and occupations.

Extra-linguistic parameters

As with the English interactions, turn taking was preserved apart from attributable silences occurring after the interlocutor asked a question. Of 18 questions asked, 13 were followed by an attributable silence. Topic maintenance was decreased in a manner similar to that observed in English conversations, as evident from this example:

[English gloss in italics. I = interlocutor]

1. **I:** Jy's jy's nie 'n verpleegster nie.
You're not a nurse
2. **AR:** Nee, nie 'n ver<u>pleeg</u>ster nie. Ek is 'n persoon wat 'n
3. (2.0)
4. Kyk jy jy vorm sulke klompies jy weet?
No, not a nurse. I'm a person who (verb omitted) a
(2.0) Look you form such groups you know
5. (1.4)
6. **I:** Ja::?
Yes?
7. **AR:** En dan (0.7) dit is nou joune daardie. Jy jy dink nie daaroor met
8. [unintelligible two syllables]. En nou was dit hierdie vrou wat nou (0.7)
9. wat net dieselfde gewees as ek. (0.5) Sy't die huis gekoop en sy't heeltemaal
And then (0.7) it is now yours. You you don't think about it with
[unintelligible two syllables]. And now it was this woman that now (0.7)
who was just the same as me. (0.5) She bought the house and totally
[ ]
10. **I:** Hoe het sy -
11. Wat het sy gedoen?
How did she - what did she do?
12. **AR:** Man, sy het op (0.6) dieselfde (0.5) Sy het nie omgegee nie. (0.4) Toe koop
13. sy weer een van drie. Sy't sy't plekke gekoop.
Man, she had the same (0.5) She did not care (0.4) Then she bought one
of three. She she bought places.
14. **I:** Ooh.
Oh.

The talk at the start of the extract was about occupations and what AR worked as before she retired. In line 4, AR appeared to have shifted the topic to talking about a friend of hers. The interlocutor however did not appear to follow this shift. In line 5, a TRP arose. The interlocutor took her turn (line 6) but did not construct a major turn. By using a token instead, the interlocutor was giving AR two forms of feedback. The first was that she was attending to AR's talk; the second was a continuer. By prolonging the vowel and using a question intonation, the interlocutor encouraged AR to continue her talk in order that the new topic of conversation would become more explicit. In lines 7-9, AR continued taking about the woman in question but the talk did not become clearer for the interlocutor. Instead, the interlocutor asked for further clarification (lines 10 and 11). In lines 12-13 AR attempted the repair, finally retrieving the noun "plekke" (*places*) that clearly marked why she had begun talking about her friend in the first place. The interlocutor then acknowledged the repair, using the token "ooh" as an indication of understanding. This example shows how because a shift in line 4 was not made explicit, it was only several turns later that the interlocutor was once again able to follow the theme of AR's talk.

Linguistic expression

As with the English interactions, word retrieval difficulties and difficulties expressing ideas caused trouble spots in AR's talk, which she tried to repair by either abandoning the phrase/clause, or using circumlocutions. Poor referencing (e.g. use of a pronoun without an antecedent) was a major cause of trouble spots resulting in other-initiated repair. However, even though there were numerous trouble spots, only isolated instances of other-initiated repair were evident (see Table 16 column 5).

T2:

The interlocutor who participated in T1 had resigned from the Residential Home before the second assessment commenced. Therefore a new interlocutor was introduced. She was also an Afrikaans-speaking nurse in the Home, and participated in conversations at both T2 and T3. In the conversation at T2, AR once again assumed a more dominant role, but not to the same extent as at T1. She constructed longer turns than the interlocutor, and took responsibility for minimising gaps, introducing new topics, and elaborating on current topics. Topics covered included the Residential Home, Real Estate, clothes and meals. Both interlocutors made use of tokens and minimal turns as feedback, indicating agreement, understanding, evidence of attention, and as continuers (Perkins, 1993; Wootton, 1989). Trouble spots were the same as with T1. Of 19 questions asked, 8 were followed by attributable silences.

T3:

As with T2, except that turn distribution was more balanced, with both interlocutors constructing short turns, not exceeding two or three utterances on the whole. Of 15 questions asked, 9 were followed by an attributable silence. Topics covered in the conversation included family, the Residential Home, and finances.

(c) Language Mixing Behaviour

[i] Formal Tests

The amount and types of code switches on various formal tests is reported in Table 13.

Language	T1	T2	T3
English	-Generative Naming (1xV)	-Confrontation Naming (1xV) -Generative Naming (1xV) -Concept Definition (1xV)	-Co-ordinate Naming (1xV)
Afrikaans	-Confrontation Naming (1xV) -Co-ordinate Naming (1xV)		-Co-ordinate Naming (2xV)

Table 13: AR: Amounts and types of code switches made on formal tests. P = whole phrase code switched. V = vocabulary item code switched. The numbers in brackets refer to the number of times such errors occurred.

As evident from the above table, only isolated instances of code switching occurred in English and Afrikaans tasks.

[ii] Sentence Translation

In order to examine for which language translation proved more difficult, and in order to describe the types of errors made on sentence translation tasks, errors made while translating sentences from one language to the other were examined. The results are provided in Table 14.

T1		T2		T3	
Eng to Afri	Afri to Eng	Eng to Afri	Afri to Eng	Eng to Afri	Afri to Eng
V+DT	V+DT	P+DT	P+DT	P+DT	V+P+DT

Table 14: AR: Results from the sentence translation task Eng = English. Afri = Afrikaans. V = single vocabulary item code switched; DT = direct translation; P = whole phrase code switched.

On the sentence translation task, similar errors were made in both English and Afrikaans sentences. Errors ranged from isolated vocabulary items being inserted to whole phrases being code switched.

[iii] CA

In order to examine code switching behaviours, overall results regarding inappropriate language mixing from the CA are reported in Table 15. Code switched utterances include both intra- and intersentential code switches, but a breakdown of each is also shown in the table.

	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Total Utt	93	110	61	97	70	88
CS Utt	5	3	2	3	8	1
Intrasent. Switches	5	1	2	3	1	0
Intersent. Switches	0	2	0	0	7	1
%	5.4	2.7	3.3	3.1	11.4	1.1

Table 15: AR: Amount of utterances code switched in conversations Total Utt = total number utterances in conversation. CS Utt = number utterances (out of the total) that were code switched. % = percentage of utterances code switched, calculated by dividing Total Utt by CS Utt.

Consistent with the patterns of language mixing on the sentence translation tasks, inappropriate code switching affected both English and Afrikaans interactions. However, language mixing was more prominent in English conversations, and the difference in amount of code switched utterances between languages at T3 reached statistical significance (Fisher's

Exact, p=0.0078). As is evident from Table 15, the pattern of language mixing ranged from insertions of isolated vocabulary items into a sentence (intrasentential switches), to full turns in the inappropriate language (intersentential switches). A statistical analysis of the amount of inter- versus intrasentential switching reveals that only intersentential switches in the Afrikaans conversations increased to a statistically significant level over the year (Jonckheere Trend Test, p=0.0008). This analysis was carried out by dividing the number of total utterances by number of intersentential switches at each time point, and analysing these figures to determine if a statistically significant increase occurred over time.

An examination of individual lexical code switches was undertaken. In English interactions, an equal number of content and function words were code switched. In the Afrikaans interactions, code switches affected content words only. There were two examples of morphologically adapted switches. The first was at T1: "gestudy" - the English content word "study" with the Afrikaans past tense marker "ge-" as the prefix. The second was at T2: "jobbie" - the English content word "job" with the Afrikaans marker for the diminutive "ie".

To determine whether language mixing gave rise to trouble spots, the number of repairs initiated subsequent to inappropriate language use was calculated. To investigate how these trouble spots were managed, the type of negotiation following the trouble source was analysed. In addition, in order to determine how far code switching affected the quality of interaction as opposed to other reasons for breakdowns (e.g. ambiguous references), amounts and type of repairs arising from language mixing behaviour versus from other (intra-language) causes were compared. All these results are reported in Table 16. The types and amounts of repair carried out in English and Afrikaans are reported, with the Afrikaans data being divided into amount and type of repair arising from a code switch; and those arising from all other reasons. Repair was not initiated subsequent to language mixing in English conversations with AR, and hence repairs in the English column refer to trouble spots arising from other causes only.

		English (other TS)	Afrikaans (TS arising from CS)	Afrikaans (other TS)
SI-SR	T1	37	0	41
	T2	38	0	39
	T3	24	0	23
SI-OR	T1	0	0	1
	T2	1	0	0
	T3	0	0	0
OI-A	T1	0	0	1
	T2	1	0	2
	T3	0	0	0
OI-OR	T1	0	0	1
	T2	2	0	1
	T3	1	0	0
OI-SR	T1	8	0	5
	T2	2	0	3
	T3	2	1	1
CoR	T1	0	0	0
	T2	2	0	1
	T3	1	0	0
Total SIR	T1	37	0	42
	T2	39	0	39
	T3	24	0	23
Total OIR	T1	8	0	7
	T2	5	0	6
	T3	3	1	1

Table 16: AR: Types and totals of repair for each language TS = Trouble Spots; CS = Code Switching; SI-SR = self-initiated self-repair; SI-OR = self-initiated other-repair; OI-A = other-initiated but repair abandoned; OI-OR = other-initiated other-repair; OI-SR = other-initiated-self-repair; CoR = collaborative repair; SIR = self-initiated repair; OIR = other-initiated repair.

Table 16 reveals a preference for self-repair in both languages. However, with regards to self-repair following code switching trouble spots, AR did not initiate repair for any of the code switching behaviour. This can be seen from the fourth column, second last row.

Table 17 shows the length of repair trajectories (in number of turns) that followed trouble spots caused by inappropriate code switching. These were compared to trajectory lengths where the trouble spot involved causes *other* than language mixing (for instance use of a pronoun without an antecedent). All self-initiated self-repairs were completed within the same turn as the repair-initiation, and are therefore not included in the table. Instances where other-repair was initiated but then abandoned involved the interlocutors requesting clarification (e.g.: what? who?), after which AR failed to provide the repair. The interlocutors did not initiate repair again, nor did they provide the repair themselves. All instances of other-initiated repair where repair was abandoned followed this pattern, and are therefore also omitted from the table.

	Trajectories (TS arising from CS)	Trajectories (other TS)	
SI-OR turn immediately after request for repair	-	T1 (A):1	T2 (E): 1
OI-OR same turn	-	T1 (A): 1 T2 (A): 1	T3 (E): 1 T2 (E): 2
OI-SR turn immediately after request for repair	T3 (A): 1	T1 (A): 4 T2 (A): 2 T3 (A): 1	T1 (E): 7 T2 (E): 2 T3 (E): 2
OI-SR over several turns	-	T1 (A): 1 T2 (A): 1	T1 (E): 1
CoR over several turns	-	T2 (A): 1	T2 (E): 2 T3 (E): 1

<u>Table 17: AR: Trajectory length (in turns) following initiation of repair</u> SI-OR = self-initiated other-repair; OI-OR = other-initiated other-repair; OI-SR = other-initiated self-repair; CoR = collaborative repair. E = English; A = Afrikaans.

From Table 17, it is evident that the only repair trajectory following a code switch occurred in Afrikaans at T3. In comparison, numerous trajectories followed trouble spots arising from sources other than code switching. For example, there were three instances where OI-SR trajectories lasted over several turns: two in the Afrikaans conversations, and one in English at T1.

5.3 Discussion

This section details an interpretation of the results reported in 5.2, discussing whether the hypotheses postulated for AR (see 5.1) were borne out, and the extent to which they held true. The Discussion is divided into five subsections corresponding to each of the five predictions.

(a) Pattern of loss

Regarding hypothesis [i], results from both formal language tests and CA (with the exception of language mixing results) support the prediction of a similar pattern of impairment between languages. A discussion of the observed patterns follows below.

[i] Formal Language Tests

The prediction of a similar pattern of impairment across languages was supported. The areas of auditory comprehension, memory and naming were impaired in both languages, while areas of relative sparing such as the familiar procedural discourse were similarly apparent in English and Afrikaans. Qualitative analyses too revealed a similar pattern of impairment. For instance, on Co-ordinate Naming, the examiner had to provide a subordinate member of the category before AR could provide co-ordinates. This indicates a marked difficulty (in both languages and at all time periods) in providing a *sub*ordinate after having being given the category name. This suggests, as do the other results on super and co-ordinate naming tasks, that this aspect of the semantic system is affected in a parallel manner for both languages.

With regards to Confrontation Naming results, the absence of inter-language differences suggests that the problem lies with access to or degradation of the actual concept, as opposed to language-specific difficulties accessing the lexicon. In other words, the concept of the word could not be accessed and therefore could not be named in either language. It is possible that visual perceptual problems also interfered with performance on the task. However, results on

Concept Definition showed that both L1 and L2 were similarly impaired. That is, AR had as much difficulty defining an item in one language as she did in another. This finding supports the theory that difficulties with naming resulted from impaired access to (or an impairment within) the semantic conceptual system. From these results as well as those from the rest of her language profile discussed above, it can be concluded that a similar pattern of impairment exists between languages as identified on formal tests.

[ii] CA Results

For all interactions, the prediction of a similar pattern of impairment across languages was borne out by CA results. Each parameter investigated is reported separately below. A glossary of terms used can be found in Appendix 9.

Turn Taking

For both English and Afrikaans interactions, a high percentage (approximately 50%) of attributable silences was evident following questions asked by her interlocutor. This suggests slowed information processing ability, an interpretation supported by neuropsychological tests: AR was unable to attempt Trail Making Test A and the AMIPB Information Processing subtest. During conversations, AR needed time to process questions and formulate answers, causing a delay in taking her turn - hence the attributable silence. However, interlocutors were tolerant of these silences, allowing AR the extra time she needed to process the questions. Although a statistically significant difference (p=0.0461) between language comprehension abilities is evident from the Token Test at T2 where she showed better auditory comprehension abilities in Afrikaans, this difference is not mirrored in CA results; attributable silences were evident in *both* languages.

Topic Maintenance

For both languages, AR had difficulty maintaining a topic over several turns. This was exacerbated by abrupt, poorly signalled topic shifts which adversely affected the quality of interaction. However, there were several examples where AR exhibited intact topic maintenance suggesting that this extra-linguistic parameter was not completely compromised. An example is illustrated in this extract from English T2, where she and her interlocutor (I) were talking about AR's weekly outing with her daughter:

1. **AR:**	Yes. And then we and see: uh wh:at (.) things (.) I need and which things she
2.	needs. °Ja::° (0.3) And we have a look there.
3. **I:**	Oh like Pick 'n Pay?[1]
4. **AR:**	Ja (0.9) And this is something like a Pick 'n Pay. There's een ding in a *one thing*
5.	big house: (0.9) that place. (0.6) Did you - did she took you there?
6. **I:**	No I haven't been with her there (0.3) °Uhuh°
7.	(0.9)
8. **AR:**	Man, there seems very (0.3) uh where she sells there's is is uh (.) cheap.
9. **I:**	Uh >so that's nice < you can get yourself a nice new dress as we:ll::: [ ]
10. **AR:**	Yes I can pick
11.	it up on a real sale, and have it >all the time<
12.	(1.1)
13. **I:**	Well very nice. I mean it's <u>nice</u> to find s:omewhere that you: (.) you like
14.	the <u>clothes</u> that they have and it's affordable
15. **AR:**	Yes: and they're very (0.3) uh good too.
	(2.7)
16. **AR:**	But now (0.6) I I must uh [one unintelligible syllable] with my clothes (.)
17.	I must <u>change</u> it you know
18. **I:**	Why you mean it that you need a new wardrobe?
19. **AR:**	Ja. No: m: yes mine is old (.) I don't want it anymore
20. **I:**	Right=
21. **AR:**	=I want a new one!=
22. **I:**	=Well why not ? [hhh]

The above extract clearly illustrates AR's good topic maintenance in this instance. However there is evidence of a difficulty expressing propositions, for example in line 8. AR is trying to explain that the shop is very cheap, but cannot retrieve the appropriate noun 'shop'. Instead she

[1]Pick 'n Pay is the name of a supermarket chain. Larger stores also sell clothing.

attempts to correct this trouble spot by substituting other pronouns (there → she). Other examples are also apparent where the use of a pronoun instead of a noun creates a trouble spot for the interlocutor (e.g. Line 2: 'there'; line 17: 'it'). While the difficulty with verbal expression is highlighted, there is an underlying theme gelling her talk together.

With regards to topic maintenance then, it was not always feasible to discern whether AR's talk was off the topic, or whether she had difficulty expressing herself because of word retrieval difficulties, resulting in circumlocutions and digressions. In other words, the pragmatic aspect of maintaining a topic over several turns appeared to be compromised. However, an additional difficulty with verbal expression may have added to the impression of decreased topic maintenance - a pattern observed in both languages.

Verbal Expression

Difficulties on a linguistic level concerning word retrieval deficits and overuse of pronouns were similarly evident across languages. These difficulties resulted in numerous trouble spots in both English and Afrikaans. For example:

(English T2)

1. **AR:** We've got two (0.3) uh: small little (1.3) things is uh (1.5) and then they come
2. here when when:

The fillers (e.g. 'uh'), empty nouns ('things'), numerous pauses and prolonged syllables in the above extract suggest that AR was finding it difficult to retrieve the target word. Such deficits adversely affected the quality of interaction as they resulted in many instances of self-initiated repair. The amount of self-initiated repair (Table 16) and occurrences of pauses in AR's talk were roughly equal for English and Afrikaans. It is therefore evident that she has similar difficulty with verbal expression in both languages.

Repair

This discussion concerns intra-language trouble spots leading to repair. Repair following code switching trouble spots is explored separately in d [iii].

With regards to repair initiation and repair trajectories, similar patterns were evident from the English and Afrikaans CA. Although linguistic deficits resulted in a marked difficulty in expressing ideas and conveying information in both languages, interlocutors withheld abundant initiation of repair. Instead they tended to use tokens or minimal turns as continuers. In this manner they would encourage AR to construct her turn, possibly waiting for the theme of AR's talk to become more transparent as she continued. However, more instances of other-initiated repair subsequent to intra-language trouble spots (Table 16) occurred for AR than any other participant. This is proportional to the extent of word retrieval deficits and poor use of referencing (using pronouns without establishing antecedents) evident in AR's talk. In other words, AR had difficulty expressing herself, causing her talk in both English and Afrikaans to be unclear and ambiguous. Interlocutors had difficulty following her message and because of AR's increased difficulty with verbal expression, her interlocutors encountered an increased need to initiate repair.

Most other-repair initiations involved yes/no questions or short wh- questions (who? what?) explicitly identifying the trouble spot and unambiguously focusing repair. This resulted in largely successful repair outcomes, as is evidenced by the few examples of OI-A trajectories in either language (Table 16, row 4). It therefore appears that the interlocutors were sensitive to the advanced stage of AR's dementia, and tailored repair initiations in a manner that resolved trouble spots in a clear and quick manner.

Evident in both English and Afrikaans interactions, collaborative repairs revealed co-operation between both interlocutors in sharing repair work (Crockford and Lesser, 1994), while the preference for self-repairs (Table 16, columns 3 and 5) is consistent with Schegloff et al's (1977) findings from healthy speakers. However, a different pattern was found regarding self-repairs following code switching (see d iii).

In summary, inter-language differences were not apparent on CA. For both languages, difficulties with topic maintenance and processing of questions were evident, as were linguistic difficulties with verbal expression. Results were consistent across time periods.

(b) Severity of Loss

[i] Formal Language Tests

The hypothesis that L2 would be more severely impaired than L1 was not upheld: English and Afrikaans were affected to a *similar* extent. Tasks impaired for L1 and L2 were generally affected to the same degree, with results falling in the moderate to moderate-severe impairment categories. The only exception is at T2, where English results on the Token Test were just significantly worse than Afrikaans ($p=0.0461$). However, by T3, this difference in severity of impairment in auditory comprehension fell away, and the task remained similarly impaired across languages. The lack of support for the original hypothesis could reflect the insensitivity of the tests selected. The test battery administered was possibly not sensitive to inter-language discrepancies in severity of impairments, especially since many results were at or close to floor. Alternatively, the possibility exists that frequent use of and constant exposure to L2 boosted automaticity levels. L2 was thus sufficiently automatised to complete the particular tasks selected for the test battery as well (or poorly) as she could in her L1. The latter possibility is congruent with findings on the CA.

[ii] CA Results

Results from the CA also did not support hypothesis [ii] as L2 was not more severely impaired than L1. Rather, findings from the CA suggested that the languages were impaired to a similar extent. Attributable silences were evident in both languages, as were linguistic difficulties with verbal expression and difficulties with topic maintenance. Furthermore an equal amount of repair was initiated and repair trajectory lengths were similar across languages. These findings suggest that English (L2) was automatised to a sufficiently high level so as to remain as spared/impaired as her L1. Inter-language differences were not apparent at the level of conversational discourse. The exception is language mixing behaviour which is discussed separately in d [iii].

(c) Rate of Loss

[i] Formal Language Tests

The hypothesis of a different rate of decline for English and Afrikaans was supported, but not very strongly. Over the year, a downwards trend in many formal test scores was apparent in both languages, although not all results reached statistical significance. Scores on other tests remained stable throughout the year, albeit approaching floor. A statistically significant difference in rate of decline between the languages was evident on two tests only: the Token Test and Confrontation Naming. As evident from Tables 10 and 11b, performance on these tests in English dropped in the first six month period (T1-T2), while the Afrikaans equivalents remained relatively stable for that period. However, the second half of the year (T2-T3) saw deterioration in Afrikaans, while the English results were stable. There are other examples from qualitative analyses where English (L2) deteriorates in the first 6 month period while Afrikaans (L1) remains stable. The first is performance on the Confrontation Naming test. In English at T2, AR gave 6 unrelated responses in English (Table 12), whereas in Afrikaans unrelated responses are only noted at T3. The second example is on Generative Naming (animals) where English results fall in the moderate-severe impairment category at T1, while Afrikaans results only deteriorate to that level six months later at T2.

Figure 2 presents a graphic demonstration between what was predicted and what was observed.

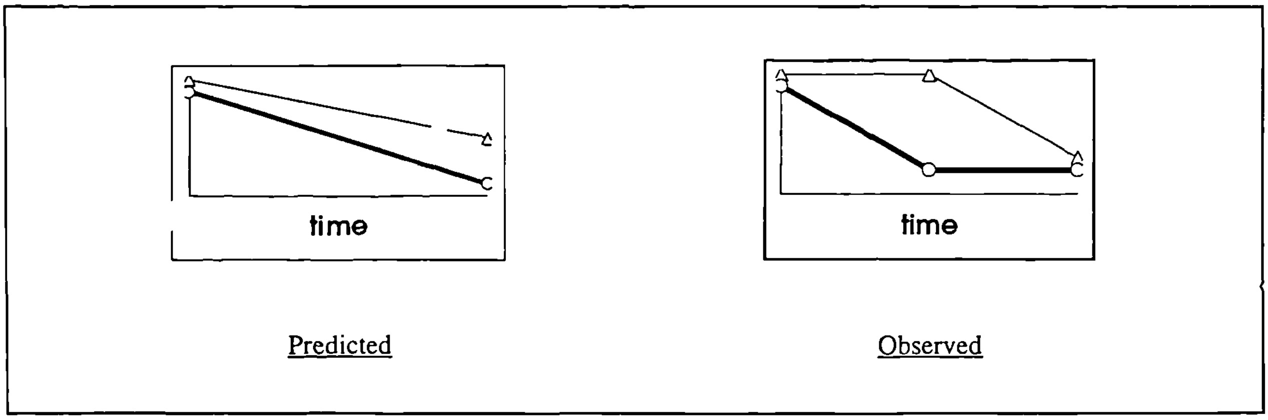


Figure 2: AR Predicted versus Observed L1/L2 rate of decline
Key: -Δ- L1
-o- L2

From Figure 2, it appears that English deteriorated at a faster rate initially, but the gap between languages narrowed by T3, thereby eliminating any inter-language differences. The end point was the same, but the route to T3 varied in rate between languages in so far as Confrontation Naming, Generative Naming and Token Tests are concerned. However, it should be noted that scores on all tests were very low, and thus statistical analyses are not as sensitive as they would be with larger numbers. Conclusions regarding rate of impairment should therefore be considered tenuous.

[ii] CA Results

With the exception of language mixing behaviour (see d [iii]), CA results did not confirm the hypothesis of L2 deteriorating at a faster rate than L1. Rather, AR's profile remained stable over the year and did not deteriorate in either language. Reasons for this finding are discussed in Chapter 10 (see 10.3).

(d) Language Mixing Behaviour

[i] Formal Language Tests

Consistent with the small number of code switches in conversations (see d [iii]), only isolated code switches occurred on formal test results in either language. These did not increase over the year's period, suggesting that they were isolated occurrences, and were not indicative of a serious difficulty keeping two languages apart.

[ii] Sentence Translation

As evident from Table 14 code switching occurred in both directions, from L1 to L2, and from L2 to L1 translations. However, these results may reflect a difficulty with the task itself as opposed to inhibiting the non-selected language. This task makes high demands on working memory: the person must hold in memory the sentence/phrase to translate, as well as the overall aim of the task, as well as keeping track of what has already been translated. For example, in Afrikaans past tense, the main verb generally goes to the end of the sentence. AR may have forgotten what the verb was by the time the end of the sentence was reached. Impaired working memory (as revealed by Digit Backwards, Token Test, Story Recall) may have strongly influenced the unsuccessful completion of this task. It can therefore be argued that this task tests the integrity of working memory more than the ability to keep two languages separate at a psycholinguistic level (See 10.4.3).

[iii] CA

Results from the CA refute the hypothesis of unilateral language mixing behaviour (L1 into L2 talk) at T1 and T2, as a similar pattern of language mixing was evident in both English and Afrikaans interactions. However, the prediction is supported by findings at T3. What follows is an analysis and interpretation of language mixing results showing how and why this conclusion was reached.

Amount of Code Switching

As evident from Table 15, inappropriate language mixing occurred in both English and Afrikaans conversations, although to a limited extent. Even though the differences in amount of language mixing between languages were statistical significant at T3 (Fisher's Exact, p=0.0078), the number of code switched utterances are still negligible.

Code Switching

An analysis of intrasentential trouble spots was carried out. By examining the type of lexical code switches made, it becomes apparent that in Afrikaans (and to a lesser extent English), content words were code switched, while switching of function words was rare. This pattern of *content* words being code switched is contrary to results from Poulisse and Bongaerts (1994) and Giesbers (1989). These authors found that *function* words were more commonly switched than content words. This finding from AR, together with the fact that some switches were phonologically and morphologically adapted into the base language without any sign of hesitation, suggests that the code switches did not arise because of language interference, but rather were loan words for her. Loan words are those words borrowed from another language and are usually adapted both morphologically and phonologically into the language being spoken (Grosjean, 1982). This interpretation is supported by the fact that the number of mixed utterances (intrasentential code switches) did not change over time to a significant extent. Rather, it was the insertion of full utterances of Afrikaans into English talk at T3 that resulted in statistically significant differences between English and Afrikaans at this time period (Table 15). In other words, the progression of the dementing process did not affect mixed utterances/intrasentential code switching (a pattern possibly originating pre-morbidly), but rather affected full utterances being constructed in the inappropriate language (i.e. intersentential code switching).

Regarding the full English utterances interspersed in Afrikaans talk at T1 (Table 15), this phenomenon can be expl'ined in terms of distractibility and influence of external variables. An example follows below. The talk was in Afrikaans, until an unidentified male comes into the room:

[Italics = English translation. I = Interlocutor]

1. **AR:**	[...] en dan sy (0.8) een ding jy is
	and then she (0.8) one thing you are
	[ ]
2. **Man:**	Now where is it?
3.	(3.2)
4. **AR:**	That's one you must keep because
5. **I:**	Hy's
	He's
	[ ]
6. **AR:**	It's not no no he's he's not interviewing me
7. **I:**	Hy bly ook net hierso. (0.7) Is die ou oom wat baie siek is.
	He also lives here (0.7) It's the old man who is very sick
8. **AR:**	Los hom net so uit
	Leave him alone

In the above example, AR's use of language is influenced by external distractions. The man speaking in English prompts her to construct her talk in English. The interlocutor does not initiate repair by asking AR to talk in Afrikaans, or requesting repetition. Rather, by the interlocutor using Afrikaans herself, AR rapidly switches back to using the appropriate language for the interaction. Giesbers (1989) explains this as reactive accommodation, whereby the person matches his/her code switching patterns to that of the interlocutor, or to the language last used. However in this instance it was not appropriate for AR to lapse into the language the stranger was using, as she was not talking to him, but to the interlocutor.

While external distractions can explain the inappropriate language mixing in this interaction, the appearance of intersentential switches in the English T3 conversation cannot be similarly accounted for. Rather, the intrusion of Afrikaans into English talk at T3 appears to arise from a difficulty inhibiting L1. This point is resumed towards the end of the section.

Repair Following Code Switching

As seen by comparing Tables 15 and 16, not every code switch gave rise to a trouble spot. In fact, for English, none of the code switched utterances caused a trouble spot, and only two code switches in the Afrikaans interactions resulted in other-initiated repair. This may reflect the fact that interlocutors tend to withhold repair to maintain the quality of interaction (Schegloff et al, 1977). Alternatively, the code switching did not present a trouble spot as the preceding/following utterances may have provided sufficient context for the gist to be understood. This reason is especially viable considering that of all the language mixing, most utterances involved code switches of individual lexical items (mixed utterances) as opposed to full utterances in the inappropriate language. The absence of self-initiated repair suggests that AR was largely unaware when she was using the wrong language.

In the two instances in the Afrikaans interactions where other-repair was initiated (Table 15, column 4), AR did not complete repair in the first instance, but could in the second. The latter example from T3 is transcribed below:

[Italics = English translation. I = Interlocutor]

1. **AR:** Dis net so goed. (.) Dis (0.3) <u>my</u> taal jy weet
It's just as good. It's my language you know
2 **I:** °Ja°
3. **AR:** Uh very easy
4. **I:** Ekskuus?
Pardon?
5. **AR:** °D-d-° jy kry dit ka-kan dit maklik (0.6) leer
D-d- you get it can learn it easily

The trouble spot in the above extract arose with the use of the inappropriate language (line 3). The interlocutor initiated repair in line 4 but did not explicitly state where the trouble spot was or why it arose. AR however still succeeded in completing the repair in her next turn (line 5). This example suggests that while AR may not always have been aware of inappropriate language mixing as it occurs (as indicated by the absence of self-initiated repairs), she retained an awareness of what caused the trouble spot in this instance, and demonstrated an ability to activate the appropriate language to repair the breakdown. Self-monitoring of language use is discussed at length in 10.4.4.

In summary, the above findings reveal a similar pattern of code switching trouble spots and subsequent repair in English and Afrikaans interactions. For both languages, code switches had a negligible adverse effect on the quality of interaction, as evidenced by minimal initiation of repair and short repair trajectories. However, although analyses of repair do not indicate a difference between languages, at T3, a difference emerges in terms of the amount of language mixing occurring, and the nature of that mixing (i.e. more inter-sentential switches and fewer intra-sentential switches).

With regards to hypothesis [iv] then, language mixing results at T1 and T2 did not support the prediction that code switching would affect English (L2) interactions predominantly. Rather, language mixing was sparse for both languages (Table 15), and many code-switches can be considered as borrowed from the other language, rather than difficulties with inhibiting the non-selected language. Furthermore, intersentential switching was not a feature of the interactions, apart from Afrikaans T1 (which has been interpreted above). However, at T3, a different pattern emerged. More utterances were code switched in the English conversation, and for the first time in the year, intersentential switching occurred with complete utterances in Afrikaans intruding into English talk. In comparison, only one English utterance occurred in the Afrikaans conversation. These results are consistent with the prediction made, as language mixing was more pronounced in the later learnt language than her L1. Findings at T3 suggest that with increasing dementia, age and method of acquisition influences may begin to override any significant influences wielded by a balanced proficiency of languages (achieved in adulthood). Certainly in AR's scenario it appears that activation of her later-learnt language and/or successful inhibition of her L1 at the level of conversational discourse was becoming more vulnerable as the dementing process progressed. This point is resumed in 10.4.4.

(e) Neuropsychological Functioning and Language

This section explores a possible link between language performance and neuropsychological profiles. First, neuropsychological findings over the year period are examined, then the hypotheses proposed are explored as to the extent to which they have been supported by test results.

Neuropsychological profile

It was predicted that with decreasing neuropsychological capacity, complex language tasks supported by sustained attention, working memory, sequencing and information processing would show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities. Furthermore it was hypothesised that L2 would be more affected than the L1. However these predictions were difficult to confirm as so few neuropsychological results could be administered. As evident from Table 10, the only neuropsychological test that could be attempted (barring Mental Status and CDR ratings) was Digit Repetition. Results from Digits Forwards fall just below normal limits, indicating a relatively preserved immediate memory. However, impaired working memory is evident at T1 (Digit Backwards), and at both T2 and T3, AR is unable to complete the task at all, indicating a severe impairment. Both Mental Status and CDR rating are consistent with a moderate dementia. Statistically significant changes on the Mental Status subtest ($p=0.0502$) suggest increasing severity of dementia over time.

Neuropsychological decline and language tasks

[i] Formal Language Tests

Even though so few neuropsychological test results are available, an apparent link between poor attention, working memory and information processing abilities, and language tasks can be inferred. This supports the first part of the prediction. For instance, performance on the Token Test - a language test with a large working memory component - deteriorated significantly over the year for both languages. Furthermore, a downwards trend in scores was also evident for Generative Naming tasks. The more complex procedural discourse task in English and Afrikaans too became severely impaired after T1, with AR appearing unable to construct and sequence a detailed procedure correctly. These results support the prediction that deteriorating neuropsychological functioning would affect complex tasks in both languages. Further support for the pattern of language impairment being influenced by decreasing neuropsychological support comes from the fact that tasks less demanding on attention and working memory (such as Super- and Co-ordinate Naming) remain constant over the year. However, it must be pointed out that scores on these tasks were depressed even at T1, and the statistical tests employed may not have been sensitive to changes in performance near floor.

[ii] CA Results

With regards to CA results for both English and Afrikaans, information processing abilities and attentional deficits affected extra-linguistic aspects of conversational discourse. Attributable silences followed questions posed to AR, and the quality of topic maintenance was also compromised as has been discussed in 5.3 (a). This finding also lends support to the prediction that impaired neuropsychological abilities appear to be linked with impaired language functions.

Neuropsychological functioning and L1 versus L2 performance

The second part of the hypothesis was that L2 would be more vulnerable to deteriorating neuropsychological functions. Again, with so few results available, interpretation has to be tempered. However, it appears that this prediction also held true as drops in several English formal language tasks occurred at T2, while the Afrikaans equivalents only followed in the second six month period (T2-T3). These findings were discussed in more detail in 5 c [i].

With regards to CA findings, results concerning language mixing behaviour support this prediction in that the amount and type of code switching differed between languages at T3. No change was noted in the Afrikaans interaction over the year, while deterioration of language mixing behaviours started to become evident in her L2 (English) interaction at T3.

It can thus tentatively be concluded that both languages were affected by deteriorating cognitive skills, with L2 being more affected than L1. This finding confirms the predictions made, and supports the reasoning that a language learnt later in life is less automatised than the first language.

5.4 Summary

For AR, a similar pattern and severity of impairment between languages was found on both formal test scores and Conversation Analysis results. However, language mixing behaviour exhibited in conversations in English (her L2) began to differ quantitatively and qualitatively from Afrikaans at the final test period T3. Where rate of decline is concerned, there was some support for the claim that L2 deteriorated at a faster rate than L1, at least within the year's time slot examined.

The appearance of differences between L1 and L2 regarding rate of loss over the year and inappropriate language mixing seems to correlate with increasing dementia as inferred from

Mental Status scores. However it does appear that the attainment of equal levels of proficiency in L1 and L2 over the lifespan, and equal amount of exposure to the languages even since living in the Residential Home, resulted in fewer differences between the languages especially where severity of impairment is concerned. It can be argued that consistent exposure to L2 and frequency of L2 use boosted automaticity levels, masking many differences between the languages until the later stages of the dementing process. Only then did differences between languages become apparent with rate of decline and language mixing behaviour. At that advanced stage of dementia, depleted resources eventually unmasked subtle differences between language caused by different ages of L1 versus L2 acquisition. It therefore appears that a language learnt later in life - even where high levels of proficiency have been attained - may never become fully automatised. It thus remains vulnerable to depleting resources and/or degradation of the language system following the onset of AD. This interpretation is consistent with claims made by Paradis (1997; see Chapter 1).

Chapter 6
SPEAKER BL

Table 18 summarises BL's personal details and language background as discussed in section 4.3. She has used her L1 since birth, speaking it da'ly for both social and vocational purposes, and at home. The pattern of L1 use has not changed over the lifespan.

Age	Time since diagnosis of AD to start of study	L1	L2	Age of L2 acquisition	Method of L2 acquisition	Past pattern of L2 use	Current pattern of L2 use	Current L1 versus L2 level of proficiency
89 yrs	2 yrs	Eng	Afri	12 years	Formally at school	Daily: home; work; social	Daily to every 2 or 3 days, depending on visitors/ staff members on duty	More proficient in English

Table 18: BL: Summary of background details L1 = first language. L2 = second language. Afri = Afrikaans. Eng = English.

6.1 Hypotheses

Based on the general hypotheses proposed (see 3.6) and on BL's personal circumstances (Table 18), the following predictions were made:

[i] PREDICTION: There will be a similar pattern of impairment between L1 and L2. That is, aspects of language (naming, auditory comprehension, discourse) that are impaired in one language will also be impaired in the other (but not necessarily to the same extent - see [ii]).
REASON: Even though BL is less proficient in her L2, she attained a high enough level of proficiency to meet daily social and vocational communicative needs. Therefore, although her L2 may be less automatised than her L1, all components of language tested in the battery were used daily. For instance she has been required both to listen to conversations in Afrikaans and to reply in that same language. Both her receptive and expressive language skills in Afrikaans

have been used on a daily basis throughout adulthood. Furthermore, since English and Afrikaans are structurally similar languages, tasks considered more/less complex in one language would also be considered more/less complex in the other. Therefore the pattern of deterioration in her L2 is expected to be similar to that seen in her L1.

[ii] PREDICTION: L2 will be more severely impaired than L1.

REASON: As shown in the literature, a language acquired later in life is less automatised and more vulnerable to the effects of aging (see Chapter 1). Not only did BL learn her L2 after acquiring her L1, but her L2 remained less proficient than her L1 throughout adulthood. If it is true that L2 requires more resources to activate and relies more on controlled processing than does L1, then with dementia L2 will be impaired to a greater degree (even though the same components of language will be impaired across languages).

[iii] PREDICTION: L2 will deteriorate at a more rapid rate than L1.

REASON: As in [ii].

[iv] PREDICTION: Inappropriate language mixing will affect L2 interactions, with language interference occurring in the direction of the more proficient L1 into the less proficient L2 talk.

REASON: The literature suggests that a difference in proficiency results in unidirectional language mixing, where the dominant language intrudes when conversing in the weaker language (see Chapter 3).

[v] PREDICTION:

(a) With decreasing neuropsychological capacity, language tasks heavily dependent on sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Token Test, Procedural Discourse) will show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) L2 will be more affected than the L1.

REASON: The literature has shown an interplay between language and cognition (see Chapter 2). The L2 will be more vulnerable to decreasing neuropsychological support as it is less automatised, thereby relying more on those cognitive skills to be activated and to make use of explicit metalinguistic knowledge and residual language competence.

6.2 Results

Results are reported in three sub-sections: (a) formal test results (b) Conversation Analysis and (c) language mixing behaviour. An interpretation follows in the Discussion (6.3).

(a) Formal Test Results

This section looks at formal test results, and examines scores for possible differences across languages and across time. Table 19 reports the raw scores across time for neuropsychological testing as well as the English and Afrikaans test batteries. The corresponding dementia severity rating as provided by the ABCD is given in brackets after the raw score. For the Generative Naming (animals) task, norms from Binetti et al (1995) are used to give an indication of the stage of dementia reflected by the raw score. As BL was far older than controls used for normative data on the AMIPB, these norms were not adhered to when interpreting performance. The full names and details of tests used are cited in Chapter 4.

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
CDR	3	1 (mild)		1 (mild)		2 (mod)	
Mental Status	13	3 (mod)		5 (mod)		2 (mod)	
AMIPB -Task A Total	Cut-off: 24	25		40		50	
-Error %	Cut-Off: 12	40		75		68	
-Speed	Cut-Off: 25	19		23		22	
-Adjusted	Cut-Off: 24	27		46		66	
AMIPB -Lists A1-5	Cut-Off: 26	19	9	15	8	7	5
-A6	Cut-Off: 3	0	0	0	0	0	0
Trails A	Mean: 38.2"	2'21 (2 errors)		2'25 (4 errors)		2'40 (5 errors)	
Trails B	-	-		-		-	
Digit Fwds	Cut-Off: 5	6		6		6	
Digit Bwds	Cut-Off: 4	3		3		3	
Memory Recognition	16	4	0	2	0	1	0
Story Recall (Immediate)	17	7 (mild)	4 (mild-mod)	6 (mild-mod)	4	5 (mild-mod)	4
Story Recall (Delay)	17	0 (mild-mod)	0	0	0	0	0
Pyramid & Palm Trees	52	30		35		25	
Confront. Naming	20	11 (mod)	7 (mod)	10 (mod)	5 (mod)	8 (mod)	6 (mod)
Generative Naming -animals	Cut-Off: 8	8 (within normal limits)	5 (mild)	4 (mod)	3 (mod)	3	3
-transport	Cut-Off: 8	8 (mild)	4 (mild-mod)	5 (mild-mod)	1 (mod)	3 (mod)	0 (mod-severe)
Super-ordinate Naming	5	4	4	3	2	4	3
Co-ordinate Naming	25	23	17	21	18	21	18
Concept Definition	15	12	9	9	6	7	5
Token Test	36	32	28	29	21	24	24
Procedural Discourse -sandwich		√	√	I	I	I	√
-post		I	I	I	I	I	I

Table 19: BL; Results Mod = moderate dementia. Below Cut-Off = abnormal. - = not administered/attempted. √ = sequence correct, all essential steps included; I = incomplete/incorrect sequence.

As seen from Table 19, the general trend evident from the test battery is one of overall decline, with Afrikaans test scores remaining consistently lower than English scores.

Analyses were carried out to determine firstly whether the differences between the tests in English versus Afrikaans were statistically significant, and secondly whether the changes in test scores across time were statistically significant for each language. Results are reported in Tables 20a and 20b respectively, along with the statistical tests used.

T1	T2	T3
List Learning (Wilcoxon, p=0.0156)	1) Token (McNemar, p=0.0107) 2) Confrontation Naming (McNemar, p=0.0313)	-

Table 20a: BL: Statistically significant inter-language differences at different time points

	T1-T2	T2-T3	T1→T3
English Tests	-	List Learning (Wilcoxon, p=0.0313)	1) Token (M and M, p=0.0033) 2) Confrontation Naming (M and M, p=0.0320 3) List Learning (Page's L, p=0.0384) 4) Concept Definition (Page's L, p=0.0054)
Afrikaans Tests	Token (McNemar, p=0.0195)	-	Concept Definition (Page's L, p=0.0127)
Other Tests	AMIPB Errors (McNemar, p=0.0039)	Pyramids and Palm Trees (McNemar, p=0.0207)	AMIPB Errors (M and M, p=0.0203)

Table 20b: BL: Statistically significant changes in scores across time T1→3 = changes that occurred over the year, analysing results across all time periods (i.e. 3 ordered conditions). M and M = Marascuilo and McSweeney Test.

As is evident from Table 20a, statistically significant differences were evident between a few L1 and L2 tasks. However, by T3, these inter-language differences had disappeared. Table 20b shows that more statistically significant changes were apparent over the year in the English test results than the Afrikaans ones.

Qualitative analyses of test performance were carried out to see if patterns of impairment not apparent from raw test scores could be discerned. On the List Learning test, a stronger recency effect was noted for both languages, while no learning curve was evident. Similarly, on the Token Test, no differences in performance were noted for English and Afrikaans. For both languages, performance broke down on level 5 for both languages at T1 and T2; and at level 3 at T3. On the Generative Naming tasks, similar strategies to facilitate recall were used, and similar performances across languages were noted. BL made use of semantic strategies at T1 for both languages to aid recall. At T3, she began to include incorrect items on trials in both languages: one in the English test, and two in the Afrikaans.

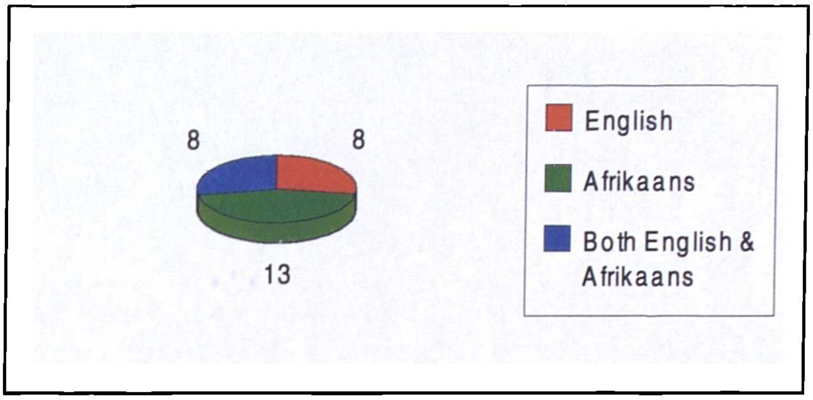
On Concept Definition, differences between languages were apparent at T1 and T2. BL could provide a full definition (i.e. score of 3) for some items in English but did not score higher than a 2 for items defined in Afrikaans. However, by T3 the top score achieved for any item in any language was only 2, and the average score was 1.

Table 21 provides an error-analysis of incorrect answers on the Confrontation Naming task. The presence of unrelated responses at T3 is congruent with the appearance of similarly unrelated responses in the Generative Naming task at the same time period.

ERROR	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Semantically Related	4	2	1	1	2	3
Visually Related	1	1	1		3	
Describe Feature/Function	2	6	2	1	2	1
Unrelated					1	2
No Response	2	4	6	13	4	8
Total Correct	11	7	10	5	8	6

Table 21: BL: Error types from the Confrontation Naming task

As evident from Table 21, a variety of errors was made on this task for both languages. Figure 3 gives an indication of how many items BL could not answer at any of the assessment periods in either language.



<u>Figure 3: BL: Number of items not named on Confrontation Naming task</u>

BL demonstrated a knowledge of some objects by giving correct definitions on the Concept Definition, or by describing their features/functions on the Confrontation Naming task. However, as evident from Figure 3, she could not provide the label for the same 8 items in either English or Afrikaans on each assessment. In addition, there were a further 5 items in Afrikaans that she could not name at all, although she could name them in English.

<u>(b) Conversation Analysis</u>

English and Afrikaans results are discussed separately, divided up into an overview of general discourse management, and extra-linguistic parameters (topic maintenance and turn taking). Linguistic expression of propositions is commented upon at the end of the section. To avoid repetition, results at T1 are discussed in detail while only those findings from T2 and T3 that differ to the initial analyses are noted. Appendix 9 contains a glossary of terms used in Conversation Analysis.

(i) English

<u>T1:</u>

General

The interlocutor for all the English conversations was the researcher. BL assumed an active role in the conversation, asking questions, introducing new topics, and minimising gaps. Topics covered in the conversation included friends, dress-making, the Residential Home, family, and immigration. Turn distribution between BL and the interlocutor was balanced, with both interlocutors constructing an average turn of 3 utterances. BL made good use of feedback, using tokens as continuers, acknowledgement of understanding, and agreement (Perkins, 1993; Wootton, 1989).

Extra-linguistic parameters

Turn taking skills were intact as she took her turns promptly, and relinquished turns appropriately. Topic maintenance was also preserved apart from one instance where she lost track of the conversation. In that instance she explicitly asked for repair:

[I = Interlocutor]

1. **I:** So when you say it's too <u>close</u> for you, what do you mean it's too close for you?
2. (3.4)
3. **BL:** Uh: what did we talk about?

In the above example, an attributable silence in line 2 (one of the very few from the conversation) greeted the interlocutor's question, indicating that the question had caused a trouble spot. BL then initiated repair (line 3), and the conversation continued. Of 16 questions asked, 4 were greeted by an attributable silence before BL replied. One such silence followed the interlocutor's question introducing a change in topic:

1. **I:** How long have you been here for?
2. (1.3)
3. **BL:** More than a year

BL initiated and completed other-repair once:

1. **I:** Where did you meet her? At a social function: or?
2. **BL:** <u>No</u>. Met her at a friend then brought her to my house
3. (1.5)
4. A <u>friend</u>. Brought <u>her</u> to <u>my house</u>=
5. **I:** =Oh so she's a friend's friend

The silence of 1.5 seconds (line 3) occurred where the interlocutor did not give any feedback that she understood BL's talk in line 2, nor even acknowledged BL's explanation of where she had met the person in question. BL interpreted the silence as meaning the interlocutor did not understand what she had said. BL subsequently initiated and carried out the repair (line 4) by repeating her utterances, and emphasising the key words. In line 5, the interlocutor provided immediate feedback, giving strong evidence of understanding by paraphrasing BL's message.

<u>T2:</u>

As with T1, except there were no difficulties with losing the theme of the conversation. Of 10 questions posed to BL, only one was followed by an attributable silence. There were no instances of BL initiating other-repair. Topics covered included friends, academic study, family and doctors.

<u>T3:</u>

As with T2, except that BL did not introduce any new topics into the conversation. However, she still played an active role in the conversation. Topics spoken about included health matters and Princess Diana's death. Of seven questions asked, 2 were followed by an attributable silence. Evidence of memory problems impinging on the conversation was noted:

(1) Oh my (0.5) So she's - is she's been buried already?
(2) Terrible isn't it. Has she been buried yet?
(3) When's the funeral?

The above three questions were all asked within 4 minutes of conversation, indicating that BL either forgot she had asked the question before, or else she had forgotten the answer.

(ii) Afrikaans

T1:

As with English T2. Seven questions were asked in total, and BL responded to all promptly. The interlocutor was an Afrikaans-speaking assistant working at the Home, who also participated in the conversations at T2 and T3. Topics spoken about in the conversation included languages, childhood, the Residential Home, past occupations, and family.

T2:

As with English T2. Of 15 questions posed to BL, 5 were greeted by an attributable silence before BL constructed her turn in reply. There was one instance where BL initiated other-repair, asking the interlocutor to provide a less ambiguous interpretation of an event they were discussing. Topics covered included school, catering, and a forth-coming party at the Residential Home.

T3:

Even though the interlocutor was the same person involved at T1 and T2, BL played a more passive role in this conversation. She passed up her chance to take a full turn, instead making use of minimal turns. The average turn length for BL was 1 utterance, and 2-3 for the interlocutor, as illustrated in this extract:

[I = interlocutor. English gloss in italics]

1. **I:** Ja. Goed dan. Waar gaan jy Vryday?
OK then. Where are you going on Friday?
2. (0.6)
3. **BL:** Ek gaan (.) ek gaan iets koop of: doen of
I'm going (.) I'm going to buy or do something or
4. **I:** Ooh jy sal jou inkoopies doen: en (0.3) miskien 'n rok gaan koop?
Oh you are going to do your shopping and (0.3) maybe buy a dress?
5. **BL:** Nee
No
6. **I:** Ooh net die inkoopies doen.
Oh only do the shopping
7. **BL:** Ja
Yes
8. **I:** Goed dan. Ek sal jou eers bel en ek sal jou nou nou sien.
OK then. I'll phone you first and I'll see you soon

As evident from the above extract, distribution of turns was unequal, with the interlocutor assuming responsibility for maintaining conversation by constructing longer turns and asking more questions.

BL did not introduce any new topics into the conversation, did not contribute towards elaborating on current topics, and only asked one question in the whole 10 minute extract. Topics covered included the death of Princess Diana, family, routines (e.g. shopping), and the Olympic Games. Of the 17 questions the interlocutor asked, 6 were followed by an attributable silence before BL answered.

Linguistic expression

In all interactions for both languages, trouble spots included abandoned phrases, revisions and word retrieval problems. For example [English T3]:

1. **BL:** What will they do if they get (0.6) punished? I mean they
2. (1.1)
3. Do you think that the: um (0.5) government will uh: probably (.) punish them?

The pause in line 1 of 0.6 seconds suggests that BL was searching for the appropriate word "punished". At the end of that line, the sentence is abandoned and is followed with a silence of 1.1 seconds (line 2). Further evidence of word retrieval difficulties is evident in line 3 by way of hesitations, prolongations and pauses. Table 25 gives a breakdown of intra-language trouble spots for each language, and this is interpreted in the Discussion section (6.3 c ii).

In summary, pragmatic aspects of conversation management (such as topic maintenance, turn-taking) remained largely preserved for both languages. It was only in the Afrikaans interaction at T3 that BL began to play a less active role in the conversation. A major difference revealed by the CA pertained to language mixing behaviour, and how it differentially affected the quality of interaction in English versus Afrikaans. These details are provided in c (iii) below.

(c) Language Mixing Behaviour

[i] Formal Tests

The amount and types of code switches on various formal tests is reported in Table 22.

Language	T1	T2	T3
English	-Story Recall (1xP) -Confrontation Naming (1xV)	-	-
Afrikaans	-Generative Naming (1xV) -Co-ordinate Naming (2xV) -Procedural Discourse (2xV)	-Co-ordinate Naming (1xV) -Concept Definition (1xV) -Procedural Discourse (1xV)	-Co-ordinate Naming (2xV) -Confrontation Naming (1xV)

Table 22: BL: Amounts and types of code switches made on formal tests. P = whole phrase code switched. V = vocabulary item code switched. The numbers in brackets refer to the number of times such errors occurred.

As revealed by Table 22, the amount of code switches occurring was minimal for each assessment, with none evident in English at T2 and T3.

[ii] Sentence Translation

In order to examine for which language translation proved more difficult, and in order to describe the types of errors made on sentence translation tasks, errors made while translating sentences from one language to the other were noted. These errors are reported in Table 23.

T1		T2		T3	
Eng to Afri	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**
V	DT	V+DT	V+P	V+DT	V

Table 23: BL: Results from the sentence translation task Eng = English. Afri = Afrikaans. V = single vocabulary item code switched; DT = direct translation; P = whole phrase code switched.

On the sentence translation task, problems were encountered on both English and Afrikaans sentences. Errors ranged from isolated vocabulary items from the wrong language being inserted, to whole phrases being code switched. For both languages, BL translated the sentences literally, resulting in sentences that were not idiomatic for that target language. There was no pattern of change in types of errors made in either language over time; errors made appeared to be erratic.

[iii] CA

In order to examine code switching behaviours, overall results regarding inappropriate language mixing from the CA are reported in Table 24. Code switched utterances refer both to intra- and intersentential switches, i.e. utterances that are mixed (contain both English and Afrikaans lexical items) and complete utterances in the inappropriate language respectively. A separate breakdown of the number of intra- versus intersentential switches is also included in the table.

	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Total Utt	118	136	81	96	94	92
CS Utt	0	31	0	31	0	38
Intrasent. Switches	0	14	0	12	0	13
Intersent. Switches	0	17	0	19	0	25
%	0	22.8	0	32.3	0	41.3

Table 24: BL: Amount of utterances code switched in conversations Total Utt = total number utterances in conversation. CS Utt = number utterances (out of the total) that were code switched. Intrasent. = intrasentential. Intersent. = intersentential. % = percentage of utterances code switched, calculated by dividing Total Utt by CS Utt.

In contrast with the patterns of language mixing on the sentence translation tasks, for the conversations, inappropriate code switching affected the Afrikaans interactions only (Table 24, final row). The pattern of language mixing ranged from insertions of isolated lexical items into a sentence (e.g. T2: Ek praat still - [*I* still *speak*]), to full turns in the inappropriate language. The increase in percentage of utterances code-switched in Afrikaans conversations from T1 to T3 is highly significant at the 0.01 level (Jonckheere Trend Test, p=0.0018). However, a statistical analysis of the amount of inter- versus intrasentential switching reveals that only intersentential switches increased to a statistically significant level over the year (Jonckheere Trend Test, p=0.0035). This analysis was carried out by dividing the number of total utterances by number of intersentential switches at each time point, and analysing these figures to determine if a statistically significant increase occurred over time.

An examination of individual lexical items code switched (i.e. intrasentential switches) was undertaken. At T1, 75% of switches affected function words. At T2 and T3 however the pattern was reversed, with over 80% of switches affecting content words. This finding is explored in detail in 6.3.

To determine whether language mixing gave rise to trouble spots, and if so, how the trouble spots were managed, the number of repairs initiated subsequent to inappropriate language use, and the type of negotiation occurring were calculated. In addition, in order to determine how far code switching affected the quality of interaction as opposed to other reasons for breakdowns (e.g. ambiguous references), amounts and type of repairs arising from language mixing behaviour versus from other causes were compared. All these results are reported in Table 25. The types and amounts of repair carried out in English (where no code switching occurred), and Afrikaans are reported, with the Afrikaans data being divided into amount and type of repair arising from a code switch; and those arising from all other reasons.

		English (other TS)	Afrikaans (TS arising from CS)	Afrikaans (other TS)
SI-SR	T1	13	1	15
	T2	13	0	17
	T3	16	3	19
SI-OR	T1	2	0	0
	T2	1	0	0
	T3	0	0	1
OI-A	T1	1	0	0
	T2	0	4	0
	T3	0	4	0
OI-OR	T1	0	1	0
	T2	1	0	1
	T3	1	3	1
OI-SR	T1	0	1	2
	T2	1	9	1
	T3	1	6	1
CoR	T1	0	1	0
	T2	1	1	0
	T3	0	0	1
Total SIR	T1	15	1	15
	T2	14	0	17
	T3	16	3	20
Total OIR	T1	1	2	2
	T2	2	13	2
	T3	2	13	2

Table 25: BL: Types and totals of repair for each language TS = Trouble Spots; CS = Code Switching; SI-SR = self-initiated self-repair; SI OR = self-initiated other-repair; OI-A = other-initiated but repair abandoned; OI-OR = other-initiated other-repair; OI-SR = other-initiated-self-repair; CoR = collaborative repair; SIR = self-initiated repair; OIR = other-initiated repair.

As evident from the last two summary rows of Table 25, there is a difference in amount and type of repair initiated. For repair initiated after intra-language/"other" trouble spots, there was a greater proportion of SIR as opposed to OIR. However, where trouble *spots arose from* language mixing behaviour, the trend was reversed: instances of OIR outnumbered instances of SIR.

Table 26 shows the length of repair trajectories (in number of turns) that followed trouble spots caused by inappropriate language mixing. These were compared to trajectory lengths where the trouble spot involved causes *other* than language mixing (for instance word retrieval difficulties). All self-initiated self-repairs were completed within the same turn as the repair-initiation, and are therefore not included in the table. Instances where other-repair was initiated but then abandoned involved the interlocutors requesting clarification (e.g.: who? what do you mean?), after which BL failed to provide the repair. The interlocutors did not initiate repair again, or provide the repair *themselves*. All instances of other-initiated repair where repair was abandoned followed this pattern, and are therefore also omitted from the table.

	Trajectories (TS arising from CS)	**Trajectories (other TS)**	
SI-OR turn immediately after request for repair	-	T1 (E): 2 T2 (E): 1	T3 (A): 1
OI-OR same turn	T1 (A): 1 T3 (A): 3	T2 (E): 1 T3 (E): 1	T2 (A): 1 T3 (A): 1
OI-SR turn immediately after request for repair	T1 (A): 1 T2 (A): 6 T3 (A): 3	T2 (E): 1 T3 (E): 1	T1 (A): 2 T2 (A): 1 T3 (A): 1
OI-SR over several turns	T2 (A): 3 T3 (A): 3	-	
CoR over several turns	T1 (A): 1 T2 (A): 1	T2 (E): 1	T3 (A): 1

<u>Table 26: BL: Trajectory length (in turns) following other-initiated repair</u> TS = trouble spots; CS = code switching. SI-SR = self-initiated self-repair; OI-OR = other-initiated other-repair; OI-SR = other-initiated self-repair; CoR = collaborative repair. E = English; A = Afrikaans.

The above table shows that while most intra-language trajectories were completed within two turns, trajectories following language mixing stretched over several turns.

There were four instances where BL explicitly asked the interlocutor to provide a word in Afrikaans, stating that she did not know how to say that particular word in her L2. Two of these examples occurred at T1, and two at T2. Only two examples were noted where a topic change was accompanied by a language shift (from L2 to L1): at T1 and at T2, in the Afrikaans interactions.

6.3 Discussion

This section details an interpretation of the Results (6.2) in order to establish whether or not the predictions outlined in 6.1 were supported. The Discussion is divided into 5 subsections corresponding to each of the five hypotheses.

(a) Pattern of Loss

[i] Formal Language Tests

The hypothesis that a similar pattern of impairment would be evident for English and Afrikaans was confirmed. That is, the same tasks were impaired in both languages. However, there are two exceptions. The first is Generative Naming (animals) at T1, where English results fell within normal limits while Afrikaans results were mildly impaired. However, the English score does fall at the very bottom of the 'normal' range, and six months later these scores drop sharply, falling in the moderate impairment category.

The second exception is seen on the Memory Recognition task over the year period. Although inter-language differences in scores on this task are not statistically significant, closer analysis does reflect an inter-language difference. BL is better able to encode and retrieve information from memory in English (her L1), while she appears less able to do so in Afrikaans. English Memory Recognition test results thus reflect equally impaired encoding and retrieval abilities, while Afrikaans scores reflect an inability to encode virtually any verbal stimulus into memory. With such results, it is not surprising that she has such difficulty with other Afrikaans memory tests: the information appears not to have been encoded in memory in the first place. However while performance on memory tasks is qualitatively different for English versus Afrikaans, the discrepancies may not actually be reflecting a different *pattern* of impairment as much as a difference in *severity* of impairment, with Afrikaans being more impaired than English.

With regards to qualitative analyses, no important differences in task performance between languages were revealed. For instance, unrelated responses in Generative Naming and Confrontation Naming became apparent at T3 for both languages (Table 21). Another example is a breakdown on the Token Test with items of *two* propositions occurring at T3, again for both English and Afrikaans. Therefore, a similar pattern of impairment for both languages can be concluded.

[ii] CA Results

Similar patterns of impairment and sparing were noted across languages with regards to discourse management. Abilities preserved in both languages over all assessment periods were topic maintenance, turn taking, and an awareness that the message must be adjusted to achieve mutual understanding between interlocutors (Hamilton, 1994). Areas impaired across languages included the ability to verbally convey propositions. Verbal expression was compromised by word retrieval deficits, abandoned phrases and incomplete sentences. These findings support the hypothesis of a similar pattern of impairment across languages. However, the degree to which these difficulties manifested themselves varied, indicating a difference in severity of impairment. These difficulties will now be discussed in (b).

(b) Severity of Loss

[i] Formal Language Tests

The hypothesis that L2 would be affected to a greater degree was confirmed by test results, with English scores remaining consistently higher than Afrikaans. Even though a similar pattern of deficit was observed, the important differences between languages are in terms of severity.

The difference in severity of impairment reached statistical significance for several tasks at T1 and T2, as is evident from Table 20a. In addition, BL's Afrikaans profile suggests a moderate dementia, tending towards severe dementia by T3. In contrast, her English test profile suggests mild dementia, moving towards moderate over the year's period. A contradiction to this trend is Confrontation Naming, where English results reflect an impairment far worse than is indicated by performance on other English tasks. This supports findings from Bayles and Trosset (1992) where impairments in naming did not always mirror the severity of dementia. However, even though English Confrontation Naming tasks are relatively more impaired than other English tests, scores remain higher than their Afrikaans equivalents. This discrepancy in Confrontation Naming scores can be explained as reflecting the contention that a bilingual speaker is not two monolinguals in one (c.f. Grosjean, 1989, 1992) and therefore may know lexical items in one language that they have no need to know in the other.

[ii] CA Results

At T1 and T2, the discrepancy in severity between English and Afrikaans performance noted on formal tasks is not mirrored in conversation in so far as topic management (turn taking, topic maintenance, turn distribution) is concerned. This suggests that the role of shared knowledge, contextual clues, and the redundancy inherent in conversations supported the interaction, limiting any damage an impaired working memory may inflict on the quality of interaction. The result is that a similar pattern of relatively preserved topic management skills is evident for both languages.

In contrast, at T3, BL played a less active role in the interaction. Turn distribution was no longer balanced and the interlocutor had to assume greater responsibility for continuing the talk. BL made use of minimal turns rather than constructing major turns, passing up opportunities to take the floor. This behaviour corresponded with an increase in language mixing, and suggests an increased difficulty in holding a conversation in Afrikaans (her L2). Causes of an increase in language mixing behaviour is discussed in sections d [iii] and e.

Discrepancies in the ability to express propositions (i.e. a difficulty with verbal expression) in L1 versus L2 can be seen by comparing the total amount of repairs initiated. These figures can be found in Table 25, columns 3 and 5, rows 8-9. A higher proportion of repair (self plus other) was made in the Afrikaans stretches (i.e. where she succeeded in using the appropriate base language, Afrikaans, without code-switching) than in the monolingual English conversations. For example, in Afrikaans at T3, a total of 22 repairs occurred in 54 utterances (40.7%). The figure 54 was calculated by taking the total number of utterances (Table 24) and subtracting the amount of code-switched utterances (i.e. 92-(13+25)=54) so that only monolingual Afrikaans utterances were being examined. In comparison, in the monolingual English conversation at T3, only 18 instances of repair occurred in 94 utterances (19%). This suggests that she had more difficulty expressing herself in her L2.

(c) Rate of Loss

The prediction that L2 would show deterioration at a more rapid rate than L1 was supported by CA results, but not by formal test scores, where L1 deteriorated at a faster rate than L2. A discussion of these findings follows below.

[i] Formal Language Tests

As seen in Table 19, a downwards trend in scores is evident over time for both languages, even though changes between time periods do not always reach statistical significance. However, although scores deteriorated for both English and Afrikaans tasks, a difference in rate of decline between the two languages is evident, with English (L1) deteriorating at a faster rate than Afrikaans (L2) in the time slot of examination. Statistically significant gaps between the same tasks in different languages (i.e. inter-language differences - Table 20a) fell away as the *English* scores worsened, but the Afrikaans scores did not deteriorate to a degree large enough to sustain that statistically significant gap. For instance, Confrontation Naming in English dropped from T2 to T3, but Afrikaans scores remained stable. This resulted in any inter-language differences for this task falling away. Another example is Generative Naming where English results plummeted from just within normal range to the moderately-impaired range in just 6 months, while the Afrikaans scores did not change as drastically. The hypothesis that L2 would deteriorate at a faster rate than L1 over the year (hypothesis [iii]) was therefore not verified satisfactorily. Figure 4 gives a visual interpretation of rate of decline, highlighting the discrepancy between what was predicted and what was observed.

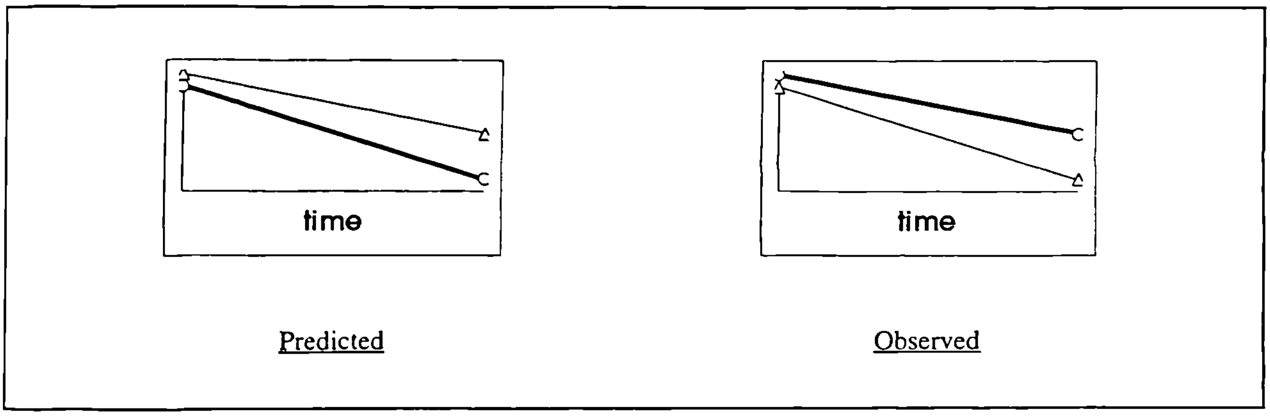


Figure 4: BL: Predicted versus Observed L1/L2 rate of decline

Key: -Δ- L1

-o- L2

Two possible reasons can explain this discrepancy between what was hypothesised and what was found. The first reason is that the English scores were markedly higher at T1 than

Afrikaans scores. The statistical tests may have been more sensitive to changes in larger numbers than smaller numbers. Therefore, because of the biased nature of statistical tests, the changes in English reached high levels of significance, while the drops in already small numbers in Afrikaans did not. In this light, Afrikaans may indeed have been deteriorating as rapidly as L1, but the small numbers precluded sensitive statistical analyses. However, on scrutiny, it is evident that scores in Afrikaans were not always very close to the floor, and could drop quite a bit further (e.g. the Token Test). This implies that the reason scores did not change was not necessarily because the tests were insufficiently sensitive, but because the abilities tapped by these tasks remained relatively unchanged. Therefore, another reason may be more valid.

The second possibility as to why hypothesis [iii] was unsupported has to do with the window of assessment. AD is a disease that can last for up to 15 years, but only one of those years was tracked in the present study. Deterioration in both languages is expected because of the nature of the disease process, but the findings of the study may have yielded a misrepresentative picture regarding which language declined more rapidly. It is highly plausible that L2 had been deteriorating at a more rapid rate than L1 since the onset of AD, but the slice of time investigated did not facilitate an accurate insight into the course of decline. The window artificially bordered the picture of attrition, where what we may be seeing is in fact the tail-end of L2 deterioration while L1 attrition had only begun more recently. Such an interpretation is consistent with CA profiles, where as predicted, L2 is not only more severely impaired than L1, but also deteriorates at a faster rate.

[ii] CA Results

The prediction of a different rate of decline was supported by CA results, where L2 deteriorated faster than L1. With regards to discourse management, L1 remained stable while L2 deteriorated over the final six month period of the assessment year. This is evidenced by unequal turn distribution and increased use of minimal turns and tokens occurring in the

Afrikaans interactions at T3. Furthermore, a progressive difficulty with verbal expression was noted over the year in L2 but not L1. The percentage of repairs initiated following intra-language trouble spots increased from 16.2% at T1 to 40.7% at T3 in Afrikaans (L2). These figures were calculated in a same way as that described in b [ii]. In comparison, in English, the percentage of repair initiation remained at a fairly constant, 13-19% over the year. This suggests that BL had more difficulty conveying propositions in L2 as evidenced by more trouble spots occurring and repair being initiated. The percentage of repairs increased over the year for L2 only. A difference in rate of decline between the languages was also revealed by code switching behaviour, and is discussed in (d) iii below.

(d) Language Mixing Behaviour

[i] Formal Language Tests

In contrast to the high amount of code switches in conversations (Table 24), only isolated code switches occurred on formal test results in either language (Table 22). This indicates that, on a single word level, or highly focused short procedures, BL could maintain a separation between her two languages satisfactorily.

[ii] Sentence Translation

As evident from Table 23, code switching occurred in both directions, from L1 to L2, and from L2 to L1 translations. However, these results may reflect a difficulty with the task itself as opposed to inhibiting the non-selected language, as discussed in 5.2(d) and Chapter 10 (10.4.3).

[iii] CA

Hypothesis [iv] was confirmed as language mixing occurred in the L2 conversations only. What follows below is a detailed analysis and account of language mixing behaviour observed in Afrikaans interactions.

Amount of Code Switching

As evident from Table 24, inappropriate language mixing only occurred in the L2 Afrikaans conversations. These code switching problems increased as the dementing process progressed, but did not appear to be influenced by topic or topic changes. While the percentage of intrasentential switches remained relatively stable, the increase in intersentential switches over the year reached statistical significance ($p=0.0035$). This finding is discussed in more detail in Chapter 10 (see 10.4.4).

Code Switching

This section discusses the different pattern of intrasentential code switches affecting function versus content words. At T1, the pattern of function words being code switched more often than content words is consistent with findings from Giesbers (1989) and Poulisse and Bongaerts (1994). The latter authors explain this pattern of code switching as a function of proficiency, whereby function words are code switched because firstly, they are high frequency L1 words and therefore readily activated. Secondly, as a result of a difference in proficiency, speakers tend to focus more on the content of what they are trying to convey in their L2 than the form. Hence, they pay less attention to the function words which have lower propositionality.

However, for BL at T2 and T3, this trend is reversed: code switches involve content words more than function words. It could be argued that BL is experiencing increasing difficulty with simultaneously inhibiting a dominant L1 and compensating for incomplete L2 knowledge. Several authors have discussed how in order to compensate for not knowing a particular lexical item in L2, a synonym will be activated, or in some cases, the corresponding L1 lexical item will be articulated (De Bot and Schreuder, 1993; Poulisse and Bongaerts, 1994). It appears that BL becomes increasingly less able to activate an appropriate L2 target word or synonym, and thus the high frequency L1 content words begin to intrude more and more into L2 talk. This interpretation is consistent with the findings of increased language mixing over the year (Table 24).

Repair following Code Switching

As seen when comparing Table 24 to Table 25, not every code switch gave rise to a trouble spot. For instance, at T3, 38 utterances were code switched, but only 16 of those gave rise to a trouble spot. All 16 repairs followed intersentential switches. This pattern suggests that other instances of code switching did not present a trouble spot as the preceding/following utterances may have provided sufficient context for the gist to be understood. In addition, even though the interlocutors considered themselves monolingual speakers of the respective languages, they may have had some knowledge of the other language, as in South Africa, scholars were required to study both English and Afrikaans at school, and the media, official signs and so forth are in both languages.

Next, an analysis of self-initiated versus other-initiated repair was carried out, comparing repairs initiated after intra-language trouble spots, and those initiated after code switching trouble spots (Table 25). With regards to *self-repair* initiated following intra-language trouble spots (e.g. word retrieval difficulties), BL initiated many repairs in the talk where she successively kept to one language. For instance, 20 intra-language trouble spots were self-repaired out of the 54 utterances in the Afrikaans interaction at T3 (37%). However, BL rarely initiated repair herself when code switching occurred. In fact, by dividing the total number of code switched utterances (Table 24) by the total number of self-initiated repair following code switching (Table 25), it is evident that BL self-repaired only 3.2% of code switching trouble spots at T1, none at T2, and 7.9% at T3. This suggests that she did not perceive potential/actual trouble spots that arose from language mixing behaviour. The discrepancy between self-repair for intra-language trouble spots versus a paucity of self-repair for code switching trouble spots is discussed at length in Chapter 10 (see 10.4.4). An example of self-initiated repair following code switching is transcribed below (English gloss in italics):

BL: [Afrikaans talk]. No, he's higher than that (0.9) Hy's hoog. Ek weet nie.
He's high. I don't know

The above example is one of the very few where BL demonstrates an awareness that her talk in English may not be understood by the interlocutor, and so immediately translates her utterance into Afrikaans.

With regards to *other-initiated* repair, what is clear from Table 25 is the higher number of instances of other-initiated repair arising from code switching compared to the relatively isolated examples of other-repair arising from intra-language trouble spots in the L2 and L1 conversations. The amount of repair initiated by the interlocutor (Table 25) corresponds to the amount of language mixing occurring in the conversation (Table 24): the more prominent the language mixing, the more instances of other-initiated repair. This suggests that, even though not all code switching gave rise to a trouble spot, inappropriate language mixing did disrupt the quality of interaction.

As seen in Table 26, lengthy repair trajectories paralleled an increase in severity of dementia and an increase in language mixing behaviour. The following example taken from the monolingual Afrikaans interaction at T3 illustrates how language mixing resulted in a complex repair trajectory. Notably, this is the only example where BL reveals she was aware language mixing had occurred, but did not appear to regard this behaviour as a potential trouble spot for her interlocutor.

[English gloss in italics. I = interlocutor]

1 **I:**	En uitgegee, ja uitgegee
	And given out yes given out
2 **BL:**	And if anybody was missing I used to - write
3	the name down
	[ ]
4 **I:**	Ekskuus ek kan dit nie verstaan nie.
	Pardon I don't understand
5 **BL:**	IF ANYONE IS MISSING =
6 **I:**	= Kan jy dit in Afrikaans se?
	Can you say that in Afrikaans?
7 **BL:**	Nee, dis Engels
	No, it's English
8 **I:**	Ja, kan jy dit in Afrikaans se?
	Yes, can you say it in Afrikaans?
9 **BL:**	Of: (0.2) is daar 'n skoolmeisie ...
	Or (0.2) if there's a schoolgirl

In the above example, the use of the inappropriate language (lines 2 and 3) caused a trouble spot, and the interlocutor initiated repair (line 4). However, BL misinterpreted what caused the trouble spot, and instead of repeating the utterance in Afrikaans, she raised her voice and repeated the English utterance (line 5). The interlocutor again initiated repair (line 6), this time stating the trouble spot more explicitly. BL then demonstrated that she was aware she was speaking English (line 7), but failed to see how using the incorrect language could disrupt the quality of interaction. However, when repair was requested for the third time (line 8), she could successfully provide the necessary repair (line 9).

Summary

Language mixing behaviour affected the Afrikaans (L2) conversations only. The amount of code switching increased to a statistically significant level over the year, where quantitative differences in the number of intersentential switches and qualitative differences in the type of intrasentential switches were noted. While BL demonstrated a relatively preserved ability to self-repair intra-language trouble spots, very few code switches were self-repaired. When the interlocutor initiated repair following code switching, repair trajectories became more complex over the year, corresponding with an increase in the severity of dementia. These findings suggest a decreased ability to compensate for a weaker L2 and an increased difficulty with inhibiting a dominant L1.

(e) Neuropsychological Functioning and Language

As reported in Table 19, all neuropsychological tasks apart from Digit Forward were impaired, and performance on these tasks further deteriorated over the year. Increasing severity of dementia is revealed by worsening ratings on the CDR, increased errors on the AMIPB (she attempts more items, but makes significantly more errors), and longer times to complete Trail Making A along with increasing number of errors on the task.

Neuropsychological decline and language tasks

The first part of the prediction that language tasks dependent on working memory, sustained attention and information processing would show decline with a concomitant deterioration of the afore-mentioned neuropsychological abilities held true. The Token Test, List Learning, and Generative Naming tasks were increasingly affected along with deteriorating neuropsychological abilities (as inferred from increasing errors on the AMIPB Information Processing task, and slower Trail Making with increasing amount of errors). In addition, attributable silences occurring after questions had been asked in conversations could reflect slowed information processing ability and/or a difficulty holding the question in working memory.

Neuropsychological decline and L1 versus L2 performance

[i] Formal tests

On formal tests, English (L1) complex tasks deteriorated more rapidly than Afrikaans (L2), thereby refuting the second part of the hypothesis which predicted that L2 would be more affected by decreasing neuropsychological support.

English language functions were operating at T1 on a much higher level than Afrikaans, as evidenced by the gap in scores indicating different severities of impairment. However, once neuropsychological support was reduced, the deterioration in cognitive skills affected L1 task performance at T2 and T3. In other words, as neuropsychological abilities deteriorated over the year, they could no longer provide the necessary support to sustain high performance on (previously unimpaired/mildly impaired) L1 language tasks. This resulted in L1 tasks showing a marked deterioration in the time period examined. Afrikaans also appeared affected by decreasing neuropsychological support, but not to the same extent. However, as discussed in c [i], these findings do not necessarily disprove the hypothesis, as before the study commenced it is highly likely that L2 had been deteriorating at a quicker rate. Support for this comes from the findings at T1 where a difference between severity of L1 versus L2 impairment was evident, with L2 being more impaired.

[ii] CA

While BL managed more successfully in her L2 on formal tests, where her attention was tightly focused, and only a single word or few sentences reply was necessary, different findings were evident during conversational discourse. Language mixing results from the CA showed that code switching affected L2 interactions, but not L1, supporting the prediction that L2 would appear to be more affected by decreasing neuropsychological support. In the open-ended, less-focused conversation, the effort of compensating for a weaker L2 and inhibiting a dominant L1 could not be sustained for the ten minute interaction. This is consistent with findings on neuropsychological tests showing impaired attention and working memory abilities. Since her less-proficient L2 relied on controlled processing and possibly required effort to compensate for incomplete L2 knowledge, this language was adversely affected by decreasing neuropsychological support. The progression of language mixing difficulties over the year period is even more important considering that the pattern of use and exposure to both languages had not changed before and after institutionalisation. Therefore, progressive difficulties with L2 can be attributed directly to the dementing process.

6.4 Summary

Findings from BL revealed a similar pattern of impairment for English and Afrikaans except for language mixing behaviour at the level of conversational discourse, where inappropriate code switching affected the weaker L2 only. The prediction of differences in severity of impairment held true for both formal tests and CA results, with L2 being more severely impaired than L1. However, with regards to rate of decline, a different conclusion was reached. Results from the CA confirmed the prediction of L2 deteriorating at a faster rate especially where language mixing was concerned. In contrast, results from formal language tests revealed that the dominant L1 deteriorated at a more rapid rate. These findings can best be explained according to the time window of assessment which artificially bordered the patterns of decline, thereby giving a misrepresentative picture where rate of decline is concerned.

Chapter 7
SPEAKER EB

Table 27 summarises EB's personal details and language background as discussed in section 4.3. She has used her L1 since birth, speaking it daily for both social and vocational purposes, and at home. The pattern of L1 use has not changed over the lifespan.

Age	Time since diagnosis of AD to start of study	L1	L2	Age of L2 acquisition	Method of L2 acquisition	Past pattern of L2 use	Current pattern of L2 use	Current L1 versus L2 level of proficiency
76 yrs	9 months	Eng	Afri	12 years	Formally at school	Daily: home; work; social	Daily: home; social. However, speaks more Eng than Afri during day	More proficient in English

Table 27: EB: Summary of background details L1 = first language. L2 = second language. Afri = Afrikaans. Eng = English.

7.1 Hypotheses

Based on the general hypotheses proposed (see 3.6) and on EB's personal circumstances (Table 27), the following predictions were made:

[i] PREDICTION: There will be a similar pattern of impairment between L1 and L2. That is, aspects of language (naming, auditory comprehension, discourse) that are impaired in one language will also be impaired in the other (but not necessarily to the same extent - see [ii]).
REASON: All components of language tested in the battery were used daily. For instance EB has been required both to listen to input in Afrikaans and to reply in that same language on a daily basis. Therefore although EB was less proficient in her L2, she attained a high enough level of proficiency to meet daily social and vocational communicative needs. In addition, given that English and Afrikaans are structurally similar languages, the pattern of

deterioration in her L2 is expected to be similar to that seen in her L1: Complex tasks in one language will also be complex in the other, and will be vulnerable to AD.

[ii] PREDICTION: L2 will be more severely impaired than L1.

REASON: As shown in the literature, a language acquired later in life is less automatised and more vulnerable to the effects of aging (see Chapter 1). Not only did EB learn her L2 after acquiring her L1, but her current status suggests that L2 is less proficient than L1. If it is true that L2 requires more resources to activate and relies more on controlled processing than does L1, then with dementia L2 will be impaired to a greater degree.

[iii] PREDICTION: L2 will deteriorate at a more rapid rate than L1.

REASON: As in [ii].

[iv] PREDICTION: Inappropriate language mixing will affect L2 interactions, with language interference occurring in the direction of the more proficient L1 into the less proficient L2 talk.

REASON: The literature suggests that a difference in proficiency results in unidirectional language mixing, where the dominant language intrudes when conversing in the weaker language (see Chapter 3).

[v] PREDICTION:

(a) With decreasing neuropsychological capacity, language tasks heavily dependent on sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Token Test, Procedural Discourse) will show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) L2 will be more affected than the L1.

REASON: The literature has shown an interplay between language and cognition (see Chapter 2). L2 complex tasks will be more vulnerable to decreasing neuropsychological support as they are less automatised, thereby requiring more controlled processing. Controlled processing in turn relies more heavily on cognitive skills to draw upon the necessary explicit metalinguistic knowledge and residual language competence.

7.2 Results

Results are reported in three sub-sections: (a) formal test results (b) Conversation Analysis and (c) language mixing behaviour. An interpretation follows in the Discussion (7.3).

(a) Formal Test Results

This section looks at formal test results, and examines scores for possible differences across languages and across time. Table 28 reports the raw scores across time for neuropsychological testing as well as the English and Afrikaans test batteries. The corresponding dementia severity rating as provided by the ABCD is given in brackets after the raw score. Norms from Binetti et al (1995) are used for the Generative Naming (animals) task. Chapter 4 provides a detailed description of tests administered.

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
CDR	**3**	1 (mild)		1		1	
Mental Status	**13**	12 (mild)		7 (mild-mod)		5 (mod)	
AMIPB -Task A Tot	**Cut-Off: 24**	18		20		22	
-Error %	**Cut-off: 12**	16.6		5		4	
-Speed	**Cut-Off: 25**	23		28		21	
-Adjusted	**Cut-Off: 24**	14		21		17	
AMIPB -Lists A1-5	**Cut-Off: 26**	19	28 (below 10 %tile)	25	24	15	14
-A6	**Cut-Off: 3**	0	0	0	0	0	0
Trails A	**Mean: 38.2"**	2'02 (impaired)		2'20		2'20 (4 err)	
Trails B	**-**	-		-		-	
Digit Fwds	**Cut-Off: 5**	5		6		5	
Digit Bwds	**Cut-Off: 4**	3		4		3	
Memory Recognition	**16**	11 (within normal limits)	11	14	12	13	11
Story Recall (Immediate)	**17**	9 (mild)	9	9	8 (mild)	3 (mod)	3
Story Recall (Delay)	**17**	0 (mild/ mod)	0	0	0	0	0
Pyramid & Palm Trees	**52**	47		46		47	
Confront. Naming	**20**	17 (within normal limits)	14 (mild)	18 (within normal limits)	16 (mild)	17	16
Generative Naming -animals	**Cut-Off: 8**	13	13	16	14	12	14
-transport	**Cut-Off: 8**	7 (mild)	8 (mild)	8	9	8	6 (mild)
Superord. Naming	**5**	5	4	4	4	4	4
Co-ordinate Naming	**25**	25	25	25	25	23	23
Concept Definition	**15**	13	14	13	13	12	12
Token Test	**36**	31	35	33	35	30	28
Proc. Dis. -sandwich		√	I	√	I	√	√
-post		I	I	I	√	I	I

<u>Table 28: EB: Results</u> Mod = moderate. Below cut-off = abnormal; 10th percentile = well below average. - = not administered/attempted. √ = sequence correct, all essential steps included; I = incomplete/incorrect

Table 28 reveals a profile consistent with mild dementia, moving towards moderate as the year progressed.

Analyses were carried out to determine whether the differences between the tests in English versus Afrikaans were statistically significant. However, no inter-language differences between task scores reached statistical significance. Changes in test scores across time for each language (i.e. intra-language changes) as well as changes in neuropsychological test scores were also statistically analysed. Those changes in test scores that reached statistical significance over time are reported in Table 29, along with the statistical tests used.

	T1-T2	T2-T3	T1→T3
English Tests	-	Story Recall (Imm) (McNemar, p=0.0352)	Story Recall (Imm) (M and M, p=0.0072)
Afrikaans Tests	-	1) Token (McNemar, p=0.0078) 2) Story Recall (Imm) (McNemar, p=0.0313)	1) Token (M and M, p=0.0021) 2) Story Recall (Imm) (M and M, p=0.0169) 3) List Learning (Page's L, p=0.0118)
Other Tests	-	-	Mental Status (M and M, p=0.0006)

<u>Table 29: EB: Statistically significant changes in scores across time</u> T1→3 = changes that occurred over the year, analysing results across all time periods (i.e. 3 ordered conditions). Imm = immediate. M and M = Marascuilo and McSweeney Test.

As evident from Table 29, scores on only one English test deteriorated to a statistically significant degree. In comparison, more changes reached statistical significance in Afrikaans over time.

Qualitative analyses of test performance were carried out to see if patterns of impairment not apparent from raw scores could be discerned. On the List Learning test, EB repeated items from the beginning, middle and end zones of the list for both languages, showing no marked primacy or recency effects. It was only at T3 that a more pronounced recency effect was noted. At no point was a learning curve evident for either language. On the Token Test, similar performances were noted for English and Afrikaans. Performance broke down on level 5 for both languages at T1; at level 6 at T2; and at T3, English broke down from level 4 while Afrikaans broke down from level 5. On the English and Afrikaans Generative Naming tasks, EB made use of semantic strategies to facilitate recall, and all items generated were appropriate for the category. On Concept Definition, similar answers were given for both languages at all time points, and she never scored lower than a 2 for any response.

Table 30 provides an error-analysis of incorrect answers on the Confrontation Naming task.

ERROR	**T1**		**T2**		**T3**	
	Eng	**Afri**	**Eng**	**Afri**	**Eng**	**Afri**
Semantic						1
Visual					1	
Describe feature/function	3	4		4	2	3
Not related						
No response		2	2			
Total correct	17	14	18	16	17	16

Table 30: EB: Error types from the Confrontation Naming task

As evident from the above table, most errors made involved describing a feature or function of the target item instead of providing the correct name. Figure 5 gives an indication of how many items EB could not answer at any of the assessment periods in either language.

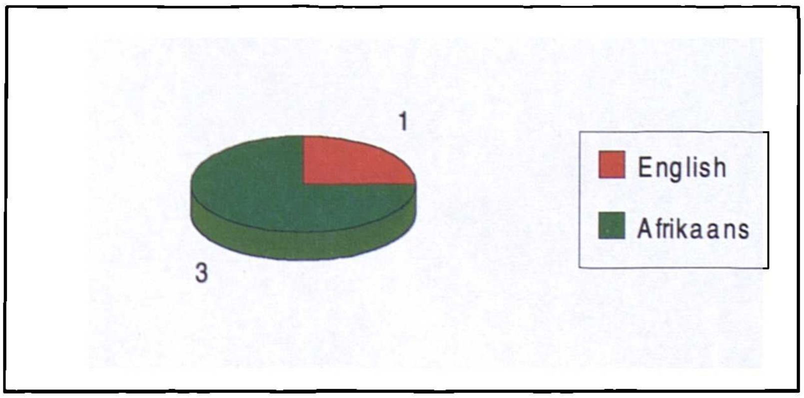


Figure 5: EB: Number of items not named on Confrontation Naming task

Items not named in one language could be named in the other.

(b) Conversation Analysis

English versus Afrikaans results are discussed separately, divided up into an overview of general discourse management, and extra-linguistic parameters (topic maintenance and turn taking). Linguistic expression of propositions is commented on at the end of Section (b). To avoid repetition, results at T1 are discussed in more detail while only those findings from T2 and T3 that differ to the initial analyses are noted.

(i) English

T1:

General

The interlocutor in all three English conversations was the researcher. EB assumed an active role in the conversation, asking questions, introducing new topics, and constructing extended turns. Turn distribution was equal, with both partners constructing extended turns. EB made use of minimal turns and tokens for feedback, which fulfilled different roles, including agreement, continuers and acknowledgement (Perkins, 1993; Wootton, 1989). Topics covered included childhood, schooling, and family.

Extra-linguistic parameters

EB took her turns promptly without attributable silences occurring. She also helped to minimise gaps in the conversation. Overlap between her turn and the interlocutor's was a feature, and EB did not always give way in these instances. For example:

[I = Interlocutor]

1. **I:** [...] That's lucky because otherwise you find families that just <u>don't</u> get on well
2. >together at all< and fight like cats and dogs
[ ]
3. **EB:** Yes I'm AMAZED (.) when I hear the ladies when we have a
4. sit around [...]

In the above example, EB commenced her turn before a TRP arose. She did not stop to let the interlocutor finish, but rather raised her voice ("AMAZED") to claim her right to a turn.

No difficulties were observed with topic maintenance or shift.

<u>T2:</u>

As with T1. Topics covered included family, past occupations, and her future great-grandchild. There was one instance where EB initiated an abrupt topic shift, indicating poorer topic maintenance than previously:

[I = Interlocutor]

1. **EB:** [Past talk about future great-grandchild] No, we're very excited about it I think (.) I can see my son Colin the d-daddy (.) um: (.) he's very excited
2. **I:** I'm sure [hh]
[ ]
3. **EB:** because he's they they (0.5) well I think it's also education wise, (.) although he didn't (.) he wasn't a teacher and Lorna and (.) my <u>old</u>er son they (.) well they took psy<u>chology</u> (.) and they're they're psychologists too [...]

In the above example, EB shifted from talking about her great-grandchild to talking about her children's occupations without signalling a change in topic. However, the interlocutor did not initiate repair, but followed her topic change, continuing the talk by asking EB about their work in psychology.

T3:

As with T1. Topics spoken about in the conversation were languages and bilingualism, music, the Residential Home, and sport.

(ii) Afrikaans

T1:

General

The interlocutor for this conversation and other Afrikaans interactions at T2 and T3 was an Afrikaans-speaking volunteer who worked at the Residential Home. EB played a dominant role in the interaction, constructing only 5 minimal turns, introducing topics, and constructing extended turns. Topics covered included family, childhood and academic studies. Turn distribution was unequal, with the interlocutor contributing less to the interaction in the way of talk than EB. The interlocutor tended to ask questions requesting information and elaborations, and used minimal turns as a means of providing feedback, and as a means of passing up her turn (Perkins, 1993).

Extra-linguistic parameters

Topic maintenance appeared preserved, even though EB had difficulty with verbal expression of propositions. Turn taking too appeared intact. EB took responsibility for minimising gaps, claiming her turn with fillers such as "um". For example:

[Italics = English translation]

1. **EB:** [...] En hy het ook die besigheid
and he also has the business
2. (2.5)
3. Maar::
but
4. (1.1)
5. Ons kan mekaar nie so (0.5) <u>dik</u>wels sien nie [...]
we can't see each other so often

In the above example, EB helped minimise the gap (line 2), claiming her turn with the filler "maar" (but) in line 3. It was only in line 5 that she constructed a full turn. However, the interlocutor did not interrupt or minimise the pause in line 4 as EB had already claimed her right to a turn.

<u>T2:</u>

As with English T1. Both partners played an active role in the interaction. There was one instance where EB initiated other-repair. Topics covered included the Residential Home and the aging process.

<u>T3:</u>

As with English T1. There was extensive use of minimal turns as confirmation and agreement from both partners. Topics discussed in the conversation were family, dinner outings, and hairdressers.

Linguistic expression

In all languages, at all time periods, trouble spots were caused by word retrieval difficulties, abandoned clauses, and revisions. An example is taken from the English conversation at T1 :

1. **EB:** [...] Jannie was quite (0.4) He said you know (0.5) he said let them (0.3)
2. Afrikaans they can always pick up.

Similar examples of difficulties expressing propositions were evident in Afrikaans, as illustrated by this example from T1 (English gloss in italics):

1. **EB:** Uh uh sy het altyd Afrikaans uh (.) as 'n <u>kind</u> in haar huis. My vader was 'n 'n 'n (0.9) En hy hy het in <u>Brits</u> daar gebly - 'n ou klein dorpie.
She always had Afrikaans (main verb omitted) as a child in her house. My father was a a a (0.9) And he he lived in Brits - an old small village.

<u>(c) Language Mixing Behaviour</u>

[i] Formal Tests

The amount and types of code switches on various formal tests is reported in Table 31. No code switching occurred on English tests, therefore only Afrikaans results are shown.

T1	T2	T3
-Generative Naming (1xV)	-Concept Definition (1xV)	-Superordinate Naming (1xV)

<u>Table 31: EB: Amounts and types of code switches made on Afrikaans formal tests.</u> V = vocabulary item code switched. The numbers in brackets refer to the number of times such errors occurred.

As apparent from the above table, code switching on formal tasks were extremely rare; only three were noted over the year period.

[ii] Sentence Translation

In order to examine for which language translation proved more difficult, and in order to describe the types of errors made on sentence translation tasks, errors made while translating sentences from one language to the other are tabulated below.

T1		T2		T3	
Eng to Afri	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**
NE	NE	V	NE	NE	NE

<u>**Table 32: EB: Results from the sentence translation task**</u> Eng = English. Afri = Afrikaans. NE = no errors. V = single vocabulary item code switched.

On the sentence translation task, a single error occurred when translating from English into Afrikaans. The other attempts were all successful.

[iii] CA

In order to examine code switching behaviours, overall results regarding inappropriate language mixing from the CA are reported in Table 33. Code switched utterances refer to both utterances that are mixed (intrasentential switches) and complete utterances in the inappropriate language (intersentential switches). A breakdown of intra- versus intersentential code switches is also included in the table.

	T1		T2		T3	
	Eng	**Afri**	**Eng**	**Afri**	**Eng**	**Afri**
Total Utt	109	114	103	88	98	113
CS Utt	0	18	0	5	0	17
Intrasent. Switches	0	7	0	2	0	3
Intersent. Switches	0	11	0	3	0	14
%	0	15.8	0	5.7	0	15

<u>**Table 33: EB: Amount of utterances code switched in conversations**</u> Total Utt = total number utterances in conversation. CS Utt = number utterances (out of the total) that were code switched. % = percentage of utterances code switched, calculated by dividing Total Utt by CS Utt.

As evident from Table 33, inappropriate code switching affected the Afrikaans interactions only. The pattern of language mixing ranged from insertions of isolated lexical items into a sentence (intrasentential switches), to intersentential switches. The decrease in amount of utterances code-switched from T1 to T2 just reaches statistical significance (Chi Square, p=0.044).

The number of repairs initiated subsequent to inappropriate language use, and the type of negotiation occurring were calculated. In addition, the amount and types of repair arising from language mixing behaviour versus from other (intra-language) causes were compared. These results are reported in Table 34. The types and amounts of repair carried out in English (where no code switching occurred), and Afrikaans are reported, with the Afrikaans data being divided into repair arising from a code switch, and those arising from all other reasons.

		English (other TS)	Afrikaans (TS arising from CS)	Afrikaans (other TS)
SI-SR	T1	42	1	28
	T2	49	0	31
	T3	36	1	12
SI-OR	T1	0	0	0
	T2	0	0	0
	T3	0	0	1
OI-A	T1	0	1	0
	T2	0	0	0
	T3	0	0	0
OI-OR	T1	1	3	0
	T2	0	0	0
	T3	0	0	0
OI-SR	T1	1	3	1
	T2	0	0	0
	T3	0	6	4
CoR	T1	2	2	0
	T2	0	0	0
	T3	1	1	0
Total SIR	T1	42	1	28
	T2	49	0	31
	T3	36	1	13
Total OIR	T1	2	7	1
	T2	0	0	0
	T3	0	6	4

<u>Table 34: EB: Types and totals of repair for each language</u> TS = Trouble Spots; CS = Code Switching; SI-SR = self-initiated self-repair; SI-OR = self-initiated other-repair; OI-A = other-initiated but repair abandoned; OI-OR = other-initiated other-repair; OI-SR = other-initiated-self-repair; CoR = collaborative repair; SIR = self-initiated repair; OIR = other-initiated repair.

Table 34 reveals that the instances of SIR far out-number OIR. This pattern is seen in both English and Afrikaans with regards to other (intra-language) trouble spots. However, in the Afrikaans interaction, the opposite pattern is seen when comparing trouble spots caused by code switching versus trouble spots caused by other reasons: There are more instances of OIR than SIR for code switching trouble spots.

Table 35 shows the length of repair trajectories (in number of turns) following other-initiated repair, and collaborative repair, subsequent to trouble spots caused by code-switching. These were compared to trajectory lengths where the trouble spot involved causes other than language mixing (for instance use of a pronoun without an antecedent). All self-initiated self-repairs were completed within the same turn as the repair-initiation, and are therefore not included in the table. The single instance where other-repair was initiated but then abandoned involved the interlocutor requesting clarification, after which EB failed to provide the repair. The interlocutor did complete the repair herself, preferring to abandon the trouble spot and to continue with the conversation.

	Trajectories (TS arising from CS)	**Trajectories (other TS)**	
SI-OR turn immediately after request for repair	-	-	T3 (A): 1
OI-OR same turn	T1 (A): 3	T1 (E): 1	
OI-SR turn immediately after request for repair	T1 (A): 3 T3 (A): 6	T1 (E): 1 -	T1 (A): 1 T3 (A): 4
OI-SR over several turns	-	-	
CoR over several turns	T1 (A): 2 T3 (A): 1	T1 (E): 2 T3 (E): 1	

<u>Table 35: EB: Trajectory length (in turns) following other-initiated repair</u> TS = trouble spots; CS = code switching. SI-OR = self-initiated other-repair; OI-OR = other-initiated other-repair; OI-SR = other-initiated self-repair· CoR = collaborative repair. E = English. A = Afrikaans

Table 35 shows that the majority of repair trajectories were completed within two turns. There were no examples of other-initiated repair trajectories stretching over several turns (5th row).

7.3 Discussion

Introduction

This section details an interpretation of the results reported in 7.2, discussing whether the hypotheses postulated for EB (see 7.1) were borne out, and the extent to which they held true. The Discussion is divided into five subsections corresponding to each of the five predictions.

(a) Pattern of Loss

[i] Formal Language Tests

Formal test results support hypothesis [i], where both languages showed a similar pattern of fragility and sparing. For instance, performance on Memory Recognition tasks fell within normal limits at all time periods, but other memory tasks dropped to the moderately impaired range. This suggests that EB's memory deficit is primarily one of retrieval as opposed to encoding. This pattern is similar for both English and Afrikaans.

Qualitative aspects of impairment which differ between the languages are negligible. For instance, on the Confrontation Naming task, EB could not label one particular picture in English, and three in Afrikaans at any time point (Figure 3). Those three items in Afrikaans that she could not name were possibly not in her vocabulary in the first place. The fact that she could describe a feature or function of those items she could not name suggests that the concept is still intact.

From the formal test results we can therefore conclude that a similar pattern of impairment exists when comparing English to Afrikaans. This conclusion is supported by the lack of statistically significant inter-language differences on task scores.

[ii] CA Results

The prediction of a similar pattern of impairment between languages was also upheld by CA results. The only difference between languages pertained to language mixing behaviour, which is discussed separately in (d) iii. The discussion below is restricted to discourse management and intra-language features of the conversations.

Extra-linguistic discourse management appeared preserved in both languages over all assessment periods, as evidenced by good topic maintenance and turn taking skills. A feature of all interactions with EB was overlapping turns, i.e. when both participants speak at the same time. However, overlap is also a feature of turn taking in normal speakers, occurring approximately 5% of the time (Levinson, 1983; Patry and Nespoulous, 1990), and therefore is not considered unusual.

With regards to repair, trajectories in both languages were short and successful, as indicated by the absence of OI-A trajectories (Table 34, row 4, columns 3 and 5; also Table 35). In other words, whenever repair was initiated following intra-language difficulties (such as word retrieval problems, or ambiguous use of pronouns), EB could repair the trouble spots quickly and successfully. Collaborative repairs revealed co-operation between both interlocutors in sharing repair work (Crockford and Lesser, 1994), while the preference for self-repairs (Table 34) is consistent with Schegloff et al's (1977) findings from healthy speakers. EB tended to self-repair rather than assume the interlocutor would manage the trouble spot - a finding consistent with principle that the least collaborative effort in repairing trouble spots is the most desirable repair (Clark and Schaefer, 1989). These findings were similar across languages.

(b) Severity of Loss

The hypothesis that L2 would be more severely impaired than L1 was not supported by either formal test results or CA findings (with the exception of language mixing discussed separately in (d) iii). There were no statistically significant differences between languages on tests scores, nor were differences apparent from qualitative analyses. The findings running contrary to what was predicted can be attributed to the stage of dementia. EB's profile is consistent with a mild dementia, and it is possible that at this early stage of the disease, sufficient resources remain to mask any inter-language differences brought about by differences in age of L2 acquisition, or different levels of proficiency.

(c) Rate of Loss

[i] Formal Language Tests

Results from formal language tests suggest that some aspects of Afrikaans (L2) began to deteriorate at a faster rate than L1, at least for the second six month period of the study (Table 29). However, this discrepancy in rate of decline is only apparent on one or two tests. The overall picture of test results does not lend strong support for upholding the prediction of L2 deteriorating at a faster rate. Figure 6 shows a graphic demonstration between what was predicted and what was observed. A detailed discussion explaining the figure follows below.

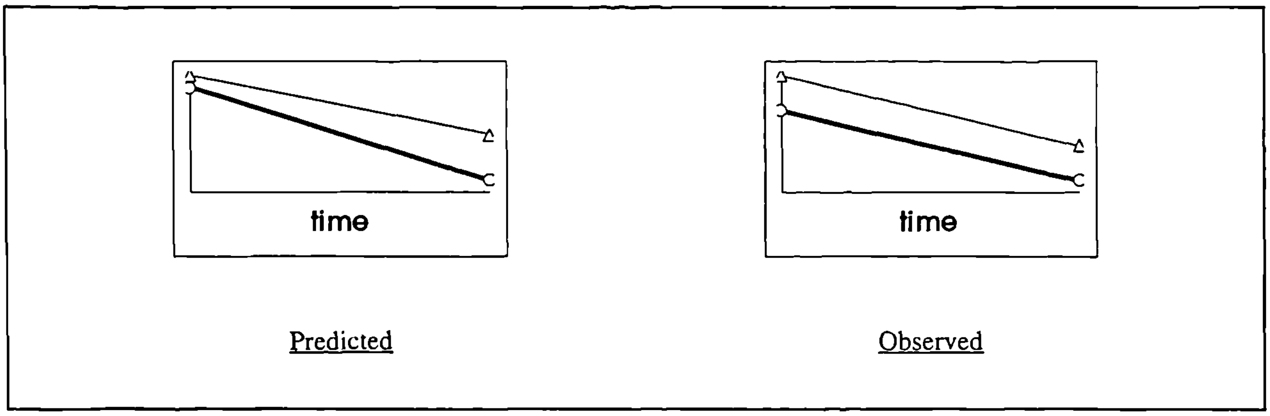


Figure 6: EB: Predicted versus Observed rates of L1/L2 decline

Key: -Δ- L1

-o- L2

T1-T2 versus T2-T3

While no statistically significant changes in English or Afrikaans test scores occurred over the first six month period, drops in both languages were evident for the second half of the year (T2-T3). Afrikaans scores deteriorated to a statistically significant extent on the Token Test ($p=0.0078$) and Story Recall ($p=0.0313$). Likewise, results from English Story Recall also deteriorated in the second half of the year ($p=0.0352$). These deteriorations were seen along with a concomitant decrease in neuropsychological test results (see (e) for full discussion).

T1→T3

A difference in rate of attrition between languages was seen on the Token Test and List Learning. These tests deteriorated to a statistically significant degree over the year in Afrikaans but not in English. Although both these results can be linked to a deterioration in neuropsychological functioning (see (e) below), List Learning results warrant a more detailed discussion as they reflect a surprising finding of superior performance in L2 initially.

List Learning scores at T1 were higher in Afrikaans than English, but at T2 and T3, inter-language scores on this task were very similar. The statistically significant change in

Afrikaans on this task reflects a drop in superior L2 performance at T1, to similar performances on this task between languages for the remainder of the year period. It is uncertain why Afrikaans T1 scores on this test were higher than the English equivalent. It is not a trend evident from other test scores, and may instead be a reflection of increased effort EB put into carrying out the task. Support for this interpretation comes from EB's comment at the time that she found the task considerably difficult especially because it was in her L2, and therefore felt she had to concentrate harder than she would on the English equivalent. It appears that enough resources were available at T1 to boost performance on List Learning in this manner. However, by T2 and T3, either EB did not feel a need to put in extra effort when doing the task, or even if she did, she did not have enough resources available to sustain increased concentration on the task. This suggestion is supported by neuropsychological profiles which show deteriorating abilities over the year (see (e) below).

[ii] CA

The hypothesis that L2 would deteriorate at a faster rate than L1 was not upheld by CA results. No difference was evident regarding rate of attrition between languages. In fact, none of the discourse parameters analysed (topic maintenance, repair, turn taking) showed any change over time in either language. It therefore appears that in the mild stages of dementia, the contextual cues and shared knowledge available when having a conversation provide support for discourse management abilities even when neuropsychological functions deteriorate.

(d) Language Mixing Behaviour

[i] Formal Language Tests

In contrast to the higher amount of code switches in conversations (see (d) iii), only isolated code switches occurred on formal test results in Afrikaans. This indicates that, on a single word level, or highly focused short procedures, EB could maintain a separation between her two languages satisfactorily.

[ii] Sentence Translation

The only error on this task involved the insertion of an English lexical item into an Afrikaans sentence. This interference can be attributed to a lapse in concentration. On all other items she succeeded in translating the sentences idiomatically, indicating she could hold the sentence to be translated in working memory long enough to activate the syntactic and semantic equivalent in the other language. Even at T3, when memory deficits are more marked on tests such as Story Recall and List Learning, this did not appear to affect successful performance on the sentence translation task.

[iii] CA

The prediction that inappropriate language mixing would be evident in L2 interactions only was supported by CA results. Language mixing behaviour evident in Afrikaans interactions is discussed below.

Amount of Code Switching

As evident from Table 33, inappropriate language mixing only occurred in the L2 Afrikaans conversations. These code switching problems decreased at T2, but increased to the original level (T1) by T3. The statistically significant improvement ($p=0.044$) in language mixing behaviour at T2 is surprising. It can perhaps be explained in terms of improved attention and/or information processing, as formal test results indicate an improvement in the amount of errors made on the AMIPB Information Processing task, and subsequent adjusted score (Table 28). However, a drop in the Mental Status score at T2 suggests advancing dementia, and slower Trail Making A times dispute claims of improved attention. Therefore a more likely explanation appears to be topic. EB was speaking about the routine in the Residential Home at T2, and it is likely that the necessary vocabulary and expressions were easily activated in Afrikaans, possibly because they were used frequently pre-morbidly, or because the terms were used often by staff working in the Home on a daily basis. This is consistent with the theory that the threshold of activation is a function of frequency of use: the more used, the less activation required (Paradis, 1997).

What follows below is an analysis of repair and code switching. The discussion is limited to Afrikaans (L2) CA findings as language mixing affected talk in this language only.

Repair following Code Switching

As evident from Tables 33 and 34, not every code switch gave rise to a trouble spot. For instance, at T3, 17 utterances were code switched, but only 7 of those gave rise to a trouble spot. It is possible that many code switches did not present a trouble spot as the preceding/following utterances provided sufficient context for the gist to be understood, or else did not disrupt communication of the intended message. Such an example was seen at T3, where EB used L1 (English) as an aside:

[Italics = English translation]

1. **EB:** Colin het die bestelling gemaak en toe
2. (1.3)
   Colin made the appointment and then
3. het ek by die
   I (main verb missing) by the
4. (1.9)
5. °Where where was I? I don't know >what that other (.) business was<° (0.9)
6. En toe het ek nou van daaraf (0.9) gekom en nou het ek eers uitgekom.
   And then I've just come from there and now I've only come out

In the above example, EB's English utterances (line 5) was said as an aside to herself, as it was said softly as if she was thinking aloud. She continued in Afrikaans in her normal volume for conversational speech. The use of English in this extract did not present as a trouble spot for either interlocutor.

The onus of repair-initiation following language mixing fell on the interlocutor, as indicated by the many instances of other-initiated repair compared to self-initiated repair (Table 34, final rows). In fact, by dividing the number of code switched utterances (Table 33) by the total number of self-initiated repair following code switching (Table 34), it is evident that EB self-repairs only 5.6% of code switching trouble spots at T1 and T3, and none at T2. The few occurrences of self-initiated repair suggest that EB was largely unaware when she was using the wrong language, or was either not aware or concerned about potential trouble spots resulting from inappropriate language use. This finding is discussed in more detail in Chapter 10 (see 10.4.4).

As evident from Table 35, when the interlocutor did initiate repair following a code switch trouble spot, EB could complete repair quickly and successfully. The vast majority of repair trajectories were completed within two turns. This suggests that while she may not always be aware of inappropriate language mixing as it occurs (as indicated by the paucity of self-initiated repairs), she retains an awareness of what caused the trouble spot, and demonstrates an ability to activate the appropriate language to repair the breakdown.

The extensive use of feedback in Afrikaans T3 using minimal turns to convey confirmation and agreement corresponds with more repair being initiated (as a result of language mixing). In other words, more repair was initiated and carried out in this conversation than in English as more code switches occurred. Therefore, more feedback was necessary in order to acknowledge that repairs were successful, or that the partner agreed with the repair being performed.

"Appropriate" Code Switching

Even though EB's interlocutors were monolingual, there was an instance where language mixing could be considered appropriate. The following interchange comes from the Afrikaans interaction with EB at T2:

[Italics = English translation. I = Interlocutor]

1 **EB:** ... en Merkyl het uh: (0.2) I don't know how you say shorthand typing
2 in Afrikaans.
... and Merkyl did (etc)
3 **I:** °ja°
4 **EB:** Uh - she helped her very much.
5 **I:** Wat se jy?
What are you saying?
6 **EB:** Sy het baie gehulp - in die besigheid
She helped a lot - in the business

In the above example, a trouble spot arose when EB could not think of a lexical item in Afrikaans (lines 1 and 2). She initiated repair, stating why a trouble spot arose. However, the interlocutor (line 3) did not engage in collaborative repair. Instead she made use of a minimal turn. 'Ja' is used by both English and Afrikaans speakers in this community, and is therefore not language specific. EB's response (line 4) indicated that she interpreted the minimal turn as both a continuer and feedback that the interlocutor understood what she meant in English. She therefore felt it was acceptable (and appropriate) to continue in English. However, when the interlocutor initiated repair (line 5), requesting EB to repeat her utterance in Afrikaans, EB could complete the repair immediately and successfully (line 6), indicating that she was aware of what caused the trouble spot, and could activate the appropriate language to repair breakdown.

In the above example, if one overlooked the interlocutor's input, it appears that EB had more of a difficulty keeping to one language than she actually did. EB's use of the 'inappropriate' language in line 4 however stemmed from a misinterpretation of the interlocutor's feedback (line 3), rather than a difficulty keeping the two languages apart.

In summary, language mixing occurring in the Afrikaans interactions resulted in more trouble spots arising, and more instances of other-initiated repair. As with BL, language mixing was prominent during conversations, but not on formal tests. This suggests that EB can keep her languages separate on tasks requiring one-word or few connected sentence responses. However, when conversing, her more dominant L1 intrudes into L2 talk. The inhibiting of a dominant L1 when holding a monolingual conversation appeared too difficult to sustain for a length of time. This theory is supported by patterns observed at T3, where language mixes mainly occurred when EB was distracted, or when commenting to herself as an aside. When concentrating, she seemed better able to inhibit her dominant L1. The following section discusses the interplay between language mixing behaviour and neuropsychological functioning.

(e) Neuropsychological Functioning and Language

This section explores a possible link between language performance and neuropsychological profiles. First, neuropsychological findings over the year period are examined, then the hypotheses proposed are explored as to the extent to which they have been supported by test results.

Neuropsychological profile

The disease process advanced over the year period of examination as indicated by an overall downwards trend of neuropsychological and Mental Status test results.

At T1, neuropsychological results are consistent with a profile of mild dementia. Performance on the Pyramids and Palm Trees test revealed a mild impairment with evaluative thinking and judgement. Trail Making A, AMIPB Information Processing, and Digit Repetition Backwards are also consistent with mild AD, indicating impairments in working memory, attention, and information processing.

At T2, a conflicting pattern of deterioration and improvement occurred. Deterioration was evident from slower Trail Making A times and poorer results on the Mental Status subtest. However, improvement was noted on the AMIPB information processing subtest, where the error percentage dropped. Not only did EB complete more trials correctly than at T1, but fewer errors were also made.

At T3, a deterioration was apparent for all neuropsychological tests, apart from Digit Recall. EB began to make errors on the Trail Making Test, and even though the error percentage remained lower on the AMIPB subtest, fewer trials were completed. A further drop in Mental Status scores also occurred.

Thus an overall pattern of declining neuropsychological abilities is evident from performance on formal tests.

Neuropsychological decline and language tasks

It was hypothesised that with decreasing neuropsychological capacity, language tasks supported by attention, working memory and information processing would deteriorate. However, this prediction was neither fully realised nor fully disproved. Decreasing performance on neuropsychological tasks occurred. Consistent with the hypothesis, some language tasks heavily dependent on the afore-mentioned neuropsychological abilities also showed decline. These tasks included Story Recall, Token Test and List Learning, which showed a downwards trend for both languages. However, not all language tasks expected to decline did in fact worsen - an observation consistent with results from JB (see Chapter 8). The notable examples are Generative Naming and Memory Recognition. The former task has been shown to be highly sensitive to the effects of AD (e.g. Bayles and Kaszniak, 1987; Nicholas et al, 1996). However, with EB, this task remained relatively unaffected even when other language tasks deteriorated to statistically significant extents, and advancing dementia was revealed on neuropsychological test batteries. This result is therefore contrary to trends observed in the literature. Two reasons can account for such a discrepancy. Firstly, the considerable heterogeneity of symptoms in AD has been highlighted by numerous studies (see Chapter 2). The fact that EB's results may be incongruent with trends does not necessarily imply that hers is a rare and unusual profile. Rather, her findings could be reflecting the heterogeneity of the AD population. A second reason compatible with the first is that even though neuropsychological abilities were impaired, these skills were still at a high enough level to provide the necessary support for successful completion of Generative Naming and Memory Recognition tasks.

With regards to CA findings, extra-linguistic aspects of discourse management appeared preserved. Topic maintenance can be adversely affected by memory and attentional deficits (Perkins et al, 1998; Ulatowska et al, 1988), and attributable silences may indicate slowed information processing. However, while working memory and information processing were impaired on formal testing, the extra-linguistic aspects of communication were intact for EB. It may be that the immediate context, structure and inherent redundancy of conversation, as well as the role of shared knowledge minimised any potential effects that decreasing neuropsychological abilities may have had, at least at this early stage of the dementing process. As working memory, attention and information processing abilities continue to deteriorate, it is predicted that the extra-linguistic aspects of conversation will begin to show concomitant decline. The supportive nature of conversation will no longer be sufficient to mask or compensate for the progressive decrease in neuropsychological support. However, while extra-linguistic aspects appeared preserved, an interplay between language and cognition at the level of conversational discourse can be inferred from language mixing behaviour. This is explored in the next sub-section as only L2 was affected by code switching behaviours.

Neuropsychological functioning and L1 versus L2 performance

Support for the second part of the hypothesis was provided by Token Test and List Learning results, where these tests deteriorated to a statistically significant degree in Afrikaans (L2), but not in English. In addition, language mixing behaviour was evident in L2 interactions only, where the dominant L1 intruded into L2 talk. For EB, conversing in L2 monolingual mode required a sustained effort to inhibit her dominant L1, and possibly to compensate for a less proficient L2 by finding synonyms for lexical items she did not know or circumlocuting around the word. Difficulties with sustained attention, concentration and working memory were identified on formal tests. It is therefore plausible that decreasing neuropsychological abilities adversely affected the quality of L2 interaction; the sustained effort of inhibiting a dominant L1 was compromised.

In summary, we see a pattern of deteriorating neuropsychological functioning. However, changes in formal language tests over the year are only apparent from Story Recall, Token Test and List Learning results. All these three tests do however depend on neuropsychological abilities for successful completion, particularly the skills of attention, working memory and information processing. Furthermore, the latter two tests declined faster in L2 than L1, and language mixing was only evident in L2 conversation. This suggests that the weaker L2 does rely more on controlled processing. Controlled processing in turn relies heavily on the neuropsychological skills of attention and working memory. These abilities declined over the year for EB as identified on formal testing, and subsequently L2 performance on some tasks showed concomitant deterioration. The reason why only a few inter-language differences were apparent appears to relate to the stage of dementia. EB was in the mild stage of AD where sufficient resources remained to activate most aspects of a weaker L2, or to compensate for areas of difficulty.

7.4 Summary

A similar pattern and severity of impairment was evident across languages, with the exception of language mixing behaviour which affected L2 interactions only. While there was some evidence that L2 deteriorated at a faster rate over the year, there were too few results showing this trend to strongly support the hypothesis of L2 declining more rapidly than L1. A deterioration in neuropsychological abilities was evident over the year. However not every language task predicted to be affected by this decline showed changes over time. Those language tasks that did deteriorate had a large working memory component to them, and more L2 complex tasks showed decline over the year than in L1. The fact that evidence was not convincing enough to strongly uphold the predictions of a different severity and rate of decline between languages is attributed to the fact that EB was the mild stages of dementia and hence sufficient neuropsychological abilities remained to support performance on (weaker) L2 tasks. It is predicted that future results will reveal more differences between L1 and L2 task performance as resources become progressively depleted.

Chapter 8
SPEAKER JB

Table 36 summarises JB's personal details and language background as discussed in section 4.3.

Age	Time since diagnosis of AD to start of study	Age of language acquisition	Method of language acquisition	Past pattern of language use	Current pattern of language use	Current levels of language proficiency
77 yrs	6 months	Both languages acquired simultaneously at an early age (around 2 months old)	Both languages acquired informally at home, and studied formally at school	Both languages used daily: home; work; social	Both languages used daily: home; social	Similar levels of proficiency for English and Afrikaans

Table 36: JB: Summary of background details

8.1 Hypotheses

Based on the general hypotheses proposed (see 3.6) and on JB's personal circumstances (Table 36), the following predictions were made:

[i] PREDICTION: There will be a similar pattern of impairment between L1 and L2. That is, aspects of language (naming, auditory comprehension, discourse) that are impaired in one language will also be impaired in the other.
REASON: No differences exist between age and method of language acquisition, level of proficiency and pattern of language use over the lifespan. Both languages were automatised to an equal level, and therefore a similar pattern of impairment is expected.

[ii] PREDICTION: Both languages will be impaired to the same degree.
REASON: As in [i]

[iii] PREDICTION: Both languages will deteriorate at a similar rate.

REASON: As in [i].

[iv] PREDICTION: Inappropriate language mixing (if present) will affect both English and Afrikaans interactions.

REASON: The literature suggests that a difference in automatisation levels results in language mixing from the direction of L1 into L2 talk (see Chapter 3). However, English and Afrikaans were automatised to a similar level, and thus a unidirectional pattern of language interference is not predicted.

[v] PREDICTION:

(a) With decreasing neuropsychological capacity, language tasks heavily dependent on sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Token Test, Procedural Discourse) will show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) Both languages will be similarly affected.

REASON: The literature has shown an interplay between language and cognition (see Chapter 2). JB's two languages are balanced in terms of proficiency and can be considered to be equally automatised as they were acquired at the same age, in the same manner, and used in a similar pattern over the lifespan. Therefore it is predicted English and Afrikaans will be similarly vulnerable to decreasing neuropsychological support.

8.2 Results

Results are reported in three sub-sections: (a) formal test results (b) Conversation Analysis and (c) language mixing behaviour. An interpretation follows in the Discussion (8.3).

(a) Formal Test Results

This section reports formal test results, and examines scores for possible differences across languages and across time. Table 37 gives the raw scores across time for neuropsychological testing as well as the English and Afrikaans test batteries. The corresponding dementia severity rating is included in brackets after the raw score, as provided by the ABCD and norms from Binetti et al (1995).

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
CDR	3	1		1		1	
Mental Status	13	10 (mild)		9 (mild)		9	
AMIPB -Task A Total	Cut-Off: 24	30		20		12	
-Error %	Cut-Off: 12	6.6 (25th %tile)		25		16	
-Speed	Cut-Off: 25	28 (below 10th %tile)		12		18	
-Adjusted	Cut-Off: 24	33 (below 10th %tile)		23		13	
AMIPB -Lists A1-5	Cut-Off: 26	22	24	17	17	15	18
-A6	Cut-Off: 3	0	0	0	0	0	0
Trails A	Mean: 38.2"	1'11 (within normal limits)		1'40 (just below normal limits)		1'50	
Trails B	Mean: 156.7"	3'35 (below normal limits)		-		-	
Digit Fwds	Cut-Off: 5	5		5		5	
Digit Bwds	Cut-Off: 4	4		4		3	
Memory Recognition	16	12 (within normal limits)	13 (within normal limits)	12	11 (within normal limits)	11	13

Table 37: JB: Results 10th percentile = well below average. Below cut-off = abnormal. - = not administered/attempted.

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
Story Recall (Immediate)	**17**	9 (mild)	8 (mild)	10 (mild)	8	10	10
Story Recall (Delay)	**17**	0 (mild)	8 (within normal limits)	0	5 (mild)	0	0
Pyramid & Palm Trees	**52**	49		47		48	
Confront. Naming	**20**	18 (within normal limits)	18	18	17 (within normal limits)	18	18
Generative Naming -animals	**Cut-Off: 8**	15 (within normal limits)	15	10 (within normal limits)	15	10	10
-transport	**Cut-Off: 8**	8 (mild)	7 (mild)	6 (mild)	8	5 (mild)	8
Super-ordinate Naming	**5**	5	5	4	5	4	5
Co-ordinate Naming	**25**	25	25	25	25	24	24
Concept Definition	**15**	15	14	14	14	13	14
Token Test	**36**	35	34	34	33	31	33
Procedural Discourse -sandwich		√	√	√	√	√	√
-post		√	=	=	=	=	=

Table 37 cont.: JB: Results 10th percentile = well below average. Below cut-off = abnormal. - = not administered/attempted. √ = sequence correct, all essential steps included; I = incomplete/incorrect sequence.

The above table reveals a profile of neuropsychological and language results that are consistent with mild AD. Tasks sensitive to the early stages of AD show impairment, such as the Mental Status subtest, Trails B and List Learning, while there remain pockets of spared functioning (e.g. Confrontation Naming, Concept Definition).

Analyses were carried out to determine firstly whether the differences between the tests in English versus Afrikaans were statistically significant (i.e. inter-language differences), and secondly whether the changes in test scores across time were statistically significant for each language (i.e. intra-language changes). Results are reported in Tables 38a and 38b respectively, along with the statistical tests used in each case.

T1	T2	T3
Story Recall (Delay) (McNemar, p=0.0039)	Story Recall (Delay) (McNemar, p=0.0313)	-

Table 38a: JB: Statistically significant inter-language differences at different time points

	T1-T2	T2-T3	T1→T3
English Tests	-	-	-
Afrikaans Tests	-	Story Recall (Delay) (McNemar, p=0.0313)	Story Recall (Delay) (M and M, p=0.0003)
Other Tests	-	-	AMIPB errors (M and M, p=0.0003)

Table 38b: JB: Statistically significant changes in scores across time T1→3 = changes that occurred over the year, analysing results across all time periods *(i.e. 3 ordered conditions). M and M = Marascuilo and* McSweeney Test.

Table 38a reveals that the only statistically significant inter-language difference was with Story Recall (Delay) where Afrikaans scores were higher than the English equivalents at T1 and T2. As seen from Table 38b, only two results reach significance regarding changes across time: a non-verbal neuropsychological task, and Story Recall in Afrikaans.

Qualitative analyses of test performance were carried out to see if patterns of impairment not apparent from raw test scores could be discerned. On the List Learning test, both primacy and recency effects were noted for both languages, but a definite learning curve was not evident. Similarly, on the Token Test, no differences in performance were noted for English and Afrikaans. Performance broke down from level 5 for both languages at all time periods. On the Generative Naming tasks, similar strategies to facilitate recall were used, and similar performance was noted. JB made good use of semantic strategies for both languages to aid recall, producing up to 4 semantic clusters (e.g. farm animals, wild animals) on animal generative naming tasks. Likewise, on Concept Definition, she was equally successful at all items in both languages at all assessments.

Table 39 provides an error-analysis of incorrect answers on the Confrontation Naming task.

ERROR	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Semantic		1				
Visual						
Describe feature/function		1			1	1
Not related						
No response	2		2	3	1	1
Total correct	18	18	18	17	18	18

Table 39: JB: Error types from the Confrontation Naming task

From Table 39 it is apparent that most errors involved responses such as "I don't know" (No Response). Of the items she had difficulty with, no one object presented consistent difficulty for either language. That is, if she could not name an item in English at T1 she could do so in Afrikaans, and at T2 could also succeed in providing the name in English on that occasion.

(b) Conversation Analysis

The interlocutor in English conversations was the researcher, while in the Afrikaans interactions, an Afrikaans-speaking female volunteer from the Residential Home participated. The same interlocutors participated at all three data assessment periods.

For both languages, across all time periods, a very similar pattern of conversation management was apparent. JB played an active role in each conversation, introducing new topics, asking questions, elaborating on current topics, and initiating both self and other-repair. Turn distribution was always unequal, with JB constructing longer turns than the interlocutors. She therefore assumed a dominant role in the conversation, but did relinquish her turn when the interlocutor attempted to claim a turn herself. JB made good use of tokens as continuers (i.e. to encourage her interlocutor to keep speaking), and as markers of understanding and agreement. Topic maintenance was excellent, and she followed topic shifts introduced by the interlocutors with ease. There were only isolated instances of attributable silences, during which JB was trying to remember or calculate the answer to the interlocutor's question.

To determine how trouble spots arising from word retrieval problems, revisions and abandoned phrases were managed, the number of repairs and the type of negotiation occurring were calculated. These results are reported in Table 40. As opposed to the other four speakers in this study, only the above-mentioned intra-language trouble spots were analysed, as language mixing behaviour was not a feature of JB's discourse.

		English	Afrikaans
SI-SR	T1	17	20
	T2	24	13
	T3	19	22
OI-A	T1	1	0
	T2	0	0
	T3	0	0
OI-OR	T1	0	0
	T2	0	0
	T3	0	0
OI-SR	T1	0	1
	T2	1	2
	T3	1	1
CoR	T1	0	1
	T2	1	1
	T3	0	0
Total SIR	T1	18	20
	T2	24	13
	T3	19	22
Total OIR	T1	1	1
	T2	1	2
	T3	1	1

Table 40: JB: Types and totals of repair for each language SI-SR = self-initiated self-repair; OI-A = other-initiated but repair abandoned; OI-OR = other-initiated other-repair; OI-SR = other-initiated-self-repair; CoR = collaborative repair; SIR = self-initiated repair; OIR = other-initiated repair.

As evident from Table 40, the instances of self-initiated repair far outnumbered instances of other-initiated repair. This pattern is similar for both English and Afrikaans.

Table 41 shows the length of repair trajectories (in number of turns) following other-initiated repair, and collaborative repair. All self-initiated self-repairs were completed within the same turn as the repair-initiation, and are therefore not included in the table. The instance where other-repair was initiated but then abandoned involved the interlocutor requesting clarification, after which JB failed to provide the repair. Repair was subsequently abandoned and talk continued.

		English	Afrikaans
OI-SR turn immediately after request for repair	**T1**	0	1
	T2	1	2
	T3	1	1
CoR over several turns	**T1**	0	1
	T2	1	1
	T3	0	0

Table 41: JB: Trajectory length (in turns) following other-initiated repair OI-SR = other-initiated self-repair; CoR = collaborative repair.

The above table reveals that repair trajectories were usually short and successfully completed. In English interactions, JB initiated other-repair once at T1, and once at T3. In the Afrikaans interactions, she initiated and carried out other-repair twice at T2. Thus a similar pattern of repair initiation and outcome was evident across languages.

(c) Language Mixing Behaviour

[i] Formal Tests

There were only two instances of code switching. Both occurred on the English Confrontation Naming tasks at T2 and T3, *involving the same item. However, on both these occasions, she* acknowledged that she had said the word in the incorrect language, and was able to self-correct the error without any prompting from the examiner.

[ii] Sentence Translation

No errors were made on this task for either language, at any assessment period.

[iii] CA

There was only one instance where a lexical item was code switched. This occurred in the Afrikaans conversation at T1:

[Italics = English translation]

1. **JB:** [...] Enter<u>tain</u>ment, jy weet [...]
you know

The above code-switch was flagged as a switch, and therefore is not considered inappropriate. In addition, it did not present as a trouble spot in the interaction. No other language mixing occurred.

8.3 Discussion

Introduction

This section details an interpretation of the results reported in 8.2, discussing whether the hypotheses postulated for JB (see 8.1) were borne out, and the extent to which they held true. The five subsections of the Discussion correspond to each of the five predictions.

(a) Pattern of Loss

The prediction that the pattern of impairment would be similar for both languages was generally borne out by formal language test scores and CA results.

[i] Formal Language Tests

A similar pattern of impairment was noted across languages. Memory Recognition, Confrontation Naming and Generative Naming (animals) tasks remained unimpaired, while other language functions were mildly impaired in both English and Afrikaans. The sole exception to this pattern is Story Recall Delayed results. JB's performance on this task in Afrikaans falls within normal limits at T1, and is mildly impaired at T2. In comparison, she is unable to do the task in English at any time point. Even though the difference between the languages did not reach statistical significance, it nevertheless reveals that in English JB was not able to retrieve memory traces after a length of time, while in Afrikaans this ability was surprisingly as intact as other healthy speakers of her age. However, her performance on Story Recall Delayed (Afrikaans) does deteriorate steadily, and by T3, it is as impaired as the English equivalent. In other words, by T3, the language profile in Afrikaans is virtually identical to that of English.

Why an inter-language difference exists on Story Recall Delayed is unclear. JB remarked that, if hard pressed to choose which language is more dominant, she would have to choose English, as that is the language in which she wrote up her Masters thesis. Even if English is slightly more dominant (a point not borne out from the language background questionnaire or other test results), this still does not account for the Story Recall Delayed results. It was her performance in Afrikaans that was superior, not English. These conflicting results cannot be explained in light of other test performances, or from patterns from the language background questionnaire. They therefore can be regarded as idiosyncratic.

[b] CA Results

Regarding discourse management ability, this appeared preserved in both languages over all assessment periods. All pragmatic skills were intact, and remained so over the year window of examination. Interlocutors initiated very few other-repairs (Table 40, last row), and the subsequent repair trajectories were swiftly and successfully completed (Table 41). JB's active role in the conversation was further demonstrated by instances where she initiated other-repair, demonstrating that she was attending to the interlocutor's talk, and requested clarification appropriately to repair communicative breakdown.

(b) Severity of Loss

Results from both formal language tests and CA support the hypothesis of English and Afrikaans being impaired to similar degrees. Both languages showed a similar pattern of fragility and sparing, and to the same degree. However, as discussed above, the results from Story Recall Delayed run contrary to these hypotheses and to the trend of other results.

(c) Rate of Loss

Figure 7 presents a graphic representation of the discrepancy between what was predicted and what was found.

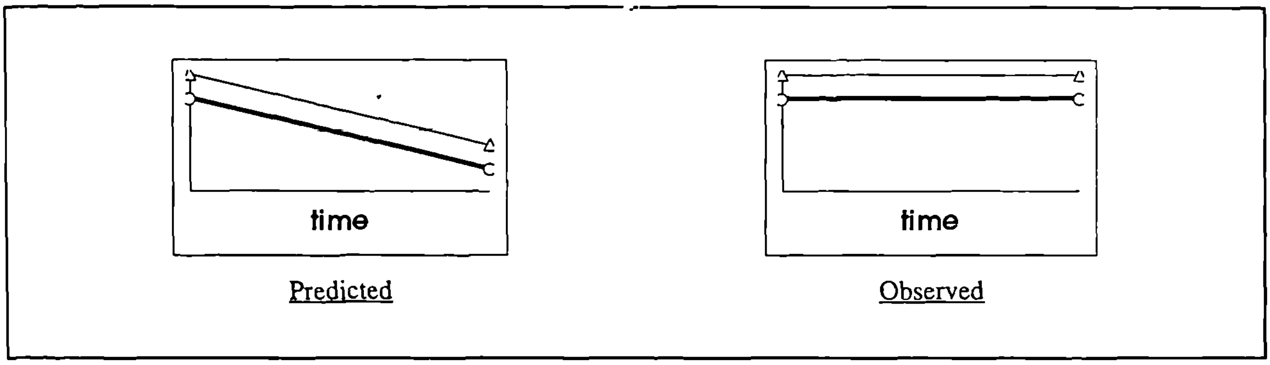


Figure 7: JB: Predicted versus Observed rates of decline
Key: -Δ- L1
-o- L2

As apparent from Figure 7, neither language showed decline over the year's time slot of examination. Findings from the CA did not change, and scores on formal tests remained constant, with the sole exception of Story Recall Delayed in Afrikaans. Performance on this task deteriorated from falling within normal limits to not being able to carry out the task at all by T3. The hypothesis of a similar rate of decline for English and Afrikaans can generally be regarded as supported by test and CA results, with the exception of Story Recall Delayed results - an exception to all trends. Section (e) explores the possible interplay of neuropsychological functioning with the findings discussed thus far.

(d) Language Mixing Behaviour

The isolated code switches on formal tests reported in the results section were self-corrected immediately without prompting from the examiner. No other language mixing occurred either on the sentence translation tasks or during conversations. It therefore appears that JB can successfully keep her two languages separate when required.

Regarding hypothesis [iv] then, the absence of any language mixing precludes any confirmation or refuting of this hypothesis. What the results do support is Luderus' (1995) contention that not every person will demonstrate inappropriate language mixing behaviour. However, JB is still in the very mild stages of AD and what difficulties may emerge concerning code-switching as the disease progresses remain unknown.

(e) Neuropsychological Functioning and Language

This section explores a possible link between language performance and neuropsychological profiles. First, neuropsychological findings over the year period are examined, then the hypotheses proposed are explored as to the extent to which they have been supported by test results.

Neuropsychological profile

Performance on neuropsychological tasks reflect a steady progression in the dementing process over time. At T1 there are pockets of preserved functioning at this stage (e.g. Trail Making A), as well as indicators of impairment on cognitive tasks (e.g. Trail Making B, Mental Status, AMIPB Information Processing).

At T2, a pattern of deterioration continues, with statistically significant drops in AMIPB Information Processing scores (Table 38b). Motoric speed slowed, and information processing ability decreased. JB attempted fewer items on this task, and of those she did attempt, a quarter were incorrect. Trail Making B could no longer be attempted, and the time taken to complete Trail Making A lengthened. Apart from Digit Recall, all other non-verbal cognitive tasks fell below normal limits.

At T3, there was evidence of further deterioration. The error percentage on the AMIPB subtest continued to remain high, and the number of trials JB attempted correctly on the information processing task continued to decline. Trail Making A took even longer to complete, and JB began making errors on the task, suggesting an impaired ability to mentally keep track of a sequence, reflecting poorer concentration and tracking skills. It is thus apparent that a pattern of decreasing performance on neuropsychological tasks occurred over the 12 month period.

Neuropsychological functioning and language performance

With regards to the first part of the hypothesis, results do not support the prediction of language tasks becoming more impaired with a concomitant decrease in neuropsychological abilities. While progressively impaired performance on neuropsychological tests was evident over the year, the expected deterioration in language tasks heavily dependent on attention, working memory, sequencing and information processing did not occur. In other words, neuropsychological decline had very little apparent influence on the languages. There was one exception to this trend however: Story Recall Delayed. For this task in Afrikaans, results showed a downwards trend. This indicates that of all the language tests, Story Recall Delayed is highly sensitive to changes in neuropsychological functioning, as maintained by various authors (e.g. Bayles and Kaszniak, 1987; Lezak, 1995). This task taps many cognitive parameters, including organisation of material, sequencing, and episodic memory. In addition, because of the delay between hearing the story and repeating it for the second time, memory traces are particularly susceptible to interference and decay. In comparison, for other language tests, no deterioration occurred over time, suggesting that the neuropsychological resources still available were sufficient to support the needs of those language tasks.

JB's profile where memory is impaired but changes in language tasks have not as yet been identified is congruent with findings by Haxby, Raffaele, Gillette et al (1992). These authors found that for some individuals, an initial deterioration in memory abilities can be followed by a plateau where language functions remain unaffected. This plateau can last for up to 35 months. For JB, a period of one year was too short to identify any changes in language, as they possibly had not yet begun to deteriorate.

Neuropsychological functioning and L1 versus L2 performance

While it is true that both languages were equally (un)affected by decreasing non-verbal cognitive parameters, one language did show deterioration in Story Recall Delayed while performance in the English equivalent was at floor. As stated in section (a), this result can be considered idiosyncratic. No obvious explanation can be found that could explain this singular finding.

8.4 Summary

All predictions regarding a similar pattern, severity and rate of decline between languages were borne out with the exception of Story Recall Delayed results. This task was unimpaired in Afrikaans at the start of the study only, but showed decline over the 12 month period of examination. However since this finding runs contrary to all other trends found in L1 and L2 profiles, it can be regarded as idiosyncratic. With regards to language mixing, none was evident thereby precluding a conclusion of whether the hypotheses regarding the direction of language mixing were supported or not. The hypothesis that tasks heavily dependent on neuropsychological abilities would deteriorate as cognitive skills decline was not upheld as no changes in languages occurred over the year (with the sole exception of Story Recall Afrikaans). Her profile may be due to the fact that, like EB, she was still in the mild stages of dementia where remaining neuropsychological support was sufficient to maintain language performance. Future predictions are that there will be a drop in complex language tasks as neuropsychological functioning continued to deteriorate. However a similar rate and degree of L1 versus L2 impairment is predicted since both languages are automatised to similar levels.

Chapter 9
SPEAKER JS

Table 42 summarises JS's personal details and language background as discussed in section 4.3. She has used her L1 since birth, speaking it daily for both social and vocational purposes, and at home. The pattern of L1 use has not changed over the lifespan.

Age	Time since diagnosis of AD to start of study	L1	L2	Age of L2 acquisition	Method of L2 acquisition	Past pattern of L2 use	Current pattern of L2 use	Current L1 versus L2 level of proficiency
80 yrs	4 yrs	Afri	Eng	12 years	Formally at school	Daily: home; work; social	Daily - extent to which depends on friends and staff members. Uses Afri more often than Eng.	More proficient in Afrikaans

Table 42: JS: Summary of background details L1 = first language. L2 = second language. Afri = Afrikaans. Eng = English.

9.1 Hypotheses

Based on the general hypotheses proposed (see 3.6) and on JS's personal circumstances (Table 42), the following predictions were made:

[i] PREDICTION: There will be a similar pattern of impairment between L1 and L2. That is, aspects of language (naming, auditory comprehension, discourse) that are impaired in one language will also be impaired in the other (but not necessarily to the same extent - see [ii]). REASON: All components of language tested in the battery were used daily. For instance JS has been required both to listen to input in Afrikaans and to reply in that same language on a daily basis. Therefore although JS was less proficient in her L2, she attained a high enough level of proficiency to meet daily social and vocational communicative needs. In addition,

given that English and Afrikaans are structurally similar languages, the pattern of deterioration in her L2 is expected to be similar to that seen in her L1: Complex tasks in one language will also be complex in the other, and will be vulnerable to AD.

[ii] PREDICTION: L2 will be more severely impaired tl an L1.

REASON: As shown in the literature, a language acquired later in life is less automatised and more vulnerable to the effects of aging (see Chapter 1). Not only did JS learn her L2 after acquiring her L1, but her L2 remained less proficient than her L1 throughout adulthood. If it is true that L2 requires more resources to activate and relies more on controlled processing than does L1, then with dementia L2 will be impaired to a greater degree (even though the same components of language will be impaired across languages).

[iii] PREDICTION: L2 will deteriorate at a more rapid rate than L1.

REASON: As in [ii].

[iv] PREDICTION: Inappropriate language mixing will affect L2 interactions, with language interference occurring in the direction of the more proficient L1 into the less proficient L2 talk.

REASON: The literature suggests that a difference in proficiency results in unidirectional language mixing, where the dominant language intrudes when conversing in the weaker language (see Chapter 3).

[v] PREDICTION:

(a) With decreasing neuropsychological capacity, language tasks heavily dependent on sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Token Test, Procedural Discourse) will show a more marked impairment compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) L2 will be more affected than the L1.

REASON: The literature has shown an interplay between language and cognition (see Chapter 2). L2 complex tasks will be more vulnerable to decreasing neuropsychological support as they are less automatised, thereby requiring more controlled processing. Controlled processing in turn relies more heavily on cognitive skills to draw upon the necessary explicit metalinguistic knowledge and residual language competence.

9.2 Results

Results are reported in three sub-sections: (a) formal test results (b) Conversation Analysis and (c) language mixing behaviour. Results are interpreted in the following section Discussion (9.3).

(a) Formal Test Results

This section looks at formal test results, and examines scores for possible differences across languages and across time. Table 43 reports the raw scores across time for neuropsychological testing as well as the English and Afrikaans test batteries.

TEST	Max Score	T1		T2		T3	
		Eng	Afri	Eng	Afri	Eng	Afri
CDR	**3**	2		2		2	
Mental Status	**13**	0 (severe)		0		0	
AMIPB -Task A Total	**-**	-		-		-	
-Error %	**-**	-		-		-	
-Speed	**Cut-Off: 25**	12		16		15	
-Adjusted	**-**	-	-	-	-	-	-
AMIPB -Lists A1-5	**Cut-Off: 26**	2	4	9	9	0	0
-A6	**Cut-Off: 3**	0	0	0	0	0	0
Trails A	**-**	-	-	-	-	-	-
Trails B	**-**	-	-	-	-	-	-
Digit Fwds	**Cut-Off: 5**	3		5		5	
Digit Bwds	**Cut-Off: 4**	2		2		0	
Memory Recognition	**-**	-	-	-	-	-	-
Story Recall (Immediate)	**17**	0 (mod-severe)	3 (mod)	0	1 (mod-severe)	0	0
Story Recall (Delay)	**17**	0 (mod)	0	0	0	0	0
Pyramid & Palm Trees	**-**	-	-	-	-	-	-
Confront. Naming	**20**	6 (mod)	8 (mod)	5 (mod)	7 (mod)	2 (mod)	6
Generative Naming -animals	**Cut-Off: 8**	5 (mod)	4 (mod-severe)	4	6 (mod)	2 (mod-severe)	5
-transport	**Cut-Off: 8**	1 (mod)	4 (mod)	0 (mod-severe)	2 (mod)	0	3 (mod)
Super-ordinate Naming	**5**	1	2	1	2	1	1
Co-ordinate Naming	**25**	13	15	14	14	12	12
Concept Definition	**15**	3	5	6	7	3	4
Token Test	**36**	16	21	18	16	14	19
Procedural Discourse -sandwich		I	I	I	I	I	I
-post		I	I	∅	I	∅	∅

<u>Table 43: JS: Results</u> Mod = moderate dementia. Below Cut-Off = abnormal. - = not administered/attempted. I = incomplete/incorrect sequence; ∅ = no evidence of a procedure.

Table 43 reveals a profile of neuropsychological and language results consistent with a moderate dementia. With isolated exceptions, English (L2) raw scores are poorer than the Afrikaans equivalents. Some tests could not be administered due to advanced dementia.

Analyses were carried out to determine whether the differences between the tests in English versus Afrikaans were statistically significant. However, no inter-language differences reached statistical significance. Changes in test scores across time for each language (i.e. intra-language changes) were then statistically analysed. Those changes in test scores that reached statistical significance over time are reported in Table 44, along with the statistical tests used. No changes in neuropsychological test scores reached statistical significance.

	T1-T2	**T2-T3**	**T1→T3**
English Tests	-	*List Learning* (Wilcoxon, p=0.0313)	*Confrontation Naming* (M and M, p=0.014)
Afrikaans Tests	-	List Learning (Wilcoxon, p=0.0156)	-

Table 44: JS: Statistically significant changes in scores across time T1→3 = changes that occurred over the year, analysing results across all time periods (i.e. 3 ordered conditions). M and M = Marascuilo and McSweeney Test.

Qualitative analyses of test performance were carried out to see if patterns of impairment not apparent from raw test scores could be discerned. On the List Learning test, a strong recency effect was noted for both languages: the last words of the list only were recalled. No learning curve was evident. Similarly, on the Token Test, very few differences in performance were noted for English and Afrikaans. At T1, performance broke down from level 3 for English, and level 4 for Afrikaans. At T2 and T3, performance broke down from level 2 for both languages. On the Generative Naming tasks, her responses fell within the same semantic sub-categories (e.g. farm animals) at all times in both languages. Items generated however were all appropriate for the category. On Concept Definition, she demonstrated similar difficulties defining items in both English and Afrikaans.

Table 45 provides an error-analysis of incorrect answers on the Confrontation Naming task.

ERROR	T1		T2		T3	
	Eng	Afri	Eng	Afri	Eng	Afri
Semantic	1	2	3		4	1
Visual	1	2	1			
Describe feature/ function		1	1	2	1	7
Not related					1	
No response	12	7	10	11	12	6
Total correct	6	8	5	7	2	6

Table 45: JS: Error types from the Confrontation Naming task

As is evident from Table 45, the most common error for both languages was a No Response. That is, in many cases JS did not attempt to label the picture. Figure 8 gives an indication of how many items JS could not answer at any of the assessment periods in either language.

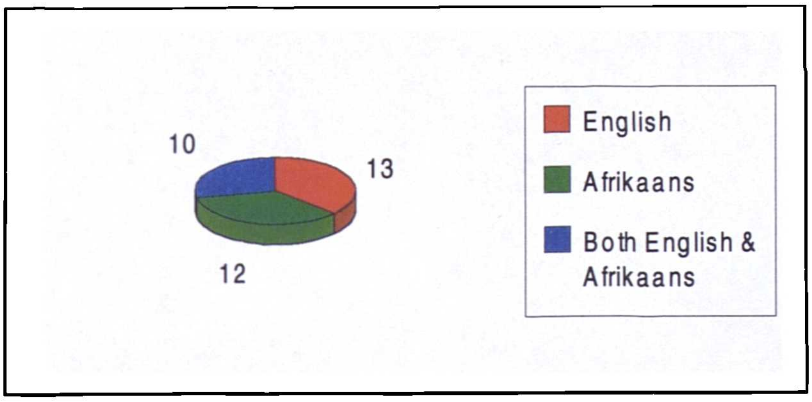


Figure 8: JS: Number of items not named on Confrontation Naming task

From Figure 8, it is evident that 50% (10/20) of all items were unnameable both in English and Afrikaans, at all assessment points. An additional two items could not be named in Afrikaans, while an extra three items could not be named in English at any time period.

(b) Conversation Analysis

English versus Afrikaans results are discussed separately, divided up into an overview of general discourse management, and extra-linguistic parameters (topic maintenance and turn taking). Linguistic expression of propositions is commented on at the end of Section (b). To avoid repetition, results at T1 are discussed in more detail while only those findings from T2 and T3 that differ to the initial analyses are noted. A glossary of terms used can be found in Appendix 9.

(i) English

T1:

General

The interlocutor in all three English conversations was the researcher. JS played an active role in the conversation, introducing new topics and making good use of minimal turns to indicate agreement, to acknowledge understanding, and to indicate that she was attending to the interlocutor's talk. She showed strong evidence of understanding by either repeating or paraphrasing the other person's comments (Clark and Shaefer, 1989). For example:

[I = interlocutor]

1. **I:** Oh so they're brand new!
2. **JS:** Ja it's new things

JS also took responsibility for minimising gaps, thereby ensuring a higher quality of interaction. For the most part, turn distribution between the conversational partners was equal, with the average turn consisting of 2 utterances. The interlocutor made use of tokens (e.g. 'mm') to show continued attention and acknowledgement of understanding when JS was speaking. Topics covered in the conversation included family and new grandchildren, Cape Town, languages, and past occupations.

Extra-linguistic parameters

Generally, JS could maintain and elaborate on a topic appropriately over a few turns. However, even though she assumed responsibility for introducing new topics, JS did not always explicitly introduce the new topic, or signal a topic shift. This resulted in abrupt topic shifts where the interlocutor could not always understand the content of JS's initial message. Such an example is transcribed in T2 below.

Turn taking skills were unimpaired, except that of 16 questions asked, 8 were followed by an attributable silence before JS answered. Three of these followed the interlocutor's question initiating a topic change. Her responses when eventually given were appropriate answers to the questions asked.

T2:

As with T1. Topics covered included family, the Residential Home, security, church, and holidays. Of 12 questions asked, half of JS's answers were preceded by an attributable silence. Apart from these instances, no problems with turn taking skills were noted. For the last three minutes of the extract, JS constructed long turns of up to 8 utterances. During such turns, the interlocutor withheld feedback (previously used at regular intervals). After these turns, the interlocutor would ask a question requesting clarification, change the topic, or make a statement showing understanding of JS talk. The example below illustrates how the interlocutor withheld feedback until she understood the theme of JS's message:

[I = Interlocutor]

1. **JS:** Was uh we was talking today
2. (1.3)
3. when he w- got too old. (0.4) Then he said then no no I can't get uh her uh:
4. this thing they must come and get it (.) and they come up here. These people (.)
5. bought it .
6. (1.4)
7. And they take it uh for a if you want to
8. (1.2)
9. say (.) c'mon say uh:
10. (3.1)
11. <u>every</u>where where you uh want to go.
12. **I:** Right=
13. **JS:** =You take the uh ah: you want to go to the uh: <u>trains</u> you say (0.8) then that's uh uh
14. you get that only that boy and say (.) take me there and then they take
    [ ]
15. **I:** Right so it's a <u>driver</u>
16. **JS:** A driver
    [ ]
17. **I:** A driver to do exactly what you want?
18. **JS:** Ja ja

In line 1, JS introduces a new topic. However, she does not explicitly mark the topic, but instead uses numerous pronouns without antecedents. It was also not clear from the preceding talk to whom she was referring. Several TRPs arose (e.g. lines 2, 6, 8 and 10), but the interlocutor did not claim a right to a turn. JS continued talking until eventually the interlocutor gave feedback, using "right" (line 12) possibly as a continuer i.e. to encourage JS to continue her talk. In line 13, JS emphasises the noun 'train', and soon afterwards, the interlocutor interrupts JS's talk, and gives feedback showing evidence of understanding (line 15). JS acknowledges that the interlocutor is correct in her understanding by repeating the interlocutor's words (line 16). Again, the interlocutor confirms the topic (line 17), and JS acknowledges the confirmation (line 18).

T3:

As with T1. However, a smaller percentage of questions were followed by an attributable silence (3 out of 10 questions asked), although the length of these silences lasted up to 3.3 seconds. One of these followed a question initiating a change of topic. Topics discussed in the conversation included health, travel, weather, the Residential Home, and family.

(ii) Afrikaans

T1:

General

The interlocutor was a healthy Afrikaans-speaking (female) fellow resident of the Home. JS played a passive role in this interaction. In comparison, her conversational partner assumed a very dominant role, constructing long turns, and did not often relinquish her turn so that JS could participate. However, JS demonstrated that she was still an active participant in the interaction by providing feedback, using minimal turns and tokens to show continued attention, and acknowledgement of understanding and agreement. She showed strong evidence of understanding by repeating or rephrasing the interlocutor's comments.

Extra-linguistic parameters

Turn taking skills appeared preserved, with JS making appropriate use of TRPs to take her turn. There were no attributable silences, as JS was not asked any questions.

Although topic maintenance appeared intact, JS had little opportunity to develop the topics and introduce new ones, as her interlocutor tended to interrupt her turns before JS could produce more than three or four utterances. However, there were isolated instances where JS left her sentences incomplete, and the interlocutor withheld initiation of repair, giving her time to complete the utterance and elaborate on the topic if she chose to. For example:

[Italics = English translation]

1. **JS:** Daar's daar's waar (0.4) my skoonsuster bly daar. (0.3) Ons gaan haar
There's there's where (0.4) my sister-in-law stays there. (0.3) We are going to (main verb omitted) her
2. (1.3)
3. Goed, dis lekker as ons daar kom
Good, it's great when we get there

In the above extract, a pause of 1.3 seconds (line 2) followed an incomplete sentence. The interlocutor tolerated that silence, giving JS an opportunity to either complete the sentence or to continue with her turn.

T2:

In this conversation, a different interlocutor to that in T1 participated, as the conversation partner involved initially had left the Residential Home. Therefore a new interlocutor participated in the Afrikaans interactions. She was an assistant who worked at the Home, and also participated in the conversations recorded at T3. For this interaction at T2, the interlocutor assumed a less active role, asking more questions, giving feedback via minimal turns, and expanding on themes introduced by JS. Turn distribution was therefore unequal, with JS constructing the longer turns. During JS's extended turns, the interlocutor tended to withhold feedback until completed, after which she would ask a question requesting clarification, or asking for elaborations. JS introduced new topics, and provided feedback in the same manner and purpose as she did for the English interactions. While JS could develop a topic over several turns, she tended to introduce new topics abruptly without signalling a topic shift explicitly. This frequently caused a trouble spot for the interlocutor. There were 5 instances of attributable silences following the interlocutor's questions (16 in all). Topics covered in the conversation included past occupations, family, friends, routines in the Residential Home, and clothes.

T3:

JS maintained an active role in the conversation, introducing new topics, providing feedback, and asking questions. There were instances were topic maintenance was compromised by abrupt, poorly signalled topic shifts. However, JS could elaborate on a topic over several turns. Turn distribution was equal, with both partners constructing major turns. Of 5 questions asked, only one was followed by an attributable silence. This could be because JS's interlocutor did not tolerate attributable silences or pauses in JS's talk. Instead, the interlocutor tended to answer her own questions herself, gave more information about the topic, or merely continued talking, thereby erasing potential trouble spots. Examples (a) and (b) illustrate this point. The extracts are from turns by JS's interlocutor; English translation is given in italics:

Extract (a)

1 Watter tyd is die lekkerste tyd in ons huis?
What is the best time in our house?
2. (0.7)
3. Ek hou van ontbyt.
I like breakfast

Extract (b)

1. En dan kom sy <u>uit</u> en dan sy's so mooi. En dan
And then she comes out and then she's so pretty. And then
2. (0.5)
3. Wat dan?
What then?
4. (0.8)
5. Het jy iets gese (0.3) jy soek 'n man?
Did you say something (0.3) you're looking for a man?

In the above examples, the interlocutor selects JS as the next speaker by asking her a question. However, she does not give JS enough time to answer the questions, and instead continues either by giving her own answer (Extract (a) line 3) or by asking another question (Extract (b) line 5).

Linguistic expression

In all interactions for both English and Afrikaans, poor referencing (e.g. overuse of pronouns without antecedents) gave rise to numerous trouble spots. In addition, word retrieval difficulties, incomplete phrases and abandoned sentences also resulted in the interlocutor becoming confused, subsequently requesting clarification and elaboration. The reader is referred to Table 49 for an analysis of repairs initiated subsequent to intra-language trouble spots.

(c) Language Mixing Behaviour

[i] Formal Tests

The amount and types of code switches on various formal tests is reported in Table 46.

Language	**T1**	**T2**	**T3**
English	-Procedural Discourse (1xP)	-Confrontation Naming (1xV) -Procedural Discourse (1xV) -Concept Definition (1xV) -Co-ordinate Naming (1xV)	-Confrontation Naming (2xV) -Co-ordinate Naming (1xV)
Afrikaans		-Confrontation Naming (1xV) -Procedural Discourse (1xV)	-Confrontation Naming (1xV) -Concept Definition (1xV)

Table 46: JS: Amounts and types of code switches made on formal tests. P = whole phrase code switched. V = vocabulary item code switched. The numbers in brackets refer to the number of times such errors occurred.

As evident from the above table, only isolated code switching occurred on formal tests.

[ii] Sentence Translation

In order to examine for which language translation proved more difficult, and in order to describe the types of errors made on sentence translation tasks, errors made while translating sentences from one language to the other were noted. These results are reported in Table 47.

T1		T2		T3	
Eng to Afri	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**	**Eng to Afri**	**Afri to Eng**
V	V+DT	P+V	V+DT	V	DT

Table 47: JS: Results from the sentence translation task Eng = English. Afri = Afrikaans. V = single vocabulary item code switched; DT = direct translation; P = whole phrase code switched.

On the sentence translation task, errors were made in both English and Afrikaans sentences. Errors ranged from isolated vocabulary items being inserted, to whole phrases being code switched.

[iii] CA

In order to examine code switching behaviours, overall results regarding inappropriate language mixing from the CA are reported in Table 48 below. Code switched utterances refer to both intra- and intersentential code switches, while a breakdown of these are also included in the table.

	T1		T2		T3	
	Eng	**Afri**	**Eng**	**Afri**	**Eng**	**Afri**
Total Utt	63	71	89	128	73	96
CS Utt	6	0	7	1	7	0
Intrasent. Switches	4	0	4	0	3	0
Intersent. Switches	2	0	3	0	4	0
%	9.5	0	7.9	0.8	9.6	0

Table 48: JS: Amount of utterances code switched in conversations Total Utt = total number utterances in conversation. CS Utt = number utterances (out of the total) that were code switched. % = percentage of utterances code switched in each conversation.

As evident from Table 48, findings from the conversations are incongruent with the patterns of language mixing observed from the sentence translation tasks. Inappropriate code switching affected the English conversations only - with the exception of the example in Afrikaans. The purpose of this switch in the T2 Afrikaans conversation was to quote somebody from her work. However, JS did not translate this quote, and the use of English in this instance gave rise to a trouble spot, where the interlocutor initiated repair:

1. JS: [Afrikaans talk] Dan gaan sy en s-se (.) sy uh (0.3) G-ginger (.) today you
2. must come and clean up.
Then she goes and s-says (.) she uh (etc.)
3. I: Se - wat se hulle?
Say - what do they say?
4. JS: G<u>inger</u>
5. I: Ginger. Wie is Ginger?
Who is Ginger?
6. JS: Ek is Ginger
I am Ginger

As is evident from Table 48, the pattern of language mixing ranged from insertions of isolated vocabulary items into a sentence (e.g. at T1: [...] (0.6) but not when it's koud *(cold)*), to full turns in the inappropriate language. The amount of language mixing however was minimal, and did not increase over the year. With regards to mixed utterances, an examination of individual lexical items inserted into the base language English revealed an equal amount of content and function words. There were no instances of morphological adaptations.

To determine whether language mixing gave rise to trouble spots, and if so, how the trouble spots were managed, the number of repairs initiated subsequent to inappropriate language use, and the type of negotiation occurring were calculated. In addition, in order to determine how far code switching affected the quality of interaction as opposed to other reasons for breakdowns, amounts and type of repairs arising from language mixing behaviour versus from other intra-language causes were compared. Intra-language 'other reasons' for breakdown in JS's interactions included ambiguous and overuse of pronouns, word retrieval difficulties, and incomplete phrases/sentences. All these results are reported in Table 49. The types and amounts of repair carried out in English and Afrikaans are reported, with data being divided into amount and type of repair arising from a code switch; and those arising from all other reasons.

		English (TS arising from CS)	**English (other TS)**	**Afrikaans (TS arising from CS)**	**Afrikaans (other TS)**
SI-SR	**T1**	0	22	0	15
	T2	0	23	0	31
	T3	0	26	0	24
SI-OR	**T1**	0	1	0	1
	T2	0	0	0	0
	T3	0	0	0	0
OI-A	**T1**	0	0	0	0
	T2	1	0	0	0
	T3	1	0	0	0
OI-OR	**T1**	0	0	0	0
	T2	0	0	0	0
	T3	1	1	0	0
OI-SR	**T1**	2	1	0	0
	T2	2	1	1	3
	T3	1	0	0	1
CoR	**T1**	0	1	0	0
	T2	0	1	0	0
	T3	0	1	0	0
Total SIR	**T1**	0	23	0	16
	T2	0	23	0	31
	T3	0	26	0	24
Total OIR	**T1**	2	1	0	0
	T2	3	1	1	3
	T3	3	1	0	1

Table 49: JS: Types and totals of repair for each language TS = Trouble Spots; CS = Code Switching; SI-SR = self-initiated self-repair; SI-OR = self-initiated other-repair; OI-A = other-initiated but repair abandoned; OI-OR = other-initiated other-repair; OI-SR = other-initiated-self-repair; CoR = collaborative repair; SIR = self-initiated repair; OIR = other-initiated repair.

By comparing the last two summary rows of Table 49, it is apparent that intra-language trouble spots resulted in many instances of self-initiated repair (SIR) as compared with far fewer examples of other-initiated repair (OIR). However this trend is reversed when comparing SIR to OIR resulting from code switching trouble spots. In fact, JS did not initiate self-repair for any of the code switches.

Table 50 shows the length of repair trajectories (in number of turns) that followed trouble spots arising from language mixing. These were compared to trajectory lengths where the trouble spot involved causes other than language mixing (for instance use of a pronoun without an antecedent). All self-initiated self-repairs were completed within the same turn as the repair-initiation, and are therefore not included in the table. The two instances where other-repair was initiated but then abandoned involved the interlocutors requesting clarification (e.g.: what do you mean?), after which JS failed to provide the repair.

	Trajectories (TS arising from CS)	**Trajectories (other TS)**
SI-OR turn immediately after request for repair	-	T1 (E): 1 T1 (A): 1
OI-OR same turn	T3 (E): 1	T3 (E): 1
OI-SR turn immediately after request for repair	T1 (E): 2 T2 (E): 2 T3 (E): 1	T2 (A): 3 T3 (A): 1
OI-SR over several turns	-	T1 (E): 1 T2 (E): 1
CoR over several turns	-	T1 (E): 1 T2 (E): 1 T3 (E): 1

Table 50: JS: Trajectory length (in turns) following initiation of repair SI-OR = self-initiated other-repair; OI-OR = other-initiated other-repair; OI-SR = other-initiated self-repair; CoR = collaborative repair. E = English; A = Afrikaans.

With regards to intra-language trouble spots, the last column of Table 50 reveals more complicated trajectories occurring in English, with all Afrikaans repair trajectories being completed in the turn immediately after the request was made. All repairs arising from code switching trouble spots in English (column 2) were completed within two turns.

9.3 Discussion

This section details an interpretation of the Results (9.2) in order to establish whether or not the predictions outlined in 9.1 were supported. The Discussion is divided into 5 subsections corresponding to each of the five hypotheses.

(a) Pattern of Loss

The hypothesis that there would be a similar pattern of impairment between languages was supported by both formal test and CA results. Language mixing results are discussed separately in (d) iii.

[i] Formal Language Tests

Quantitative analysis of test scores revealed a similar pattern of deficit; all tests were impaired in both languages. Similar patterns were also apparent from qualitative analyses. For instance, from the Concept Definition subtest, JS could describe items that she could not label in either English or Afrikaans on the Confrontation Naming test. This suggests that although the verbal label cannot be activated in either language, the concept still remains accessible (albeit somewhat degraded).

Another example of a similar pattern of impairment are memory tests. List Learning results appeared better than Story Recall performance in both English and Afrikaans. At T1 and T2, JS was better at repeating isolated words from a list than she was at remembering any information units from a story. This is surprising as, with a story, the semantic and syntactic context should support a richer encoding of material. However, it may be that the story lacked relevance for her, thereby cancelling out any contextual advantages the story may have had over random lists.

[ii] CA Results

CA results revealed similar patterns of sparing and impairment of conversational discourse abilities across languages. Areas of discourse management that were relatively preserved in both languages included an awareness that the message must be adjusted so that the interlocutor can achieve mutual understanding (Hamilton, 1994). This is demonstrated by the numerous instances of self repair following intra-language/"other" trouble spots (Table 49). The preference for self-repairs is consistent with Schegloff et al's (1977) findings from healthy speakers.

Areas of impairment included failure to orientate the interlocutor to new topics (Perkins et al, 1998) by not introducing the subject of the topic explicitly or by using pronouns without establishing the antecedent. Below is an example from the Afrikaans conversation at T2, where JS introduces a new topic in line 1:

[I = interlocutor. English gloss in italics]

1. **JS:** Ja. Hulle se: (.) met myne was dit soos (0.4) As jy my so weer vra wat het ek
2. dan weet ek nie wat nie. Eers moet ek gaan kyk wat ek het [hhh] Jy weet (0.3)
3. want dit was nie (0.3) <u>sterk</u> nie. Dit was net (0.4) min.
They say (.) with mine it was like (0.4) If you ask me again what I have
then I don't know what. I must first go look what I have [hhh] You know (0.3)
because it was not (0.3) strong. It was just (0.4) little.
4. (1.2)
5. **I:** Wat?
What?
6. **JS:** Hare
Hair
7. **I:** Ooh.
Oh.

In the above example, the trouble spot arose in line 1 where JS used a pronoun "myne" (*mine*) instead of explicitly stating the noun. Throughout her turn she does not specify the topic she is talking about, but continues to use pronouns such as "dit" (*it*) in line 3. After the TRP in line

4, the interlocutor initiates repair, asking "wat?" (*what?*), requesting JS to name the subject she is talking about. JS carries out the repair (line 6), and the interlocutor acknowledges the repair in her next turn (line 7).

Another area of impairment that was similar for English and Afrikaans was a difficulty with verbal expression and how this affected the quality of interaction in terms of repair initiated. Intra-language difficulties such as word retrieval problems resulted in JS initiating repair herself for both languages (Table 49 columns 4 and 6). The fewer amounts of self-initiated repair in the Afrikaans interaction at T1 is proportional to the (lesser) amount of talk JS constructed during that conversation, but is still consistent with the pattern of self-repair found across languages. Across both languages at all time periods, there was a limited occurrence of other-initiated repair, suggesting that interlocutors will refrain from initiating repair in order to maintain the quality of interaction. The interlocutors used minimal turns and tokens as feedback while JS constructed her major turns. This suggests a tolerance of trouble spots such as word retrieval difficulties, and a willingness to encourage JS to express herself in any manner she can. Notably, in several conversations, the withholding of feedback during JS's extended turns can be interpreted as a sign the interlocutor was not understanding, or was quite unclear about what the theme of JS's talk is. This interpretation is consistent with behaviour after JS's extended turns, where the interlocutor either asked a question requesting clarification or elaboration, or changed the topic altogether, suggesting that they were unable to follow JS's talk, and were unwilling to initiate any form of repair. This trend was evident in all interactions, both English and Afrikaans.

In summary, a similar pattern of conversational discourse abilities and difficulties was apparent across languages.

(b) Severity of Loss

Results supported hypothesis [ii] in that L2 was more impaired than L1, on both formal tests and CA.

[i] Formal Language Tests

English L2 scores were consistently lower than their L1 Afrikaans counterparts. While inter-language differences did not reach statistical significance, the raw scores were extremely low, and it is possible that the statistical tests may not have been sensitive enough to pick up such small differences. A lack of statistically significant results therefore does not necessarily suggest that languages were impaired to a similar degree. For instance, on Story Recall, JS could recall some of the story in Afrikaans at T1 and T2 (although only a very limited amount) but was unable to do this task in English. Likewise, for Generative Naming (transport), she could only come up with one exemplar in English at T1, and none at T2, while she could still manage to retrieve a few items in Afrikaans at these time periods. These results support the prediction of a differential degree of impairment between languages.

Confrontation Naming results at T1 suggest that the primary difficulty with naming lies with accessing the semantic conceptual system: 50% of items could not be named in either language. This interpretation is consistent with results on Concept Definition, where a difficulty defining words was similarly evident in L1 and L2. However, scores on Confrontation Naming deteriorated to a statistically significant degree over the year in English ($p=0.014$) but not Afrikaans. This could indicate language-specific difficulties accessing the L2 lexicon. The semantic concept could still be accessed because these items that could not be named in L2 could still be labelled in L1.

In summary, findings from formal language tests support the prediction that L2 was impaired to a greater degree than L1.

[ii] CA

Although there were many similarities between conversational discourse abilities in English and Afrikaans, the prediction that L2 would be more severely impaired than L1 was upheld by one finding. Repair trajectories arising from intra-language trouble spots were longer and more complicated in English (L2) than Afrikaans (Table 50). This suggests that JS had more difficulty activating the appropriate lexical and/or syntactic aspects of L2 to repair her trouble spots.

(c) Rate of Loss

Results supported hypothesis [iii] in that L2 appeared to deteriorate at a faster rate than L1, but on some formal tests only. No changes over time were revealed from the Conversation Analysis. Each will now be discussed separately.

[i] Formal Language Tests

It was predicted that L2 would show a faster rate of attrition over the year than L1. However, since scores were very low, changes are difficult to interpret with any certainty. On careful scrutiny it appears that while both languages showed decline over time, some L2 tasks appeared to deteriorate more rapidly than their L1 counterparts. For instance, a downwards trend in English scores only is indicated for Generative and Confrontation Naming, with changes in the latter task reaching statistical significance (p=0.0142). On the more unfamiliar procedural discourse task, JS could not sequence steps to form a cohesive and ordered procedure at T2 in English. In contrast, she could produce a better attempt in Afrikaans at T2 in that some essential steps were included and correctly sequenced. By T3 however, the difficulties in English performance at T2 also became apparent in Afrikaans.

Figure 9 shows a graphic representation of predicted versus observed rate of decline over the year.

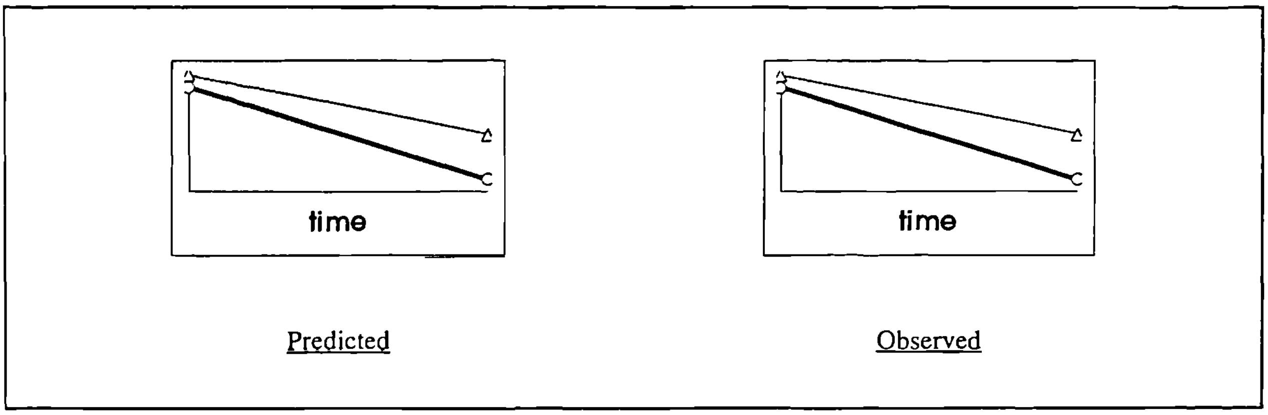


Figure 9: JS: Predicted versus Observed L1/L2 rate of decline
Key: -Δ- L1
-o- L2

From Figure 9 it appears that the prediction was borne out in that L2 deteriorated more rapidly than L1. This is depicted by the gradient of the L2 line. However it must be emphasised that this trend was evident for only a few tasks since scores were near or at floor for most other tests. Conclusions regarding rate of L1 versus L2 attrition are tentative at best.

[ii] CA

The prediction that L2 would deteriorate at a faster rate than L1 was not supported by CA results. Rather, no change over the year was observed in conversational discourse skills for either language. Topic maintenance abilities did not deteriorate, nor did attributable silences increase. The amount of repair following intra-language trouble spots also remained stable. These findings contradict results from formal tests, where deterioration occurred over time. This discrepancy between CA and formal test results is discussed in Chapter 11 (see 11.1.1).

(d) Language Mixing Behaviour

[i] Formal Language Tests

Only isolated code switches occurred on formal test results in either language (Table 46), indicating that JS could maintain a separation between her two languages satisfactorily.

[ii] Sentence Translation

As evident from Table 47, code switching occurred in both directions, from L1 to L2, and from L2 to L1 translations. However, these results may reflect a difficulty with the task itself as opposed to inhibiting the non-selected language. A more detailed discussion can be found in 10.4.3.

[iii] CA

The prediction that language mixing would affect L2 interactions only was proved correct, apart from one isolated occurrence in the Afrikaans conversation at T2. However, the use of English in that instance was to quote somebody, and therefore implies an intentional code switch (although inappropriate for the monolingual interlocutor). While language mixing in L2 English interactions did occur, it was minimal, and did not increase over the year.

As seen from Tables 48 and 49, not every code switch gave rise to a trouble spot. For instance, JS used the inappropriate language for 6 utterances at T1 (E), but only two of these gave rise to a trouble spot. The minimal amount of language mixing did not adversely affect the quality of interaction, as is indicated by the very few repair-initiations following a code switch. Much of the code switching involved intrasentential switches (Table 48), and the context of the sentence and the surrounding utterances may have provided enough of the gist for the interlocutor to understand what was said. JS did not attempt to self-repair any of the code switches, suggesting that she was unaware that they had occurred. However, when other-repair was initiated, she could repair successfully by translating the utterance in most instances. Repair trajectories were always short (Table 50), being completed over a maximum of three turns. Language mixing therefore did not cause many asides.

An interesting instance of language interference occurred in the English interaction at T2:

1. **JS:** I don't like to play here uh (.) s:: bly- stay here
stay

The above example is one of cross-linguistic influences at the phonological and lexical levels. A trouble spot first arose with the word "play". JS initiated self-repair, and started to say a word beginning with "s". She then said the Afrikaans word "bly" (pronounced [bleɪ]) which is the translation equivalent of the English word "stay" - the target word. Finally JS succeeded in saying the word she was looking for: "stay". An error analysis reveals that the first attempt "play" is phonologically similar to the target. She then begins to say the correct word, but instead the Afrikaans word is articulated. This word too is semantically identical and phonologically very similar to the English target. This is a good example of how the similarities between the two languages resulted in code switching.

In summary, while language mixing occurred mainly in L2 interactions, only a few code switches occurred. These did not disrupt the quality of interaction as repair initiations were minimal, and when carried out, trajectories were short and completed successfully.

(e) Neuropsychological Functioning and Language

This section explores a possible link between language performance and neuropsychological profiles. First, neuropsychological findings over the year period are examined, then the hypotheses proposed are explored as to the extent to which they have been supported by test results.

Neuropsychological profile

Many tests could not be administered as the dementing process was too far advanced for them to be attempted, even at the initial assessment. Deterioration over time however can be inferred by poorer performances on Digit Backwards, where by T3 she was unable to hold any of the items in working memory long enough to complete the task.

There is a discrepancy between the CDR rating (moderate) and the results on Mental Status, which suggest a severe dementia. However, the results on the latter test do not accurately reflect JS's orientation to place and person. In conversations, she showed she was aware of her surroundings, demonstrating an orientation to place, and a consistent orientation to person. Her results on the Mental Status test may therefore reflect a refusal to attempt to answer the questions, possibly stemming from a fear of failure or an awareness she may not know all the answers, as opposed to a complete disorientation to person, place and time.

Neuropsychological decline and language tasks

It was hypothesised that with impaired neuropsychological capacity, language tasks supported by attention, working memory and information processing would be adversely affected. This prediction was supported by findings in that a very marked impairment in neuropsychological functioning was evident. In addition, all language functions were very impaired, especially those heavily dependent on working memory, such as Story Recall. With regards to performance on Generative Naming, by naming items from one sub-group of the category only, JS demonstrated impaired divergent thinking skills, a difficulty shifting sets, and inadequate search procedures. It therefore appears that it is the cognitive skills underlying these language tasks which gave rise to impairments, as maintained by Bayles et al (1993).

Where conversational discourse is concerned, extra-linguistic aspects of language dependent on working memory and attention were also impaired. Topic maintenance was compromised by abrupt, poorly signalled topic shifts. This could reflect a difficulty with sustained attention and a difficulty inhibiting distractions. Rather it appears that as a new idea was activated (e.g. by association), JS could not inhibit this idea and continue to attend to the current topic of conversation. Another aspect of conversation affected by impaired neuropsychological abilities is the occurrence of attributable silences. It could be argued that the attributable silences evident in both languages reflect slowed information processing. For example:

(English T2)

1. **JS:** They've got to go to the <u>cheap</u>est one
2. (0.9)
3. **I:** (0.9) What? The cheapest place to live?
4. (1.0)
5. **JS:** Uh::
6. **I:** Are you talking about the cheapest place to live?
7. **JS:** <u>Ja</u> the cheapest (0.8) place to live

In the above example, a trouble spot arose in line 1 with JS using the ambiguous 'one'. In line 3, the interlocutor initiates repair in a question form. This question is greeted by an attributable silence (line 4), before JS claims her turn with a filler 'uh::' (line 5). The interlocutor repeats her question, and in line 7, JS answers immediately. The emphasis on 'ja' indicates she agrees with the correctness of the other-initiated repair. It is possible that the silence in line 4 could reflect the time it took JS to process the question as a request for repair. This explanation is consistent with findings from neuropsychological testing, where information processing was so impaired that the AMIPB subtest could not even be attempted. It is also consistent with findings from the Token Test indicating a difficulty with auditory comprehension.

Neuropsychological functioning and L1 versus L2 performance

The hypothesis that L2 would be more vulnerable to decreasing neuropsychological support was supported by two test results: Story Recall and Generative Naming. Performance on these tasks were more impaired than their L1 counterparts (see b [i] for discussion). However, scores on most other tasks were either at or near floor, and therefore inter-language differences were difficult to identify. Findings from CA upheld the hypothesis in that language mixing affected the L2 conversations to a greater extent than the L1 interactions. This finding suggests that L2 is more reliant on controlled processing than L1 and is therefore more vulnerable to decreasing neuropsychological abilities. However, the amount of language mixing was minimal. Therefore, as with other conclusions drawn for JS, results should be interpreted with caution.

9.4 Summary

While a similar pattern of impairment was evident across languages, L2 was more severely impaired than L1. There was some support from formal tests for the hypothesis that L2 would deteriorate more rapidly than L1. However no change in conversational discourse abilities was noted over the year - in either language. Language mixing results confirmed the hypothesis that L1 would intrude into L2 talk, but code switching behaviour was minimal. Results from both formal tests and CA gave support for the prediction that language aspects heavily dependent on neuropsychological abilities would be affected by impaired cognitive skills. However, the fact that most tests were at or near floor rendered identification of changes in time difficult, and results should be interpreted with caution.

Chapter 10
GENERAL DISCUSSION

Introduction

This chapter draws together findings from the individual case studies in order to address the main questions of the study (see 3.5). Each question is discussed separately, in the order in which they were asked. For convenience, Tables 51a and 51b provide a summary of results obtained. Speakers are ordered according to stage of dementia, from mild (JB) to moderate-severe (AR).

	L1 versus L2 Pattern of Impairment	L1 versus L2 Severity of Impairment	L1 versus L2 Rate of Decline	Language Mixing	Language and Neuro-psychological Functioning
JB	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: Similar with a single exception (Story Recall Delay - Afrikaans) *CA*: similar	*Formal Tests*: No decline in either language, with a single exception (Story Recall Delay - Afrikaans) *CA*: No decline	None	Deterioration in neuropsychological tests over year, but no change in either language (formal tests + CA), with exception of Story Delay
EB	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: Several results suggest L2 deteriorating faster in second 6 month period *CA*: No decline in either language	Evident in L2 interactions only	*Neuropsychological Tests*: Deterioration over year. *Formal Tests*: Some language tasks heavily dependent on neuropsychological abilities impaired, with L2 more so at second six month period *CA*: Language mixing in L2 only. No increase over year

Table 51a: Summary of results: JB, EB

	L1 versus L2 Pattern of Impairment	L1 versus L2 Severity of Impairment	L1 versus L2 Rate of Decline	Language Mixing	Language and Neuro-psychological Functioning
BL	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: L2 more impaired *CA*: Verbal expression worse in L2; other aspects similar at T1 and T2 but L2 worse at T3	*Formal Tests*: L1 deteriorated faster than L2 over year *CA*: L2 faster than L1	Evident in L2 interactions only. Increased over the 12 month period	*Neuropsycho-logical Tests*: Deterioration over year *Formal Tests*: Some tasks heavily dependent on neuropsycho-logical abilities deteriorated in both languages, but L1 more so than L2 *CA*: L2 more vulnerable
JS	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: L2 more impaired than L1 *CA*: L2 more impaired than L1 (Re: repair trajectory length)	*Formal Tests*: Similar with two exceptions (Confrontation Naming and complex procedural discourse in L2) *CA*: No deterioration in either language	Minimal language mixing, mainly evident in L2 interactions	Deterioration in neuropsycho-logical tests over year. Both languages equally affected, but L2 apparently more so than L1
AR	*Formal Tests*: Similar *CA*: Similar	*Formal Tests*: Similar with a single exception (L2 Token Test) *CA*: similar	*Formal Tests*: Several results suggest L2 deteriorating faster in first 6 month period *CA*: No decline in either language	Minimal language mixing evident in both languages at T1 and T2, but at T3 code switching increased in L2 interactions	Deterioration in neuropsycho-logical tests over year. Both languages showed decline too, with L2 more so than L1

<u>Table 51b: Summary of results: BL, JS, AR</u>

What follows is a discussion of the findings from this study according to the main questions asked. Each section contains firstly a brief summary of predictions made (as derived from the literature); and secondly, how the results from this study did/did not confirm the predictions made.

10.1 Pattern and rate of loss compared to monolingual speakers

The first question of the study was whether the pattern and rate of loss seen in a bilingual speaker's two languages is similar to that observed in monolingual speakers with AD. Since many of the tests used have been normed on a monolingual population, and since most of our knowledge of language loss in AD is derived from monolingual speakers, it is important that a comparison is made between the two groups if only on a superficial level, especially since this has not been done in previous studies. The present study can for the first time provide some evidence to answer the question: Does being bilingual result in a completely different pattern of loss with the onset of AD?

The methodology of the present study does not replicate past studies on monolingual AD in terms of the depth of assessment or range of tests included, and so the discussion is limited to general trends. Specific examples are included to highlight a point rather than to detail similarities/divergencies between the language profile of bilingual versus monolingual speakers with dementia. Results from formal tests will first be discussed, after which findings from the CA will be drawn together.

10.1.1 Formal tests

(a) Predictions

Findings from the literature

Studies on monolingual speakers have established a putative hierarchy of tasks vulnerable to AD (See Chapter 2). Most vulnerable are complex tasks i.e. those tasks reliant on a number of sub-processes in order to be carried out. An example is generative naming tasks which require searching of the memory stores, generating responses, organising and categorising information, and keeping track of what items have already been generated. Other examples of complex tasks are concept definition, superordinate and co-ordinate naming. With regards to rate of loss, extreme variations exist in the AD population, but correlations have been found between increasing stage of dementia and progressive decline on language tasks. The more complex the task, the earlier in the disease process it begins to deteriorate (Bayles et al, 1993; Faber-Langendoen et al, 1988; Tomoeda and Bayles, 1993).

Predictions

It was predicted that a similar hierarchy would exist for the bilingual speakers in the present study as tasks in English require as much or as little complex processing as the same tasks in Afrikaans. Further support for such a prediction comes from findings from the bilingual speaker NT (De Vreese et al, 1988). The authors report that the types of impairments evident with NT on formal testing were similar in nature to those observed in monolingual speakers with AD. For instance, NT exhibited difficulties with naming and comprehension in his languages although to different degrees, while repetition of words and reciting series remained intact.

(b) General findings

Consistent with findings from the monolingual literature, results from this study revealed a hierarchy of task vulnerability, affecting all participants, and evident in both their languages, even the weaker L2. Several tasks considered more complex in that they were reliant on more processes, including search procedures, working memory, sequencing and organisation of information, were impaired for all participants, although to different degrees. These tasks were AMIPB Information Processing subtests (error percentage, speed, adjusted score), AMIPB List Learning, Trail Making B, Story Recall, and Generative Naming (transport). At the bottom of the hierarchy of task difficulty was Digit Repetition (Forwards) which appeared to be most resistant to the dementing process, indicating relatively well preserved immediate memory abilities.

The observed hierarchy suggests that whether a person is monolingual or bilingual, AD has a characteristic pattern in that complex tasks appear to be more vulnerable than tasks comprising less numerous sub-components. This is not to say that all complex tasks were compromised in all speakers. While there were the same tests impaired across the five participants (as discussed above), other tasks considered highly sensitive to AD were *differentially* impaired/preserved across participants. In other words, they may have been impaired in one speaker but not another, even though speakers were both at the same stage of dementia. While these difference exist, they do not necessarily negate the conclusion of a general effect AD has on language tasks. Rather the differences highlight the heterogeneity of the population group where although general trends can be discussed, great variation exists. Section (c) below discusses three main divergencies between the expected pattern of impairment and that found in individual speakers participating in the study.

(c) Findings from individual participants

The aim of this section is to highlight differences in findings between the predictions made and individual speakers' results by giving specific examples, and to explain why they may have arisen. It will be shown that the discrepancies do not necessarily result from a fundamental difference between bilingual and monolingual speakers, but rather reflect deeper methodological concerns.

The first discrepancy concerns a hierarchy of task vulnerability/resistance to AD on superordinate and co-ordinate naming tasks. Bayles et al (1993) found that such tasks were highly vulnerable to AD, and were impaired even in the mild stages of the disease process. However, results from JB and EB - both mildly impaired - contradict this conclusion as these two speakers could complete the tasks successfully in both their languages. These conflicting findings could be directly attributed to the nature of the stimuli used. It could be argued that the categories used for this research (animals, colours, musical instruments etc.) were easier than those used in the Bayles et al study, and/or the number of responses elicited may have differed: It is easier to generate 5 co-ordinates than it is to generate 10. The stimuli devised for the present study may therefore not have been challenging enough to pick up potential difficulties in the mild stages of AD. Alternatively, the heterogeneity in task performance so often remarked upon in the literature may once again account for the difference in results. Unfortunately, Bayles et al do not describe the stimulus items they used, nor the amount of examples elicited. Therefore, the reason underlying the diverging results remain a source of speculation.

The second discrepancy, although not so marked, involved generative naming tasks. There is strong agreement in the literature that this task is highly sensitive to even the early stages of AD (e.g. Bayles and Kaszniak, 1987; Martin, Brouwers, Cox and Fedio, 1985; Nicholas et al, 1996). Results from the present study are on the whole consistent with such conclusions. However, BL's English (L1) results for animal naming fell within normal limits at T1, while the rest of her language profile at that time was consistent with a mild to moderate dementia. Given this profile and findings from the literature, it is surprising that BL performs as well as she does on the animal naming task.

The third discrepancy concerns memory recognition. The nature of memory problems differed for JB and EB versus claims by the ABCD that such a task is highly sensitive to the initial stages of AD, and versus findings from a study by Salmon, Granholm, McCullough et al (1989). Using a test similar to the Memory Recognition test used in the current study, the latter authors found that memory recognition was impaired in AD, even in the mild stages of the disease. They concluded that memory deficits in AD therefore consist of a difficulty with encoding and storing the information, as well as retrieving information from existing memory stores. However, this study found that for the two mildly demented participants, Memory Recognition results fell within normal limits for both their languages. This suggests that at least in the mild stages of dementia, in some speakers, the memory deficit is initially one of retrieval. Only as the disease progresses does less encoding of information occur, as revealed for instance by poorer Memory Recognition results in BL (mild to moderately impaired).

However, all three discrepancies may have one common underlying explanation. The studies referred to from the literature used a group study design. Criticism has been levelled at such a methodology which, by assuming patient homogeneity, averages out results and ignores extreme variations from the mean (Caramazza, 1986; Gray and Della Sala, 1996). For instance, the manual in the ABCD states that 80% of speakers with mild AD scored below the cut-off point for the memory recognition subtest. However, what about the remaining 20%? Might they have scored as well as normal controls did? It is very likely that performances from participants in the present study indeed represent such deviations from the mean. Furthermore, it is unlikely that unimpaired performance for some speakers (e.g. JB, EB) in the above-mentioned three tasks reflects advantages of their bilingual status. English and Afrikaans were used by these participants in the same culture, in the same society, and frequently in the same community. The concepts to be expressed or objects to be labelled were therefore similar. As an arbitrary example, if a person had lived in America, he/she may be aware of and more familiar with different animals to those found in South Africa (for instance a gnu, or a rattlesnake). This may have presented an advantage for the animal naming tasks. It is highly doubtful that such benefits boosted performance for the bilingual speakers in this study, especially considering that, for BL, good performance on animal naming was only evident for English (L1), not Afrikaans (L2).

To summarise, many of the same patterns of decline found in monolingual AD were observed in the bilingual participants. A broad hierarchy of tasks more/less sensitive to AD could be established for both languages that closely followed results from studies such as Bayles et al (1993) and Faber-Langendoen et al (1988). However, heterogeneity of results was apparent for all 5 participants. This heterogeneity included the extent to which tasks were impaired, and the rate of loss over time. As discussed in Chapter 2, to summarise all findings from monolingual speakers with dementia is an extremely complicated undertaking because of the different study designs used and test batteries selected. What can be upheld is that the heterogeneity of results seen in either of the participants' two languages reflects the heterogeneity of findings from the monolingual AD population. Therefore, while a broad hierarchy of task vulnerability can be discerned, there is no one consistent immutable pattern of loss in so far as complex versus less complex tasks are concerned.

10.1.2 CA

(a) Predictions

The literature on conversational discourse abilities in monolingual AD shows a steady decline in pragmatic and linguistic skills as the disease progresses (see Chapter 2). Consistent with these findings, it was expected that bilingual speakers in the mild stages of AD would have relatively preserved discourse skills, while speakers in the moderate stages of the disease would have increased difficulties with topic maintenance and verbal expression. Hence, as maintained by Orange et al (1996), advancing dementia was predicted to correlate with an increase in repair as conversations became more problematic. The prediction of similar findings for bilingual speakers receives support from De Santi et al (1990). In their study with bilingual speakers, these authors concluded that participants exhibited similar language problems in discourse compared to monolingual speakers with AD, although the deficits were differentially exhibited in each of the languages. Such problems included circumlocutions, topic loss and naming difficulties.

(b) General findings

Since a wealth of information can be obtained from a CA, this section confines itself to general trends observed. For a more detailed exploration, see 10.2.2, 10.3.2 and 10.4.

As predicted, participants in the mild stages of AD demonstrated relatively preserved discourse management skills, while those speakers at a more advanced stage of dementia had difficulty with verbal expression and topic management. However, consistent with findings by several authors (e.g. Hamilton, 1994; Illes, 1989; Orange et al, 1996; Sabat, 1991), participants in the moderate stage of AD still demonstrated many intact pragmatic abilities such as responding to a need for repair. This was evidenced by initiation of self-repair and by successful completion of other-initiated repair. Most trouble spots were caused by discourse-related difficulties (such as problems with lexical referencing), especially with participants at a more advanced stage of the disease.

As with formal tests, variability among participants existed in the range and extent of topic management difficulties. Section (c) explores several examples where divergencies were apparent, and explains what the causes of these differences may be.

(c) Findings from individual participants

This section reports two main differences in trends between CA results found from several participants in this study versus those results from monolingual speakers with AD. The first concerns repair, as researched by Orange et al (1996), and the second difference concerns topic maintenance. In each case, the differences in findings are highlighted and then explanations as to why they occurred are suggested.

Repair

Findings:

(i) *Orange et al (1996)*: with advancing AD, conversations became more problematic and the need for other-initiated repair increased.
Present study: For all participants except AR, other-initiated repair resulting from intra-language trouble spots did not occur frequently. Even with speakers who were at a more advanced stage of dementia (i.e. BL and JS), no greater amount of other-initiated repair was evident.

(ii) *Orange et al (1996)*: The majority of other-initiated repair when speaking to moderately demented speakers consisted of non-specific repairs (e.g. what? huh? pardon?)
Present study: JS's and AR's interlocutors tended to withhold repair unless they could precisely identify the trouble spots, and then ask questions explicitly focusing on the required repair (e.g. Are you talking about x or y?).

These differing results do not necessarily indicate a qualitative difference between how a bilingual speaker manages a conversation as compared to a monolingual speaker. Instead, the discrepancies can be attributed to the different interlocutors involved in the studies. Orange et al recorded interactions between the AD speaker and a family member. In comparison, the current study involved conversations between the speaker and another resident in the Residential Home, or staff member/assistant. The differences in example (i) arose because the less-familiar interlocutors in the present study may have been less comfortable with initiating other-repair, preferring instead to withhold repair until the speaker either self-corrected, or until they could once again pick up the gist of the speaker's talk. The varying results in example (ii) could likewise be interpreted as reflecting the influence of different interlocutors in terms of their style of interaction.

While the effects of individual interlocutor styles of interaction, and degree of familiarity/ unfamiliarity result in seemingly different patterns of impairment in conversations with monolingual versus our bilingual speakers, they might also explain why some findings were congruent. For example, Bayles and Kaszniak (1987) revealed that speakers asked fewer questions of the interlocutors than their interlocutors did of them. This trend was also found in the present study. Yet again, this could reflect different interlocutor styles. The less familiar interlocutors in this study asked more questions to keep topics flowing, find out information and so forth, as they were not familiar with the speaker's personal details, family situation, past occupations and so on. There was less shared information between the two. If the interlocutors participating in this study were family members, a different pattern regarding amount of questions asked may have been found.

Topic maintenance

Several authors contend that decreased topic maintenance is a major adverse influence on the quality of interaction in AD (e.g. Kempler, 1995; Nicholas et al, 1985; Tomoeda and Bayles, 1993; Ulatowska et al, 1988). Ulatowska and Bond Chapman (1995) go so far as to contend that the primary impairment is communication, not language. They cite as evidence the disjointed flow of ideas with incomplete information units and intrusions, all contributing to poor topic maintenance. However, results from this study on CA suggest that topic maintenance is better preserved than previously considered in the literature. It is the overuse of empty nouns ('stuff' 'thing') and pronouns without antecedents that render their talk difficult to understand, giving the impression that the speaker has changed topic several times. On close scrutiny however it is evident that participants - even those in the moderate stages of AD - could maintain topics of conversation to a better extent that the literature suggests, and the difficulty is more to do with linguistic expression of propositions. For example:

Extract from Speaker JS [T2 English. I= interlocutor. Italics = English translation]:

1. **JS:** Oh w-well my son was here today. I was SO glad.
2. **I:** Oh that's ni:ce
3. **JS:** Ooh I was longing for him (0.6) Because he (0.4) uh two weeks ago (0.4)
4. he was l-living in a house - in the old house with his: he and his wife. (0.7) But
5. they tell that he must be there (0.6) He's very clever with e-everything to do
6. **I:** Is it?
7. **JS:** Ah. And uh they go (0.6) and here I'm sitting >here just today< here (.) on
8. the bed (.) like this (1.4) and uh somebody (.) opened the door (0.7)
9. >Here's sy< uh: Johannes [...]
his

In line 1, JS introduced the topic appropriately, using a noun ('son') as an explicit identification of the subject. In lines 3-5 she establishes the background as to why his visit was an important event at this time. The interlocutor's feedback (line 6) is a rhetorical question (similar in function to 'really?'), indicating that she understood JS talk, and returned the floor to JS to continue talking. JS then elaborates on the actual visit (lines 7-9), appropriately extending the topic. This topic was maintained over the next 14 turns. JS's talk may have been difficult to follow because of the numerous instances of abandoned phrases (e.g. line 3), and use of pronouns without antecedents (e.g. line 5). However, JS did demonstrate a good ability to maintain the topic. It is the poor use of linguistic expression that complicated the ease with which JS's talk could be understood, rather than a difficulty with topic maintenance.

This is not to say that topic maintenance was always satisfactory. Indeed, as reported in previous chapters, decreased topic maintenance was evident in conversations with JS and AR in particular. In such cases, as maintained by Kempler (1995), decreased attention and working memory may have been contributing factors. However, what is being suggested in findings from this study is that a more damaging effect on the quality of interaction than decreased topic maintenance is the difficulty speakers had expressing propositions and with word retrieval. Word retrieval deficits have been identified on formal testing, and the hesitations, pauses, revisions and circumlocutions on CA can readily be interpreted as evidence of word finding difficulties. Therefore, contrary to claims by Ulatowska and Bond Chapman (1995) but consistent with assertions by Perkins et al (1998), the linguistic impairment must therefore contribute to deficits seen in discourse in as an important manner as cognitive deficits such as poor information processing and working memory.

In summary, similar trends were found on CA for monolingual and bilingual speakers with AD in that the same areas were impaired and preserved for both groups, as divided according to the stage of dementia. Where differences occurred, these have been shown to be a reflection of different interlocutor styles and different ways of interpreting the same surface behaviour.

10.2 Pattern of loss between the speaker's two languages

The second question of the study was whether there were any regularities in the pattern of loss between a speaker's two languages. After summarising predictions made and patterns expected, this question is addressed using results from formal language tests and CA. As explained in 2.7, a distinction between pattern of loss and severity of loss was made for the purposes of a clearer interpretation. This distinction will be upheld when discussing the findings. Any differences stemming from language mixing behaviour are omitted from this section since they are explored in detail in 10.4. Therefore all comments refer to intra-language behaviours only.

10.2.1 Predictions

Pattern:

For all speakers it was predicted that a similar pattern of impairment would be evident from L1 and L2 results. That is, tasks/aspects impaired in one language will also be impaired in the other - irrespective of degree of impairment. There was no reason to expect a difference between languages with regards to pattern of loss as it is expected that the hierarchy of components of language vulnerable to the effects of AD (see Chapter 2) will be similarly exhibited across a bilingual speaker's two languages. Even though the L2 may be less automatised than L1, all speakers attained a high enough level of L2 proficiency to meet social and vocational communicative needs, with all aspects of language assessed in this study (semantics, comprehension, discourse) having been activated daily. Therefore, it was predicted that L2 tasks would be vulnerable to dementia in a similar pattern to L1.

Severity:

For speakers who acquired both languages simultaneously, a similar degree of impairment across languages was predicted. For speakers who learnt their L2 after acquiring their L1, it was predicted that a difference in severity of impairment would be found, with their L2 being impaired in the same pattern but to a greater degree than their L1. As shown in the literature, a language acquired later in life is less automatised and more vulnerable to the effects of aging (see Chapter 1). If it is true that L2 requires more resources to activate and relies more on explicit knowledge than does L1, then with dementia, L2 will be impaired to a greater degree.

10.2.2 Formal Tests

General Findings

Pattern:

For all speakers, the prediction of a similar pattern of L1 versus L2 impairment on formal tasks was borne out by test results. That is, there were no marked dissociations between semantics, comprehension, procedural discourse and memory tasks in one language versus the other. If the task was impaired in L1 it would also be impaired in L2. This is hardly surprising considering the previous section (10.1) concluded that both languages exhibited a similar pattern of impairment to that seen in monolingual speakers with AD. The conclusion drawn here is that no matter whether an individual is monolingual or bilingual, as long as both his/her languages have reached Neisser's critical threshold (see 1.4), they are similarly affected by AD in terms of pattern of impairment.

There were isolated examples where a task was unimpaired in one language but impaired in the other. However, in these situations, results could be interpreted as reflecting a difference in severity rather than a difference in L1 versus L2 pattern of impairment. One example from JB is discussed to highlight this point.

The instance involved JB's Story Recall Delay (henceforth SRD) where results were unimpaired in Afrikaans but impaired in English. This appears to fulfil the criteria for a difference in pattern of impairment regarding resistance of memory traces over time for each language, as the task fell within normal limits in one language but could not be completed in the other. However, on another memory task (List Learning), similar results between languages were found: JB could not recall any items from the original list in either language after a period of time had elapsed. This implies that memory traces for both languages were equally susceptible to interference and trace decay. Similar results are also found on a third memory task (Memory Recognition) where English and Afrikaans performances were highly similar. Therefore differences on SRD do not necessarily imply a different *pattern* of L1 versus L2 memory impairment, but rather that one language was more severely affected than the other on one of the tasks.

In summary, at first glance a discrepancy in results could be misinterpreted as reflecting a difference in L1 versus L2 pattern of impairment while in fact what is really being reflected is a difference in severity of impairment.

Severity:

While similar patterns of impairment were found between languages, differences across the five participants were noted in terms of severity of impairment between languages. The ensuing discussion is divided up into sub-sections where the various points stemming from this find are explored separately. First, results are examined to determine whether the predictions made were borne out for all speakers. Secondly, specific results are scrutinised in order to see whether some tests are more sensitive to differences in L1 versus L2 severity than others, and why this may be. Finally, results from this study are compared to findings from the few previous studies on bilingual speakers with AD.

Predictions versus Results

Table 52 provides a summary of predictions made and results observed on formal tests.

	JB	EB	BL	JS	AR
Predicted	similar	L2 worse	L2 worse	L2 worse	L2 worse
Observed	similar	similar	L2 worse	L2 worse	similar

Table 52: Summary: Severity of impairment (formal tests)

The first prediction was that speakers who acquired their two languages simultaneously would exhibit a similar severity of language impairment. This prediction was generally supported by results from JB - the only speaker for whom the hypothesis was applicable. There was a single exception to this finding concerning SRD, where the task performance was impaired in one language but not in the other. However, by T3 this difference had disappeared, revealing a virtually identical degree of impairment in her two languages. Why a discrepancy was evident on this task remains unclear (see 8.3 for discussion).

The second prediction was that in cases where L2 was acquired after L1, a difference in severity of impairment was expected, with L2 more affected than L1. This prediction was only supported by results from two speakers (BL and JS).

For EB, this prediction was not borne out as English and Afrikaans results were impaired to a similar degree. This is apparent from both a lack of statistically significant inter-language differences, and from qualitative analyses. The reason why the prediction was not confirmed for her can be attributed to the stage of dementia. EB was in the mild stages of AD as evident from her CDR score. Even though her L2 may not have been fully automatised, it appears that sufficient resources were still available in the early stages of AD to activate L2 language production as demanded by formal tests. Thus a similar degree of impairment was evident between languages.

For the last speaker, AR, the predicted difference between L1 and L2 severity of deficit was also not supported. One reason could be that performance on many tasks were near or at floor and therefore not sensitive to inter-language differences. However for those tasks not near floor, similar degrees of impairment were evident between languages. It therefore appears that frequent use of and consistent amount of exposure to L2 boosted L2 automaticity levels to an extent where, at least at this stage of the dementing process, it appeared as affected on formal tests as its L1 counterparts. Discussion of this point is resumed in 10.6 and 10.7.

In summary, not all predictions regarding severity of L1 versus L2 impairment were supported. Differences between predictions and findings reflected the influence of stage of dementia in one case, and the influence of high levels of L2 proficiency in the other. These factors are discussed in more detail in 10.7.

Sensitivity of specific tests

Several tasks apparently highly sensitive to inter-language differences could be identified. They were the Token Test, Memory Recognition, List Learning and Confrontation Naming. The common underlying factor for the first three tests is the load placed on sustained attention and working memory. Data needs to be stored in working memory for a period of time in order for the task to be successfully completed. As argued in previous chapters, a less automatised language (L2) is more dependent on controlled processing. Therefore a decrease in the neuropsychological abilities supporting L2 processing (i.e. attention, information processing, working memory) will result in impaired performance on language tasks heavily dependent on these skills. This could explain why those tests are so sensitive to contrasting levels of ability in each language.

With regards to the sensitivity of Confrontation Naming in identifying inter-language differences, this can be accounted for by two mutually compatible explanations. Firstly, since a bilingual speaker should not be viewed as two monolingual individuals rolled into one (Grosjean, 1989; 1992), differences between the two languages could be expected on naming tasks. For instance, poorer scores on the Confrontation Naming task for L2 could reflect the fact that speakers had never known some of the lexical labels for items in L2 pre-morbidly. The differences therefore may not always be incurred by the progression of AD. For example, at any time point, BL could not name 5 items in Afrikaans that she could in English, even though she could describe the object in Afrikaans. It is plausible that she had not known the Afrikaans label for the item pre-morbidly, contributing to a poorer score on the task in L2.

The second explanation is that results could be reflecting different age of acquisition (AOA) effects. It has been shown that in healthy monolingual speakers, impairments in naming can be predicted by AOA influences (Hodgson and Ellis, 1998; see 1.2.2). Extrapolating from this finding, the L2 lexical items acquired later in life may be more inaccessible, while the earlier acquired L1 words remain accessible. However, not every participant who acquired her L2 after L1 showed statistically significant differences between the two languages on Confrontation Naming. This point is elaborated upon 11.1.4 and 11.1.5.

Findings from previous studies

There is very little data available from previous studies on bilingual speakers with AD regarding patterns and severity of impairment across a whole battery of formal tests (Chapter 3). In fact, some studies only reported formal test results from one of the two languages, thereby precluding any comparison between languages (e.g. Hyltenstam and Stroud, 1993; De Santi et al, 1990). Furthermore, the only longitudinal study in this field (by Luderus, 1995) did not even report what formal tests were administered, let alone what results were found. Therefore the results from the present study are, to the writer's knowledge, the first set of findings from a broad test battery detailing longitudinal patterns of decline in this population. To what extent these findings are representative of the whole bilingual AD population requires further study.

There are only three papers from which limited comparisons between findings from this thesis and other studies can be made. All participants in these three studies learnt their L2 at school, or even later in life. Dronkers et al (1986) found that their patient performed equally well in both languages, although raw scores were not provided. De Vreese et al (1988) demonstrated that the pattern of impairment was similar for all three of NT's languages, although they differed in severity (the most proficient language was the least severely impaired). The final pertinent study is Cooper (1995), although only two formal tests were administered. Her findings revealed that there were no statistically significant differences between raw scores from tasks in L1 versus L2 on either the Confrontation Naming task or verbal fluency. However, qualitative differences were observed on the Confrontation Naming test, where a more variable pattern of error responses occurred in L2 than L1, suggesting that word retrieval is more problematic in L2. In conclusion, it is evident that although L2 was learnt after L1 was acquired for the above-mentioned speakers, performance on formal language tests did not always indicate a difference in severity of impairment between languages. These findings are consistent with those from the present study.

Gaps between predictions and results can stem from different methodologies employed. For instance, if tasks were easy, one might expect fewer differences between languages in terms of severity of impairment. Gaps can also arise from different interactions between the stage of dementia and L2 proficiency levels, as was the case for EB and AR. However, the previous studies included for comparison in this section did not fully report information about proficiency levels. In addition, test batteries were incomplete (e.g. Cooper, 1995), or not even listed (e.g. Dronkers et al, 1986). Therefore their data cannot be used with confidence to confirm or refute conclusions drawn from this study with regards to influences of age of acquisition, proficiency levels, and stage of dementia (see 10.7).

Summary

Not all predictions regarding severity of L1 versus L2 impairment were supported, but the expectation of similar patterns of impairment across languages was met. This is consistent with the few results published in the literature.

10.2.3 CA

General Findings

<u>Pattern:</u>

The prediction of a similar pattern of impairment across languages was supported. In all speakers, in both languages, similar abilities regarding topic maintenance were evident. For instance, if a speaker had problems introducing a new topic in L1, the same problem would be evident in L2 interactions. Likewise, similar intra-language trouble spots were evident in both languages (e.g. word retrieval problems, ambiguous lexical referencing), as were abilities to repair these trouble spots. As a final example, if attributable silences were evident in interactions in one language, they were also evident in conversations in the other

Severity:

As with formal tests, not all the predictions made were supported. The discussion below firstly explores discrepancies between predictions and results; and secondly compares results to findings from previous studies on bilingual AD.

Predictions versus Results

Table 53 provides a summary of predictions made and results observed on CA.

	JB	EB	BL	JS	AR
Predicted	similar	L2 worse	L2 worse	L2 worse	L2 worse
Observed	similar	similar	L2 worse	L2 worse	similar

Table 53: Summary: Severity of impairment (CA)

The prediction that speakers who acquired both languages simultaneously would exhibit a similar degree of impairment across languages was borne out by JB's results. However, with regards to speakers who acquired their L2 after their L1, the hypothesis of L2 being more affected was only supported by two speakers: BL and JS. For these speakers, differences between languages were found with verbal expression and ability to carry out other-initiated repair respectively.

With the other two speakers (AR and EB), very similar results were found on Afrikaans (L2) versus English (L1) conversation analyses, contradicting the prediction that the L2 would be more impaired. This finding is consistent with results from their formal tests (10.2.1). The same reasons accounting for why the predictions were not upheld in formal tests holds true with CA. EB, although exhibiting a difference in L2 versus L1 proficiency (as determined from the language background questionnaire), was in the mild stages of the disease process. Therefore sufficient resources were still available to activate a less automatised L2. AR, although in the moderate to severe stages of dementia, had gained a high level of L2 proficiency. Her L2 was therefore sufficiently automatised so as to be resistant to depleting resources as L1 at that stage of the dementing process. Therefore for EB and AR, L1 and L2 were impaired/spared to similar degrees. In comparison, JS and BL had wider gaps in proficiency levels, and decreasing resources resulted in the less automatised language deteriorating faster than the dominant language (see 10.7. for full discussion).

Findings from previous studies

Of the few studies on bilingual dementia published in the literature, only one included a cursory attempt at analysing other parameters of their participants' discourse management apart from language choice/separation difficulties (3.1.3). Hyltenstam and Stroud (1989) examined topic changes, digressions and turn-taking abilities in their speakers. One speaker (KL) acquired both languages at the same age, and difficulties in discourse were exhibited to the same extent between her languages. Her results are consistent with JB's, who also acquired her two languages simultaneously. Their other speaker (GM) learnt his L2 after acquiring his L1. A difference in languages was noted in so far as he made fewer topic changes or topic digressions in his L1 than his L2. His profile therefore is similar to JS and BL. However, further comparisons cannot be made between speakers from the present study and participants in Hyltenstam and Stroud's as the latter authors did not analyse or comment on discourse abilities in any more depth.

Summary

As with findings from formal tests, a similar pattern of impairment and sparing was exhibited across a speaker's two languages during conversational discourse. However, the predicted difference in severity with L2 being more impaired than L1 was not supported in all cases: two speakers showed a similar degree of impairment between languages as revealed by the CA. These findings are explained by differences in degree of L2 proficiency and the stage of dementia. Section 10.7 draws together a full discussion of interplay between AOA and proficiency level factors, and stage of dementia.

10.3 Rate of loss

The third question of the study was whether there was any regularity in the rate of attrition between the bilingual speaker's two languages. This section firstly summarises the predictions made. Secondly findings from formal tests are discussed and reasons accounting for the observed rates of decline are explored. Thirdly findings from CA results are discussed, and lastly differences between results found on the formal tests versus CA are accounted for. Differences in rate of decline stemming from language mixing behaviour are omitted from this section since they are explored in detail in 10.4. Therefore all comments refer to intra-language behaviours only. No comparisons could be made to previous studies as all except one involved assessing languages at one time point only. The longitudinal study (Luderus, 1995) only examined changes in language mixing behaviour over time, and is therefore discussed in 10.4.

10.3.1 Predictions

For speakers who acquired both languages simultaneously, a similar rate of decline between languages was predicted. For speakers who learnt their L2 after their L1, it was predicted that L2 would deteriorate at a faster rate than L1. As argued in the literature, a language acquired later in life is less automatised and more vulnerable to the effects of aging (see Chapter 1). If it is true that L2 requires more resources to activate and relies more on explicit knowledge than does L1, then with dementia L2 would deteriorate quicker as resources diminish.

10.3.2 Formal Tests

General Findings

Table 54 provides a summary of predictions made and results observed on formal tests.

	JB	EB	BL	JS	AR
Predicted	similar	L2 faster	L2 faster	L2 faster	L2 faster
Observed	similar	L2 faster	L1 faster	L2 faster	L2 faster

Table 54: Summary: Rate of decline (formal tests)

The prediction that languages having been acquired simultaneously would deteriorate at a similar rate was neither strongly supported nor refuted. Results from JB (the only speaker for whom this hypothesis was relevant) revealed that her languages did not show decline over the time slot of examination. The sole exception to the trend was Story Recall Delayed (SRD). This task had reached floor in English at the start of the study but appeared preserved at T1 in Afrikaans. SRD however did show marked deterioration in Afrikaans over the twelve month period. As a plausible explanation cannot be found (see 8.3), this result is regarded as idiosyncratic. There is no obvious reason why only one specific task declined in one language only, while the numerous other tasks assessed (targeting similar processes) did not show decline in any language. Returning to the prediction then, the lack of change over time precludes firm conclusions whether the hypothesis is valid. It appears that at the mild stage of Alzheimer's Disease, even where deterioration in neuropsychological abilities is evident (see 10.5), language functions do not necessarily show decline. However, another feasible explanation is that at the mild stages of AD, the test battery employed was not sensitive enough to detect subtle changes in language performance. This point is resumed in the next sub-section.

The second prediction was that speakers who learnt their L2 after their L1 would exhibit a faster rate of decline in their L2 All speakers showed deterioration in both languages over time. However results suggesting that L2 deteriorated at a more rapid rate were only evident for three speakers (EB, JS, AR). For these three cases, support for upholding the prediction was not very strong: L2 performance appeared more affected than L1 on several tasks only, but there was no distinct trend apparent. For the last speaker (BL), results were surprising as, contrary to predictions, L1 deteriorated at a faster rate than L2. Reasons as to why these different profiles were found are explored in the next sub-section.

Reasons why predictions were not supported

The fact that results did not always present strong support for the hypotheses proposed does not necessarily negate the validity of the predictions. Instead, the gap between the predictions made and results obtained could rather be reflecting two methodological issues: window of examination and sensitivity of tests employed.

(a) Window of examination

The hypotheses proposed were interpreted solely in light of what was found in the time frame of twelve months. However, these findings regarding rate of decline do not necessarily reflect what preceded the year's window, and what will follow in subsequent months. The period of deterioration assessed was arbitrarily bordered by when the study commenced and when it ended. Different findings may have been observed if the borders fell even 6 months either way. For instance, AR's L2 deteriorated in the first 6 months of the study, and then plateaued as her L1 began to decline. This pattern was taken as supporting the hypotheses proposed for her regarding rate of L2 versus L1 decline. However, if the study had commenced 6 months later than it did, the first findings would reveal L1 deteriorating while L2 remained relatively constant - similar to what was found with BL. This would be contrary to the predictions made. With BL, the observed gap between predictions and results may merely reflect the slice of time examined rather than an unusual pattern of decline. It is highly likely that in the years preceding the start of this study, L2 deteriorated rapidly while L1 was relatively maintained. It is equally plausible that in the year(s) to follow, her L2 would decline quicker than her L1.

In conclusion, the study is only a snapshot of a twelve month period of a disease process that can last up to 15 years. What preceded the patterns observed and what may follow after this twelve month period provide the context in which the snapshot can be interpreted. However, due to the time limitations of this study, this was not feasible. Findings of rate of decline contrary to what has been predicted should therefore be interpreted with caution.

(b) Sensitivity of tests

With regards to changes over time, only a few results reached statistical significance. However this does not necessarily imply that changes did not take place. It could be that the formal language tests selected and statistical tests employed were not sensitive enough to pick up the changes that occurred, especially where speakers' scores were at ceiling (e.g. JB) or at floor (e.g. JS). Therefore, returning to the predictions made, findings where L1 deteriorated at the same rate as L2 do not always indicate a similar rate of change. Rather, the tests were not sensitive enough to pick up the (possibly) slightly faster rate of L2 decline. This point is discussed in more detail in 11.1.4.

10.3.3 CA

General findings

Table 55 provides a summary of predictions made and results observed on CA.

	JB	EB	BL	JS	AR
Predicted	similar	L2 worse	L2 worse	L2 worse	L2 worse
Observed	similar	similar	L2 faster	similar	similar

Table 55: Summary: Rate of decline (CA)

From conversation analyses, the only clear support for the hypothesis regarding L2 deteriorating faster than L1 was found for BL. For her, the percentage of repair initiation following intra-language trouble spots increased over the year in L2 only, revealing an increasing difficulty with verbal expression in that language. Her performance supports Paradis's (1997) contention that a language learnt later in life will not become fully automatised and so will be more vulnerable to depleting resources and decreased neuropsychological support (see 10.5). Furthermore, the lesser amount of exposure to L2 since retirement also contributed to the lowering of L2 automatisation. This resulted in the weaker language deteriorating at a faster rate as revealed by Conversation Analysis.

For all the other speakers, conversational discourse abilities as revealed from the CA did not change over the year for either language. On a superficial level, this seemingly contradicts the predictions that the language learnt later in life would deteriorate at a faster rate. However results showing a lack of decline in conversational discourse abilities are open to several readings - all explored in the following sub-section.

Reasons why predictions were not supported

Contrary to predictions made, no changes in CA results were evident in L2 (or L1) over the year period for four of the five participants. Several reasons can be offered to account for this finding.

(a) It is possible that changes in conversational discourse did occur, but the method of analysis was not sensitive enough to identify this decline. Deterioration may have been occurring at too slow and subtle a rate to be sensitively differentiated from influences of different interlocutor styles or topic. For instance, a certain topic may be more relevant to the speaker, thereby promoting better topic maintenance because of the autobiographical support available. A topic less salient and with less recourse to autobiographical memories may exacerbate topic maintenance problems. At the same time, though, the ability to sustain a topic over several turns may be deteriorating as distractibility increases and sustained attention abilities become more impaired. However, these subtle changes may not be identified by CA because of the confounding effect of topic influences. Therefore the prediction that a weaker L2 deteriorates faster than L1 is not necessarily refuted by findings of a lack of change over the year. If one had to collect data points further apart, the slow, subtle attrition of conversational discourse abilities may become more obvious.

While this reason remains plausible, it was discussed in Chapter 3 how CA facilitates a bottom-up, in-depth analysis of how a conversation is structured. This close scrutiny of talk invites a detailed assessment and is thus more likely to identify changes over time than would top-down analyses which filter data into fixed categories (Perkins and Lesser, 1993). Therefore even though it may not be an ideal instrument tool to measure change, its advantages far outweigh those afforded by other methods of conversational discourse assessment (see 11.1.2).

(b) It is possible that the assessment tools employed were accurate and that deterioration in conversational discourse abilities did not occur in L2 (or L1) in the time slot of examination. However changes over time were noted in L2 for two speakers (AR and EB) from formal test performance. Why then were they not evident on Conversation Analysis? It appears that the answer lies in the different demands CA places on an individual as compared to formal tests. Conversation is rich with situational and contextual cues. The redundant nature of conversation may therefore provide the necessary support for L2 production even when neuropsychological support is reduced (see 10.5). Furthermore, interlocutors may adjust their communicative expectations and conversational styles. For instance, they may be more/less tolerant of attributable silences and construct extended turns to compensate for this (as JS's Afrikaans interlocutor tended to do). This behaviour may mask any changes in L2 conversational abilities over the year. In contrast, the contextually-stripped, non-redundant demands of formal tests appear to be more challenging, with L2 performance on tasks deteriorating over time. This does raise the question whether functional performance can be inferred from formal test results - a point which is discussed in more detail in 11.7.1.

Why then was deterioration in L2 interactions observed for BL? The reason could stem from the wide gap between L1 and L2 proficiency levels. The less automatised the language, the more resources needed to activate it. With BL, her L2 may have been so reliant on controlled processing that the beneficial redundancy of conversations was not sufficient to boost L2 production. Hence, changes over time occurred in her L2 as identified by CA. This account is compatible with the explanation postulated in (c) below.

(c) Time window of examination

As discussed in 10.3.2, if assessments had been carried out a year before they had been commenced, or indeed a year after the study was completed, then a different picture may have emerged - one congruent with the predictions made. An additional consideration is that deterioration on L2 formal tests may herald decline in L2 functional communication. If the study were to continue beyond the twelve month period, a lag between functional communication and formal test performance may be revealed. Due to the less redundant nature of formal tests, decline occurred first, while the supportive nature of conversational interaction may have temporarily sheltered L2 from the effects of decreasing neuropsychological support as identified on formal tests.

This explanation accounts for BL's disparate results where over the twelve month period L1 deteriorated more rapidly on formal tests, while with L2, functional communication abilities deteriorated. It is likely that in the time period preceding this study, decline would have been noted from L2 formal test performance, heralding the decline in L2 CA - which became evident in the year's frame of the present study. Possibly in the time extending after the study terminated, a decline in L1 CA may become evident, as heralded by deterioration on L1 formal tests picked up in the present study. This trend would be consistent with the predictions made as L2 would be deteriorating at a faster rate than L1.

10.3.4 Summary

L2 deteriorated at a faster rate than L1 on formal tests for three speakers (EB, JS, AR). For others, either L1 deteriorated more rapidly (BL), or no changes occurred over the twelve month period (JB). From the Conversation Analysis, it was evident that L2 deteriorated at a faster rate than L1 for one speaker only (BL). As for the other participants, no deterioration was noted in either language on CA. Identification of changes over time may be limited by poor test sensitivity, and may also reflect the arbitrary boundaries imposed by when the study commenced and terminated. The observed changes in language are limited to a window of twelve months only, and may not be an accurate reflection of the process of attrition in a disease lasting up to 15 years.

10.4 Specific bilingual behaviours

The fourth question of the study asked whether problems with specific bilingual behaviours such as code switching occurred. It is important to emphasise again that this study examined the bilingual speakers' two languages separately in monolingual mode, and therefore language mixing was not expected. For these participants, situations arose frequently throughout their life where they were required to speak each language separately. Code switching was therefore not a habitual pattern, and it was reasonable to expect the speakers to converse successfully in monolingual mode. Even healthy bilingual speakers however make language slips when in monolingual mode. Therefore the use of the term 'problem' when analysing data to answer this fourth question is contentious. By using a CA methodology, the subjective judgement of whether language mixing was 'problematic' was circumvented by analysing the code switch in the context in which it occurred, and whether it presented as a trouble spot in that particular conversation, and for those particular interlocutors. With formal tests, self-corrected language slips were considered to be behaviours that healthy bilingual speakers may exhibit and therefore were accepted as correct. Only non-corrected slips were included in the analysis.

The following sections first summarise predictions made regarding the direction of language mixing behaviour. This is followed by a discussion of findings regarding code switching on (a) formal tests, (b) the sentence translation task, and (c) conversational discourse.

10.4.1 Predictions

It was predicted that with speakers who acquired both languages simultaneously, inappropriate language mixing (if present) would affect both English and Afrikaans interactions. The reason is that no differences existed in terms of age of acquisition or proficiency levels, and therefore no apparent imbalances between languages were evident. Thus a unidirectional pattern of language interference was not predicted. For speakers with an imbalance between L1 and L2 (i.e. have a more dominant L1), it was predicted that inappropriate language mixing would affect L2 interactions. The literature suggests that a difference in proficiency results in language mixing from the direction of the more proficient L1 into the less proficient L2 talk (see Chapter 3).

10.4.2 Formal Tests

Only isolated examples of code switching were evident from formal test results. This finding stands in direct contradiction to results from the CA, where for EB and BL, much language mixing occurred in L2 conversations. These discrepant findings can be explained thus: Formal language tests require single word responses, or a few connected utterances such as is required for the procedural discourse. While Story Recall involved a somewhat longer narrative, participants did not have to generate the narrative, but rather had heard the model before repeating it. The relevant syntactic structures and semantic lexical items were therefore already activated in the relevant language for this task, thereby minimising effortful searching of target words and idiomatic phrasing in the language being tested. In this manner, the focused nature of formal tests and the limited demand on verbal output were conducive to maintaining a strict separation between languages. For all speakers, there were sufficient resources available to inhibit a dominant L1 when only short stretches of language production were demanded. In comparison, conversation is a far less-structured interaction, more open to influences of external distractions, and certainly requiring longer stretches of verbal expression. Inhibition of the dominant L1 was therefore difficult to sustain under these conditions. For a more detailed discussion, see 10.4.4.

10.4.3 Sentence translation

The predictions made were not borne out by performance on this task in that instead of code switching behaviours only being evident in L2 output, code switching occurred in both L1 and L2 translations. This pattern cannot be easily interpreted as a difficulty keeping two language separate. If this was the cause, one would expect EB to have more difficulty on this task, in keeping with the pattern of language mixing in her L2 conversations; and AR to have far less difficulty with translation than she did, as she showed very little language mixing during conversational discourse. Instead, the pattern of performance on sentence translation appeared to be linked with the relative severity of dementia. The two speakers in the mild stages of AD (JB and EB) made no errors when translating from one language to another, while participants in the mild-moderate and moderate-severe stages found the task more problematic. To translate a sentence, the original needs to be held in working memory while the corresponding lexical and syntactic structures in the other language need to be activated. It can therefore be argued that this test reflects a difficulty with working memory rather than impairments in keeping two languages separate - as was the original motivation for its inclusion in the test battery. Memory results from formal tests support this interpretation, where speakers further along the dementing process (BL, JS and AR) were more impaired on memory tests than speakers who were in the mild stages of dementia (JB and EB).

10.4.4 CA

There were numerous issues stemming from findings of the CA, each of which are discussed separately in detail. After a brief general overview, this section firstly addresses the question whether the predictions made in 10.4.1 were supported by CA results, and if so to what extent. Secondly, findings are compared to those of previous studies to determine how congruent the results are. Thirdly, an analysis of self-initiated versus other-initiated repair is undertaken, and reasons are explored as to why self-monitoring of inappropriate language mixing appeared to have broken down in Alzheimer's Disease.

General Overview

From the CA, results indicate that not every speaker demonstrated inappropriate language use, and the amount of code switching varied across participants and across languages. Furthermore, language mixing did not always increase over the twelve month time slot of examination. With regards to the type of switches occurring, both intra- and intersentential switches were observed in those speakers exhibiting code switching behaviour. The intrasentential switches were compatible with the appropriate base-language frames. For example, if holding a conversation in Afrikaans, the English lexical items inserted did not violate any syntactic constraints of Afrikaans. This finding is consistent with those from other studies on bilingual dementia (e.g. De Santi et al, 1990; Hyltenstam and Stroud, 1989; Obler et al, 1995): All code switching that occurred was grammatically correct.

Predictions versus Results

Table 56 provides a summary of predictions made and results observed regarding which interactions were affected by language mixing behaviour.

	JB	EB	BL	JS	AR
Predicted	neither/both	L2 interactions	L2 interactions	L2 interactions	L2 interactions
Observed	neither	L2 interactions	L2 interactions	L2 interactions	Both, but more in L2 inter-actions at T3

Table 56: Summary: Direction of language mixing behaviour

The prediction that speakers who learnt their two languages simultaneously would exhibit language mixing behaviour in both their languages could neither be confirmed nor refuted. JB (the only speaker to whom the prediction applies) did not code switch in any of her conversations. She is however still in the mild stage of AD and it is plausible that language mixing may occur as the disease progresses. However, the present data does not provide any evidence for or against the hypothesis.

The other prediction was that speakers who learnt their L2 after their L1 was acquired would show language mixing in the direction of the dominant L1 into L2 talk. This prediction was supported by three of the speakers (EB, BL, JS). However, findings from the fourth speaker (AR) were the most conflicting, with this prediction only receiving support at T3.

What factors influenced these results? It appears that the stage of dementia cannot be the sole determinant of amounts of code switching exhibited. EB (in the mild stage of AD) code switched to a larger extent than did JS (in the moderate stage of AD). Another important influence of inappropriate language mixing appeared to be language proficiency. Code switching in the L2 interactions was more pronounced in speakers who were less proficient in their second language (i.e. EB and BL). For speakers equally proficient in L1 and L2 (i.e. AR), fewer code switches were evident, and affected both languages at T1 and T2. What emerges is an interplay between level of L2 proficiency and stage of dementia. The less proficient the L2, the more susceptible it is to L1 interference. Even in the mild stage of the disease process, a depletion of resources results in incomplete inhibition of a dominant L1. Conversely, the more proficient the L2, the less resources are required to activate it and inhibit the non-selected language.

However where languages are equally proficient as in AR's case, why did a statistically significant increase of L1 into L2 talk occur at T3? It appears that Paradis' (1997) contention holds true yet again: a language learnt later in life will never become fully automatised, even if highly proficient. Therefore, as AR moves towards the moderate to severe stages of the disease, the subtle differences between her languages in terms of resources required to activate them becomes apparent, and the imbalance caused by age of acquisition (AOA) factors finally becomes evident.

Previous studies

How congruent are the findings from this work with those from previous studies? As emphasised in Chapter 3, much of the work on bilingual AD has concentrated on language mixing at the level of conversational discourse. However authors frequently omitted reporting case history information regarding level of proficiency and pattern of use - both premorbidly and at the time of assessment. Because of these omissions, comparisons of AOA, proficiency levels and language mixing behaviour between findings from this study and those from Dronkers et al (1986) and De Vreese et al (1988) cannot be undertaken. In addition, the De Santi et al (1990) study is also excluded from this discussion as language mixing occurred in a bilingual setting and therefore cannot be considered inappropriate. Comparisons are therefore only drawn from the three other discourse studies reviewed in Chapter 3 (i.e. Hyltenstam and Stroud, 1989; 1993; Luderus, 1995).

Table 57 summarises the language mixing profiles of speakers described in previous studies as well as those from the present study.

L1 VERSUS L2 ACQUISITION	SPEAKER	PROFICIENCY	STAGE OF DEMENTIA	INTERACTIONS AFFECTED BY LANGUAGE MIXING
Simultaneous	**JB** [4]	Balanced	Mild	Neither
	KL [1]	Balanced	Severe	L1 and L2
L2 after L1	**AS** [3]	Balanced	Mod-severe	L2
	RA [2]	Balanced	Mod-severe	1% in L2; none in L1
	AR [4]	Balanced	Mod-severe	Both, but more in L2 over time
	JE [3]	L2 less prof.	Mild	L2
	EB [4]	L2 less prof.	Mild	L2
	BL [4]	L2 less prof.	Mild-mod	L2
	AKJ [2]	L2 less prof.	Mild-mod	L2
	VH [3]	L2 less prof.	Mild-mod	L2
	JS [4]	L2 less prof.	Moderate	L2
	DH [3]	L1 less prof.	Mod-severe	L1
	EZ [3]	L1 less prof.	Mod-severe	L1
	KJ [3]	L2 less prof.	Mod-severe	L2
	GM [1]	L2 less prof.	Severe	L2

Table 57: Summary of language mixing profiles [1] speakers from Hyltenstam and Stroud (1989). [2] speakers from Hyltenstam and Stroud (1993). [3] speakers from Luderus (1995). [4] speakers from present study. Mod = moderate. Prof. = proficient

From Table 57 it is apparent that findings from the present study concur with results from previous studies. Speakers with similar age of L1 and L2 acquisition exhibit similar patterns of language mixing across L1 and L2. With speakers learning their L2 after their L1, the general trend was for code switching to affect L2 interactions more even if proficiency levels were balanced. This suggests that of all factors, AOA wields the greatest influence. However, two findings contradict this conclusion: DH and EZ. As reported by Luderus (1995), these two speakers left Germany at the age of 15, married Dutch speaking men, and lived in Holland for the rest of their lives. She does not provide any details about the pattern of L1 versus L2 use, or amount of exposure they had to their L1 after immigrating. On one extreme it is possible that these speakers rarely spoke their L1 after age 15. Can they therefore still be considered to be bilingual in late adulthood? Without knowing the necessary details, the observed pattern of language mixing for these two speakers does not necessarily provide conclusive evidence against the conclusions drawn.

In summary, for speakers learning their L2 after acquiring their L1, it appears that age of acquisition factors may have the greatest influence over language mixing behaviour, even when a speaker is highly proficient in both languages. The boost in levels of automaticity gained from frequency of L2 use do not appear to compensate for the lowered automatisation caused by age of L2 acquisition.

Inter- versus intrasentential switches

The increase in code switching behaviour for two speakers (AR and BL) occurred as the amount of intersentential switches increased over the year, while the number of intrasentential switches remained relatively stable. These findings are consistent with those from the Luderus (1995) study, where only intersentential switches increased over time for her participants. Models of bilingual language production (e.g. De Bot and Schreuder, 1993; Green, 1993; Poulisse and Bongaerts, 1994) describe the preverbal message as containing a language cue or tag. This is fed into the speech production system (the Formulator) where the lexical items of the selected language receive more activation than the non-tagged language. However, in cases where L2 is less proficient, Poulisse and Bongaerts (1994) have demonstrated that the more frequent L1 items (e.g. function words) are activated instead of the L2 item, which is less frequent and requires more activation. This results in intrasentential code switching.

What appears to be happening in dementia is that this pattern is exacerbated. Not only are individual L1 words code switched, but the spread of activation triggered by the switch spreads to other L1 lexical and syntactic frames, resulting in intersentential switches. This accounts for the fact that an increase in code switching happens as intersentential switches increase, while intrasentential switches remain relatively constant. It could be that the intersentential switches possibly originated from an intrasentential switch, which was caused by an impaired ability to compensate for (pre-morbid) incomplete L2 knowledge. However, L1 items have strong links between them (c.f. the subset hypothesis), and an abnormally rapid spread of activation may have resulted in an intersentential switch. These findings are perhaps linked to priming studies in dementia, where it has been shown that attentional abnormalities and/or degraded semantic representations result in hyperpriming (Chenery, 1996; Chenery, Ingram and Murdoch, 1998; Hartman, 1991; Ober and Shenaut, 1995). However, because the formal tasks in the present study were all off-line tasks, the underlying cause of an increase in intersentential switches remains highly speculative and awaits further investigation.

A further consideration is that a difficulty in shifting set - a frontal lobe, executive function - is a feature of AD (Morris, 1996; Lezak, 1995). The difficulty of re-activating the appropriate language once the inappropriate language has been used may reflect this difficulty with shifting set, especially when the shift is from a more easily activated language to a language demanding a much higher level of activation and controlled processing. This theory is compatible with CA findings where intersentential switches sometimes stretched over full turns - especially for speaker BL. When interlocutors initiated repair following language mixing trouble spots, they did so using the 'appropriate' language (i.e. whichever language that particular monolingual interlocutor spoke). This external input possibly facilitated a shift in set back to the original language of interaction, as evidenced by speakers generally being able to carry out the requested repair successfully (i.e. repeating their utterance in the appropriate language).

However, apart from Trail Making B, the test battery in this study did not formally investigate the ability to shift sets. Future studies might consider administering the Modified Card Sorting Test (MCST; Nelson, 1976) which is a shorter version of the Wisconsin Card Sorting Test (Grant and Berg, 1948). This test was devised to assess ability to shift set, and is sensitive to dementia (Funnel, 1996; Morris, 1996). Results from the MCST can be compared to the increasing amount of intersentential switches. However, the more advanced the dementia, the less likely the speaker will be able to attempt the MCST. Therefore a comparison between this test and intersentential switches may only prove useful for speakers with a weaker L2 (such as BL) where code switching problems become apparent earlier on in the disease process.

In conclusion, it appears that if the ability to inhibit a dominant L1 and activate a less-automatised L2 becomes progressively compromised in AD, this difficulty extends beyond the single-word boundary.

Pre-morbid code switching behaviour versus the effects of AD

It has been questioned whether language mixing behaviour in dementia results from pathology or reflects pre-morbid code switching behaviours (Grosjean, 1991, cited in Singh, 1994) This is a valid question as healthy less-proficient L2 speakers do code switch. Singh (1994) goes so far as to maintain that there is a correlation between code switching behaviour and language proficiency, with intrasentential switches being particularly indicative of poor levels of L2 attainment. In a single snapshot of conversational discourse taken at one time point then, it would be very difficult to conclusively argue that the amount of language mixing is directly attributable to the dementing process, and does not reflect pre-morbid code switching patterns.

This study attempted to circumvent this problem by using speakers as their own controls. With exposure to languages kept constant, any increase in language mixing over time could then be attributed to the dementing process. Since changes in language mixing behaviour occurred in two speakers (BL and AR), these findings unambiguously support the hypothesis that increasing dementia will result in an increased difficulty with inhibiting a dominant L1 and compensating for a less-automatised L2.

With regards to EB and JS where language mixing did not increase over the year, it is uncertain as to how much of a pre-morbid pattern is being reflected, and how much language mixing has been caused because of AD. Both speakers maintained that they rarely code switched when speaking in L2 monolingual mode - a fact corroborated by their families. However, as pointed out by Grosjean (1982), bilingual speakers are usually not aware of the extent to which they code switch or borrow. With EB however it can perhaps be argued that she code switched pre-morbidly to a lesser extent than exhibited at the time of the study. The reason is that her ability to inhibit L1 improved at T2, possibly because of the benefit of the topic where words were of high frequency and the topic was relevant to the immediate context. Given that additional support then, she was better able to inhibit L1. Extrapolating from this finding, it is feasible that pre-morbidly, when neuropsychological support was still intact and resources had not yet begun to deplete, EB was better able to compensate for her weaker L2 and therefore did not code switch as much as she does once the dementing process commenced. However, this interpretation remains speculative, and answers will only be found by tracking EB and JS for longer periods to see whether any increase in language mixing occurs.

Self- versus other-initiated repair

This section draws together findings from trouble spots and subsequent repairs in order to highlight trends observed, and to account for reasons behind these trends.

Regarding the effect language mixing had on the interaction, it was evident that not every code switch gave rise to a trouble spot. For instance, in the English conversations JS used the inappropriate language for 6 utterances at T1, but only two of these gave rise to a trouble spot. This may reflect the fact that interlocutors tended to withhold repair to maintain the quality of interaction. Alternatively, the code switching may not have presented a trouble spot as the preceding/following utterances provided sufficient context for the gist to be understood. A further consideration is that even though the interlocutors considered themselves monolingual speakers of the respective languages, they may have had some knowledge of the other language. In South Africa, scholars were required to study both English and Afrikaans at school, and the media, official signs and so forth are in both languages. How this knowledge of the other language may have affected the conversation (e.g. the interlocutor not needing to initiate repair following a code-switched phrase) is unclear.

Different trends were evident with regards to repair initiated following language mixing versus repair arising from intra-language trouble spots (e.g. ambiguous use of pronouns, sudden shifts in topic). With intra-language trouble spots, there were numerous instances of self-initiated repair, and very few instances of other-initiated repair. This trend is consistent with findings from healthy speakers (Schegloff et al, 1977) and is also consistent with the principle that the least collaborative effort in repairing trouble spots is the most desirable repair (Clark and Schaefer, 1989). However, with trouble spots arising from language mixing, the pattern was reversed: other-initiated repair outnumbered self-initiated repair.

The finding regarding a paucity of self-initiated repair following code switching as compared to the abundant examples of self-initiated repair following intra-language trouble spots merits a detailed discussion. Very few studies have been reported that offer even a cursory analysis of self-repair in healthy bilinguals speakers, let alone bilingual speakers with AD. Why was such a pattern found in this study? Why is the mechanism for self-monitoring intact for intra-language trouble spots, but virtually absent for trouble spots arising from language mixing? Before exploring the possibilities, a brief discussion of what is involved in self-monitoring is necessitated, as it is believed the answer lies in this direction.

Self-Monitoring and Production Errors

Self-monitoring of one's speech output is a feature of most models of language production. A discussion of what aspects are involved in the process has been undertaken by Levelt (1983, 1989; also Levelt, Roelofs and Meyer, in press). According to the editing theories of self-monitoring, as discussed by Levelt (1989), two opposing types of monitors have been discussed. While both are external to the language production system, the distributed monitor edits results from different levels of processing (e.g. lemma activation, phonological encoding). It therefore has access to all stages of language production. However, this requires reduplication of knowledge, as the monitor has to have the same knowledge contained in each component of the language production system in order to ascertain whether the output is correct or not. A second difficulty with this type of monitor is that it undermines the concept of components of the production system being autonomous (as is upheld in staged, feedforward models such as Levelt, 1989). With this view of the monitor as omnipresent, a component cannot be autonomous if it is always being monitored.

The second type of monitor proposed is the pre-articulatory editor, which can only edit output once phonological encoding is complete, but before articulation occurs (Motley, Camden and Baars, 1982, as cited in Levelt, 1989). In comparison with the distributed monitor, this editor cannot evaluate every step of the production system. Rather, Levelt compares it to the language comprehension system, whereby with a double 'perceptual loop', speakers can attend both to their inner speech (before it is articulated) as well as their already-articulated overt talk. At the same time however, speakers can also self-monitor messages in terms of appropriateness, politeness and so forth before they are formulated. The role of working memory in such a model is highlighted (Levelt, 1983).

Levelt (1989) lists several aspects of speech production that speakers appear to monitor:

- match between intended message/concept and final output
- accuracy of the message (e.g. contextual appropriacy and sufficiency of information conveyed)
- appropriate to social standards (e.g. in a formal situation, slang is avoided)
- lexical errors
- syntactic and morphological errors
- phonological errors
- prosodic features (e.g. rate, loudness, fluency)

While monolingual speakers show evidence of monitoring and correcting their speech output, not all errors remain detected or repaired (Levelt, 1983, 1989; Schegloff et al, 1977). For instance, in his corpus on errors in colour naming, Levelt (1983) found that of the 472 errors that occurred, only 46% were repaired by the speaker. Higher figures were reported by Nooteboom (1980) who found the 64% of errors were corrected, with phonological errors being repaired slightly more often than lexical errors.

With regards to bilingual speakers, an extra aspect of speech-monitoring must be included: appropriateness of language selected. This monitoring is especially important when the interlocutor is a monolingual speaker, and where language mixing may have consequences for the quality of interaction. However, no insights into the monitoring or editing of output in bilingual speakers can be gained from existing models of bilingual production. One of the most widely cited bilingual models is that of De Bot (1992; also De Bot and Schreuder, 1993). These authors describe lexical items as containing various cues. For example, if size is an important variable, then the size cue of all potential target words activated will have more value. De Bot and Schreuder (1993) suggest that 'language' is one of these cues. If choice of a language is relevant as it would be in monolingual interactions, then this cue will be highly important. The authors contend that there is a relationship between importance of cues and level of activation of lexical items. In less proficient L2 speakers there is a trade-off between needing more time to retrieve a less-easily activated word, and selecting the most appropriate lexical item that meets all cue-constraints. In some situations then a less appropriate item will be selected that matches many but not all necessary cues. The tagging of languages and subsequent lexical retrieval happens automatically and is not available for editing until the final (pre-articulatory) stages. However, with regards to the actual monitoring of the eventual output, De Bot (1992) dismisses the process by saying the how and where of feedback remains as yet unclear. In their 1993 paper too, the monitor is only mentioned briefly. The authors describe that the monitoring system forms part of the Discourse Model, which feeds information into the Conceptualiser about the setting, interlocutor status and the like.

However the monitor does not edit the processes involved in the actual language production system (the Formulator).

What insights then do other studies have to offer with regards to language mixing and subsequent repair? As stated in Chapter 1, language slips are not uncommon, even in so-called balanced bilingual speakers. However, while studies have quantified how many slips occurred and the nature of these errors (e.g. Westwood, 1997), to the writer's knowledge, no study has been published noting the type and amount of *repairs* healthy bilingual speakers make when speaking in monolingual mode. Only Poulisse and Bongaerts (1994) report how many of the code switches were repaired by their healthy bilingual speakers: 53.4% of content words code switched were repaired as opposed to 30.7% of the function words code switched, with most content words being repaired before they were fully uttered. No further analysis was undertaken, although they did provide some examples of repair being carried out. The italics indicate the intrusion of the L1 word into the L2 sentence, while the underlined word is the equivalent word in the appropriate L2:

(1) and then you *neem* a smaller, <u>take</u> a smaller elevator

(2) we *noem* it uh, we <u>call</u> it uh 'rollade'

(From Poulisse and Bongaerts, 1994: 48)

Even though it is evident that healthy bilingual speakers will initiate self-repair when language interference occurs while in monolingual mode, more research is needed regarding the extent to which they are aware of each error and then initiate repair. The lack of theory and data available leaves us with a number of questions. For instance, do healthy bilingual speakers correct code switching errors to the same extent as they correct intra-language errors? Is the percentage of repair initiation linked to the level of language proficiency attained? In other words, is a person more or less likely to be aware of language mixing errors if he or she is highly proficient in a language? Does this change with topic, interlocutors, aging? Without having a clear understanding of what healthy speakers do, any account of the role pathology plays in affecting the speech editor/monitor can only be speculative.

Given the above, we return to the present thesis and our findings that very little self-repair is initiated following language mixing. Since existing models of bilingual language production have not as yet fully described how self-monitoring takes place, explanations accounting for this pattern are limited to the findings from a mere four bilingual speakers with Alzheimer's Disease. Several possible accounts will now be explored.

(i) As described by Marshall, Robson, Pring et al (1998), since comprehension appears to monitor speech output, a difficulty with self-monitoring could reflect a comprehension deficit. Such a theory received support from studies showing a correlation between comprehension deficits and decreased monitoring in jargon aphasia (e.g. Marshall, Neuberger and Phillips, 1994; Butterworth, 1979). However this theory does not explain why speakers in the present study who showed comprehension deficits (as seen from Token Test results) still demonstrated a relatively intact ability to self-repair intra-language trouble spots. The difficulty in self-monitoring appears mainly to affect language mixing behaviours.

(ii) The correct tagging of lexical items in the language appropriate to the situation and interlocutor is self-monitored in either a different manner to which other aspects of speech output are monitored, or by a different monitor altogether, and is an aspect unique to bilingual speakers. With AD, this specialised self-monitor is impaired for any number of reasons, in accordance with any number of theories (e.g. is highly effortful, but the many resources required to sustain it are depleting; the actual node responsible begins to degenerate). However, there is no reason to postulate a completely distinct, discrete component to the language system to accommodate the monitoring of language selection. It is not efficient and certainly redundant. The 'existing' monitor can easily accommodate another addition to one of many aspects of speech production.

(iii) Anecdotal reports from healthy bilingual speakers reveal that when both interlocutors are in bilingual mode, they cannot always remember in which language the last few utterances had been encoded. In such cases there was no need to self-repair any language mixing, as both interlocutors were operating in the same language mixing (bilingual) mode. Perhaps for the participants in this present study, their interlocutor's monolingual status was either not noted, or forgotten during the course of the interaction. They therefore saw no need to repair language mixing trouble spots, as they considered the interlocutors to be similarly bilingual, and therefore also operating in bilingual mode. In other words, the paucity of self-initiated repair following language mixing reflected a difficulty at the level of De Bot's (1992) discourse model, while the ability to monitor speech output, identify trouble spots and subsequently make repairs, remained intact (as evidenced by the numerous instances of self-repair following trouble spots *other* than those arising from code switching). The speakers presumed the interlocutor was also in bilingual mode, and therefore felt no need to monitor output for language mixing as potential trouble spots in the conversation. The monitor itself remained intact. Such an explanation aptly accounts for BL's behaviour where, as transcribed and discussed in 6.3, she demonstrated an awareness that she had used her L1 in an L2 conversation, but failed to identify this as a problem for the interlocutor.

The difficulty with the above explanation is that it does not explain why EB, only mildly impaired on formal tests, and for whom all pragmatic parameters of discourse management were intact, would display such a marked effect of disorientation to the interlocutor's monolingual status. Furthermore, there was only one explicit example from BL to support this theory (transcribed and discussed in 6.3 d iii).

(iv) The monitoring system could not maintain its capacity for monitoring all aspects of speech production due to a decrease in available resources. As noted previously, Levelt (1983) emphasised the role of working memory in the pre-articulatory editor. Impaired attention, concentration and working memory abilities were apparent for all participants, and according to Levelt's theory, may have resulted in the monitor not being able to function as well as it did pre-morbidly. Unlike Just and Carpenter (1992) who suggest that with decreasing resources, an across-the-board budget cut occurs, thereby limiting the capacity of the system, the monitor continued to be able to function well in editing all aspects *except* for monitoring language selection. It is possible that for less balanced bilingual speakers, the monitoring of which language is produced is extremely effortful, and is the first of all aspects to be monitored that is compromised with AD. This theory is consistent with the hierarchy of tasks vulnerable to AD: more complex tasks requiring integration of linguistic and neuropsychological abilities deteriorate first.

Further support for the above hypothesis comes from the fact that when asked by their interlocutors to translate their L1 utterance into the appropriate L2, the speakers were generally able to do so with very little difficulty. This shows that firstly, participants were aware of the message they had chosen to convey. Secondly, the sentence to be translated could be held in working memory long enough for the repair to be completed. Thirdly, when the interlocutor asked them to focus their ability of language selection, they were able to comply. This demonstrates that the functions involved in selecting the appropriate language are still available for the participants. However, for those less proficient in their L2, these functions involve considerable effort, and are therefore the first to be compromised in AD.

It can be argued that different behaviours can be explained by either (iii) or (iv), depending on the nature of impairments observed. However, the lack of explicit examples for (iii) suggests that the more common difficulty in AD is monitoring language separation. Since this aspect appears most effortful for less-proficient L2 speakers, with a decrease in resource availability speakers may focus more on the content of the message they want to convey, and less on the language cue in which the message should be conveyed.

Conclusion

This study is one of the first to identify and explore the discrepancy between amount of self-repair initiated subsequent to intra-language trouble spots as opposed to the paucity of self-repair following code switching trouble spots. Since only a handful of data is available regarding repairs made by healthy speakers, the extent to which the findings from the study are particular to bilingual speakers with AD only is uncertain. If pathology does result in an inefficient monitor as findings from the present study suggest, monitoring of language selection when conversing in the less proficient language is highly effortful and is the first aspect of self-monitoring that is compromised.

10.4.5 Summary

This section explored language mixing behaviour across formal tests and conversational discourse. While formal language tests and sentence translation tasks were not especially sensitive to code-switching behaviours, results from the CA largely supported the hypothesis of language mixing occurring in the direction of the dominant L1 into L2 talk. When talk in the less automatised language had to be sustained over a ten minute conversation, speakers were less able to compensate for a weaker L2 and therefore language mixing became apparent. It is likely that some speakers may have code switched pre-morbidly. However the fact that language mixing behaviour increased over the year for two of the speakers strongly suggests that with increasing dementia, inhibiting a more dominant L1 and activating a less-automatised L2 is increasingly compromised. Another important finding was that, similar to healthy speakers, participants showed an ability to self-repair intra-language trouble spots. However they did not appear to monitor for code switching trouble spots. Whether this trend is also apparent in healthy bilingual speakers is as yet uncertain, and awaits further research.

10.5 Cognitive Decline versus Language Decline

The fifth question of the study asked whether there appeared to be a link between neuropsychological functions and language decline. The discussion of what was found begins with a brief summary of findings from the literature thus far, after which the predictions made regarding possible parallels between neuropsychological decline and language decline are outlined. Next, findings from the present study are discussed, first from formal test results and then from Conversation Analysis. Tasks heavily dependent on neuropsychological abilities as listed in 10.5.2 (a) are referred to as complex tasks because of the numerous sub-components that have to be integrated in order to carry out the task successfully.

10.5.1 Findings from the literature

Results from previous studies suggest a cause and effect link between neuropsychological and linguistic performance. Studies have shown how a language deficit may be secondary to a neuropsychological deficit. An example is poor working memory and the Token Test, where understanding of complex syntactic structures may be intact, but the difficulty lies in holding the command in working memory (Waters et al, 1998). Another example is Generative Naming. This task involves activation of suitable targets from semantic memory stores, but also taps the cognitive skills of searching, organisation, and categorisation (Lezak, 1995). Language tests are thus not always discrete tests of linguistic integrity, but also tap the neuropsychological components of information processing, sequencing, attention, and working memory. In addition, it has been demonstrated how task complexity influences the pattern of decline: The more the task depends on successful integration of numerous sub-components, the more vulnerable it is in dementia (Bayles and Tomoeda, 1993). It can therefore be plausible to have a language deficit emerging secondary to cognitive deficits.

10.5.2 Predictions

Two hypotheses were postulated for this question:

(a) With decreasing neuropsychological capacity, language tasks supported by sustained attention, working memory, sequencing and information processing (i.e. Generative Naming, List Learning, Story Recall, Memory Recognition, Token Test, Procedural Discourse) would show a more marked decline compared to language tasks not so dependent on the above-mentioned neuropsychological abilities.

(b) For speakers who acquired their languages simultaneously, English and Afrikaans complex tasks would be similarly vulnerable to decreasing neuropsychological support. This is because they are equally automatised as they were acquired at the same age, in the same manner, and used in a similar pattern over the lifespan. For speakers who acquired their L2 after their L1, it was predicted that L2 complex tasks would be more vulnerable to decreasing neuropsychological support. The L2 is less automatised and is therefore more reliant on controlled processing. This type of processing makes higher demands on attention and concentration than would automatic processing (Paradis, 1994). A weaker L2 is also more dependent on working memory. For instance it may take longer to process a complex command or question in L2 because the decoding is more effortful, and so the sentence needs to be held in working memory for a longer period of time. Cognitive skills are thus needed when making conscious use of explicit metalinguistic knowledge and residual language competence.

Results for prediction (a) will be discussed first.

10.5.3 Language and neuropsychological decline

Results from formal language tests and Conversation Analysis are explored separately.

Formal language tests

An apparent link between neuropsychological impairment and language impairment was investigated at a single time point when the study first began (T1), and also over the twelve month period to order to infer links between the rate of cognitive versus language decline. Table 58 provides a summary of results observed on formal tests regarding neuropsychological versus language impairment at T1, given the prediction that complex language tasks were expected to be impaired if neuropsychological tasks were also impaired.

	JB	EB	BL	JS	AR
Neuropsychological tasks impaired?	√	√	√	√	√
All complex tasks impaired?	x	x	x	√	√

Table 58: Summary: Language and neuropsychological decline (formal tests) at T1 *√ = yes. x = no.*

At T1, performance on every neuropsychological test was impaired for every participant, with the single exclusion of JB. For this speaker who is in the mildest stages of AD, Trail Making Task A fell within normal limits. However scores from the rest of her neuropsychological battery were depressed. With neuropsychological profiles being impaired for all speakers then, it was expected that language tasks heavily dependent on neuropsychological abilities would be similarly impaired. However, this was only the case for participants at the more advanced stages of AD (JS and AR). Not only were the predicted language tests affected but the complete language test battery was depressed. For speakers in the milder stages of AD, there were pockets of preserved language functioning even on those tasks expected to be impaired. In fact, with the participant in the earliest stages of the disease (JB), most language tasks fell within normal limits.

It is therefore evident that a single assessment point did not reveal strong support for a link between neuropsychological tasks and those language tasks heavily dependent on cognitive abilities. At the mild stages of AD it appears that even though cognitive support may have been reduced, attention, information processing and working memory abilities were still at a high enough level to support complex language tasks. Support for this claim comes from raw scores on neuropsychological tests: JB and EB's results were less impaired than those of BL, JS and AR. At the more advance stages of AD, the full test battery was depressed, not only complex language tasks. Therefore the effect of deteriorating cognitive skills on complex tasks alone could not be ascertained.

What then would the relationship between language and cognition reveal when studied longitudinally? The prediction of an apparent link between neuropsychological decline and deterioration on the formal language tasks listed in 10.5.2 (a) was supported by results from all participants - but to varying degrees. That is, while a progressive deterioration in neuropsychological abilities occurred for all speakers, many but not all of the language tasks predicted to show concomitant deterioration did so. For instance, several tasks were affected over the year for some speakers (e.g. BL, EB), but for JB only one task showed progressive impairment: Story Recall Delayed. Possible reasons as to why a variation in task performance occurred across speakers is discussed 10.5.4. As for tasks less dependent on the integration of numerous neuropsychological to be carried out, these more discrete language tests did not show any decline over the year. These tasks include Co- and Superordinate Naming, where the task categories selected were familiar ones and where the number of items elicited did not exceed five per category.

There is however an exception to the trend of relatively stable discrete language tests: Confrontation Naming. This task, like the more complex language tasks, also deteriorated to a statistically significant extent in three of the five speakers (AR, BL, JS). Confrontation Naming does not have a large working memory component to it as the picture to be named is always in view. Furthermore, sustained attention is not required as each item consists of a single picture to be named. Studies have suggested that visual perceptual deficits may adversely influence task performance (Silveri and Leggio, 1996). However the fact that items could be named in one language but not in another suggests that visual perceptual disorders too did not confound the task, at least for some speakers. It therefore appears that not all language deficits can be explained as being secondary to cognitive impairment. While a link between the two can be inferred, it appears that impairments of the linguistic system itself also occurs in AD. It is plausible that two factors combine in influencing the symptoms observed in AD: depleting neuropsychological functioning, and degradation of the semantic system. However, since findings from the study relate to surface behaviours, it is not within the scope of the dissertation to comment on the underlying cause of the observed symptoms. The issues of access versus loss/depleting resources versus degradation of language nodes remain contentious debates to be resolved in more focused, more detailed research studies.

Conversation Analysis

Working memory, attention and information processing deficits have been shown to influence topic maintenance, topic shift and turn taking in AD (e.g. Hamilton, 1994; Perkins et al, 1998). CA investigated an apparent link between cognitive and language impairment at T1. While working memory, attention and information processing were impaired for all speakers (as revealed on formal testing), extra-linguistic aspects of conversation dependent on these abilities were not similarly impaired across participants. For speakers in the mild stages of AD (JB and EB), topic maintenance and turn taking skills were preserved across both languages. In comparison, for participants in the more advanced stages of dementia, these extra-linguistic skills were compromised. It therefore appears that the stage of dementia determines the extent to which language abilities become compromised by impaired underlying neuropsychological functions. For instance, the number of attributable silences following questions varied among participants, but correlated with the degree of dementia. That is, very few attributable silences were observed for JB and EB (mild AD), while 50% of all questions were greeted by an attributable silence for AR (moderate-severe AD). This also appeared to correlate with information processing ability as assessed on the AMIPB, where although JB and EB showed impaired performances on the task, AR could not even attempt the task.

The relationship between language and cognition when examined longitudinally however revealed a different finding. Neuropsychological tasks deteriorated progressively over the year for all speakers. However none of the extra-linguistic parameters showed decline over the year for any participant. This finding contradicts the predictions made, where it was hypothesised that a link between neuropsychological decline over time and language decline could be inferred. However it may be because of the supportive nature of conversations that extra-linguistic decline was not detected. In conversational discourse, support is provided by the immediate context, by the redundant nature of conversation, and by knowledge shared between the two interlocutors pertaining for instance to family members or routines in the Residential Home (Murphy, 1990). This additional support may have minimised the effect of deteriorating working memory and progressive attentional deficits identified on formal testing. The possibility remains that deterioration of the extra-linguistic parameters of language may have been occurring. However decline was taking place at such a slow rate and was being boosted by the supportive nature of conversation. Therefore it could not be identified over a relatively short period of time.

10.5.4 L1 versus L2 and neuropsychological decline

The second part of the hypothesis was that L2 would be more affected than L1 with decreasing neuropsychological functioning, and would decline at a faster rate. A less-proficient language relies more on controlled and effortful processing (Paradis, 1997). Therefore decreasing working memory abilities, attention and information processing would adversely influence L2 to a greater extent than L1, which requires less effort to process and produce. Findings from formal language tests and CA are discussed separately.

Formal language tests

Table 59 provides a summary of predictions made and results observed on formal tests, regarding whether complex L2 tasks would be more impaired over time than their L1 equivalents with a concomitant deterioration of neuropsychological abilities.

		JB	EB	BL	JS	AR
PREDICTION	**L2 complex tasks to be more impaired than L1?**	x	√	√	√	√
FINDINGS	**Neuropsych. tasks impaired?**	√	√	√	√	√
	L2 complex tasks more impaired?	x	√	x	√	√

<u>**Table 59: Summary: Neuropsychological decline and L2 complex tasks**</u> √ = yes. x = no.

For speakers who acquired both languages simultaneously (i.e. JB), the prediction that neither language would be more affected by depleting neuropsychological support was confirmed. Most language tasks fell within normal limits at all time periods of the study, and those complex tasks that were impaired were similarly affected in both languages. The single exception is Story Recall Delayed where performance was better in Afrikaans. However as discussed in 8.3, this finding can be considered idiosyncratic as it runs contrary to all trends observed.

For speakers who learnt their L2 after their L1, it was hypothesised that L2 complex tasks would be more affected than L1 equivalents by a decrease in neuropsychological abilities. At T1, neuropsychological functions were impaired for all speakers as identified on formal testing. However, no inter-language differences were evident except for a few isolated exceptions. When examined longitudinally, a steady decline in neuropsychological abilities occurred over the year for all speakers. The prediction of an apparent link between cognitive and L2 decline was supported by results from three of the four participants, where L2 complex tasks deteriorated at a faster rate, but less complex tasks did not show attrition.

With the last speaker (BL), L1 complex tasks deteriorated more rapidly over the year even though L2 tests were more *severely* impaired. This is not to say that the weaker L2 tasks did not deteriorate. Rather, more tasks showed decline in L1 than L2. While BL's findings are compatible with the prediction of an interplay between language and cognition, the findings of L1 being more affected are contrary to what was expected. However the findings may be an artefact of the time window assessed. Decline in both languages was predicted, and had been borne out. However the rate of L1 versus L2 deterioration may vary. If BL had been assessed a year before the study commenced, results may have shown that deteriorating neuropsychological abilities affected her L2 more than her L1. The time frame assessed thus yielded misrepresentative results. Support for this theory comes from the fact that L2 tasks were more severely impaired than L1. This suggests that they were affected by deteriorating neuropsychological functions to a greater extent than L1 equivalents before the study commenced.

Neuropsychological decline appeared to precede or at least be parallel to L2 language decline. There were no examples where neuropsychological abilities remained constant but L2 complex tasks deteriorated. No correlation however was found between stage of dementia, neuropsychological decline and language deterioration. For instance, EB (mild AD) and AR (moderate-severe AD) exhibited similar language profiles. L1 and L2 were impaired to a similar degree at T1 in that no inter-language differences were apparent. As neuropsychological functions deteriorated over the year, three complex L2 tasks deteriorated for EB as opposed to only one English task. Likewise with AR, neuropsychological tests declined progressively over the year. Some L2 complex tasks began to decline in the first six month period of the study, and only after this lag did the L1 equivalents show deterioration. It is thus evident that a more advanced stage of dementia does not necessarily exacerbate the rate at which L2 complex tasks deteriorate. Other factors must be considered such as level of proficiency. The higher the proficiency, the more resistant the L2 to decreasing neuropsychological support. This point is elaborated upon in 10.6.

For all speakers not all complex tasks expected to reveal inter-language differences did so. Explanations for this include the time window of examination. The study extended over a period of 12 months only. If the disease process lasts for numerous years, then it remains feasible that all tasks heavily dependent on neuropsychological abilities do in fact deteriorate at a faster rate than less complex tasks, and L2 more so than L1. However the time period of examination was too short to identify or track many of these changes. Previous studies have emphasised how rate of decline varies from person to person (e.g. Bayles et al, 1992; 1993; Haxby et al, 1992). Therefore the assessment times may have identified a period of more rapid change in some speakers but not others (e.g. BL but not EB). A steady, predictable linear rate of decline is certainly not a feature of AD.

Another possible explanation as to why all complex tasks were not similarly affected concerns test sensitivity. The statistical analyses used to detect changes in time may not have been of sufficient sensitivity, especially when test scores approached floor (e.g. JS, AR). For speakers in the milder stages of AD (e.g. JB, EB), the formal tests themselves may not have been challenging enough to reveal inter-language differences or changes across time. Sufficient neuropsychological skills were available to support complex language tasks in the mild stages of AD. A more constrained test could therefore be constructed to increase the sensitivity of the battery for speakers in the early stages of dementia. Specific suggestions are discussed in 11.1.4.

Conversation Analysis

It was predicted that the extra-linguistic parameters of topic maintenance, shift and turn taking would be more affected by decreasing neuropsychological support in L2 than L1 (see 10.5.3). However results from the CA did not support the hypothesis; no inter-language differences were evident. Perhaps these functions should be considered as language universal. They are the foundations of pragmatic language use upon which linguistic expression is superimposed. Even if verbal expression is more difficult in one language than another, those language-specific difficulties would not be reflected in extra-linguistic aspects of communication that spread across all languages. Furthermore, these pragmatic skills are relatively primitive in that even very young infants exhibit turn taking skills (Stevenson, Ver Hoeve, Roach et al, 1986). They transcend language-specific boundaries and therefore are highly unlikely to be sensitive to inter-language differences.

Difference between L1 and L2 however were evident with regards to language mixing behaviour and verbal expression. Code switching behaviour was exhibited with four participants albeit to varying degrees, while increases over year were only apparent with BL and AR. In addition, linguistic expression of propositions was more difficult in L2 than for some L1 speakers, notably BL. This suggests that with increasing dementia, speakers are less able to compensate for incomplete L2 knowledge by finding synonyms or by circumlocuting around words. Rather, the more frequent L1 lexical items and syntactic frames are activated. These findings lend support to the hypothesis that a less automatised L2 relies on controlled processing and is therefore more susceptible to decreases in attention, concentration and working memory.

10.5.5 Summary

This section discussed how neuropsychological tests decreased for all participants over the twelve month period, but had differing effects on language. The prediction of an apparent link between depressed cognitive abilities, complex formal language tasks and conversational discourse was supported at T1 for all participants, but to various degrees. Many language aspects were affected for some speakers while only isolated trends were affected for others. However as neuropsychological abilities continued to deteriorate, only complex language tasks showed a concomitant decline. Extra-linguistic aspects of conversation did not change over the year, possibly because they were supported by the redundant and contextually-rich nature of conversational interaction. The next prediction was that L2 would be more affected than L1 with a decrease in neuropsychological support. This hypothesis was generally supported by results on complex formal language tests. The extent to which complex language tasks appeared to be influenced by declining neuropsychological support varied across languages and across speakers. This inconsistency may reflect individual variation, the relatively short time slot of examination, and/or sensitivity of tests to identify changes in time. In comparison on CA, no inter-language differences could be discerned with regards to extra-linguistic aspects of communication. Rather, differences between L1 and L2 were apparent from language mixing behaviour and verbal expression of propositions. These findings suggest that a language learnt later in life does rely more on controlled processing and therefore is susceptible to decreasing neuropsychological support. As a final point, the complex tasks predicted to decline were not the only tasks affected: Confrontation Naming also appeared sensitive to changes in L1 versus L2. This implies that not every language deficit seen in Alzheimer's Dementia can be considered as secondary to cognitive decline.

10.6 Variables (AOA, method of acquisition, pattern of use, proficiency) affecting patterns and rate of decline

The final question of this study asked to what extent do the variables of pattern of use, proficiency, age of acquisition (AOA) and method of acquisition influence the pattern and rate of language decline in bilingual AD. For any one variable to be considered as having an unique influence on the pattern and rate of language attrition, similar patterns of decline should be observed for speakers with similar variables. For instance, all speakers who learnt their L2 after their L1 should demonstrate a similar pattern of attrition. However it is not always easy to tease out the influence of each factor separately, and one factor may be intricately linked with another. For instance, learning a language at age 12 meant language acquisition taking place in a formal (school) environment for the speakers in the present study. How then is it possible to differentiate the effects of AOA versus method of acquisition? Since there are no contrasting speakers in this study who learnt their L2 informally later in life, it is not possible to separate the effects of age of acquisition from method of acquisition. Until further studies carefully contrast these variables, the ensuing discussion of the effect of age of acquisition on language attrition will therefore implicitly include the factor of method of acquisition.

The above-mentioned factors were similar for both of JB's languages in that she acquired both simultaneously, used them in a similar pattern over the lifespan, and was equally proficient in both. In addition, since a similar profile of language behaviour was evident from the test battery, she is excluded from the following discussion. Her results confirm the hypothesis that with all factors being equal, a similar pattern and rate of L1 and L2 language attrition will be evident. What needs to be examined is the effect a differing balance of variables will have on language profiles in the other four speakers.

10.6.1 Proficiency

Language proficiency is dependent on pattern of use, frequency of use, and degree of fluency needed for communication. For instance, some individuals may never become fully fluent in their L2 as only a certain level of fluency is necessary for everyday communication in that language (Grosjean, 1982). Even if a language is learnt later in life, a very high level of proficiency can still be attained. For instance, if a person uses their L2 daily to meet social and vocational needs, and to read newspapers, watch the television, complete crossword puzzles and the like to the same extent and with the same ease as can be achieved in L1, then that person can be considered to have attained a very high level of L2 proficiency.

With regards to the speakers in the study, two speakers (EB and BL) had large differences between L1 and L2 proficiency levels. This was because they had not attained a highly proficient level pre-morbidly, as indicated by results from the language background questionnaire. Pre-morbidly, these speakers claimed they were more able (and indeed if given the choice preferred) to express propositions in L1 than L2, and found it less effortful to read newspapers and books in their L1. Furthermore, over the recent years before the study commenced, the amount of exposure to L2 lessened, although a plateau had been reached since joining the Residential Home. Since lexical items used frequently are more easily activated (Paradis, 1997), the lack of constant use of L2 over time would raise the amount of activation required. Levels of L2 activation were therefore raised in these speakers because of less exposure and less use of L2 over time. This in turn lowered L2 proficiency levels. A gap between L1 and L2 proficiency levels was similarly noted with the third speaker (JS). However, she had attained a higher level of L2 proficiency in adulthood than the first two speakers, as she claimed that although she was more comfortable talking in L1, she was able to converse equally well in both her languages. The fourth speaker (AR) was as proficient in her L1 as she was in her L2. Pattern of use and amount of exposure to the languages was similar throughout adulthood and even when joining the Residential Home. She claimed she was equally comfortable and equally able to speak her L1 and L2, and had no preference for either.

The relative differences in language proficiency levels noted in the three speakers (EB, BL, JS) were evident on testing, although to various degrees. On formal tasks, differences were noted in terms of severity of impairment and rate of loss over the year period. On CA, language mixing was predominantly evident in L2 interactions. These finding support the theory that language mixing will occur along with a difficulty inhibiting a dominant L1, and that lower levels of L2 proficiency result in inter-language differences on formal tests. However for AR whose L1 and L2 proficiency was reportedly equal, inter-language differences were also apparent. Results suggest that her L2 deteriorated at a faster rate than L1, and language mixing increased in L2 interactions over the year, but not in L1 conversations. Her profile of results therefore contradicts the claim that a difference in level of proficiency as influenced by frequency of language use only will result in inter-language differences. There thus must be another factor that overrides the variable of frequency of use. AOA is explored in the next sub-section as a potential candidate accounting for AR's language profile.

10.6.2 Age of L2 Acquisition

All 4 participants learnt their L2 at 12 years of age, long after their L1 was acquired. Strong evidence is emerging from the literature showing how age of L2 acquisition influences the processing and organisation of L2, for instance as a translation equivalent of L1 versus having direct links to the conceptual system (Paradis, 1994; 1997; Harley and Wang, 1997). A language learnt later formally at school involves explicit memory and metalinguistic knowledge that often does not become integrated for automatic use. In addition, the literature on AOA and naming in monolingual speakers has shown that later-learnt lexical items are more susceptible to the aging process (e.g. Hodgson and Ellis, 1998) - irrespective of frequency of use.

Given these findings from the literature, were inter-language differences apparent in all the speakers who learnt their L2 later? As discussed in 10.6.1 above, the answer is yes, irrespective of the degree of L2 proficiency attained. However, these differences became apparent at different stages of the dementing process for each participant. For instance, L1-L2 discrepancies were evident at T1 when EB was first assessed even though she is only in the mild stages of AD. In comparison, AR was already in the moderate to severe stages of the disease process but no inter-language differences were apparent at T1. Subtle inter-language differences were only revealed over the year, becoming more evident at T3 with regards to an increase in language mixing in L2 interactions. On this evidence, there therefore appears to be no direct link between AOA, stage of dementia and L1-L2 differences. All participants learnt their L2 at the same age, but inter-language differences became apparent at different stages of the dementing process for each speaker. It thus appears that the factor of AOA alone cannot predict the language profiles observed in the study. It is contended here that AOA interacts with frequent use of L2, the claim being that constant use boosts proficiency levels, and raises resistance to AD. However, as AD progresses, the subtle differences between languages that still remain because of a later age of L2 acquisition will become unmasked.

Paradis (1997: 345) contends that a distinction may be drawn between bilingual speakers with complete implicit competence, and fluent second language speakers with a limited implicit competence supplemented by pragmatic knowledge and declarative, metalinguistic knowledge. Even if the L2 does become automatised in such a scenario, L2 production may remain a translation equivalent of the L1 (see 1.2.2). According to Paradis, the older the age of L2 acquisition, the more likely the person will be a fluent L2 speaker. If this distinction is valid, it may be that BL, and possibly also EB, is a fluent L2 speaker as opposed to a bilingual speaker. She managed well pre-morbidly conversing in her L2 when all her resources were available. However, with the onset of AD, the metalinguistic, explicit knowledge that she used to boost communicative success in L2 became less available. Resources were depleted as a result of the disease process, while the more effortful L2 continued to place high demands on this smaller pool of available resources. This resulted in a progressively less successful ability to communicate in L2. However, Paradis' distinction may raise more problems than solutions. This split between bilingual versus fluent L2 speaker is fairly arbitrary. Where should the line be drawn? On the basis of what evidence? While the variable of proficiency is an important influence on how a language is processed, proficiency is a continuum, and not a cut-off point between bilingual and fluent second language speakers.

10.6.3 Conclusion

From this study of only 5 speakers, the variable of age of L2 acquisition emerges as a consistent influence on the pattern of loss between the two languages. However, the patterns of language loss observed on formal test results and CA are also influenced by proficiency levels in that the higher the L2 level of proficiency, the later in the disease process inter-language differences will become apparent.

10.7 Accounting for language profiles in bilingual AD

This section draws together the language profiles observed in all five case studies, highlighting how each participant's profile, although distinct, can possibly be accounted for by a single explanation: degree of language automatisation as influenced by AOA and frequency of use. In addition, a hierarchy of language aspects most sensitive to inter-language differences in automatisation levels is presented. Because of its holistic approach to assessment, this is the first study that offers an insight into what tests or aspects of language functioning are most appropriate to detect inter-language differences, and when in the progress of AD these differences may become apparent. Results from two participants are used to illustrate how the hierarchy of task sensitivity interacts with the degree of L2 automatisation to yield the language profiles observed. Furthermore, findings from previous studies are examined to determine whether they too are congruent with the schema just described.

10.7.1 Degree of L2 automatisation

Findings from the present study have begun to provide answers as to which factors are most influential on degree of L2 automatisation. The data from the five participants suggests an interaction between stage of dementia, levels of proficiency, and age of acquisition. While results indicate that a language learnt first is more resistant to the progression of AD because it is highly automatised, this study supports Paradis' (1994; 1997) claim that a language learnt after the first was acquired may never become fully automatised and is therefore more vulnerable to AD and depleting resources than L1. However, when in the dementing process L2 begins to show a more marked impairment than L1 depends on how proficient the L2 was premorbidly. Increased frequency of use and exposure to L2 over the lifespan boosted L2 automaticity levels, resulting in higher levels of L2 proficiency. The higher the level of proficiency, the higher the resistance to AD, and therefore the later in the disease process inter-language differences in rate and severity of impairment were noted. Conversely, the lower the level of L2 proficiency, the earlier on in the disease progress inter-language differences become apparent. However, even if a similar degree of proficiency between the two languages had been attained (e.g. through similar patterns and extent of use over the lifespan), the subtle differences in automatisation levels resulting from different ages of acquisition still exist, and will only become unmasked towards the end stages of the disease, where resources (or the language nodes) have become greatly depleted (or degraded).

This account is congruent with models of bilingual language production. For instance Green (1986, 1995, 1997) discusses how depleting resources result in a difficulty inhibiting a dominant L1. De Bot's (1992; also De Bot and Schreuder, 1993) model of bilingual language production also takes into account the influence of different levels of automatisation on the production of L2 in healthy bilingual speakers. These differences affect the Formulator, where language-specific processing takes place.

10.7.2 Hierarchy of tasks sensitive to inter-language differences

Results from this study also indicate that the manifestation of inter-language differences is hierarchically determined. Despite different stages of dementia, the order of task fragility in terms of which tasks were performed better in one language than the other as AD progressed, was the same across speakers. Figure 10 describes which aspects of language appear to be most sensitive to inter-language differences in automatisation levels (Levels 1 and 2), and which seem to be highly insensitive (Level 5).

Level 1:
Language separation and monitoring of code switching trouble spots

↓

Level 2:
Confrontation Naming & more complex formal language tasks
(i.e. those with a linguistic component as well as being heavily dependent on neuropsychological abilities such as working memory)

↓

Level 3:
Verbal expression of propositions

↓

Level 4:
Less complex formal language tasks
(e.g. a familiar procedural discourse)

↓

Level 5:
Topic maintenance; turn taking; awareness of need for repair (intra-language)

Figure 10: Hierarchy of language aspects in terms of sensitivity to inter-language automatisation differences

The hierarchy described in Figure 10 is data-derived; it has been compiled after examining the results from all five case studies to determine which aspects of language best revealed imbalances between L1 and L2. In other words, while the order of task fragility in bilingual AD appears to be the same as in monolingual AD, Figure 10 describes the areas most likely to show up differences between automatisation levels in a bilingual speaker's two languages. For instance, a speaker will code switch in a (less automatised) L2 conversation, but not in an L1 interaction. The figure also shows a temporal difference in the order in which tasks reveal inter-language differences in automatisation. Aspects of language functioning most sensitive to inter-language differences are language separation difficulties (Level 1), and these are one of the first difficulties to appear in the less automatised language. In contrast, aspects least sensitive to differences in L1 versus L2 automatisation levels are extra-linguistic parameters

(Level 5), where inter-language differences may never become apparent, or if they do, only appear later in time after the other levels were reached. The differences between languages as stratified in Figure 10 become progressively revealed over time as speakers are increasingly less able to compensate for a less automatised L2. Each level of Figure 10 will now be discussed separately, beginning with the top level of the hierarchy.

LEVEL 1:

It appears that the highly bilingual language skill of inhibiting L1 when conversing in L2 monolingual mode is the first aspect of language to reveal inter-language differences. In addition, the ability to self-monitor output in order to detect potential trouble spots arising from inappropriate language mixing also appears highly vulnerable. All four speakers of the study who acquired their L2 after their L1 - even in speakers with very high levels of L2 proficiency - showed inter-language differences at Level 1. This result ties in with studies on healthy bilingual speakers. Such studies have shown that reaction times are longer when naming items in L2 as a function of AOA and level of proficiency (e.g. Meuter, 1994; Von Studnitz and Green, 1997), and that even when highly proficient in L2, inter-language differences will still be apparent (e.g. Chen and Leung, 1989). These inter-language differences may not always be evident in conversations as the speaker has enough resources available to compensate for incomplete L2 knowledge, for example by finding a synonym in L2 or by using circumlocutory strategies (Poulisse and Bongaerts, 1994). De Bot and Schreuder (1993) also contend that less-proficient L2 speakers can converse in L2 if they devote enough attention to doing so. In AD however, resource availability is decreased. Compensatory behaviours are therefore not as effective and/or cannot be sustained for a lengthy period of time (as is needed when holding a conversation). Furthermore, fewer resources are available to simultaneously inhibit L1 and activate L2 items. Thus the differences between languages in healthy speakers identified on studies measuring reaction times now become apparent in conversational discourse as the dementing process begins.

LEVEL 2:

The next stage of the hierarchy involves complex formal language tasks and Confrontation Naming. This aspect of the task hierarchy is similar to that found in monolingual dementia, where complex tasks are affected earlier in the disease process than less demanding tasks. With our bilingual speakers, these tasks were sensitive to inter-language differences in terms of severity of L1 versus L2 impairment and rate of decline over time for all participants. Which tasks these were however differed across speakers; there was no one task (of those used in the study) that consistently revealed inter-language differences. This could be because changes in scores near ceiling or floor are not sensitively identified by statistical analyses. Such an explanation is particularly valid for speakers in the early stages of the disease and those in the more advanced stages, where extreme performances are evident. Alternatively, the heterogeneity of results on complex tests across speakers could reflect individual differences as the progression of AD is not smooth and linear. This account is consistent with findings by Bayles et al (1993) who found marked individual variation in performance. Whatever the reasons, the findings remain that inter-language differences were identified on complex formal language tasks while none were evident on less complex tasks (Level 4).

Formal tasks are considered more complex if they incorporate a linguistic component as well as being heavily dependent on neuropsychological abilities such as working memory and sustained attention. Many parameters of functioning need to be simultaneously co-ordinated for successful performance. Therefore an impairment in any one of these functions will result in poorer task performance. Taking it a step further, since a less automatised language requires more controlled processing even in healthy speakers (Paradis, 1994), a task that is itself highly demanding will require an increase in controlled processing. In AD, this can no longer be achieved as available resources have been depleted. Inter-language differences therefore become apparent as the task demands exceed resources available.

As with complex formal tasks, Confrontation Naming also did not consistently reveal inter-language differences. For speakers in the mild stages of AD and for AR who was the most impaired participant, no inter-language differences were apparent on this task. Again for these speakers, scores were near ceiling or near floor respectively across the year, rendering statistical analysis insensitive (also see 11.1.4). For the other two speakers however (BL and JS), Confrontation Naming proved sensitive to inter-language differences. These differences resulted because access to the semantic system via the L2 lexicon was impaired, while access via the L1 lexicon was better preserved. This suggests that the actual concept remains intact as items could be named in L1. Instead performances reveal a language-specific difficulty accessing or activating the L2 lexicon. These findings too are congruent with results from healthy speakers showing that lexical retrieval is more efficient in L1 than L2. In Alzheimer's Disease this difficulty with accessing L2 lexical items is exacerbated and hence even off-line confrontation naming tasks prove sensitive to inter-language differences.

The distinction drawn between Levels 1 and 2 in terms of time may prove arbitrary. The present study investigated changes over a 12 month period only. What preceded this time slot and what follows remains speculative. Findings from future studies may indicate that Level 1 and 2 problems in fact manifest themselves at the same time. This point is resumed in 10.8 where further research ideas are discussed.

LEVEL 3:

Further down the hierarchy is the ability to verbally express propositions as determined by the amount of repairs initiated in conversations. Level 3 can be viewed as an extension of differences seen in Level 1. Problems at Level 1 reflect a difficulty inhibiting L1 and sustaining compensatory behaviours in L2. At Level 3, not only are difficulties noted with inhibiting a dominant L1, but marked difficulty with activating L2 lexical items and syntactic frames occurs. This results in an increase in effortful speech as revealed by a progressive increase in intra-language trouble spots such as word retrieval difficulties, hesitations and revisions, and lengthier, more complex repair trajectories. Differential impairment on this level was evident in one speaker only (BL), where the ability to express propositions in L2 was more impaired than in L1. This speaker had the widest gap between her L1 and L2 proficiency levels, and accordingly her L2 was assumed to be the least automatised of all the speakers in the study. By the time when the study commenced, the depletion of resources had revealed inter-language differences for BL all the way to Level 3. However, since difficulties at this level were only apparent for one speaker, further research may reveal it to be an arbitrary distinction.

LEVEL 4:

At the next level of the hierarchy are simple formal language tasks. These include highly familiar procedural discourse tasks (e.g. how to make a sandwich) and co-ordinate and superordinate naming of familiar categories. Inter-language differences were not apparent on these tasks for any speaker. It thus appears that pre-morbidly familiar and practised routines, familiarity of categories, and shorter tasks all boost (weaker) L2 performances. Shorter tasks refer to the co-ordinate and superordinate naming task where only five items were tested, and only single word responses were elicited. This reduced the effect of waning attention on task performance, but also reduced task sensitivity to inter-language differences.

LEVEL 5:

As in the previous level, topic maintenance and turn taking as well as a pragmatic awareness of the need to repair intra-language trouble spots were similarly impaired/spared across languages for all speakers. These last aspects are more language universal, forming the foundation of interaction upon which linguistic expression is superimposed. They are basic abilities underpinning communication, in any language and in any form (linguistic, non-linguistic, gestural). Turn taking skills are even seen in very young infants (Stevenson et al, 1986). These relatively primitive pragmatic skills have been developed and maintained throughout the lifespan, transcending language-specific boundaries. With the onset and progression of AD, these skills may become impaired as a secondary effect of deteriorating working memory and information processing abilities. However, because they are language universal, they appear to be least sensitive to inter-language differences in L1 versus L2 level of automatisation.

In summary, while aspects of the preverbal message (c.f. De Bot, 1992) and extra-linguistic parameters such as turn taking are language universal, the activation of a language to express these propositions is where inter-language differences in automatisation become apparent.

The hierarchy has been drawn from findings on both formal language tests and Conversation Analysis. This has implications for methodologies used to assess bilingual speakers with AD. Inter-language differences are less evident on CA with the more language universal aspects such as topic maintenance; language specific difficulties associated with lowered levels of automaticity and raised levels of activation are reliably revealed on CA in terms of code switching behaviour and subsequent trouble spots. On formal language tasks, the most sensitive manner to detect L1 versus L2 differences is by using complex tasks and confrontation naming tests. Unless the speaker is minimally proficient in L2 (as indicated from a language background questionnaire) and unless the speaker is in the more advanced stages of AD, test batteries can be shortened to include these afore-mentioned parameters only and still be reliable tools in detecting inter-language differences.

To summarise thus far: For the speakers in the study, the degree to which L2 is automatised appears to be a function of AOA, but when inter-language differences first appear in the disease process is influenced by the level of L2 proficiency attained premorbidly. The higher the level of L2 proficiency (resulting from frequent use of and exposure to L2), the more resistant the language to AD. However even if languages are used frequently, the AOA factor always appears to result in a difference between L1 and L2 levels of automatisation. This difference may be subtle, and may only be unmasked in the more advanced stages of AD as resource availability is greatly diminished (or as the language nodes became highly degraded). The aspects of language functioning most sensitive to differences in L1 versus L2 are keeping the two languages separate when speaking in L2 monolingual mode, monitoring trouble spots caused by code switching behaviour, and attempting complex formal language tasks.

A schema of L2 language profiles

Figure 11 shows the bilingual language profile of two speakers from this study as a function of resource availability and level of L2 automatisation. The speakers are AR who is in the moderate to severe stages of dementia, and EB who is in the mild stages of the disease process. While the schema can account for the profiles of all the speakers in the study, only two speakers were selected for this illustration to show how two individuals at different stages of the dementing process can exhibit the same profile in terms of inter-language differences.

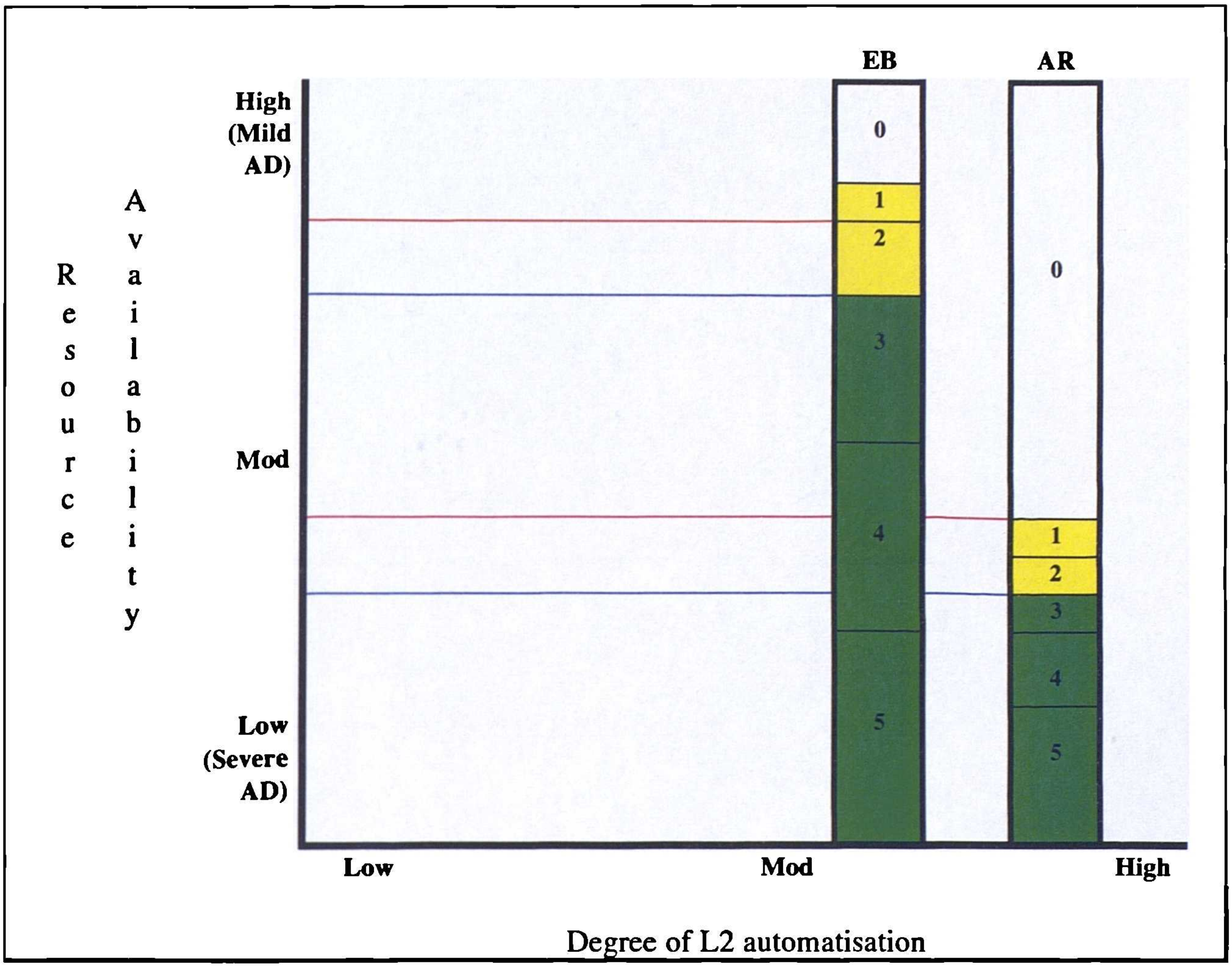


Figure 11: EB and AR profiles as a function of L2 level of automatisation and resource availability

Key:

—	Time point when study began
—	Time point when study ended
0	No inter-language differences apparent
1	Level 1: Language separation and repair of code switching trouble spots
2	Level 2: Complex formal language tasks
3	Level 3: Verbal expression
4	Level 4: Less complex formal language tasks
5	Level 5: Topic maintenance, turn taking, repair of intra-language trouble spots
	Sensitive to inter-language differences in automatisation
	Showing differences between L1 and L2 on some tasks
	No inter-language differences apparent, but may become apparent at a later stage of the disease process

In Figure 11, automatisation levels are represented by the x axis. AR had a higher level of L2 automaticity than EB, as she had used her L2 frequently and to the same extent as her L1 premorbidly, and so her profile lies further along on the x axis. However, since she acquired her L2 later in life, it did not become as fully automatised as her first language. That is why her profile does not lie on the extreme right of the x axis, which would indicate a fully automatised language. The y axis represents amount of resources available, as revealed by the stage of dementia (mild to severe). For both speakers, the dementing process resulted in a progressive sapping of amount of resources available. The y ayis however can also represent degree of degradation of the language system, depending on which theory one adopts (access versus loss). However for the purposes of this illustration, the resource theory will be referred to when describing the schema.

Since EB's L2 was less automatised than AR's and therefore more dependent on controlled and effortful processing, depleting resources unmasked the differences in language automaticity earlier on in the disease than it did for AR. This is represented by the time length of Level 0. For EB, Level 0 lasted for a shorter time, with inter-language differences becoming apparent in the mild stages of AD. When the present study began (as indicated by the red line on Figure 11), at T1 EB already exhibited differences between her two languages in terms of language mixing in L2 interactions only (Level 1). This suggests that differences in automaticity levels were starting to become evident before the start of the study. Over the year period of examination, differences between languages also began to show at Level 2. Although a similar degree of L1 versus L2 impairment was evident on formal tasks, there was some support for claims that L2 was beginning to deteriorate at a faster rate than L1.

In comparison, no inter-language differences became apparent until well into the dementing process for AR. Her L2 was automatised to a higher level than EB, and required fewer resources to process. It was only as the bottom of the resource pool was being reached that the differences between L1 and L2 levels of automatisation were revealed. For instance it was at the final time point (T3) of the study that differences between languages at Level 1 first began to manifest themselves.

Even though the stage of dementia differed between AR and EB, the manner in which inter-language differences were revealed was the same: Levels 1 and 2 were affected first. Presumably, as the disease progresses and resource availability declines, further language differences will be revealed at Levels 3 and 4, and perhaps ultimately even Level 5. Evidence suggesting that the lower levels of the task hierarchy will also begin to show inter-language differences comes from BL's profile: a discrepancy between her two languages was apparent with Level 3 aspects too.

It must be noted that the relative time duration of each level (as denoted by length of the different blocks in the schema) is speculative. Since the study only assessed a time window of one year and used only certain assessment tasks, it remains unclear when difficulties with language separation first became evident. For example with EB, such difficulties were already present at T1 when the study first began. Likewise, it remains unknown for how long inter-language differences will remain confined to Levels 1 and 2 in these two speakers before further differences become revealed at Level 3. Section 10.8 elaborates on what questions future research should address to confirm and expand the theory.

10.7.3 Previous findings and the schema

How useful is the schema in Figure 11 in accounting for findings in the literature on other bilingual speakers with AD? Unfortunately no comment can be made regarding the hierarchy of aspects sensitive to inter-language differences in levels of automatisation, as the test batteries employed are not comparable across studies. What can be compared is the findings of difficulties conversing in monolingual mode, as most of the previous research focused on this aspect of bilingual behaviour. This schema offers an explanation for some authors' observations that the extent of language mixing difficulties does not necessarily correlate with degree of dementia. Rather, it has to do with the interplay of the premorbid level of L2 automaticity and level of resource availability post-onset of AD. Speakers who were less proficient in their L2 showed language mixing behaviour earlier on in the disease process than more proficient speakers.

The reader is referred back to Table 57 in 10.4.4 for a summary of what has been found across studies thus far. All speakers who learnt their L2 after acquiring L1 showed difficulties with conversing in L2 monolingual mode, irrespective of the level of L2 proficiency. Even speaker RA began to show (minimal) difficulties inhibiting L1 in the more advanced stages of the disease process. The only exceptions were DH *and EZ from the Luderus study, who showed* difficulties in L1 interactions. This pattern of difficulty however cannot be accounted for satisfactorily as full language history information was not provided. A second potential difficulty for the theory that a later-learnt language may never become fully automatised is that in some studies, researchers found that *not* all speakers who acquired their L2 after their L1 exhibited inappropriate language mixing. However this may be because these speakers were assessed at one time point only. The schema has demonstrated that while differences between languages may become apparent in the earlier stages of the disease for some speakers, increased automaticity levels resulting from increased use of and exposure to L2 may delay the unmasking of inter-language differences until the later stages of the disease. If these speakers had been tracked for a longer period of time, inter-language differences may then have become apparent. This point then leads us into the next section: what further research is needed to confirm and/or extend the theory that a later age of L2 acquisition means that the language will not become fully automatised?

10.8 Further Research

The schema presented in Figure 11 illustrates findings from speakers who learnt their L2 at the age of 12 years, and used their L2 in a similar pattern in adulthood. However they differed in terms of proficiency levels attained. What would the findings from speakers with different language profiles reveal?

For instance, when individuals emigrate to another country, they may begin to use their first-learnt language less and less as they become integrated into the new society and culture, until eventually they converse primarily in their L2. The present study found evidence that could be used to support the contention that learning a language at the age of 12 years old resulted in that language never becoming fully automatised, even when used frequently in adulthood. However would the factor of AOA continue to wield such a strong influence when exposure to L1 lessens? The schema illustrated in Figure 11 may accurately be showing an interaction between degree of automaticity and stage of dementia, as well as task sensitivity to differences in levels of language automatisation. However, the various weightings of factors that influence the degree of automaticity may not be uniform across bilingual speakers, given for example the different ages one can learn a language, and different patterns of language usage possible.

A longitudinal single case study methodology is still advocated for future studies. Cross-sectional studies comparing groups at different stages of AD are not conducive to lowering noise in an already heterogeneous population. Rather, variables influencing language profiles can be controlled for more carefully by tracking each speaker individually over time, with each speaker being followed for as long as possible. The earlier in the disease process assessments can be undertaken, the more an understanding can be gained of the rate and patterns of L1 versus L2 language loss. Alternatively, laboratory studies can be conducted whereby dementia is simulated (similar to Kilborn, 1991), or else computerised networks can also be set up to simulate the effects of dementia (similar to Meara, in press). However, to test out the universality of the schema in Figure 11 for actual bilingual speakers with AD, the following parameters need to be varied:

10.8.1 Differences in factors versus equally matched language profiles

To test out whether factors such as AOA, proficiency, and pattern of use will always be the cause of inter-language differences in automatisation levels, speakers who acquired both languages simultaneously and used them in a similar pattern throughout the lifespan could be investigated. These speakers should not show any differences between their languages even in the most advanced stages of the disease, as both languages are automatised to the same level. If inter-language differences are apparent even when all factors are similar, then the variable of L2 automaticity levels should be questioned as a valid influence on language profiles. However this is unlikely to be the case given the limited findings thus far from bilingual speakers with AD. Results from speaker JB in this study support the hypothesis that with similar language backgrounds, similar impairments will be evident across languages. However, she (and other speakers) should be tracked until the final stages of the disease process in order to confirm the prediction at all stages of AD.

10.8.2 Effects of AOA on language profiles

To confirm whether the factor of AOA will always result in a lower degree of L2 automatisation, other speakers could be studied who learnt their L2 after acquiring their L1, but who used both languages in a similar manner and attained a high level of L2 proficiency (i.e. similar to AR's profile). If all these speakers show inter-language differences, even if only at Level 1 or 2 and only in the more advanced stages of the disease, then that aspect of the schema will be supported. Several sub-studies stem from this one:

Study 1

After confirming whether AOA results in a lower degree of automatisation, the next step would be to investigate whether the actual age of L2 acquisition determines how early inter-language differences become apparent in AD (all other factors being equal). Is it a case where the earlier the L2 is acquired (e.g. age 5 versus age 12), the later in the dementing process inter-language differences will be revealed? Is there some critical age of L2 acquisition before which inter-language differences may never become apparent?

To answer these questions, studies could investigate bilingual speakers with AD who learnt their L2 at different ages. The following age cut-off groups are potential critical points determining processing of L2 as found by various researchers:

-age 2:	De Houwer (1995)
-age 7:	Hyltenstam (1992)
-puberty:	Johnson and Newport (1989); Patkowski (1980)
-adulthood:	Birdsong (1992); White and Genesee (1996)

All other factors (level of L2 proficiency, method of acquisition, pattern of use over lifespan) should be kept constant as far as is feasible. For instance it is unreasonable to expect someone acquiring L2 at age 2 to have learnt the language in the same method as someone learning it more formally at school. Speakers should be tracked until the final stage of AD to obtain a complete picture of the pattern of loss.

Study 2

The influence of AOA can also be studied by developing a confrontation naming task to measure response times in naming. Using a methodology similar to Hodgson and Ellis (1998), the task should comprise items controlled for frequency, familiarity, picture complexity and imageability, and inter-language response times should be recorded for comparison. The confrontation naming task used in the present study was taken from the ABCD test battery and was not controlled for these variables. In addition, AOA and frequency norms are not available in Afrikaans. Therefore before a confrontation naming task can be constructed that controls for these variables, a list of comparable words across languages should be compiled. This can be done by using Snodgrass and Vanderwart (1980) pictures which have been standardised for visual complexity, name and image agreement and familiarity in American English. Norms need to be re-established for all except visual complexity for South African English and Afrikaans as norms for American English are not necessarily transferable to other language populations (Sanfeliu and Fernandez, 1996). Once such norms have been gathered, a reliable confrontation naming task can be devised in which variables of familiarity and imageability are matched across languages. In this manner the independent effects of AOA on naming in bilingual speakers with AD can be examined. By repeating this task at regular intervals along the disease process, the inter-language differences in naming can be carefully monitored as to when they first become evident or exacerbated (as revealed by increased reaction times), and whether these differences can be explained by AOA factors.

Study 2 will also be able to address the issue of conceptual fall-off where the semantic concept is degraded versus language-specific difficulties accessing lexical items. For instance, if an item could not be named in L2 but could be labelled in L1, a language-specific difficulty is apparent. If later in the disease process the item can no longer be named in L1 either, then this could indicate that the actual semantic concept has been degraded. To cross-check the hypothesis, speakers could be asked to verbally define the target word in a separate task. If they cannot do so, this supports the theory of a difficulty with semantic concepts.

Study 3

Another method to examine AOA effects is to study the influence of autobiographical relevance on naming abilities, similar to the methodology employed by Snowden, Griffiths and Neary (1994). These researchers included (monolingual) speakers with AD as one of the subject groups. They found that for this population, autobiographical relevance did not appear to influence naming ability. However, the study can be faulted on several points, viz.: only four AD speakers were included; participants were not differentiated in terms of stage of dementia; the design was cross-sectional and perhaps differences would have become evident as the disease process progressed.

Adapting the above methodology to bilingual speakers with AD then, a study could be designed to investigate whether AOA also has an effect on languages in terms of autobiographical relevance. A recent study by Schrauf and Rubin (1998) provided some support for this theory. Some of their participants recalled a subset of memories for events that occurred prior to immigration in L1 (used before immigrating from Spain and before acquiring English), while events occurring after immigration were more frequently recalled in English (L2). The proposed methodology investigating the effects of autobiographical relevance involves compiling a list of pictured objects and/or events to be named on confrontation. Half the items should have autobiographical relevance for L1 only. For instance if a person lived on a farm when very young (before L2 was acquired) then stimuli can include items and activities associated with that farm. The remaining 50% of stimuli should consist of neutral items. All stimuli should be matched in terms of frequency, imageability and picture complexity, and should also be held constant across languages. Speakers are then asked to name the pictures in L1 and then L2, and response times are measured. Data analysis would involve comparing L1 to L2 reaction times to determine whether inter-language difficulties are evident when naming

(a) autobiographically relevant items, and

(b) neutral items

While a difference in reaction times between L1 and L2 is expected for items from both (a) and (b) because L2 was learnt after L1, the inter-language differences in response times in naming autobiographically relevant items may be further exaggerated. For convenience, the extent of the L1 versus L2 difference in reaction times when naming autobiographically relevant items could be termed x; and the inter-language difference in naming neutral items could be termed y. The next step of data analysis would be to compare x to y. If x is larger to a statistically significant degree than y, then we can conclude that AOA also has a differential effect on languages in terms of autobiographical relevance.

As with Study 2, this naming task should be repeated at regular intervals to determine when inter-language differences first become apparent in AD and to what extent they are exacerbated by the disease process. In this manner, an insight can be gained as to when differences in autobiographical relevance manifest themselves in AD. The additional influence of L2 proficiency levels can also be examined in this task (see 10.8.3).

10.8.3 Effects of proficiency on language profiles

The present study has shown that the level of L2 proficiency influences when inter-language differences become apparent. To systematically test out the advantages of a high level of L2 proficiency in delaying the emergence of inter-language differences caused by AOA, speakers with high, medium and low levels of L2 proficiency could be investigated. Comparisons could be drawn in terms of when inter-language differences first become apparent in AD; how rapidly L2 deteriorated as compared to rate of L1 decline; and to what extent these findings are a function of different levels of L2 proficiency. Final results should then be able to specify what level of L2 proficiency individuals have to have attained premorbidly in order to best delay the emergence of inter-language differences. The age of L2 acquisition should be held constant for this design, as should the variable of pattern of language use. Proficiency levels can be compared across participants by rating levels according to a 5-point scale (similar to that of Hyltenstam and Stroud, 1993), with information gained from completing a detailed language background questionnaire.

The parameters of proficiency in language comprehension versus expression can also be contrasted. Take for instance the example of a speaker who is highly proficient in receptive understanding of L2 but less proficient in expressive abilities. Would this individual be more vulnerable to the dementing process than someone who is highly proficient in both receptive and expressive L2 language skills? Presumably a test battery tapping expressive abilities more than receptive skills will be biased towards the latter speaker. To counteract this bias, equal number of matched receptive and expressive language tasks should be included in the test battery, controlling for task difficulty. The test battery used for the present study placed a heavier emphasis on expressive language tasks and therefore would have to be extended to include more receptive language tests. Suggestions include tasks assessing receptive vocabulary, and understanding of complex sentences using pictured stimuli to reduce the load on working memory (for comparison to Token Test results).

Another possible study is a prospective longitudinal study, involving speakers who are still in the very mild stages of AD (i.e. a CDR of 0.5 - questionable dementia), and therefore can still participate in formal proficiency testing. These speakers could then be tracked over time to determine when proficiency differences established (virtually pre-morbidly) in the very early stages of AD would become apparent on the formal test battery administered. In this manner one could determine which precise level of premorbid L2 proficiency is most beneficial in delaying the effects of AD. This information has important clinical implications for the management of bilingual speakers with AD. For instance, how soon in the disease process provisions should be made to help the speaker compensate for an increasing difficulty conversing in L2 (e.g. using an interpreter, moving them into a monolingual Residential Home).

10.8.4 Effects of method of acquisition on language profiles

This study involved participants who learnt their L2 at age 12 in a formal manner. It therefore was not possible to tease out the different effects these two variables (AOA and method) may have had on patterns of loss. To systematically investigate the effect of method of acquisition, speakers who acquired their L2 at the same age as each other but in different settings (e.g. school versus social) could be assessed using the same methodology as that used in the present study. Once again variables of proficiency and pattern of use should also be controlled for.

10.8.5 Effects of different patterns of use on language profiles

Speakers in this study all had a similar pattern of language use. To test out the interaction between AOA and pattern of use as an influence on automatisation levels, speakers who have used their L2 to a far greater degree than their L1 in adulthood can be studied. An example of this population group are speakers who have moved from their L1 context to a new language environment. Olshtain and Barzilay (1991) found that in healthy speakers, emigration from one country to another where a different language was spoken resulted in first language attrition, affecting vocabulary retrieval in particular. De Bot and Schreuder (1993: 199) describe a speaker whose L1 was Dutch but who had resided in America for an (unspecified) number of years. When speaking Dutch, she had difficulty preventing her L2 (English) from intruding into L1 talk. The authors claim this behaviour reflects different levels of activation as influenced by frequency of use. The L1 was so deactivated that even the combined level of L1 activation and L2 inhibition could not suppress the activated L2 element. Obler and Mahecha (1991) too maintain that L1 attrition will occur if it is not used for a long enough period of time. However, what is a "long enough period of time"? Will the variable of frequency of use override the differences in L1 versus L2 degree of automatisation resulting from AOA effects? When is the point where L1 becomes less automatised than L2 in speakers who have emigrated from their country of birth? How will this influence language profiles in AD?

To answer these questions, various population groups can be studied who moved from one language culture to another at various ages. An example is families who emigrated from America to Israel (as in the Olshtain and Barzilay study) where the parents learnt their L2 (Hebrew) at a later age than their children, and used their L1 to varying extents. However an important question for these population groups is: Can these speakers still be considered bilingual as defined by Grosjean and Paradis (i.e. use their two languages to meet everyday social and vocational needs)? If their L1 is still being used, then the answer to the question is most likely yes, given that individuals may use their two languages in diglossic situations. If not, then what is being reflected is not necessarily the effect AD has on two languages, but rather first language attrition as a result of lack of exposure and use. To control for this effect, subject groups should include speakers who still use their L1 at the time of assessment albeit to a lesser extent than L2.

10.8.6 Effects of linguistic distance on language profiles

Speakers in the present study spoke two languages that were structurally similar. Several authors have maintained that the structural distance between languages influences the way in which they are organised and proces^ed. These influences may be advantageous, as demonstrated for instance by the numerous studies cited by Harley (1995) which showed that L2 acquisition is facilitated when languages are typologically similar. Cognates are most likely stored in a separate sub-system of the mental lexicon (Paradis, 1997) and can benefit from cross-linguistic activation. However, De Bot and Schreuder (1993) give an example where the structural similarity of languages may not always be advantageous: The similar word forms may trigger a code switch as activation is spread from the L1 word form to the similar L2 form, activating the L2 lexical item instead of the target L1. Romaine (1995) states that different processing strategies can also affect language use. For instance English places emphasis on word order as an important cue. If the speaker is learning Japanese as an L2, then errors may occur as word order is not a valid cue in that language.

In the present study assessing English/Afrikaans speakers, cognates are numerous and grammatical structures overlap. This may have influenced the nature and extent of language mixing. For instance, intrasentential switches did not violate the syntactical structure of the appropriate base language. This may be because word order is a valid cue in English and Afrikaans, with both languages using verb-second positions in present tense. Studies could be commenced examining the nature of language mixing difficulties where languages are structurally dissimilar, such as Chinese and English. Would this result in inter-language mixing being exacerbated or diminished as AD progresses? Would the nature of code switching violate any language-specific constraints? To answer these questions, the variables of AOA, proficiency and pattern of use should be kept constant in this design in order to tease out the influence of language-specific influences.

10.8.7 Uniformity of task hierarchy

From the current study, a hierarchy of tasks sensitive to inter-language differences in level of automatisation could be established (Figure 10). However, it is as yet unclear whether this hierarchy holds across all bilingual speakers, albeit becoming apparent at different stages of dementia. A second question concerns the approximate time length of each level. For instance, what is the time period that separates Level 1 from Level 2 differences? How soon after that can we expect Level 3 differences? It is likely that the rate will vary between speakers. Bayles et al (1992; 1993) found that the most rapid deterioration in language occurred in monolingual speakers with a GDS of 5 (moderately severe). How does this link in with the appearance of inter-language differences? How do the effects of different L2 proficiency levels, patterns of use, and age of acquisition influence the rate at which inter-language differences will be exposed? Since the present study investigated language attrition over a twelve month time period only, all these questions asked above can only be answered by embarking on numerous single case studies tracking changes in languages longitudinally from the early to final stages of Alzheimer's Disease. The influence of different factors on task hierarchies can be varied as described in 10.8.1 - 10.8.6.

A final difficulty with the task hierarchy concerns Level 1. As discussed in Chapter 3, inappropriate language use can reflect a difficulty with inhibiting a dominant language, or alternatively result from disorientation i.e. inappropriate choice of language given the context and conversational setting. Conversation Analysis indicated that apart from an isolated example from BL (Chapter 6), the language mixing exhibited by speakers in the study did not appear to reflect incorrect choice of language. However, disorientation to person, place and time is a prominent feature of the disease process (Lezak, 1995). Thus even though disorientation did not appear to influence inappropriate language use, it poses a potential problem for other studies. Difficulties in Level 1 of the hierarchy therefore needs to be carefully distinguished from problems arising from orientation. Such a distinction is feasible using a Conversation Analysis which invites a close investigation of where, how and why code switching may occur (see Chapter 3 for motivation).

10.8.8 Studies with healthy bilingual speakers

This study revealed a paucity of self-initiated repair following code switching trouble spots as compared to a relatively preserved ability to self-repair intra-language trouble spots. However, as discussed in 10.4.4, it remains unclear as to whether this finding is caused or exacerbated by pathology, or whether it reflects self-monitoring behaviours in healthy bilingual speakers. In order to determine the extent to which findings are pathological, norms from healthy speakers need to be established. This can be done by carrying out a Conversation Analysis on healthy bilingual speakers holding a monolingual conversation in L2. Similar to the methodology employed in the present study, the percentage of self-initiated repair following intra-language trouble spots can be compared to those initiated after code switching trouble spots. If the percentages are similar, this will have important implications for findings from this dissertation in so far as proving that impaired self-monitoring of language mixing behaviour results from pathology. In addition, healthy bilingual speakers with different levels of L2 proficiency could be investigated to determine whether there is a clear correlation between (a possible paucity) of self-initiated repair following code switching and level of L2 proficiency. These findings will also have implications for the task hierarchy (Figure 10) which includes a difficulty with self-monitoring language mixing as one of the first aspects to reveal inter-language differences in automatisation levels.

10.9 Summary

The first six sections of the chapter drew together the findings from individual speakers to answer the main questions of the study. Section 10.1 discussed how the pattern of impairment seen in bilingual AD is similar to that found in monolingual AD. Section 10.2 explored the pattern and severity of L1 versus L2 impairment. Predictions that L2 would be more impaired were not always confirmed, and reasons why such results were found were suggested. Section 10.3 discussed differences in the rate of L1 versus L2 decline. Again, the prediction that L2 would decline at a faster rate was not supported by every speaker. One of the main reasons accounting for this is the time frame of examination: 12 months was too short a time period to identify changes. Section 10.4 examined language mixing behaviours, concluding that code switching affects L2 interactions as a result of differences in automatisation levels caused by AOA and proficiency factors. The interesting finding of a relative absence of self-initiated repair following code switching trouble spots was also explored. Section 10.5 examined apparent links between neuropsychological functioning and language decline. Both predictions were borne out in that language tasks heavily dependent on neuropsychological abilities declined with a concomitant decrease in neuropsychological support, and L2 was generally more affected than their L1 equivalents. However not all tasks expected to show decline did so. Reasons explaining this heterogeneity of results include test sensitivity and individual variation.

Section 10.6 explored the influence of age and method of acquisition, proficiency and pattern of use on the language profiles observed. It was concluded that even if very high levels of L2 proficiency had been attained, the factor of age of L2 acquisition always appeared to result in a lower level of L2 automatisation. Section 10.7 presented a schema accounting for profiles of inter-language differences as a function of degree of L2 automatisation and stage of dementia. Since this schema was derived from only four speakers, section 10.8 discussed various questions that should be addressed in order to confirm and expand this schema. The investigation into bilingual speakers with AD is a very new field of investigation and many more case studies are required to build up a more representative sample.

The following chapter explores methodological issues stemming from the present study, and also discusses clinical implications that can be drawn from the results.

Chapter 11
CONCLUSIONS

Introduction

This dissertation describes five single case studies and findings are not necessarily representative of the general population of bilingual speakers with AD. Many other case studies are required before we can discuss trends of language loss in this population with any confidence. However, several important methodological and clinical issues arising from this study have repercussions for future research. This chapter discusses these issues, offering suggestions for how further investigations could overcome some of the difficulties encountered in this study. Clinical implications regarding assessment and management issues are also discussed, and the chapter concludes with a General Conclusion, summarising the questions and findings of the study.

11.1 Methodological Issues

This section discusses several methodological issues that have arisen from the study. Firstly, the test battery included both formal tests and a CA. However, these two methodologies sometimes yielded different results. 11.1.1 explores these differences and accounts for why they may have occurred. 11.1.2 then discusses the advantages that CA provided in assessing language mixing behaviour, and offers several challenges for future research. The final three sub-sections explore several limitations of the study viz.: the time frame of investigation, task sensitivity, and the use of statistical analyses.

11.1.1 CA versus Formal Tests

The nature of formal tests differs fundamentally to a conversation analysis. The former investigate discrete language functions such as naming and auditory comprehension, while the latter facilitates an exploration of functional language use in everyday life. Depending on the methodology employed (formal tests versus CA), results from the present study at times yielded different answers as to whether or not languages were similarly preserved/impaired and declined at similar rates. These discrepant findings may be an artefact of the nature of the assessment procedures, as different strengths and weaknesses are tapped by these two different methodologies. This section first compares results from formal tests to those on CA for all parameters except language mixing, and then compares language mixing findings separately.

Formal test, CA and language functioning (excluding code switching)

Formal tests generally proved more sensitive to inter-language differences in severity of impairment and rate of decline than did CA, at least in the stages of decline examined in this study, and according to the battery of tests selected. Two implications can be drawn from this observation. Firstly, formal tests tap very different demands on linguistic functioning than does conversational discourse. The former are stripped of any contextual cues, and are focused on isolated language processes. In contrast, conversations are inherently redundant, and are rich with situational and contextual cues, as well as benefiting from shared knowledge between interlocutors (Murphy, 1990). The redundant nature of conversation may therefore provide the necessary support for L2 production even when neuropsychological support is reduced (see 10.5). In addition, interlocutors may adjust their communicative expectations and conversational styles. For instance, they may be less tolerant of attributable silences and construct extended turns to compensate for this (as JS's Afrikaans interlocutor tended to do). This behaviour may mask any changes in L2 conversational abilities over the year.

The second implication is that formal assessments are not necessarily valid predictors of patterns of success/impairment in conversations held in L1 versus L2 - a finding highlighted on numerous occasions in monolingual neurogenic disordered populations (Frattali, 1992; Friedland and Miller, 1996; Perkins, 1995; Snow, Douglas and Ponsford, 1995; Ylvisaker and

Szekeres, 1994). For instance, L1 versus L2 difficulties in auditory comprehension identified on the Token Test were not mirrored on CA for BL or AR. Another example is that for both mildly impaired speakers (JB and EB), working memory deficits identified on formal testing were not apparent in conversational discourse, as topic maintenance and shift appeared preserved. An additional consideration is that deterioration on formal tests may precede decline in functional communication. In other words, a lag between deterioration of functional communication abilities and formal test performance may occur. Due to the less redundant nature of formal tests, language decline was identified on the formal test battery first in this study, while the results from the CA remained largely unchanged over the year. The supportive nature of conversational interaction may have temporarily sheltered the languages from the effects of decreasing neuropsychological support, as identified on formal tests.

However, where differences in language proficiency were considerable and the dementing progress was more advanced (i.e. with BL), differences between languages could not be diminished, supported or masked by redundant, contextually-rich conversations. In such cases, the effort of expressing verbal propositions in L2 resulted in trouble spots arising and more instances of self-initiated repair of these intra-language trouble spots. With such speakers, Conversational Analysis then proved as sensitive to identifying changes over times and inter-language differences as formal language tests were.

Formal tests, CA and language mixing

Different findings regarding language mixing were revealed by formal tests versus CA. Only isolated examples of code switching were noted on formal tests. This is most likely because on a formal test, only single word responses and short sentence answers are required. Distractions are minimal, and the responses are limited and focused. These factors are all conducive to promoting successful language separation abilities as the dominant L1 needs to be inhibited for only short stretches of time.

In contrast, language mixing behaviours were apparent in conversational discourse for all four speakers who learnt their L2 after acquiring L1. Code switching also increased over the year for two participants (BL and AR). Conversing in L2 monolingual mode appears to require a sustained effort to inhibit a highly automatised L1, and in cases where L2 is less proficient, to compensate for incomplete L2 knowledge by finding synonyms for lexical items or circumlocuting around the target word. However, difficulties with sustained attention, concentration and working memory - identified on formal tests - compromised the ability to sustain inhibition of a more dominant L1 for a long period of time. The difficulty of inhibiting a fully automatised L1 appears to become further compromised as the dementing process progresses, overriding any benefits that the contextually-rich conversations appear to provide for other language functions. With decreased neuropsychological support, the inter-language differences observed even in healthy bilingual speakers become exacerbated as the effort to produce L2 can no longer be adequately sustained by existing resources.

Conclusion

To investigate changes in language and cognition over a period of time in bilingual speakers with AD, both formal tests and CA should be included in the test battery as each yields different answers. Formal tests are more sensitive to intra-language changes over time than the CA, as the redundant nature of conversational discourse may mask any changes occurring or provide support for residual linguistic abilities. However, with regards to investigating language mixing behaviour, CA is a more sensitive analysis tool than formal tests, as difficulties with sustaining inhibition of a dominant L1 becomes more apparent when examined over longer periods of time. The next section provides a closer examination of the advantages of using Conversation Analysis to examine language mixing difficulties.

11.1.2 Advantages of CA

Conversation Analysis was selected above other methods of analysing conversational discourse. This sections explores whether CA lived up to expectations as a sensitive tool for examining language mixing behaviour, and whether it did indeed solve many of the problems associated with the clinically difficult language separation/language choice dichotomy discussed in Chapter 3.

Analysis of language mixing

Did CA facilitate a better explanation and description of inappropriate language mixing compared to other discourse and quantitative measures? As outlined in Chapter 3, previous attempts at analysing inappropriate language mixing included tallying the number of utterances code switched (c.f. Luderus, 1995). However, by merely adding up the amount of utterances code switched, or by analysing utterances divorced from the context in which they occurred, vital information regarding the cause and nature of the language mixing is forfeited. In addition, discourse measures impose arbitrary categories rather than seek an explanation as to why inappropriate language mixing occurs in the contexts it does. What CA offered beyond discourse measures was an analysis of the interlocutor's contribution to the ongoing talk, and careful scrutiny of repair trajectories. This gave insights into why instances of inappropriate language mixing occurred, and how it affected the quality of interaction. In this manner, CA proved a better approach to answering questions such as whether language mixing was a problem in conversations, and what the nature of that problem was. As a tool for characterising behaviours, CA could be used for comparisons over time and across interlocutors and interactions.

The following example discussed in Chapter 7 aptly illustrated some of these points. There were situations where language mixing could not always be considered inappropriate (in addition to flagged code switching), as in the Afrikaans interaction with EB at T2, repeated here for convenience.

[English gloss in italics. I=interlocutor]

1 **EB:** ... en Merkyl het uh: (0.2) I don't know how you say shorthand typing
2 in Afrikaans.
... and Merkyl did (etc)
3 **I:** °ja°
4 **EB:** Uh - she helped her very much.
5 **I:** Wat se jy?
What are you saying?
6 **EB:** Sy het baie gehulp - in die besigheid
She helped a lot - in the business

As discussed in 7.3, if one overlooked the interlocutor's input in the above example, it appears that EB had more of a difficulty keeping to one language than she actually did. CA however was able to reveal that EB's use of the 'inappropriate' language in line 4 stemmed from a misinterpretation of the interlocutor's feedback (line 3), rather than a difficulty keeping the two languages apart. The strength of CA lay in the analysis of language mixing behaviour in the context in which it occurred, and in acknowledging that conversation is a collaborative achievement (Levinson, 1983).

Another example highlights how important it is to consider the interlocutor's role in a conversation. This extract is from an Afrikaans conversation from AR at T1, discussed in Chapter 5 but repeated here for convenience.

[English gloss in italics. I=interlocutor]

1 **AR:** ...en dan sy. (0.8) Een ding jy is
and then she (0.8) One thing you are
[ ]
2 **M:** (man enters room) Now where is it?
(3.2)
3 **AR:** That's one you must keep because
4 **I:** Hy's
He's
[ ]
5 **AR:** It's <u>not</u> no no he's he's <u>not</u> interviewing me
6 **I:** Hy bly ook net hierso (0.7) Is die ou oom wat <u>baie siek</u> is
He also just lives here (0.7) It's the old man who's very sick
7 **AR:** Los hom net so uit
Just leave him alone

An analysis of the above example using syntactic measures, numerical summaries, or pre-determined category labels may have missed the subtle interplay between the languages the interlocutors used, and the distractibility effects of AD, all combining to result in inappropriate language use. CA however facilitated such a sensitive analysis by exploring how the conversation unfolded turn by turn.

Overcoming the impasse of language choice/separation distinctions

The advantage of using CA over the language choice/separation classification of language mixing (see 3.4.4) was strongly supported by the results obtained. By removing the temptation to label behaviour as either a choice or separation problem, CA fostered a more context-relevant explanation of the language switching behaviour. For instance, in the extract from EB above, her use of English in an Afrikaans conversation was neither indicative of a language separation problem nor a language choice problem (however defined). Indeed, even the label of 'inappropriate language mixing' is unsuitable in this case.

The language choice/separation distinction, as argued in Chapter 3, provides a dead end for data analysis because of the ambiguity involved in applying the labels to clinical data. CA had the advantage of being able to offer an analysis of how code switches did or did not affect the *quality* of interaction, and how ensuing trouble spots were managed. It is highly improbable that the cause of inappropriate langu ge mixing can be unambiguously determined in each naturalistic instance, as it is impossible to know what intra-speaker factors (such as attention, intention) influenced mixing in every case. It is conceivable that insights could be gained through experimental laboratory tasks. However, this totally removes the naturalistic dimension and still leaves open the question of how the experimentally verified levels of dysfunction might manifest themselves in real life conversation. This imposes a limit on any approach to assessing inappropriate language mixing behaviour. However, CA delivers a more constructive approach from its data-driven perspective, thereby removing ambiguity, and resulting in a more informative understanding of mechanisms operating in a conversation with a bilingual speaker with dementia.

CA, though, did not always yield an unambiguous insight into why language mixing occurred. On occasions speakers inserted an L1 utterance in a L2 conversation with no apparent reason from the context. The language switch did not seem to be prompted by a change in topic, lack of a lexical item, environmental distraction in the other language, nor for any other apparent reason. The switches may relate more to the possible effects of AD, such as disorientation to person or time. However, such effects are not always explicitly apparent to interlocutors or researchers. Interestingly, none of the unaccounted for code switches gave rise to a trouble spot, and therefore did not result in a repair trajectory that may have provided an insight into why the switch occurred. The low number of such occurrences in this study makes further comment impossible. A lengthier, systematic comparison of these behaviours awaits a more extensive study.

In conclusion, while the terms language separation and language choice can be neatly defined in abstract, there remains a great difficulty in unambiguously applying the terms to conversational behaviour. This study proposed that it is more helpful to discard these *a priori* categories, and instead engage in a focused, bottom-up analysis, as in CA. This dissertation has demonstrated the advantages CA offers for assessing language use in the bilingual speaker with AD. By concentrating on the systematic, collaboratively achieved interaction, CA removed the temptation to superficially label language mixing behaviour, and thereby achieved a less prejudged description and more insightful analysis of the area. CA showed how language mixing manifested itself, and how it did (or did not) disrupt the quality of interaction, in terms of type and amount of repair, and length of repair trajectory. CA enabled an insight into why some language switching occurred, and also highlighted the fact that not all language mixing can be considered inappropriate. While CA did not explain why code switching occurred in *all* instances, it remains a more systematic, more sensitive analysis tool than other discourse analysis approaches used in past studies on bilingual AD.

Future research ideas

A difficulty with analysing conversations across time is that every conversation will be different to the next. Different topics will be spoken about for different time lengths, with different interlocutors bringing their own communication style to the interaction. Even though an attempt at controlling the variables of different interlocutors was made in this study, this could not always be achieved as some interlocutors left the Residential Home before the study terminated. In addition, topics also varied as the nature of CA is to record a naturally occurring conversation that is not driven by pre-determined topics. However, future research could consider systematically varying the following parameters in order to ascertain their effect on communication and language separation abilities. Some of these variables have been shown to influence the talk constructed with monolingual speakers (e.g. Hamilton, 1994; Orange et al, 1996; Perkins, 1998) and the extent of language mixing behaviour in both healthy bilingual speakers and those with Alzheimer's Disease (e.g. Grosjean, 1982; Hyltenstam and Stroud, 1989). To what extent each variable listed below influences the construction of talk needs to be investigated in carefully controlled situations.

(a) The influence of different topics:

The degree to which topic reduces language mixing behaviour remained contentious from this study. In only one case did topic appear to minimise the amount of code-switching (EB, Afrikaans interaction at T2). This parameter therefore should be investigated in a more controlled manner. This could be carried out by constructing a semi-structured interview where various topics are introduced. By analysing the pre-morbid pattern of language use beforehand, topics can be manipulated in terms of subjects habitually spoken about in L1 versus those usually spoken about in L2. The amount of language mixing in each can then be compared to determine the effects certain topics have on language separation abilities. For instance, would a speaker find conversing about a work-related topic in their L1 more effortful if they pre-morbidly only spoke about such topics in their L2? Accordingly, would this increase in effort result in inappropriate language mixing as the resources necessary to sustain that effort become progressively depleted with AD? To answer this last question, the semi-structured interview could be repeated at regular intervals by the same interlocutor and changes in the amount and nature of language mixing could be calculated in a manner similar to that used in the present study.

(b) The influence of different interlocutors:

Discrepancies have been discussed between findings from Orange et al (1996) and results from this study pertaining to different interlocutor styles (see 10.1.2). Future studies could investigate the influence interlocutors have in minimising or promoting language mixing behaviour. For instance, a more familiar interlocutor may play a more didactic, dominant role in the conversation, while a relative stranger may play a more passive role, asking questions and refraining from initiating repair. A careful CA could identify the most successful communicative strategies used by an interlocutor to minimise language mixing behaviour, in a manner similar to studies on monolingual pathologies undertaken by Perkins (1993) and Perkins et al (1998).

(c) The influence of different settings:

Settings too can influence language mixing. For instance, if L2 was never spoken at home, a conversation in L2 taking place in that setting may be more prone to language interference, especially in the moderate to severe stages of AD where contextual support has been shown to boost communicative ability (Hyltenstam and Stroud, 1989). To explore this variable, a conversation taking place with the same interlocutor but in different environments could be recorded to determine the extent to which settings support language separation abilities.

These research suggestions have theoretical relevance in terms of establishing which factors exacerbate or minimise inappropriate language mixing in the context of depleting resource availability. However they also facilitate important clinical pointers as to the best manner in which to promote successful communication. For instance, talking with a familiar interlocutor in a familiar setting about topics pre-morbidly spoken about in that language may prove most effective in minimising language mixing behaviour. However, whether the aim of the research is to further theoretical insights into language separation abilities or to identify factors most conducive to promoting successful interaction in clinically relevant situations, the use of a single case study methodology is strongly indicated. Patterns of language use differ from person to person, as do interlocutor styles of communication. This unique and inherently variable nature of interaction thus demands an individualised approach to assessment.

The following sections explore several limitations of the study as far as methodological issues are concerned. The first limitation to be discussed is the time frame of examination.

11.1.3 Time frame

Due to time limitations, this study tracked changes in language and cognition for a period of twelve months only. However, as has been repeatedly highlighted in the Results and Discussion chapters, this time window was perhaps not sufficient to sensitively identify many changes, especially changes in conversational discourse abilities. In a disease lasting up to 15 years, differences in individual rates of decline have been emphasised in the literature, with some speakers deteriorating at faster rates than others, depending on the stage of dementia (e.g. Bayles et al, 1993, Haxby et al, 1996, Lezak, 1995; Maxim and Bryan, 1994). Because participants in the present study were at different stages of the dementing process, it is therefore not surprising that various language aspects deteriorated at different rates for different speakers. Thus, while a period of twelve months may be sufficient to identify intra-language changes and inter-language differences in some speakers (e.g. BL - in the mild-moderate stages of dementia), only a few changes were noted in others (e.g. JB and EB - both in the mild stages of dementia).

In addition, the question was raised whether what was found in the year period in fact is representative of each particular speaker's general pattern and rate of decline. In many cases the answer is affirmative as most hypotheses were confirmed, or if not confirmed, certainly not refuted. However, the important exception was BL. Contrary to the predictions made, performance on her L1 formal tests declined more rapidly than L2 over the year. However, discrepancies in severity of L1 versus L2 impairment suggest that L2 had already been deteriorating before the study commenced. It could therefore be argued that the starting and terminating points of the study arbitrarily bordered the investigation, yielding a misrepresentative picture of the rates of decline. If the study had commenced six months before it did, we may have indeed found a pattern of L2 deteriorating faster than L1.

The ideal solution to the difficulties described above would be to assess language and cognition in speakers who are in the very mild stages of dementia, and to track changes at regular six month intervals thereafter throughout the disease process. Six month intervals appear most suited to identifying periods of rapid decline, which may facilitate a deeper insight into which languages begin to deteriorate first, and how quickly this deterioration progresses (although see 11.1.3 final point). Such a study certainly is feasible and has been carried out with monolingual speakers (e.g. Bayles et al, 1992; 1993; Faber-Langendoen, 1988).

A second solution is to adopt a cross-sectional approach and compare bilingual speakers in the mild, moderate and moderate-severe stages of the Alzheimer's Disease. However, as cautioned in Chapters 1 and 2, both the bilingual population and the AD population are extremely heterogeneous. Since a cross-sectional approach is not suitable for gaining an insight into individual trajectories, results may reveal a misleading picture of decline in bilingual AD. However, cross-sectional studies may still prove useful in providing a loose indication of language patterns at various stages of dementia, and can certainly serve as important adjuncts to longitudinal studies.

In summary, this study tracked changes in language over the period of one year, for speakers who varied in terms of stage of dementia. All interpretations and conclusions from this study are therefore limited to a year's frame of a disease process that can last for up to 15 years. Different findings will be yielded depending on which stage of the individual's progression is assessed as a more rapid rate of attrition may be noted in the moderate stages of AD, while a relatively slow rate may be apparent in the mild stages. A need for longitudinal studies tracking changes from the early stages of the disease process onwards for several years is clearly indicated. The next section explores ways in which task sensitivity can be increased to identify changes as soon as possible after they begin.

11.1.4 Task sensitivity

It was predicted that complex tasks would be especially sensitive to decreasing neuropsychological support and inter-language differences since they relied on the successful integration of both linguistic and neuropsychological functions. However, results did not always support this expectation as only some tasks showed statistically significant changes over time and between languages, while others remained stable. These findings were explained as possibly reflecting a lack of sensitivity of the test battery in identifying intra-language changes or inter-language differences over time. An alternative explanation was that the time period assessed was too short for many changes to be noted, as discussed in the preceding section (11.1.3).

Task sensitivity could be increased in future studies in the following manner:

(a) In situations where test scores remained at or near ceiling for speakers in the mild stages of dementia, more complex tasks can be included in the battery. For example, similar to the methodology used by Kilborn (1991), noise can be introduced into the test situation, thereby degrading the quality of the input stimulus. This task should bring out inter-language differences as, by reducing the number of cues available, speakers have to resort to residual linguistic competence in order to compensate for the degraded cue. If linguistic competence is poorer in L2 than L1, then task performance should be better in L1, and more errors should be made in L2. A second method for identifying inter-language differences or intra-language changes over time in the mild stages of AD is to use reaction times for naming or cross-linguistic priming as an index of performance. Reaction times have revealed inter-language differences in healthy bilingual speakers (e.g. Chen and Leung, 1989; Meuter, 1994; Von Studnitz and Green, 1997). It is therefore expected that response times would increase subsequent to the onset of dementia (as has been demonstrated in studies of monolingual AD), thereby exacerbating any pre-morbid L1/L2 differences. This increase in response times can be measured and compared across languages and across time.

However, if the test battery is to be used clinically and not only for research purposes, then on-line tasks may not be a feasible option given financial and time constraints. Ideas for off-line tasks include a confrontation naming task constructed as outlined in 10.8.2 (Study 2), where test stimuli would comprise items of low frequency, low familiarity, and later age of acquisition - items more difficult to name even for the normal elderly (Hodgson and Ellis, 1998; Maxim and Bryan, 1994). Following on from this, inter-language differences should be revealed earlier on in the disease process for these items than they would on a confrontation naming tasks incorporating many high frequency words (as in the ABCD naming subtest).

Other modifications to the tasks included in this study's test battery involve the co-ordinate and superordinate naming tasks. Although proving sensitive to early language deficits in monolingual speakers with AD (Bayles et al, 1993), these tasks were completed successfully by speakers with mild dementia in this study (JB and EB). Five items were originally selected for the present study as the test was meant to be a screening task rather than an in-depth investigation of superordinate naming. However, since speakers performed at or near ceiling, it appears that the task should be modified to increase sensitivity to changes in the early stages of AD. To increase sensitivity, the categories selected could include more unfamiliar categories. In addition, the number of exemplars required could be increased from 5 to 10. Since task complexity has been shown to influence performance, this task would therefore be more complex in terms of levels of unfamiliar categories and number of exemplars requested, and therefore more sensitive to intra-language changes and inter-language differences.

(b) In situations where test scores are at or near floor, as common in the moderate to moderate-severe stages of AD, the possibilities of increasing test sensitivity are more limited. Individuals at this stage of dementia are often unable to complete many formal tasks. Therefore, in order to assess discrete language tasks such as naming and auditory comprehension, this could best be done by reducing demands on working memory. For instance, once the individual is no longer able to complete the Token Test, a comprehension test could be introduced where participants are required to identify the correct picture out of four, corresponding to the sentence read out. Such a test is the auditory comprehension subtest of the Psycholinguistic Assessments of Language Processing in Aphasia (PALPA; Kay, Lesser and Coltheart, 1992). By using pictures, this test reduces the load on working memory. In addition, for speakers in the moderate to advanced stages of dementia (such as AR), it might prove helpful to limit the possible confounding variable of visual perceptual deficits by using real objects instead of pictured stimuli in a confrontation naming task. In this manner, access to semantic concepts can still be assessed via language-specific routes.

However, in the later stages of AD, the most sensitive manner in which to detect intra-language changes and inter-language differences (especially with regards to language mixing) appears to be a Conversation Analysis. Similar to the methodology used in the present study, conversations can be analysed according to the amount and nature of language mixing behaviour, repair initiation, and length and complexity of repair trajectories. In addition, turn taking and topic maintenance skills can be investigated to infer progressive difficulties with information processing, working memory and attention - abilities that can no longer be formally assessed on individual tests.

In summary, to increase sensitivity of tasks for speakers in the mild stages of AD, timed tasks can be introduced where reaction times are compared across languages. Existing off-line tasks can also be modified in ways suggested in (a). For speakers in the more advanced stages of dementia, language tasks with a heavy reliance on neuropsychological abilities such as working memory should be substituted by tests that place less demands on working memory. However, while the original test battery can be modified and adapted, the range of formal tasks available to assess linguistic and cognitive parameters is reduced. Therefore, even though not sensitive to every change over time, Conversation Analysis appears to remain the most appropriate method of exploring inter-language differences for speakers in the more advanced stages of dementia.

11.1.5 Statistics

Although downward trends were evident from participants' performances, not all these changes reached statistical significance. However, there are a number of reasons why many changes in scores were not shown to be significant. Firstly, as discussed in 11.1.4, the tests themselves may not have been sensitive enough to identify deterioration. For instance, on the superordinate naming task, only 5 categories were tested. By modifying the existing tests or including other tasks as described in 11.1.4, test sensitivity would be increased.

Secondly, as discussed in 11.1.3, the speaker's stage of dementia could have been a contributing factor. From their longitudinal study, Bayles et al (1993) showed that a GDS of 5 (moderate-severe dementia) was a crucial period in that the fastest rate of decline in linguistic abilities occurred at this stage. In comparison, mildly demented speakers from their study only showed deterioration on tasks 12 months after entering the study. It therefore appears that the stage of dementia at which participants enter a study will contribute to the variations in findings regarding rate of decline. Hence, not all tests are expected to deteriorate to statistically significant extents for all speakers.

Thirdly, raw scores were frequently low. For instance, all of JS's Story Recall Immediate scores were below 4. Although over the year scores fell from 3 to 0, this was not picked up as a significant change by statistical tests, even though such a deterioration is qualitatively and clinically very important (discussed in 9.3). As noted by Gray and Della Sala (1996), with small sample sizes, the power of a statistical test in rejecting the null hypothesis is very low. The paucity of statistically significant results in this study may therefore be partly due to statistical tests of insufficient power.

Considering the above points, the importance of supplementing quantitative analysis with qualitative analysis is strongly urged. This was achieved in the present study by including error analyses on formal tasks, as well as using a bottom-up, detailed Conversation Analysis. Quantitative changes in scores did not necessarily equate with changes in functional communication, as discussed in 11.1.1. Likewise, a lack of statistically significant results did not necessarily imply an absence of change. Rather, this change was revealed through qualitative analyses, such as the emergence of unrelated errors on Confrontation Naming with BL.

There is one final point that needs to be raised concerning statistics and study designs such as that employed for this study: the issue of reliability. To increase reliability and decrease signal:noise ratios when assessing a disorder whose variability is its hallmark feature, repeated measures of the same test should be carried out (Gray and Della Sala, 1996). However, for the present study, this simply was not feasible. Each participant was requested to complete a battery of many tests, not only in one language, but in two. To administer each of these tests three times over raises many dilemmas. How justifiable is it to expect a person with AD to spend several weeks completing test after test, three times over in each language? Even if they do consent, how reliable are the results obtained anyway? Fatigue, decreased motivation, and even boredom might adversely affect test performance. Fluctuations noted may thus reflect influences of these parameters rather than effects of AD on language processing. In other words, did the nature of the study contribute to the observed variability, or was it caused by the disease process itself? A compromise between a need for reliable results and practical issues of data collection has to be reached. One solution is to have longer intervals between assessment periods to increase confidence that the changes in time are due to AD, rather than being temporary downward fluctuations. Alternatively, specific aspects of language can be examined that require only one test which could be administered several times over a few days.

11.1.6 Summary

This section discussed methodological issues arising from the study. First, Conversation Analysis was compared to formal tests to account for why different patterns were identified on each. It was discussed that while conversation possibly masks deficits identified on formal tests, it is most sensitive to language mixing behaviour because speakers were not able to sustain the inhibition of a dominant L1 for the full ten minute conversation. Next, it was concluded that CA was indeed a sensitive method of analysing language mixing behaviour, and circumvented many difficulties associated with imposing an arbitrary language choice/separation approach to data analysis. The final three sub-sections explored weaknesses of the study, namely the fact that a twelve month period was too short to identify many changes in language; tasks were not sensitive to changes in performance near ceiling or floor; and that while the study did supplement quantitative analyses with qualitative approaches, the signal:noise ratio may have undermined the reliability of statistical results. Ways in which these weaknesses could be improved in future studies were also discussed. The following section proceeds to explore the clinical application of findings from the study.

11.8 Clinical Implications

> *"There are a number of factors determining which language is preferred in a polyglot individual if he acquires an aphasia. No factor, however, can be considered isolatedly as a cause of the individual picture, but only if one evaluates it in respect to the total personality (premorbid and after insult) and to the environment in which he lives, in respect to the trend of the man to use language as a means for the highest form of self realization which he can achieve under the circumstances."*
>
> Goldstein (1948: 146)

The role of the speech-language pathologist is becoming increasingly important in the assessment and management of people with AD, and a need for appropriate and effective intervention has been strongly urged (Clark and Witte, 1995; Maxim and Bryan, 1994; Price, 1998; Ripich, 1995). However, with regards to bilingual speakers with AD, firm guidelines as to the management of such individuals are glaringly absent, despite a recent call by Obler et al (1995: 133) for professionals working with this population " to learn more about the communicative consequences of bilingualism". The present study, although limited to only 5 participants, has provided an important first step towards establishing a protocol of clinically relevant assessment and intervention strategies. Findings have highlighted several important clinical issues pertaining to assessment and management of bilingual speakers with AD, each of which is explored separately below.

11.8.1 Assessment Issues

Results from this study have suggested that a language learnt later in life will be more vulnerable to the effects of AD, irrespective of the level of proficiency attained. However, this conclusion is based on findings from a small group of speakers, and the extent to which this trend is representative of the larger bilingual AD population is as yet unknown. Until further research has provided these answers for us, no firm predictions can be made a priori as to the expected patterns and rates of loss. Therefore, a detailed, comprehensive and regularly-administered test battery is essential for determining the most effective clinical intervention strategies. Furthermore, the heterogeneous nature of both the AD and bilingual populations necessitates an individual approach to assessment. Each speaker has his or her own particular pattern of language use over the lifespan and level of language proficiency attained, and will vary in the rate of language attrition subsequent to the onset of AD. Each person should therefore be approached as a single case study, comparing changes over time to initial baseline scores. Moreover, both (or all) languages should be assessed. To only assess one language is the same as an audiologist only assessing hearing acuity in one ear. A bilingual speaker by definition uses both languages to communicate in everyday life. In addition, this study has shown how severity and rate of language loss may vary between L1 and L2. These findings further urge a thorough assessment of both L1 and L2.

Having established the need for an individualised assessment of both languages, the next issue is how best to carry out this assessment. Results from this study confirm that the test battery should draw on both formal tests and an ecologically more valid conversational assessment. As discussed in 11.1.1, different patterns may emerge from these contrasting methodologies. Therefore, to omit one is to sacrifice a holistic impression of the speaker's communicative and linguistic abilities (Frattali, 1992; Scherzer, 1992). Furthermore, formal test results are not always a reliable indicator of functional everyday ability. For instance, both EB and BL were largely successful in keeping their two languages separate on formal tests. In contrast, language mixing was a notable feature during connected discourse. This has important clinical implications, as in everyday life, conversations form the basis of social interaction, and inappropriate language mixing has the potential to adversely affect the quality of interaction.

The aim of the study was to administer a comprehensive and vast test battery in order to discern which tests are most sensitive to changes in time and across languages. However, if time is a factor as it usually is in a clinical setting, findings from this study can serve as guidelines of how the full test battery can be shortened or adapted to suit clinical demands. The hierarchy of tasks sensitive to inter-language differences (Figure 10) can be used as a guideline to determine which tests are most suitable for individual speakers. For instance, complex tasks were shown to be more sensitive to inter-language differences and changes over time than simple tasks, especially for speakers in the earlier stages of AD where scores on simple tasks were at ceiling. Therefore, if time limitations necessitate an abridged test battery, simple tasks can be omitted until the individual reaches the moderate stages of the disease process. Other ideas of how the test battery could be modified were discussed in 11.1.4 and can be incorporated into the original test battery. However, even though the test battery can be shortened, qualitative analyses and the ecologically valid CA should always be included as these parameters provide vital insights not afforded by quantitative raw scores. They facilitate an understanding of how the individual may compensate for various difficulties, or conversely highlight areas of concern not identified by statistical analyses (for instance the profile of L1 memory deficits in JS).

A final issue is the need for repeated assessment of L1 and L2. The test battery should be administered at regular intervals as this study has shown how languages may deteriorate at different rates. there therefore is a need for careful tracking and monitoring of language attrition so that difficulties can be identified and potentially overcome before they adversely affect the quality of social interaction. Repeated conversation analyses for interactions between the person with AD and his/her more frequent interlocutors in particular will yield invaluable information what strategies are useful or contra-indicated when conversing with a speaker with AD. The examples are elaborated upon in 11.2.2.

11.2.2 Clinical intervention

With speakers with AD, strengths need to be emphasised and harnessed in order to compensate for progressively increasing areas of deficit. For instance, as discussed in the monolingual literature, loads on working memory should be lessened, and increased used of contextual cues should be encouraged. However, *findings from this* study have specific clinical relevance for management of bilingual speakers with AD. Several examples will be highlighted, commencing with speaker BL who exhibited the greatest difficulty processing her L2 out of all the participants.

With BL, performance on both formal tests and CA revealed a discrepancy between her two languages. She found it more difficult conversing in her L2 (Afrikaans) than in her L1, with the profile on the latter indicating a mild to moderate level of impairment, while performance on the former consistent with a moderate to severe level. Management issues arising from BL's assessment results raise important questions. It is apparent from results on the language background questionnaire that L2 proficiency was sufficient to meet pre-morbid work and social demands. However, with the onset of Alzheimer's Disease, the neuropsychological support or resources that were available pre-morbidly, have deteriorated. One therefore needs to look closely at her present social situation. How is her quality of life affected because she cannot use her L2 as well as before? What modifications to her environment and social life need to be made to compensate for her decreased ability to communicate in L2?

Results from her assessment indicate that BL finds conversing in Afrikaans effortful and difficult. Therefore interlocutors should be encouraged to converse with her in English rather than Afrikaans in order to make the most of residual language skills, and to lessen the effort of conversing so evident when she spoke Afrikaans. Perhaps her family might consider moving her to an English-speaking Residential Home, or arrange to have staff at her present Home converse with her in English only. However, such interventions may exacerbate isolation and withdrawal - problems well-documented in the literature that affect even the normal elderly

(Lubinski, 1995). BL still has friends who speak Afrikaans only, and to reduce the number of occasions when they visit her will only increase isolation. Therefore, other strategies could be employed. For instance, in order to maintain the quality of interaction when her interlocutors are monolingual Afrikaans speakers, it may be beneficial to have a bilingual person present who can translate BL's code switches for the interlocutor should they present dire trouble spots in the interaction. In this manner, the interlocutor would be able to follow BL's talk, and could refrain from initiating other-repairs that may compromise BL's topic maintenance and flow of talk.

However, even though language mixing adversely affected the quality of interaction to a considerable extent for BL, this pattern was not echoed with the other participants who code switched. Rather, the relative paucity of repair following code switching suggests that the interlocutors could still follow the gist of the message conveyed. This implies that language mixing behaviour need not necessarily present an area of concern. If speakers can still relay their messages successfully then a need for clinical intervention is not indicated. Language mixing behaviour should be monitored and if it begins to adversely affect social interaction, then steps can be taken to compensate for this difficulty in a manner similar to that suggested for BL.

CA findings from other participants (apart from BL) have however identified various strategies that proved successful in minimising language mixing. The first examples is drawn from findings of other-initiated repair following code switching trouble spots. Even though interlocutors did not always explicitly request the speaker to talk in a specific language, the mere initiation of other-repair appeared sufficient to trigger a switch back to the appropriate language. In most cases, the repair outcome was usually successful, and the trajectories were kept short, thereby minimising disruption to the ongoing flow of talk. This strategy was successful in promoting a better quality of interaction.

A second example comes from the fact that language mixing sometimes occurred when speakers were distracted by external stimuli. For instance, language mixing increased with EB at T3 when she was distracted, and AR lapsed into the inappropriate language when an unknown man entered the room speaking English at T2. It may therefore be helpful for the interlocutor to focus their attention by calling their names, seating them on the chair opposite to the interlocutor's, but in close range, and minimising external distractions by conversing in a quiet room with the door closed. These strategies could minimise language mixing behaviour.

11.8.3 Summary

Although investigating language loss in bilingual AD is of vast theoretical importance, these speakers are not merely research opportunities. They are first and foremost individuals, part of a family and members of a larger society. It is therefore incumbent upon us as researchers to draw clinical implications from our findings in order to provide families and carers with concrete, useful suggestions as how best to care for bilingual speakers with AD. This study provided an important first step towards establishing the most effective and efficient manner in which to monitor language attrition, and to provide advice on strategies most conducive to promoting successful interactions. It is hoped that by promoting an individualised approach to assessment and management, a tailored and relevant intervention program can be implemented for each individual.

11.3 General Conclusion

This study was the first comprehensive, detailed investigation into language loss in bilingual speakers with AD. Since the (very few) previous studies in this area can be criticised heavily in terms of incomplete, flawed methodologies and conflicting terminology, our knowledge of what happens to the two languages of a bilingual speaker was negligible. What this study aimed to do was administer a detailed, methodically-compiled test battery, and analyse results with reference to findings from healthy bilingual speakers, monolingual and bilingual speakers with AD, and existing theories of bilingual language production. The test battery was derived from findings of language decline in monolingual AD, and incorporated a new approach to analysing language separation at the level of conversational discourse: Conversation Analysis. The battery was then administered to five bilingual speakers with AD, tracking changes over a period of one year. Hypotheses were postulated based on findings from healthy bilingual speakers, and from the limited findings from previous studies on bilingual AD. Inevitably, such a preliminary investigation into a relatively unexplored field raised more questions than it did answers. However, it did provide important new insights into how the pathology of AD affects the two languages of a bilingual speaker, and furthermore established theoretical foundations upon which future research can expand and refine.

The findings of the study revealed that in general, the pattern of deficits and rate of language attrition found in bilingual speakers with AD were similar to those described in the monolingual AD literature. The heterogeneity in results from the bilingual speakers reflects the heterogeneity of findings from the monolingual AD population.

Several hypotheses were postulated at the start of the study. Firstly, it was hypothesised that with all factors being equal (i.e. both languages acquired at similar ages, through similar methods, reaching similar levels of proficiency, and used in similar patterns over the lifespan), a similar pattern, severity and rate of language loss would be evident. This hypothesis was supported by results from the single speaker in the study with a balanced language history profile.

With regards to patterns of language loss for speakers who learnt their L2 after acquiring their L1, hypotheses were again supported by results in that a similar pattern of impairment was evident across languages. For instance, if naming was affected in the one language, it would also be affected in the other. However, with regards to severity of impairment, results did not always confirm the hypothesis that L2 would be more impaired than L1. While this prediction was upheld in some speakers, L1 and L2 were similarly impaired/spared for other speakers. These discrepancies were attributed in some cases to the stage of dementia, in that in the early stages of the disease, many tasks employed were not sensitive to inter-language differences, as sufficient neuropsychological support remained to compensate for potentially incomplete L2 knowledge. In other case., similar severity of impairment across languages reflected a high level of L2 automatisation achieved in adulthood.

The third prediction was that L2 would deteriorate at a faster rate than L1. Again this hypothesis was not confirmed by all results. In particular, findings from the Conversation Analysis revealed that no changes in extra-linguistic parameters and verbal expression abilities occurred over time for all speakers except one. Discrepancies between what was predicted and what was found could be artefacts of the (relatively short) time window of examination, insensitive assessment tasks, and the heterogeneous nature of the population being assessed.

The fourth prediction was that language mixing would mainly affect L2 interactions. This hypothesis was confirmed across all participants even though the extent of language mixing behaviour varied from speaker to speaker. The amount of code switching increased for two speakers over the year as a result of an increase in intersentential switches. An additional finding was revealed regarding a paucity of self-initiated repair following code switching trouble spots as compared to many instances of self-repair following intra-language trouble spots. This finding warrants further investigation to determine whether the trend resulted from pathology or whether this is a trend also apparent in healthy bilingual speakers.

The fifth prediction was that complex language tasks would appear to be more compromised by deteriorating neuropsychological support than less complex tasks, and that L2 would be more affected than L1. Both these hypotheses were supported by results, although the extent to which complex language tasks appeared to be influenced by declining neuropsychological support varied across languages and across speakers. This inconsistency may reflect individual variation, the relatively short time slot of examination, and/or sensitivity of tests to identify changes in time

Finally, of the variables hypothesised to influence the pattern and rate of language attrition (namely: age and method of L2 acquisition, pattern of language use over the lifespan, and relative levels of language proficiency), results suggested that a language learnt later in life will never become fully automatised, even if high levels of L2 proficiency had been attained in adulthood. The higher the L2 proficiency, the more resistant the language to the effects of AD. However, the differences in levels of L1 versus L2 automatisation levels resulting from different ages of language acquisition will be unmasked in the later stages of the disease process as resources become considerably diminished.

In conclusion, although preliminary, this study involved the first detailed exploration of a rich and complex field. The contribution this thesis has made lies in its comprehensive and original methodology, covering both cognitive and linguistic assessments, and investigations at the level of formal tests and conversational discourse. The longitudinal single case study approach facilitated a new and detailed insight into the pathology of bilingual AD, overcoming many flaws inherent in the few previous studies in this field. What has been found is an important contribution to this as yet vastly under-researched field of knowledge, but considerable research is necessitated in order to achieve a fuller understanding of the area of bilingual dementia.

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APPENDIX 1

Afrikaans

Afrikaans falls under the West Germanic branch of Indo-European, having been derived from 17th century Dutch. Although it has severed its main ties with Dutch, it has retained its Germanic character over the years (Campbell, 1991; Van Schalwyk, 1988). Afrikaans has been influenced by many languages including Khoisan, French and English. Originally called Kaaps-Hollans, the language was named 'Afrikaans' only towards the end of the 19th century, and received its status as a joint official language with English in 1925 (Campbell, 1991). It currently remains one of the 11 official languages of South Africa.

Overview of the Structure of Afrikaans (adapted from Campbell, 1991, and Van Schalwyk, 1988)

(a) Phonology
Similar to Dutch, although some modifications are evident, e.g. loss of the Dutch intervocalic /x/ in Afrikaans. Stress is free, and is associated with pitch. The root of the word is usually stressed, but in some verbs, the prefix is stressed.

(b) Morphology
Grammatical gender marked in Dutch has been dropped in Afrikaans. Similar to English, the definite article "die" and indefinite article " 'n" apply to all nouns. The plural markers 'e' and 's' are used, while case is not inflected.

(c) Syntax

Adjectives:	Precede nouns. Usually inflected.
Pronouns:	Third person singular is marked for gender.
Nouns:	No declensions. Varied plural forms.
Verbs:	The only inflection is a "ge-" prefix on most past participles. For the passive form, the modal auxiliary "word" is used.
Negation:	The double negative "nie" directly after the verb, and at the end of the sentence e.g. "Ek praat nie Engels nie" (I don't speak English).
Word order:	Similar to Dutch. Verb-second in main clauses (SVO), and word final in subordinate clauses (SOV). The principle clause however has a VSO word order if it is preceded by a subordinate clause.

APPENDIX 2

Letter of Consent

This study will look at how various aspects of language (e.g. vocabulary, grammar, understanding, how people manage in conversation) are affected by Alzheimer's Disease and how they change over the period of one year. We will look at how you get on speaking in your different languages. We will also ask you how well you recognise places, how well you remember things, and how well you manage when there is more than one thing to remember at a time.

Three assessments will be carried out: when we first meet, about six months later and about one year later. Each set of assessments will last for about five hours, but these can be spread out over a few days if necessary. Each assessment will involve an interview with you and your spouse/carer about how you have been managing generally. Then we will carry out short tasks with you to look at your vocabulary, grammar and so on. None of the tasks will involve more than a few words' response or paper-and-pencil tasks.

Participation in this study is purely voluntary, and you can choose to discontinue taking part at any time without any penalty. Confidentiality will be maintained and at no time will your name appear in any communications to do with the study.

If you have any questions about this research, you can ask me, or contact Dr Nicholas Miller at the University of Newcastle Upon Tyne (in England) at 0944 191 222 5603. The address is:

Department of Speech
King George VI Building
University of Newcastle Upon Tyne
NE1 7RU
England

For any queries about research subjects' rights, please contact the Committee for research on Human Subjects at Johannesburg (011) 716 3582.

Signed: ______________________________

Date: ______________________________

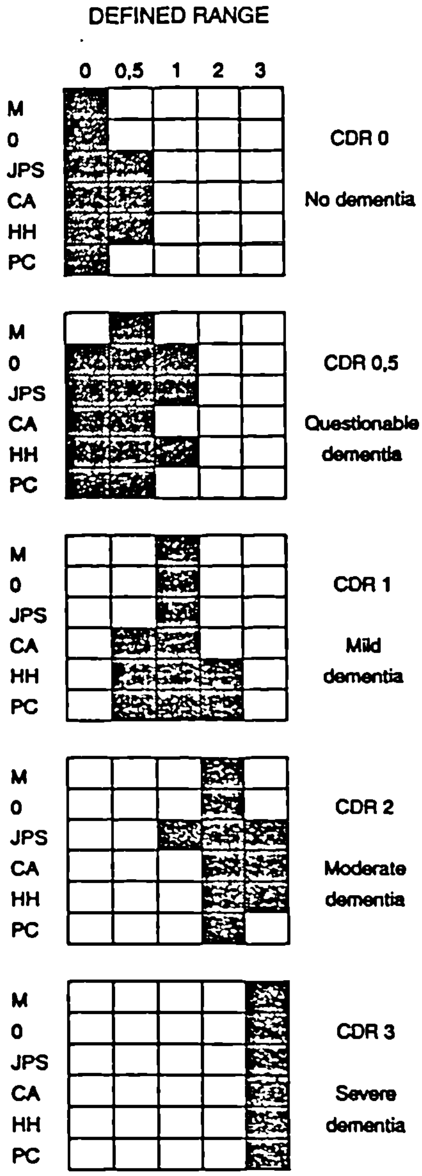
APPENDIX 3

Clinical Dementia Rating (CDR)

From: Hughes, Berg, Danzinger, Coben and Martin (1982: 568-569).

Clinical dementia rating (CDR)

	Healthy CDR 0	Questionable dementia CDR 0,5	Mild dementia CDR 1	Moderate dementia CDR 2	Severe dementia CDR 3
Memory	No memory loss or slight inconstant forgetfulness	Mild consistent forgetfulness; partial recollection of events	Moderate memory loss, more marked for recent events; defect interferes with everyday activities	Severy memory loss; only highly learned material retained; new material rapidly lost	Severe memory loss; only fragments remain
Orientation	Fully Oriented		Some difficulty with time relationships; oriented for place and person at examination but may have geographic disorientation	Usually disoriented in time, often to place	Orientation to person only
Judgement problem solving	Solves every day problems well; judgement good in relation to past performance	Only Doubtful impairment in solving problems, similarities, differences	Moderate difficulty in habdling complex problems; social judgment usally maintained	Severely impaired in handling problems, similarities, differences; social judgement usually impaired	Unable to make judgements or solve problems
Community affairs	Independent function at usual level in job, shopping, business and financial affairs, volunteer and social groups	Only Doubtful or mild impairment, if any, in thes activities	Unable to function independently at these activities though may still be engaged in some; may still appear normal to casual inspection	No pretence of independent function outside home	
Home hobbies	Life at home, hobbies, intellectual interests well maintained	Life at home, hobbies, intellectual interests well maintained or only slightly impaired	Mild but definite impairment of function at home; more difficult chores abandoned hobbies and interests abandoned	Only simple chores preserved; very resticted interests, poorly sustained	No significant function in home outside of own room
Personal care	Fully capable of self care		Needs occasional prompting	Required assistance in dressing, hygiene, keeping of personal effects	Requires much help with personal care; often incontinent



Use all information and make the best jugdment. Score each category (M, O, JPS, CA, HH, PC) as independently as possible. Mark in only one box, rating each according to the subject's cognitive function. For determining the CDR, memory is considered the primary category; all others are secondary. If at least three secondary categories are given the same numerical score as memory, then CDR = M. If three or more secondary categories are given a score greater or less than the memory score, CDR = score of majority of secondary categories, unless three secondary categories are scores on one side of M and two secondary categories are scored on the other side of M. In this last circumstance, CDR = M.
When M = 0.5, CDR = 1 if at least three of certain others (O, JPS, CA, HH) are scored 1 or greater (PC not infuential here). If M = 0.5, CDR cannot be 0; CDR car only be 0.5 or 1. If M = 0, CDR = 0 unless there is slight impairment in two or more secondary categories, in which case CDR = 0.5.

Figure 1. The assigning of the CDR. Shaded areas indicate defined range within which scores of individual subjects must fall to be assigned a given CDR.
M = Memory; O = Orientation; JPS = Jugment and problem solving; CA = Community affairs; HH = Home functions; PC = Personal care

APPENDIX 4

Language Background Questionnaire

(Adapted from the BAT; Paradis, 1987)

Childhood / Family Background

1) What is your date of birth?

2) Where were you born?

3) As a child, what language did you speak most at home?

4) As a child, did you speak any other languages at home? If so, what were they?

5) What was your father's native language?

6) Did he speak any other languages?

    (a) If so, what were they?

    (b) What language did he speak most to you at home?

    (c) Did he speak any other languages at home? If so what were they?

7) What was your mother's native language?

8) Did she speak any other languages?

    (a) If so, what were they?

    (b) What language did she speak most to you at home?

    (c) Did she speak any other languages at home? If so what were they?

9) Did anyone else take care of you as a child?

    (a) What was his / her native language?

    (b) Did he / she speak any other languages?

    (c) If so, what were they?

    (d) What language did he / she speak most to you at home?

    (e) Did he / she speak any other languages at home? If so, what were they?

10) What language did you speak most with friends as a child?

11) At what stage did you start speaking English?

12) (a) Were you taught English formally at school?

    (b) Did you pick up English speaking with family / friends?

    (c) Did you pick it up in any other situation?

13) At what did you start speaking Afrikaans?

14) (a) Were you taught Afrikaans formally at school?

    (b) Did you pick up Afrikaans speaking with family / friends?

    (c) Did you pick it up in any other situation?

15) Was the community in which you grew up bilingual (i.e. extended family, friends, school, shopkeepers ...).

Education

16) How many years of education have you had?

17) When you started school, what was the language of instruction?

18) What language did most of the other children speak at this school?

19) Did you change to a school with another language of instruction after that?

    (a) What was this language?

    (b) After how many years did you switch to this new language of instruction?

    (c) What language did most of the other children speak at this school?

20) Did you change to another school with a different language of instruction after that?

    [Repeat Q 19 a-c]

21) Did you study further after school?

    (a) what?

    (b) where?

    (c) in what language?

    (d) dates?

Occupation

22) What was your occupation after you completed your education?

23) What language/s did you speak at work?

24) Did you move away from your community when taking up this job?

    (a) where?

    (b) was this a bilingual community?

25) Subsequent work history:

    (a) place

    (b) languages spoken

    (c) dates

Premorbid Background

26) Have you ever lived in another country where you learned another language?

(a) where?

(b) dates?

27) With English, could you: -read

-write

-speak fluently

-understand everything

28) Where did you use English (e.g. home, work, friends, shopping)?

29) With Afrikaans, could you: -read

-write

-speak fluently

-understand everything

30) Where did you use Afrikaans (e.g. home, work, friends, shopping)?

Marital Status

31) Are you single / married / divorced / widowed?

32) At what age did you marry your spouse?

33) (a) What language does he / she speak?

(b) Would you consider him / her bilingual?

(c) What language/s do you speak with each other?

34) Any previous marriages?

[Repeat Q 32-33]

35) Do you have any children?

(a) Ages?

(b) What language/s do you speak with them?

(c) What language/s does your spouse speak with them?

(d) What language/s do they speak with each other?

(e) What was the language spoken by teachers at their school?

(f) Do their friends speak English / Afrikaans / both?

(g) Do their spouses speak English / Afrikaans / both? (if relevant)

(h) Do their children speak English / Afrikaans / both? (if relevant)

Current Language Status

36) What language/s do you speak at home / in Residence?

37) What language/s do you speak with your friends?

38) In what language do you -read newspapers
-listen to the TV / radio

39) Can you still read / write / speak / understand English
-as well as before?

40) Can you still read / write / speak / understand Afrikaans
-as well as before?

41) Where are you living now?
-is it a bilingual environment?

42) Are you more comfortable using one language above the other?
(a) Which?
(b) Why?
(c) Has this changed over time?

43) In what situations do you use English? (e.g. socialising, family / caregiver, priest, shopping etc. ...).

44) In what situations do you use Afrikaans? (e.g. socialising, family / caregiver, priest, shopping etc. ...).

45) Is there anything else you would like to tell me?

APPENDIX 5

Memory Recognition Task

Instructions to participants: This is a memory test for words. Can you see this word? I'm going to cover this word next and wait for 10 seconds. After that I'll turn the page. There will be the old word and a new one. You must POINT to the NEW word.

Give 10 seconds to decide. If answer is incorrect, SHOW (don't say aloud) the correct one and continue. Accept self-corrections as correct.

1. truth
2. right
3. thing
4. month
5. sense
6. trade
7. piece
8. front
9. order
10. level
11. value
12. claim
13. place
14. cause
15. range
16. force

APPENDIX 6

Concept Definition Scoring (from ABCD manual: 20-23)

Three points: Awarded to a definition containing at least three ideas, one of which is a use/function of the item, another an attribute. The third idea can be either a function or attribute. If more than three ideas are provided, the response is still awarded only three points.

Two points: Awarded to a definition that contains two uses/functions, attributes, or a use/function and an attribute.

One point: Awarded to a definition containing one idea e.g. Broom = "for sweeping".

APPENDIX 7

Superordinate Naming

Give the group that these belong to (they are all ...)

1) red, yellow, blue	(colours)
2) shirt, dress jacket	(clothes)
3) tennis, soccer, golf	(sport)
4) trumpet, drums, piano	(musical instruments)
5) milk, tea, Sprite	(drinks)

Coordinate Naming

Give 5 (give first subordinate in brackets if no response):

1) colours (red) ____ ____ ____ ____ ____
2) clothes (shirt) ____ ____ ____ ____ ____
3) sport (tennis) ____ ____ ____ ____ ____
4) musical instruments (trumpet) ____ ____ ____ ____ ____
5) drinks (milk) ____ ____ ____ ____ ____

Appendix 8

Sentence Translation Task

1) I had toast and coffee for breakfast today
2) My sister will start her new job tomorrow
3) My neighbour bought a beautiful table for her kitchen
4) I play cards every night with my friends
5) There is a small house on the corner for sale

APPENDIX 9

Transcript Symbols (adapted from Lesser and Milroy, 1993)

(0.0)	Gaps in tenths of seconds
(.)	Micropause
(hhh)	Laughter
= =	Latched utterances (no pause between turns)
:	Prolonged syllable (e.g. mme for 'me'; hee for 'he')
?	Rising intonation contour (e.g. as when asking a question in English)
[ ]	Overlapping utterances (speakers talk at the same time)
-	Cut-off of prior word or sound
° °	Relatively soft speech
CAPITALS	Relatively loud speech
> <	Relatively fast speech
underlined	Extra stress/emphasis
[...]	Words omitted from original transcript

Glossary

Tokens:	e.g. "Mm" "MmHmm"
Minimal turn:	Consists of single words e.g. "Yes" "No" and/or tokens.
Attributable silence:	A silence that occurs after a turn before the next speaker who has been selected starts talking.
Topic:	Theme of talk; subject matter.
Topic maintenance:	Appropriately extending a topic over numerous turns.
Topic shift:	Shifting from one topic to another.
Turn distribution:	Refers to the amount of talk each speaker constructs during their turn. If the turns of Interlocutor A are of similar length to those constructed by Interlocutor B (in terms of utterances), then turn distribution is regarded as balanced.
Trouble spot/source:	This is a difficulty or error that has occurred
Repair trajectory:	Refers to the repair sequence consisting of the trouble source, repair initiation, and repair completion.
Turn Constructional Unit (TCU):	This refers to an interlocutor's turn in the conversation.
Transition Relevance Place (TRP):	This is the recognisable end of a TCU.

APPENDIX 10

<u>Extract from the Conversation Analysis of AR (English T1)</u>

Below follows an extract of the English conversation with AR at T1. The purpose of this extract is to illustrate how turn distribution was calculated, and how active versus passive roles were decided.

I = Interlocutor. English gloss in italics.

1. **AR:**	I know when my sister she was then older than I. (0.4) And I said to my mom
2.	that's not fair (hhh) she said well you come in those same things, see, because
3.	she's old as jy and she knows what to do.
	you
4. **I:**	Yes: yes
	[ ]
5. **AR:**	And now you uh you can wait (0.3) a year or two. And then you can do
6.	it=
7. **I:**	=and then it's YOUR TURN=
8. **AR:**	=yes
9. **I:**	Oh gosh it must be quite frustrating being a younger sister then. You always
10.	have to wait until you get older for your turn.
11. **AR:**	Ja, for your turn (0.4) Yes, yes you have to
	[ ]
12. **I:**	I'm lucky because I have a younger sister. And I'm
13.	the oldest so I get my turn first (hhh)
14. **AR:**	You're <u>lucky</u>
15. **I:**	I <u>am</u> lucky
	[ ]
16. **AR:**	You're <u>lucky</u> because <u>I'm</u> the youngest that's why that's why
17. **I:**	So you had to wait for three people to do it before your turn=
	[ ]
18. **AR**	YES
19. **AR:**	=I I was youngest of three people before I could say
20. **I:**	Shame (hhh) So did you use to get all the old clothes too?
21. **AR:**	Ah no- uh: f:unny. My mother uh changed it (0.3) She takes the thing and then
22.	it looks the same as the other one. Then she (0.3) cut it and uh and make it two.
23. **I:**	Oh so she made duplicates so mm:::
24. **AR:**	Ja, so that she could (0.4) uh <u>change</u> it again you know
25.	(0.7)
26. **I:**	Oh so you mean you got your your brother's or sister's old clothes. (0.3) But
27.	she fixed it up and she::
28. **AR:**	Yes=
29. **I:**	=she made it nice
30. **AR:**	She made it nice. <u>Very</u> nice.

Comment: Turn distribution is balanced.

Evidence: Both interlocutors construct major turns of similar length, with an average of two utterances per turn. Both also construct minor turns (e.g. lines 4, 8, 18, 28) which serve as feedback of understanding and agreement.

Comment: AR plays an active role in the conversation.

Evidence: She introduces new information into the conversation (lines 1-3), and elaborates on the topic too (lines 21-22), providing more information than was requested by the interlocutor. She also makes use of minimal turns to convey confirmation and agreement (e.g. lines 18 and 28), thereby showing she is attending to the interlocutor's talk.

Comment: The interlocutor assumed a more passive role in as far as introducing new information into the conversation is concerned.

Evidence: The interlocutor only gave new information about herself in line 12. For all her other turns, she either paraphrases AR's talk (e.g. lines 7 and 23), or asks a questions requesting new information (e.g. line 20).

The Conversation Analyses of other speakers in the study were analysed in a similar manner. This extract serves as an illustration of how certain conclusions were reached.