Paths of mental access in aphasic narratives

PATHS OF MENTAL ACCESS IN APHASIC NARRATIVES

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Final Year Project submitted for SL6036, formatted for *Aphasiology.*

Word Count: 6,841

ACKNOWLEDGMENTS

I would like to thank Professor Sue Franklin for her invaluable input, guidance and support throughout this project. Huge thanks also to my family for their patience and support over the last 2 years, in particular to my dad Ciaran for being ever-generous with advice and his willingness to proof-read earlier drafts *ad nauseam*. Last but not least I truly appreciate my good friend Sarah Corrigan and fab classmates Michelle Boles, Claire Johnston, Rachel Kennedy, Cáit O'Halloran, Síle O'Shea and Bridget Scanlon, all of whom kindly gave up their time to parse samples in the pursuit of inter-rater reliability. The responsibility for the contents of this dissertation is incumbent on myself alone.

ABSTRACT

Background: Aphasia is generally taken to be a language-specific impairment and cognitive difficulties are not predicted from traditional models of aphasia. Furthermore, it has been shown that people with aphasia have relative strengths at the macro level of discourse, which is arguably more cognitive than linguistic. Many contemporary semantic approaches however, demonstrate the cognitive underpinnings of language and discourse structure. Within Cognitive Linguistics, all linguistic form is conceptually meaningful. Information structure follows temporal, spatial and causal *paths of mental* access, and builds upon what has already been established in the discourse space. Such an approach transcends lexicogrammatical analysis of discourse cohesion, and schematically unites macro and micro levels of discourse as instances of more generalised cognitive processes.

Aims: This study uses a Cognitive Linguistics approach to investigate whether people with fluent and non-fluent aphasia have difficulty at macro and micro levels, and whether there is any correlation of difficulty at each level.

Methods & Procedures: 32 Cinderella story samples were cleaned and segmented into attentional frames (10 normal controls, 16 with non-fluent aphasia and 6 with fluent aphasia). The samples were analysed for problems with macro and micro discourse levels as follows:

1. Macro level: temporal order, retrospective elements and prospective elements
2. Micro level: pronouns, definite / indefinite article omission or errors, subject +/or object omission and proportion of nominal attentional frames.

Non-parametric testing was performed to determine evidence of significant differences between and within groups, and correlation across levels.

Outcomes & Results: There is evidence of significant differences across groups for both macro-level variables and micro-level variables, apart from article errors. Problems with prospective and retrospective elements are correlated with the omission of subject +/or object; and high proportions of nominals are also correlated with retrospective element errors. There is no correlation between temporal order and micro-level difficulties. Furthermore inspection of the results suggest a double dissociation between temporal order difficulties and both omission of subject +/or object and proportion of nominals.

Conclusions: The results indicate that people with aphasia have difficulty at both macro and micro discourse levels. Furthermore, there is evidence for dissociation as well as correlation between macro and micro level errors. The results create possibilities for schematic description of aphasia across discourse levels within a cognitive linguistic paradigm. Further research is indicated regarding the pattern of correlation between levels, as well as more finely-grained analysis of the factors responsible for breakdown at the macro level.

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1. FROM FORMALIST TO FUNCTIONAL ACCOUNTS OF APHASIC DISCOURSE

1.1 Models of aphasia

Since the end of the 20th century psycholinguistic, linguistic, cognitive and psychosocial approaches have been increasingly influential in aphasiology (Code 2013). Sentence processing models, such as Garrett's Production Model (GPM) (Garrett 1988; Schwartz *et al* 1985), derived from speech error data, have provided therapists with the tools required to diagnose and treat overt sentence production difficulties that may be secondary to breakdown at a higher level of language processing (Marshall 2013).

GPM assumes three hierarchically organised levels of processing – the pre-linguistic *message* level (although some authors argue that language shapes thought to some extent (e.g. Levelt 1989; Slobin 1991); the *functional* level (selection of verb and predicate argument structure); and the *positional* level (construction of surface form of sentence including phrase structure, grammatical morphemes and phonology).

Although widely used by clinicians, GPM does not allow for feedback and interaction between processing levels (Bock 1987), effects of task constraints on language production (Webster, 1999) or differences between language production and reception (Dipper *et al* 2005). Additionally GPM's description of how concepts are mapped from message to positional levels and how non-arguments are produced has been shown to be under-specified (e.g. Webster 1999). This has implications for identifying and treating the exact level of linguistic breakdown in individuals with aphasia.

A distinction is commonly drawn between fluent (paragrammatic) aphasias characterised by substitution errors, and non-fluent (agrammatic) aphasias characterised by omission errors. In practice however there tends to be variability and overlap between fluent / non-fluent groups (e.g. Webster 1999). Furthermore, cross-linguistic research suggests that substitution is the dominant error pattern across all groups (e.g. Slobin 1991; Crago *et al* 2008), but that 'agrammatics' tend to be semantically closer to the target in gender, number, case and tense (Menn and Obler 1990).

There are various theories about the underlying nature of language breakdown in people with aphasia (see Marshall 2013, pp.198-9 for an overview). For example non-fluent aphasia has been attributed to central syntactic impairment (e.g. Grodzinsky 2000); difficulty

activating (intact) syntax (Kolk 2006); and impaired sentence processing system (Mitchum and Berndt 2008). Fluent aphasia has been attributed to difficulty controlling syntax (Butterworth and Howard 1987); and impaired access to syntactic processes.

Aphasia has traditionally been viewed as a language-specific impairment, however more recently researchers have been examining the interaction between language and thought (e.g. Dipper *et al* 2005), and the impact that cognitive disorders, such as frontotemporal dementia, have on language (Silveri *et al* 2003). It has been suggested that an explanation of why individuals with aphasia have the particular difficulties that they do, will only be possible by integrating knowledge from linguistics and psycholinguistics (Black and Chiat 2008), and indeed that clinicians are not sufficiently refreshing their approaches in line with new theories (e.g. Conroy *et al* 2006). The next section explores linguistic analysis of aphasia in more detail.

1.2 Linguistic analysis of aphasia

There is much evidence to show that many people with aphasia, particularly agrammatic aphasia, have difficulty with selection and retrieval of verbs and their arguments (Cairns *et al* 2007; Black and Chiat 2008) and grammatical inflection, particularly tense-marking (Faroqi-Shah and Thompson, 2007). There are various suggestions as to why verbs are particularly problematic, such as their relatively lower imageability compared with other word types (Bird *et al* 2003). Additionally it has been shown that difficulty increases for 'reversible' transitive situations and voice-raising constructions (e.g. Thompson 2003); verbs with 3 arguments (Thompson *et al* 1997; Byng and Black 1989).

Clinical linguistic analysis of aphasic language has traditionally been concerned with breakdown at a single level, i.e. overt features of sentences and clauses. Analytic tools include morpho-syntactic analysis, inflectional errors, omission of obligatory arguments and assessment of complexity and variety of verb and construction types (Webster 1999). Thematic role analysis (Dowty 1991) is also widely used, and has permitted clinicians to determine patterns of difficulty at the syntax-semantic interface, (for example with predicate argument structure and voice-raising operations). This is particularly useful in languages like English, in which mapping for non-canonical word order is highly opaque.

There has been much debate in recent years however, regarding the limitations of analysing role reversal errors and omission of arguments (Byng and Black 1989). Similarly,

semanticists over the past 30 years have started to propose that meaning is specified not by thematic roles, but by the linguistic constructions that incorporate them (see Saeed 2007 for discussion). Rather than being divided into regular and irregular, constructions are graded from simple to complex, and from concrete to abstract (Tomasello 2003). They correspond to conceptual events, which may be analysed schematically in terms of sub-event components such as perspective and attentional processes, space and time construal, motion events and force dynamics and causation (for example Jackendoff 1997; Talmy 2003; Pustejovsky 1995; Goldberg 1995; Langacker 1987).

This is in line with more recent clinical research suggesting that language production *"requires schematisation or simplification of conceptual information for coding in language"* (e.g. Dipper *et al* 2005). Language impairment at pre-verbal level can impair the 'thinking for speaking' (term from Slobin 1996) necessary to formulate the event structure required for complex verb types (Black and Chiat 2000, 2003; Dipper *et al* 2005). Note that 'thinking for listening' is the distinct but equivalent pathway for extracting event structure from heard language *(ibid*). Transactional verbs with 3 arguments and several possible perspectives (such as *buy / sell*) are thus more difficult for people with aphasia than verbs with an equivalent number of arguments with less possible situation perspectives, (such as *running, walking from a to b*) (Dipper *et al* 2005, p.428). It is thus suggested that verbs with additional possible perspectives have more complex requirements at the 'thinking for speaking' stage.

In order to describe an event, it is necessary to identify the main participants and their relative prominence, and assume a particular temporal and aspectual perspective on the event (Marshall 2013). Although event-structure specification lies at the conceptual level, some researchers argue that such decisions must be '*linguistically sensitive*', in that "*the speaker has to construct a message that can be mapped onto the language that he or she plans to use"* (Marshall 2013, p.200). Indeed many researchers are critical that existing verb therapy approaches fail to engage with linguistic theory and take into account the complexity of verb meanings (Conroy *et al* 2006*;* Marshall 2013).

Analysis of aphasic language has generally focused on breakdown at word and sentence levels; however researchers and clinicians are increasingly interested in the functional communication and discourse of people with aphasia (Armstrong *et al* 2013). Discourse analysis commonly focuses on the lexicogrammatical cohesion of aphasic texts,

using an approach based on Halliday and Hasan (1976) (e.g. Lock and Armstrong 1997). People with aphasia have been shown to have difficulty with micro (clausal) level cohesion, for example the impaired referential cohesion and pronouns of people with fluent aphasia (Nicholas *et al* 1985). At the same time, people with moderate aphasia are reported to have relatively intact macro (inter-clausal) level discourse structure and overall quantity of information (e.g. Lock and Armstrong 1997; Lemme *et al* 1984).

1.3 A Cognitive Linguistic approach to aphasia

The field of Cognitive Linguistics has developed in parallel to neuropsychology, cognitive science and theories of grounded cognition (e.g. Barsalou 2008) and encompasses various approaches such as cognitive grammar, conceptual metaphor, construction grammar, conceptual semantics, and blends and mental spaces (Ungerer and Schmid 2006). Cognitive Linguistics provides an alternative to traditional formal grammar frameworks for understanding linguistic constructions (Tomasello 2003). All linguistic form is conceptually meaningful, including the closed classes, which are often problematic for people with aphasia.

Within this paradigm the notion of a formal 'Grammar' of a language (cf Chomsky 1980) is a myth – instead linguistic meaning is perspectival, subject to change, non-autonomous of cognition and grounded in sensory-motor and cultural experiences (Geeraerts 2006). As grammar is 'meaningful', it is key to understanding cognition itself (Langacker 2008). Aphasia is traditionally understood as a language-specific impairment, but to what extent do other cognitive processes interact with language, and underpin its organisation? As above, some contemporary researchers are examining the possible impact of impaired 'thinking for speaking' on sentence production and linguistic realisation of event structure. How might such difficulties impact on discourse?

Within Cognitive Linguistics, discourse itself is the basis for understanding language. Linguistic structure is "*indissociable from other factors involved in language use"* (Langacker 2008, p.459). The following discussion is a brief overview of Langacker's (2008) Cognitive Grammar discourse principles (see Appendix 1 for more detail and examples). Central to the analysis of discourse is the concept of *natural paths of mental access and search* for presenting, tracking and interpreting new information. Information structure is presented sequentially along temporal, spatial and causal *lines of sight*, building upon what has already

been established in the current discourse space, CDS (Langacker 2008). Discourse unfolds as manageable amounts of conceptual content are presented into the CDS in cohesive intonation groups called *attentional frames* (see Figures 1-2 below).

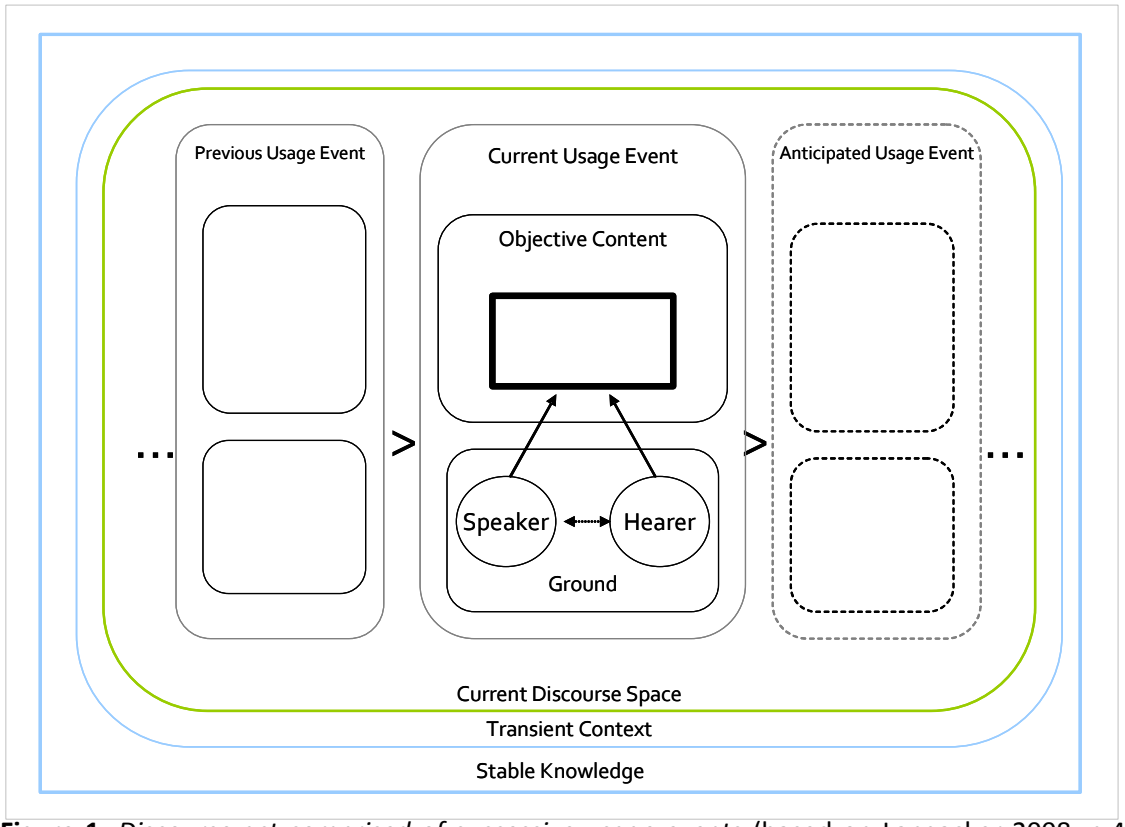

Figure 1: *Discourse act comprised of successive usage events* (based on Langacker 2008, p.466, fig. 13.2)

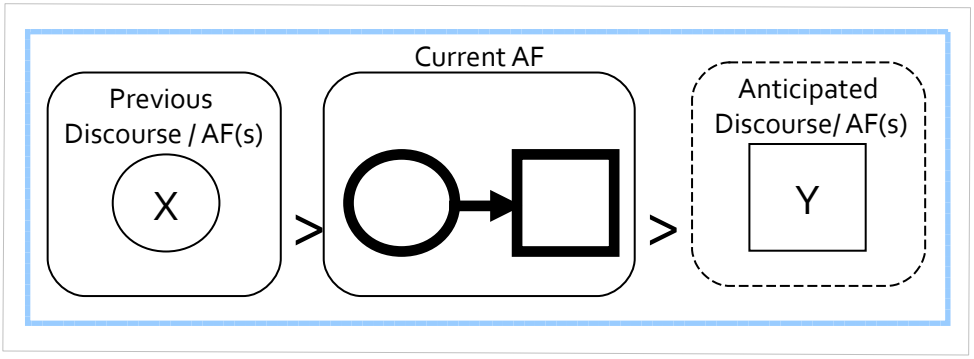

Figure 2: *Attentional Frames (AF) and the unfolding of discourse* (based on *ibid*, p.486, fig. 13.6(b))

Discourse acts are dynamic. Speaker and hearer must follow natural paths through the discourse space, processing new information in relation to what has preceded it. At all discourse levels, reference points act as figure and ground for interpreting incoming information and uniting it with that already in the CDS. Information is presented in logical temporal order and at a manageable rate, such that each incoming frame is interpreted in

relation to that which has preceded it and the need for back-tracking is minimised. *"All along the way, speaker and listener are guided by such fundamental motions as figure / ground organization, focus of attention, and temporal sequence"* as certain aspects of a scene are placed in foreground or background, depending on their pragmatic prominence (Van Hoek 2003, p.192).

Ideas and events are introduced, shaped and linked schematically both prospectively and retrospectively at all levels. For example at the inter-clausal level conjunctions and discourse markers act as cohesive devices with particular conceptual content structures (see Figure 3 below for a schematic representation of story markers).

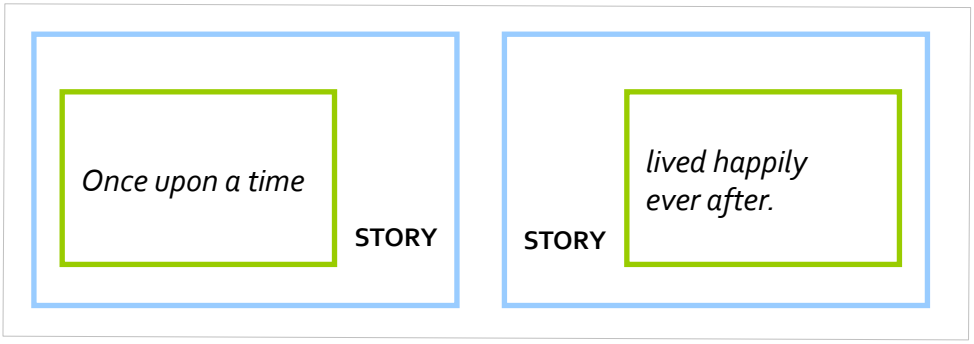

Figure 3: *Prospective and retrospective story elements* (based on *ibid*, p.460, fig. 13.1)

Participants and ideas are introduced into the discourse space, and tracked dynamically via grounding devices such as pronouns and definite articles, which serve to establish and identify particular instances of a type. In Figure 4 below the definite article singles out, or directs attention to, a particular instance of the specified type, *bear*, that subsequently functions as the discourse referent, *the bear* (Langacker 2008). By contrast, pronouns single out particular instances of highly schematic types that are indicated by the pronoun itself (e.g. *Cinderella...she*) (Langacker 2008).

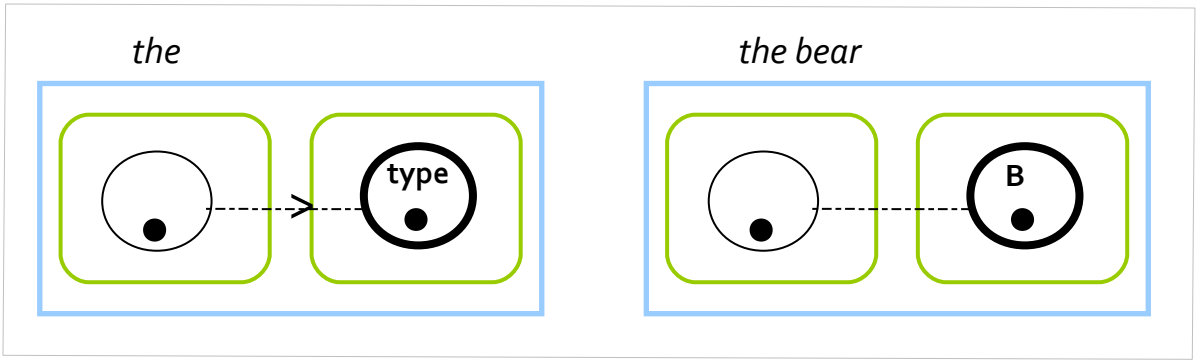

Figure 4: *Grounding of an instance of type using definite article* (based on *ibid*, p.497, figs. 13.10 (a)-(b))

In Figure 5 below (based on Langacker 2008, p.487) successive discourse units build upon what has already been established in the discourse space. The starting point is the blank box in the lower left corner with the assumption that nothing has yet been built (as it is the start of the discourse). Correspondence lines connect it to the first AF (top row) *I just ran into Jill*, (*1s* denotes that *I* is in the 1st person singular; *Jill* is represented by *J*). This first AF is then used to construct structure in the CDS (bottom row, middle box). The first structure produced in the CDS has the same content and construal as the first AF, and profiles an event in which the speaker (S) meets Jill. The second AF *she's upset* is retrospective – the pronoun *she* carries the expectation that it has a clear referent established in the CDS, *Jill*, with the same schematic specifications of number, person, gender – i.e. 3rd person, singular and feminine, *3sf.* A second structure is built identifying Jill as the referent and profiling the speaker's conception of her emotional state (*U* representing *upset*). For an expanded example see Langacker (2008, pp.487-491).

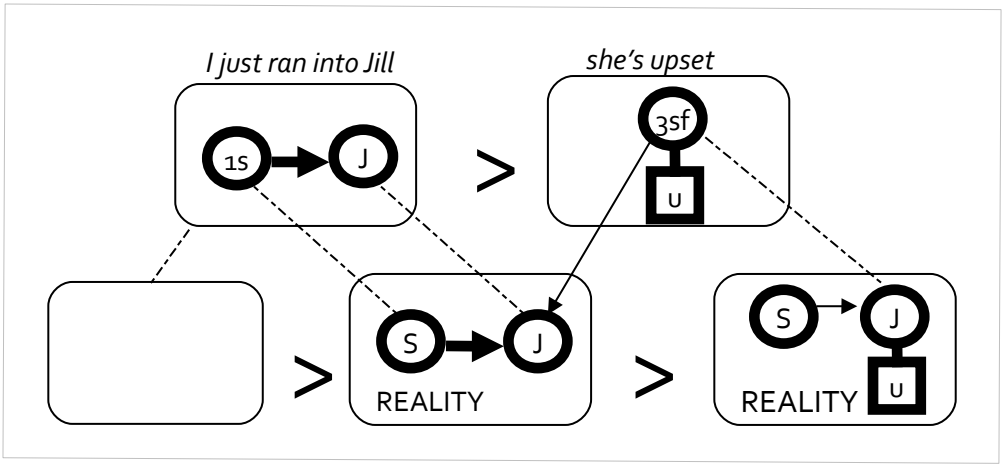

Figure 5: *Building on what is already established* (based on *ibid*, p.487, fig. 13.7)

Discourse structure is not uniquely linguistic in that natural paths of mental access, reference points and grounding devices are instances of more generalised cognitive processes. The process of introducing a CDS, profiling its content and configuration is akin to building mental spaces (Fauconnier and Sweetser 1996), essential for the transfer of epistemic knowledge, to which the speaker may or may not subscribe (Langacker 2008). Such an approach subsumes and surpasses lexicogrammatical analysis of coherence and cohesion and schematically unites macro and micro discourse levels. It differs fundamentally from the standard c-command account (e.g. Chomsky, 1980), in that it provides conceptual semantic principles for explaining discourse patterns at all levels *"as*

*opposed to an unexplained list of rules stated on syntactic tree structures" (*Van Hoek 2003, p.193). The following section sets out the research aims to investigate the discourse samples of people with aphasia at macro and micro levels within a Cognitive Linguistics framework.

2. AIM OF THE RESEARCH

Aphasia is generally taken to be a language-specific impairment and cognitive difficulties are not predicted from traditional models of aphasia. Furthermore, it has been shown that people with aphasia have relative strengths at the macro level of discourse, which is arguably more cognitive than linguistic.

The analysis of aphasic discourse commonly incorporates lexicogrammatical analysis of discourse cohesion. Cognitive Linguistics however, offers a unified description of discourse pattens at all levels, in which all linguistic form is conceptually meaningful. It holds the potential to provide a schematic description of language breakdown across discourse levels that surpasses lexicogrammatical approaches.

The present study aims to examine narrative samples of people with aphasia and compare them with that of a group of normal controls. The analysis will focus on difficulty with variables at both macro (M) and micro (μ) levels. It is expected that people with aphasia will show micro-level problems, but that the macro-level will be relatively intact. Furthermore, it is not expected that difficulty with macro-level elements will correlate with micro-level problems. No difference is anticipated between aphasic groups.

3. METHOD

3.1 Subjects

In total, 32 Cinderella story samples were included in the study, all collected for previous studies. 22 aphasic samples, including 16 non-fluent (NF) and 6 fluent (F) (Webster 1999) were compared with 10 normal controls (N) (samples 1-10, Bird and Franklin 1996). The subjects with aphasia consisted of 10 males and 12 females with mean age of 60.64 years (range 40-80 years). All subjects were at least 6 months post-onset (mean 3.5 years, range 7 months – 10 years), and were selected for the original study on the basis of having difficulty with sentence production in spontaneous speech. All subjects had acquired aphasia predominantly as a result of a single left hemisphere CVA, with the exception of two subjects, one who had acquired aphasia as a result of surgery; and one who had had two strokes previously, with no impact on language. All subjects had been assessed using an early unpublished version of the Comprehensive Aphasia Test (Swinburn *et al* 1997) and the results for the cognitive sections were reported as being within normal limits (Webster 1999). The procedure for obtaining the narrative samples from the people with aphasia was as per Saffran, Berndt and Schwartz (1989).

3.2 Variables

Independent and dependent variables are listed in Table 1 below. An overview of how each variable is related to the Cognitive Grammar discourse principles is in Appendix 1; definitions and examples of appropriate / inappropriate use of each variable are in Appendix 2.

Independent variables	Dependent variables
a. Non-fluent aphasia group (NF) b. Fluent aphasia group (F) c. No aphasia – normal controls (N)	*macro level* a. % AF with inappropriate temporal order b. % Retrospective elements (conjunctions, discourse elements) inappropriate or redundant c. % Prospective elements (conjunctions, discourse elements) inappropriate or redundant *micro level* d. % Pronouns with error e. % Definite & indefinite articles with error f. % Definite / indefinite articles (omitted) (of total words) g. % AF with subject +/or object omitted h. % Nominal-only AF (i.e. no verb)

Table 1: Independent and dependent variables

3.3 Data Preparation

In keeping with Bird and Franklin (1996), the whole sample was used as basis for analysis. A brief description of how the samples were cleaned and parsed is provided below (see Appendix 3 for more detailed information). The samples were cleaned according to instructions in Webster (1999) with the exception of direct speech, which was retained. To assist with accuracy of parsing and simplify the process of determining inter-rater reliability, the samples were segmented in two separate stages. The samples were first split into Communication Units (CU; see SALTSoftware 2013), such that independent clauses and their modifiers (dependent and relative clauses) were kept as a single unit, (in keeping with Saffran *et al* 1989). The CU were then split into Attentional Frames (AF), short stretches of cohesive discourse that each hold a manageable amount of conceptual content (Langacker 2008). As phonological information was not available to inform segmentation into AF, (as per Langacker 2008), the instructions in Appendix 3 are indicative and aim to standardise the parsing approach across the samples (Langacker 2008).

Inter-rater reliability was assessed at two stages, firstly following cleaning and segmentation into CU, and then again following segmentation into AF. Results are shown in Table 2 below.

Stage	Samples and no. raters	Agreement
1+2: cleaning and segmenting into CU	*6 colleagues; 6 samples (2xNF, 2xF, 2xN) – 2 per colleague*	*Initially 58%* *following clarifications from colleagues, 99.97%*
3: splitting into AF	*1 colleague; 4 samples (2xNF, 1xF, 1xN)*	*100.00%*

Table 2: Inter-rater reliability for data preparation

3.4 Error Analysis

Every AF was analysed for the appropriacy or inappropriacy of each variable (see Appendix 2). The analysis was recorded on a spreadsheet. Inappropriate instances were marked and counted and the dependent variables calculated as per Appendix 4.

3.5 Statistical analysis

All the analyses were conducted with IBM SPSS for Windows Version 20. Critical alpha probability (p) value at which differences and relationships were considered to be statistically significant was a confidence level of 95%. Missing values were excluded from the analysis.

The assumption of normal distribution for each variable, tested with the Shapiro-Wilk test of normality, was found to be violated for every variable. The significance of the differences across the three groups on all macro and micro level variables was tested with non-parametric Kruskal-Wallis H Test, in which the degrees of freedom have been corrected to 2. If there was a significant difference across groups on individual variables, post hoc analysis using Mann-Whitney U Test (Exact Significance) was completed to determine the between-group contrasts. The correlation of difficulties at macro and micro levels was assessed using non-parametric Spearman's Rank Order Correlation.

The range of normal functioning for each dependent variable was derived from the mean of the N-group ± 2 standard deviations. The NF and F groups were then rated as impaired or within normal limits (WNL) on each variable. Correlation matrices were subsequently compiled to visually inspect whether there was any pattern of co-impairment between macro and micro elements, where no significant correlation was obtained. The results of the analyses are presented in the next section.

4. RESULTS

The evidence for differences across and between groups on macro and micro level variables, and correlation between levels is presented in the sections below.

4.1 Differences at the macro level

From the Shapiro-Wilk test of normality, it was concluded that the assumption of normal distribution across sample groups was violated for the three dependent variables. The data was examined for evidence of differences across and between groups using Kruskal-Wallis H Test and Mann-Whitney H Test (Exact Significance) respectively. The results are summarised in Table 3 below.

Macro-level variables:	**Significant difference across groups** (Kruskal-Wallis H Test)	**Significant difference between groups** (Mann-Whitney U Test)		
	NF/F/N	**NF/F**	**NF/N**	**F/N**
Temporal order	**yes** H(2)=15.051, *p*=0.001	no U=45, *p*=0.858	**yes** U=16.5, *p*=0	**yes** U=1, *p* =0
Retrospective elements	**yes** H(2)=12.059, *p*=0.002	no U=15, *p*=0.053s	no U=55, *p*=0.771	**yes** U=10, *p*=0.031
Prospective elements	**yes** H(2)=9.2, *p*=0.01	no U=17.5, *p*=0.122	no U=38.5, *p*=0.251	**yes** U=5.5, *p*=0.005

Table 3: M-level difference across groups

From Kruskal-Wallis, there was evidence of differences across groups on all macro level variables. Post hoc Mann Whitney testing demonstrated the differences in error patterns between the groups. Both non-fluent and fluent groups with aphasia have difficulty with temporal sequencing, compared with normal controls. There was no difference between the aphasia groups. The group with fluent aphasia had difficulties with retrospective and prospective elements, compared with the non-fluent and normal groups.

4.2 Differences at the micro level

From Shapiro-Wilk, it was concluded that the assumption of normal distribution across sample groups was violated for the dependent variables. The data was examined for evidence of differences across and between groups using Kruskal-Wallis H Test and Mann-Whitney H Test (Exact Significance) respectively. The results are summarised in Table 4 below.

Micro-level variables:	**Significant difference across groups** (Kruskal-Wallis H Test)	**Significant difference between groups** (Mann-Whitney U Test)		
	NF/F/N	**NF/F**	**NF/N**	**F/N**
Pronoun errors	**yes** H(2)=10.009, *p*=0.007	no U=30, *p*=0.267	**yes** U=38, *p*=0.041	**yes** U=1, *p* =0
Def / indefinite article errors	no H(2)=3.666, *p*=0.160			
Def / indefinite article omission	**yes** H(2)=6.429, *p*=0.040	**yes** U=0, *p*=0.030	no U=0, *p*=0.182	no U=1, *p*=1
Subject +/or object omission	**yes** H(2)=17.137, *p*=0.000	**yes** U=18, *p*=0.027	**yes** U=11, *p* =0.000	**yes** U=11, *p*=0.042
Proportion of nominal AF	**yes** H(2)=10.802, *p*=0.005	no U=43.5, *p*=0.747	**yes** U=36.5, *p*=0.020	no U=18.5, *p*=0.220

Table 4: μ-level difference across groups

From Kruskal-Wallis, there was evidence of differences across groups on four of the five micro level variables, pronouns, omission of articles, omission of subject +/or object and proportion of nominal AF. There was no difference across groups on errors with definite and indefinite articles. Post hoc Mann Whitney testing was used to determine between-group differences.

Both groups with aphasia had difficulty with pronouns, compared with the normal controls. There was no difference between the aphasia groups. There was a significant difference between fluent and non-fluent aphasia groups on omission of definite / indefinite articles, but no difference between either of the aphasia groups and the normal controls.

There was a significant difference between all groups on omission of subject +/or object. The group with non-fluent aphasia also had a significantly higher proportion of nominal attentional frames, compared with normal controls and the fluent aphasia group.

4.3 Correlation between difficulty at macro and micro levels

From Spearman's Rank Order Correlation, (see Table 5 below) there was strong evidence of correlation between retrospective element problems and omission of articles (n=8); weak evidence of correlation between retrospective element problems and omission of subject +/or object; and modest evidence of correlation between prospective element problems and subject +/or object omission. There was no correlation between difficulty with retrospective and prospective elements and other micro level variables.

M-level	**Evidence of correlation** (Spearman's Rank Order) μ-level				
	Pronoun errors	**Definite / indef article errors**	**Definite / indef article omission**	**Subject +/or object omission**	**Proportion of nominal AF**
Temporal order	no *rs*(21)=0.314, *p*=0.166	no *rs*(21)=0.339, *p*=0.132	no *rs*(12)=0.133, *p*=0.681	no *rs*(22)=-0.214, *p*=0.388	no *rs*(22)=0.371, *p*=0.090
Retrospective elements	no *rs*(18)=0.175, *p*=0.488	no *rs*(18)=-0.112, *p*=0.659	**strong** *rs*(8)=-0.733, *p*=0.039	**weak** *rs*(18)=-0.491, *p*=0.039	no *rs*(18)=-0.413, *p*=088
Prospective elements	no *rs*(17)=0.075, *p*=0.776	no *rs*(17)=-0.213, *p*=0.411	no *rs*(8)=-0.302, *p*=0.467	**modest** *rs*(17)=-0626, *p*=0.007.	no *rs*(17)=-0.108, *p*=681

Table 5: Correlation between M and μ-levels

From Spearman's Rank Order Correlation, there was no evidence of correlation between temporal order problems and any of the micro level difficulties. Furthermore, visual inspection of correlation matrices for the groups with aphasia showed that while the numbers were higher for co-impairment, temporal order difficulties were doubly dissociated with both subject +/or object omission (Table 6) and higher proportions of nominals (Table 7); i.e. some subjects performed within normal limits on one variable and were impaired on the other, and vice versa. This indicated that temporal order problems and difficulty with subject +/or object omission and higher proportions of nominals were independent of each other.

NF vs F groups	**%AF with s/o omission "WNL"**	**%AF with s/o omission "impaired"**	*Row total*
Temporal order "WNL"	0	3	3
Temporal order "impaired"	4	15	19
Column Total	4	18	n=22

Table 6: Correlation matrix - temporal order & omission of subject +/or object

NF vs F groups	**% Nominal AF "WNL"**	**% Nominal AF "impaired"**	*Row total*
Temporal order "WNL"	2	1	3
Temporal order "impaired"	5	14	19
Column Total	7	15	n=22

Table 7: Correlation matrix - temporal order & proportion of nominals

5. DISCUSSION

This present study sought to examine whether people with aphasia have macro level discourse problems, and whether errors at micro and macro levels are related. The analysis incorporated a Cognitive Linguistics framework, which informed the selection of the variables and approach to error analysis.

32 Cinderella story samples were cleaned and segmented into attentional frames (10 normal controls, 16 with non-fluent aphasia, 6 with fluent aphasia). The samples were analysed for errors and the results were analysed statistically using SPSS. Correlation matrices were also used to visually inspect the data.

5.1 Inspection of the results

The results show that people with aphasia have difficulty at the micro-level of discourse, consistent with previous lexicgrammatical studies. Additionally, the results indicate that people with aphasia have macro-level difficulties, which are not predicted from the literature. There is also evidence of both correlation and dissociation between macro and micro level problems. A detailed discussion of findings follows.

5.1.1 Macro level difficulties:

People with non-fluent and fluent aphasia show significant difficulty with macro level temporal sequencing, compared with normal controls. This result is surprising and not predicted from the literature, particularly since temporal sequencing is arguably cognitive rather than linguistic. It indicates that people with aphasia may also have breakdown at the message level, and shaping conceptual information into language, i.e. 'thinking for speaking'. Furthermore, this difficulty is significant for both groups with aphasia, and there is no difference between fluent and non-fluent speakers.

People with fluent aphasia have difficulties with prospective and retrospective elements. This finding is not predicted from previous studies such as that of Lock and Armstrong (1997), who found that people with anomia had no difficulty with either discourse elements or conjunctions. Further research is indicated to examine whether discourse elements or conjunctions (or both) are responsible for the errors. There was a significant difference between fluent and non-fluent groups, however it should be noted that the NF group had less instances of prospective and retrospective elements overall

(mean no. retrospective elements: NF=3.25; F=8.67; N=12.3; and mean no. prospective elements: NF=2.5; F=12; N=10.5). The findings suggest that there are qualitative differences in fluent and non-fluent performance. The fluent speakers have a similar amount of schematic elements compared with the normal group, however they have a significantly higher number of errors; the non-fluent speakers however tend to omit schematic elements. This pattern is suggestive of the agrammatic-paragrammatic distinction, commonly made in the literature, between non-fluent and fluent aphasia symptoms.

5.1.2 Micro level difficulties:

Both groups with aphasia have significant problems with pronouns, compared with normal controls, supporting previous findings in the literature. Further examination of the error data is indicated to determine whether error types for fluent and non-fluent groups differ qualitatively as per Appendix 2.

There was no significant difference across groups on Kruskal-Wallis H Test for errors with definite and indefinite articles, and hence, between-group differences were not examined. Visual inspection of mean percentages of errors across the groups (NF: 7.8%; F: 23.5%; N: 2.9%) suggests that the fluent group has difficulties with articles that would warrant further exploration. The findings also indicate that the non-fluent group omit a significantly higher proportion of articles in obligatory contexts, compared with the fluent group, (but not with the normal controls, perhaps as the variable is expressed as a percentage of total number of words, which is lower for NF). Hence, this indicates that the non-fluent group also has difficulties with articles, but the pattern of breakdown is predominantly one of omission, again consistent with descriptions of agrammatic-type aphasia. Hence, errors of definiteness further point towards qualitative differences in difficulties between fluent (error) and non-fluent (omission) groups.

Omission of subject +/or object was significantly different between the three groups. Mean percentage of AF with omission was 9.17% for NF group, 2.77 for F group and 0.099% for N group. Omission, as a percentage of overall number of attentional frames, is clearly higher for the non-fluent group, again consistent with descriptions of agrammatic omission, however these results must be interpreted in the context of overall number of AF being lower for the NF group compared with F.

The proportion of nominal-only attentional frames is significantly higher for the non-fluent group compared with both fluent and normal groups, again consistent with the 'agrammatic' description of non-fluent aphasia in the literature.

5.1.3 Correlation between levels:

There is significant evidence that problems with retrospective elements are weakly correlated with subject +/or object omission (a feature of both aphasia groups); that problems with prospective elements are modestly correlated with subject +/or object omission; and that retrospective element errors are strongly correlated with omission of articles (a feature of the NF group), although the sample size is low (n=8).

One explanation for the findings is that the difficulties at clausal and inter-clausal levels have potentially similar cognitive underpinnings, and that both are surface-level manifestations of schematic difficulties across discourse levels. Note however, that the results should be interpreted cautiously as the categories of retrospective and prospective elements have a rather wide scope and include both conjunctions and discourse markers. Hence, a more finely-grained analysis would be warranted.

There is no correlation between micro-level difficulties and temporal order errors. Furthermore, visual inspection of the correlation matrices shows that temporal order problems are doubly dissociated both with omission of subject +/or object and with higher proportions of nominal-only attentional frames. Hence, temporal order problems are independent of both micro-level variables.

While the pattern of correlation between macro and micro elements suggests that the aphasic groups may have schematic difficulties with reference points and linguistic figure- ground organisation across discourse levels, it should be noted that not all micro-level variables were correlated with the macro level. For example, there was no correlation between macro levels and proportion of nominals, pronouns or article errors. This suggests that while there is some correlation of problems between levels, the levels clearly dissociate. Further research regarding dissociation and correlation in individuals, with more finely-grained analysis of the variables, is required to better understand the relationships.

5.2 Evaluation of the analysis

The results provide evidence of difficulty at both macro and micro levels, and both correlation and dissociation of problems across levels. The analysis of the data within a Cognitive Linguistics paradigm provided various challenges, however, and findings should be appraised within this context.

In the first instance, the data was cleaned and segmented into attentional frames. Langacker (2008) suggests that discourse comprises several *communication channels* including conceptual and expressive channels. Attentional frame segmentation should ideally incorporate expressive channel content, such as suprasegmental, gestural and prosodic information, however this was not possible, as the Cinderella story samples obtained for the present study, comprised conceptual content alone. While the 2-stage segmentation process was found to facilitate transparency in the parsing and inter-rater reliability processes, future analysis of aphasic discourse incorporating information from both channels would perhaps shed light on increased usage of a variety of communication 'channels' to compensate for language difficulties. This would be in line with approaches that are not solely focused on impairment, but also on successful communication of meaning (Armstrong *et al* 2013).

Secondly, the definition of certain variables might be improved upon in further studies. For instance, measuring the proportion of articles omitted as a percentage of the total words in a sample is not particularly meaningful. In general, omission-type problems are relatively difficult to identify and measure compared with inappropriate or redundant type errors. Similarly, the merging of conjunctions and discourse elements into prospective and retrospective schematic categories makes it difficult to identify the underlying difficulties. The findings from the present study indicate there are differences in the performance of the fluent aphasia group compared with controls on this measure, contradicting previous research findings. Thus, it would be useful to have separate counts for errors on each variable to see if one or both types are responsible.

Lastly, it should be noted that while the study provides some potentially interesting findings, the variables selected for analysis are only a representative sample of the many possible variables that might, perhaps more meaningfully, be selected.

5.3 Clinical implications

The study has demonstrated that people with aphasia have difficulty with discourse macrostructure using a Cognitive Linguistics approach, which contradicts previous research using lexicogrammatical analysis of cohesion (e.g. Lock and Armstrong 1997). Temporal sequencing problems are not commonly investigated, and as they are arguably non-linguistic they suggest difficulty at the 'thinking for speaking' message level stage (see Dipper *et al* 2005 for discussion). Temporal sequencing difficulty is not predicted by traditional models of aphasia, as the standard view has been that people with aphasia do not have cognitive difficulties. To what extent do problems sequencing temporal concepts linguistically impact on functional communication and other levels of discourse?

The results indicate that there is no significant correlation between temporal order problems and micro level difficulties, which might indicate that a difficulty with 'thinking for speaking' is not necessarily all-pervasive. Additionally, visual inspection of correlation matrices indicates that temporal order difficulties are doubly dissociated with both subject +/or object omission and higher proportions of nominals. Both of these micro-level variables arise when verbal output is reduced, either through word-finding difficulties, difficulty with forming predicate argument structure etc. Schematically, they indicate problems with profiling event processes +/or linguistically realising figure-ground organisation at clausal level. Thus, the data suggests that while they may co-occur, temporal sequencing difficulties are independent of such difficulties.

At the same time, the results also indicate that prospective and retrospective errors are correlated with subject +/or object omission; and that retrospective errors are related to omission of articles. As above, these omission-type errors are characteristic of overall reduced verbal output. Schematically, subject +/or object omission suggests difficulty with event profiling or producing figure-ground organisation; problems with retrospective and prospective errors too suggest difficulty establishing reference points at the inter-clausal level, and thus establishing macro level figure-ground organisation. Schematically, the omission of articles suggests an impaired ability to introduce and track participants retrospectively in the discourse space. It stands to reason that omission of (retrospective) articles would be correlated with macro-level retrospective element errors (note however that there is no correlation with article errors, only omission).

It is unclear at this stage, whether correlation between macro and micro level problems supports the thesis that problems at different levels might have similar cognitive underpinnings. Although patterns are emerging, it is still not possible to answer if problems at both levels arise due to difficulty with 'thinking for speaking', or whether multiple difficulties arise as a result of reduced cognitive processing capacity when a person with aphasia is trying to speak?

While the questions above are not answered by the present study, there is significant evidence that people with aphasia have difficulty with discourse levels not previously identified in the literature, and whatever the underlying impairment, problems with certain macro elements are related to micro level difficulties. Additionally, the findings provide some evidence for qualitative differences in the error types of fluent and non-fluent speakers. The Cognitive Linguistics framework for language and discourse analysis employed provides a unified account that transcends lexicogrammatical or c-command approaches – since it unites difficulties at various discourse levels in a conceptual semantics way. In a clinical context this might eventually lead to more focused intervention techniques targeting functional communication across discourse levels.

5.4 Limitations of this study and directions for future research

While the present study provides evidence both of correlation and dissociation between macro and micro levels, a clear pattern of schematic connections across levels is not yet emerging. As mentioned above, this may be due in part to the variables selected being a representative sample of many more possible variables that might, perhaps more meaningfully, be selected and contrasted.

Additionally, although the findings provide evidence for difficulty at the macro level it is unclear at this stage whether Cognitive Linguistics has the capacity to deliver a unified account of any underlying difficulty with shaping conceptual content into language. Can a *Cognitive Grammar* provide insights into areas poorly accounted for by GPM, for example mapping between message and functional or positional levels? Further research is required to investigate whether patterns of aphasic difficulty can be explained schematically using a Cognitive Linguistics approach, and whether such an approach can make sense of cross-linguistic aphasic data.

A further limitation of the study is that Cinderella narrative studies are examined rather than authentic discourse usage events. It has been shown that context plays an important role in language production (Armstrong *et al*, 2013) and furthermore, that stories elicited from pictures (as is the case in the present study) are more impoverished in terms of story structure, including temporal sequencing aspects, compared with stories elicited following prompts such as "*I want you to look at the pictures and tell me a story that has a beginning, middle and end"* (Wright and Capiluto 2009).

6. CONCLUSIONS

The results indicate that people with aphasia have difficulty at both macro and micro discourse levels. Difficulty at the macro level is not predicted by traditional models of aphasia, and temporal order difficulties in particular are suggestive of problems that are not purely linguistic in nature. There is also evidence of both correlation and dissociation between macro and micro levels; however it is unclear at this point, what such a pattern suggests about the underlying nature of impaired language in aphasia. Additionally, the findings provide some evidence for qualitative differences in the error types of fluent and non-fluent speakers.

The results create possibilities for schematic description of aphasia across discourse levels within a Cognitive Linguistic paradigm. In a clinical context this might lead to refined intervention approaches targeting functional communication at the discourse level. Further examination of the pattern of correlation between levels is indicated, as well as a more finely-grained analysis of the factors responsible for breakdown at the macro level.

7. REFERENCES

Armstrong, E., Ferguson, A & Simmons-Mackie, N. (2013) 'Discourse and functional approaches to aphasia'. In Papathanasiou, I., Coppens, P. & Potagas, C., eds., *Aphasia and related neurogenic communication disorders*. Burlington, MA: Jones & Bartlett Learning, 217-231.

Barsalou, L.W. (2008) 'Grounded Cognition'. *Annual Rev. Psy*chology, 59, 617-645.

Bird, H. & Franklin, S. (1996) 'Cinderella revisited: A comparison of fluent and non-fluent aphasia'. *Journal of Neurolinguistics, 9,* 187-206.

Bird, H., Howard, D., & Franklin, S. (2003) 'Verbs and nouns: The importance of being imageable'. *Journal of Neurolinguistics, 16,* 113-149.

Black, M. & Chiat, S. (2003) *Linguistics for clinicians.* London: Arnold Publishers.

Black, M. & Chiat, S. (2008) 'Interfaces between Cognition, Semantics, and Syntax'. In Ball, M.J., Perkins, M.R., Müller, N. & Howard, S., eds., *The Handbook of Clinical Linguistics*. Oxford, UK: Blackwell Publishing Ltd, 290-307

Bock, K. (1987) 'Exploring levels of processing in sentence production'. In G. Kempen, ed., *Natural Language Generation.* Dordrecht: Martinus Nijhoff.

Butterworth, B.; Howard, D. (1987) 'Paragrammatisms'. In *Cognition*, 26(1), 1–37.

Byng, S. & Black, M. (1989) 'Some aspects of sentence production in aphasia'. *Aphasiology,* 3, 241-263.

Cairns, D., Marshall, J., Cairns, P., & Dipper, L. (2007) 'Event processing through naming: Investigating event processing in people with aphasia'. *Language and Cognitive Processes, 22,* 210-233.

Chomsky, N. (1980) *Rules and Representations.* New York: Columbia University Press.

Code, C. (2013) 'Significant landmarks in the history of aphasia and its therapy'. In Papathanasiou, I., Coppens, P. & Potagas, C., eds., *Aphasia and related neurogenic communication disorders.* Burlington, MA: Jones & Bartlett Learning, 3-22.

Conroy, P., Sage, K., & Lambon-Ralph, M. (2006) 'Towards theory driven therapies for aphasic verb impairments: A review of current theory and practice'. *Aphasiology, 20(12),* 1159-1185.

Crago, M., Paradis, J. & Menn, L. (2008) 'Cross-linguistic perspectives on the syntax and semantics of language disorders'. In Ball, M.J., Perkins, M.R., Müller, N. & Howard, S., eds., *The Handbook of Clinical Linguistics*. Oxford, UK: Blackwell Publishing Ltd, 275-289.

Dipper, L. T., Black, M. & Bryan, K.L. (2005) 'Thinking for speaking and thinking for listening: The interaction of thought and language in typical and non-fluent comprehension and production'. *Language and Cognitive Processes,* 20(3), 417-441.

Dowty D.R (1991) 'Thematic Proto-Roles and Argument Selection'. *Language 67,* 547-619.

Edwards, S. (2005) *Fluent aphasia.* Cambridge: Cambridge University Press.

Faroqi-Shah, Y., & Thompson, C. (2007) 'Verb inflections in agrammatic aphasia: Encoding of tense features'. *Journal of Memory and Language, 56,* 129-151.

Fauconnier, G. & Sweetser, E. (1996) 'Cognitive Links and Domains: Basic Aspects of Mental Space Theory'. In Fauconnier, G. & Sweetser, E. eds., *Spaces, Worlds, and Grammar.* Chicago: University of Chicago Press.

Garrett, M. (1988) 'Processes in language production'. In F.J. Newmeyer (ed.), *Linguistics: The Cambridge survey: 111. Language: Psychological and biological aspects.* Cambridge, England: Cambridge University Press.

Geeraerts, Dirk (2006) 'A rough guide to Cognitive Linguistics'. In Geeraerts D. (ed.), *Cognitive Linguistics Research, 34. Cognitive Linguistics: Basic Readings*. Berlin: Mouton de Gruyter, 1-28.

Goldberg A. (1995) *Constructions. A Construction Grammar approach to argument structure*. Chicago: University of Chicago Press.

Grodzinsky, Y. (2000) 'The neurology of syntax: Language use without Broca's area. *Behavioural and Brain Sciences, 23,* 1-21.

Halliday, M.A.K. & Hasan, R. (1976) *Cohesion in English.* London: Longman.

Jackendoff, J. (1997) *The architecture of the language faculty.* Cambridge, MA: MIT Press.

Levelt, W.J. (1989) *Speaking.* Cambridge, MA: MIT Press.

Kemmerer, D. (2000) 'Grammatically relevant and grammatically irrelevant features of verb meaning can be independently impaired'. *Aphasiology, 14(110),* 997-1020.

Kolk, H.H.J. (2006) 'How language adapts to the brain. In Progovac, L, Paesani, K., Casielles, E. & Barton, E., eds., *The syntax of nonsententials: Multi-disciplinary perspectives*. Amsterdam: John Benjamins, 229-258.

Langacker, R.W. (1987) *Foundations of Cognitive Grammar, Vol I. Theoretical prerequisites.* Stanford: Stanford University Press.

Langacker, Ronald W. (1990) *Concept, image, and symbol: The cognitive basis of Grammar*. Cognitive Linguistics Research 1. Berlin/New York: Mouton de Gruyter.

Langacker, R.W. (2008) *Cognitive Grammar. A basic introduction.* Oxford: Oxford University Press.

Lemme, M.L., Hedberg, N.L. & Bottenberg, D.E. (1984) 'Cohesion in narratives of aphasic adults'. In R. Brookshire, ed., *Clinical Aphasiology Conference Proceedings.* Minneapolis: BRK Publishers.

Levelt, W. J. M. (1989) *Speaking: From intention to articulation.* USA*:* MIT Press.

Lock, S. & Armstrong, L. (1997) 'Cohesion analysis of the expository discourse of normal, fluent aphasic and demented adults: A role in differential diagnosis?' *Clinical Linguistics & Phonetics, 11*(4), 299-317.

Marshall, J. (2013) 'Disorders of sentence processing in aphasia'. In Papathanasiou, I., Coppens, P. & Potagas, C., eds., *Aphasia and related neurogenic communication disorders*. Burlington, MA: Jones & Bartlett Learning*,* 197-216.

Menn, L., & Obler, L. K. (1990) *Agrammatic aphasia: A cross-language narrative sourcebook.* Philadelphia, PA: John Benjamins Publishing Company.

Mitchum, C. & Berndt, R. (2008) 'Comprehension and production of sentences'. In R. Chapey, ed., *Language intervention strategies in aphasia and related neurogenic disorders, 5th ed*. Baltimore, MD: Lippincott Williams & Wilkins, 632-653

Nicholas, M., Obler, L., Albert, M.L. & Helm-Estabrooks, N. (1985) 'Empty speech in Alzheimer's Disease and fluent aphasia'. *Journal of Speech and Hearing Researcher, 28,* 405-410.

Pustejovsky, J. (1995) *The generative lexicon.* Cambridge, MA: MIT Press.

Saeed, J.I. (2007) *Semantics.* 2nd Edition. Oxford: Blackwell Publishing.

Saffran, E.M., Berndt, R.S., & Schwartz, M.F. (1989) 'The quantitative analysis of agrammatic production: Procedure and data. *Brain and Language, 37*, 440-479.

SALTSoftware (2013) Available at: http://www.saltsoftware.com/coursefiles/shared/Cunits.pdf [Accessed May 2013].

Schwartz, M., Linebarger, M. and Saffran, E.M. (1985) 'The status of the syntactic deficit theory of agrammatism'. In M.L. Kean, ed., *Agrammatism*. Orlando: Academic Press.

Silveri, M., Salvigni, B., Cappa, A., Della Vedova, C. & Puopolo, M. (2003) 'Impairment of verb processing in frontal variant-frontotemporal dementia. A dysexecutive symptom'. *Dementia and Geriatric Cognitive Disorders, 16,* 296-300.

Slobin, D.I. (1991) 'Learning to think for speaking: Native language, cognition, and rhetorical style'. *Pragmatics,* 1(1), 7 - 25.

Swinburn, K., Baker, G. & Howard, D. (1997) *The Comprehensive Aphasia Test.* Unpublished.

Talmy, L. (2003) 'Concept structuring systems in language'. In Tomasello, M; (Ed.), *The new psychology of language. Cognitive and functional approaches to language structure,* Vol. II, New Jersey: Lawrence Erlbaum Associates, Inc., Publishers, 15-46.

Thompson, C.K. (2003) 'Unaccusative verb production in agrammatic aphasia: The argument structure complexity hypothesis'. *Journal of Neurolinguistics*, *16*, 151-67.

Thompson, C.K., Lange, K.L., Schneider, S.L., and Shapiro, L.P. (1997) 'Agrammatic and non-brain damaged subjects' verb and verb argument structure production'. *Aphasiology, 11,* 473-90.

Tomasello, M. (2003) 'Introduction: Some surprises for psychologists'. In Tomasello, M, ed., *The new psychology of language. Cognitive and functional approaches to language structure,* Vol. II. New Jersey: Lawrence Erlbaum Associates, Inc., Publishers, 1-14.

Ungerer, F. & Schmid, H. (2006) *An introduction to cognitive linguistics.* 2nd Ed. Harlow, UK: Pearson Education Ltd.

Van Hoek, K. (2003) 'Pronouns and point of view: cognitive principles'. In Tomasello, M, ed., *The new psychology of language. Cognitive and functional approaches to language structure,* Vol. II. New Jersey: Lawrence Erlbaum Associates, Inc., Publishers, 169-194.

Webster, J. (1999) *A semantic and syntactic analysis of aphasic speech. University of Newcastle upon Tyne:* PhD dissertation.

Wright, H.H., & Capiluto, G.J. (2009) 'Manipulating task instructions to change narrative discourse performance'. *Aphasiology, 23*(10), 1295-1308.

APPENDIX 1 – DISCOURSE PRINCIPLES IN COGNITIVE GRAMMAR / LINGUISTICS
(based on Langacker 2008)

Cognitive Grammar discourse principles	**Variable examined**
(1) **Build upon what has already been established**	• Temporal order / sequencing • Use of schematic elements (retrospective & prospective) including conjunctions • Pronouns • Definiteness • Presence of subject (ground) +/or object (figure) in profiled clausal event • *{Also includes broader scope of referents, limited to pronouns in this study}*
(2) **Present new material at a manageable rate**	• Proportion of nominals • Presence of subject (ground) +/or object (figure) in profiled clausal event • *{Also entails that no more than one new participant or idea is introduced per attentional frame – not examined in this study}*
(3) **Sequence of presentation follows natural path of mental access**	• Temporal order / sequencing • Pronouns • Definiteness • Presence of subject (ground) +/or object (figure) in profiled clausal event • Proportion of nominals • *{Also entails that the default starting point for a clause is the subject (landmark) – not examined in this study}* • *{Also includes causal and spatial paths of mental access – not included}*
(4) **Avoid the need for back-tracking and repair**	*{Not included, since sample clean-up stages involved deleting all material subsequently repaired}*
(5) Discourse is cohesive / coherent	*{Subsumed by principles 1-3}*

APPENDIX 2 – DEFINITION & EXAMPLES OF APPROPRIATE AND INAPPROPRIATE VARIABLES

MACRO LEVEL	
1. Temporal sequencing Appropriate	Inappropriate
Sequence of attentional frames and information progresses in logical temporal order – generally information structure unfolds temporally, however it may be appropriate for the story to track back in time. Temporal flow does not hinder interpretation of information.	*An attentional frame disrupts the flow of temporal information of the Cinderella story. This does not include material subsequently repaired.* *Example:* *Well she goes to the ball where everybody is dancing the prince and princess were dancing the ladies were having thoughts *Cinders was going to the castles*
2. Prospective schematic elements Appropriate	Inappropriate
Scope: Conjunctions including, but not limited to *if, when, because, although, so, then, finally, only, either*; story elements such as *once upon a* time; and idiosyncratic discourse markers at start of clause including, but not limited to *so, well, of course, anyway.* *Appropriate use:* introduces a new piece of information with logical order of presentation.	Inappropriate or redundant use does not fit with the information that follows it. *Examples:* *she lost a slipper *then anyway they had a great time* *then anybody that got the slipper* *then three sisters are talking {opening line of story}*
3. Retrospective schematic elements Appropriate	Inappropriate
Scope: Conjunctions including, but not limited to *but, so* (sometimes prospective)*, or, however, when*; story elements such as *happily ever after;* discourse elements such as *of course, right, or whatever, or something, you see, and things, anyway, after that;* relative pronouns such as *who, which.* *Appropriate use:* builds upon what has already been established and where appropriate, links to next piece of information.	Inappropriate or redundant use does not fit with the information that precedes it. *Example:* *so the fella slippers wants to go see whose slippers *but three of them*

MICRO LEVEL	
4. Pronouns Appropriate	Inappropriate
Scope: nominative, accusative, possessive pronouns. Appropriate use: pronoun used anaphorically to single out a clear reference previously established in the discourse space.	Inappropriate use: Referent is not clearly established in the discourse space, or identity of referent is ambiguous. Over-use of pronouns where more than one participant is being identified causing difficulty establishing identity of referent. Errors of gender, number or person. *Example:* *Cinderella was very small her mam died *his dad wanted to married*
5. Definiteness Appropriate	Inappropriate
Scope: definite and indefinite articles. Appropriate use: indefinite articles used to introduce new participant or entity to the discourse space. Definite articles used to identify specific instance of an entity type that has been established in the discourse space.	a. Inappropriate or redundant use: Definite article used without clear referent – i.e. An instance of a type not already established in the discourse space. Alternatively the indefinite article may be used in place of definite article , where referring to a particular instance of a type already established would be more appropriate; or to introduce a proper noun. b. Omission of articles: nominal is identified without definite / indefinite grounding. *Examples:* **the Cinderella working all the time* *six mice turn into *the horse* *Ø nice man* *there's the fairy godmother *the pumpkin and* a coach
6. Omission of subject +/or object Appropriate	Inappropriate
Profiled clausal events are mentally accessed with reference to ground (syntactic subject) and figure (yntactic object)	Subject +/or object omitted, and thus event is not fully expressed. *Examples:* *then the prince was going to the Ø* *the ladies was Ø* *Ø saw the fairy godmother*
7. Proportion of nominals Appropriate	Inappropriate
Discourse generally consists in a series of clauses or attentional frames, rather than a series of nominals (no verb).	Higher proportions of nominal-only attentional frames with respect to normal controls. *Example:* *Cinderella two sister ball Cinderella no ball two sister off nice ball Cinderella crying*

APPENDIX 3 – INSTRUCTIONS FOR CLEANING UP THE SAMPLE

1. CLEANING

Delete	Conjoining conjunction *and* wherever it is used at the start of a new clause ○ NB keep *and* if*:* ▪ *1.* if it joins two nouns under the same subject + verb e.g. *She bought chocolate and icecream or* ▪ *2.* it joins two phrases that have the same subject e.g. "*prince charming picks up the shoe and keeps it*" - coded as 1 c-unit)
	Direct responses to questions by the examiner; repetitions of what examiner has just said.
	Neologisms, and the clause containing it if it makes no sense once you've deleted the neologism (e.g. *They're all of a whoha you know*)
	Any material that is subsequently repaired.
	Direct comments on the task e.g. Not being sure of a word; trying to figure out parts of the story; frustration about not being able to think of something; *eh, ehm, no* etc.
Keep	Discourse markers, including tag questions and idiosyncratic pragmatic phrases (e.g. *'and everything you know'; isn't it; you know; anyhow; you see; well; and things like that; and everything...*)
	Story phrases (e.g. *Once upon a time*)
	Direct speech (e.g. *She said I want to go to the ball*)
	All conjunctions (e.g. *But, so, then, because*)

2: COMMUNICATION UNITS

A communication unit = independent clause plus modifiers (incl. dependent / relative clauses)

- Split up independent clauses – a clue to identifying independent clauses is that they are joined using coordinating conjunctions such as *but, so, then, and then, and...*
- Keep independent and dependent / relative clauses together as 1 unit - a clue is the use of subordinating conjunctions such as *because, when, who, that, so that, which although, if, unless, while, as, how, until, like, where, since, although, before*
- *NB this may mean that relatively long communication units are retained in the sample.*

Examples:

- *When she thought about it she got sad* (1 c-unit)
- *she wanted cake because she was hungry* (1 c-unit)
- *when she arrived at the ball she danced with the prince* (1 c-unit)
- *she told Cinderella that she could go to the ball* (1 c-unit)
- *They got in trouble, right?* (1 c-unit)
- He left having ate the cake (I c-unit)
- *And the boy said, "That/'s my frog"* (1 c-unit)
- *The boy, the dog, and the frog, // they were friends* (2 c-units)
- *She wanted more cake, // but there was none left* (2 c-units)

3: ATTENTIONAL FRAMES

Attentional frames (intonation units) are short stretches of discourse that each hold a manageable amount of conceptual content. They tend to coincide with clauses, but may also be non-clausal – e.g. *She said* // yes.

a. **SEPERATE DEPENDENT CLAUSES**

– a clue that a clause is dependent may be use of subordinating conjunctions such as *because, when, who, that, so that, which although, if, unless, while, as, how, until, like, where, since, although, before*

Examples:

- *to tell them // everything's fine for them*
- *but she said//then go to the ball*
- *they find // that it doesn't fit*
- *they//according to the story//were not very bright*
- *the next day the prince came round // to see // if they could match the slipper*
- *otherwise it'd go back // to what it had been previously*

b. KEEP NOMINALS (NOUNS) COORDINATED BY 'AND' TOGETHER IF OBJECT OF SAME VERB

Examples:

- *their lovely clothes and everything*
- *she had hens and chickens*

Exceptions:

if nominals are an elaboration of the original statement:
1. the hens were hers and the chickens →
the hens were hers // the chickens (delete the *'and')*

2. she had 2 daughters//ugly ones

3. where there is a long list of nominals then segment only if you think that an intonation gap might occur: e.g.
Cinderella lived in the castle with baron hardcastle and her father and two stepsisters →
Cinderella lived in the castle with baron hardcastle // her father and two stepsisters

c. SEPARATE LEXICAL VERBS THAT SHARE THE SAME SUBJECT

Examples:

- *she danced and sang → she danced//sang*
- *he picked up her glass slipper and said → he picked up her glass slipper // said*

d. INFINITIVE COMPLEMENTS OF MODAL / COGNITIVE VERBS = 1AF

Examples:

- *Cinderella has to get them all dressed up*
- *somebody wants to go to the palace*
- *she would go to the thing in a bus*
- *I'll have to get her the ring*
- *he decided to go out*

Full worked example:

uncleaned sample:	*the prince following her trying to find out who she was found this slipper and decided to er scour the country to find out who she really was*
communication units:	*the prince following her trying to find out who she really was found this slipper //* *and decided to scour the country to find out who she really was*
attentional frames:	*the prince //* *following her //* *trying to find out //* *who she really was //* *found this slipper //* *decided to scour the country //* *to find out //* *who she really was*

APPENDIX 4 – CALCULATION OF VARIABLES

The analysis of dependent variables was divided into macro and micro discourse level features. Each AF of each sample was analysed for appropriacy / inappropriacy of each variable. The appropriacy of each variable was determined as per examples in Appendix 2, and noted on a spreadsheet; each variable had its own column.

Inappropriate instances were marked and counted and the dependent variables calculated as per below.

	Dependent Variable	Measured Parameters	Calculation
Macro level	**Temporal Order:** % Attentional Frames (AF) that are inappropriately sequenced	a. Total no. AF b. no. AF with inappropriate temporal order	% AF with inappropriate Temporal Order = (b / a) x100%
	Retrospective Elements: (includes discourse elements and conjunctions): % Instances that are inappropriate	a. Total no. Instances of retrospective elements. b. Total no. Instances that are inappropriate.	% Retrospective elements inappropriate = (b / a) x100%
	Prospective Elements: (includes discourse elements and conjunctions): % Instances that are inappropriate	a. Total no. Instances of prospective elements. b. Total no. Instances that are inappropriate.	% Prospective elements inappropriate = (b / a) x100%
Micro level	Pronouns: (nominative, accusative, possessive): % instances that are inappropriate	a. Total no. Instances b. Total no. Instances that are inappropriate.	% Pronouns inappropriate = (b / a) x100%
	Definiteness: (definite & Indefinite articles): % instances that are inappropriate	a. Total no. Instances b. Total no. Instances that are inappropriate.	% Articles inappropriate = (b / a) x100%
	Definiteness omission: unexpressed obligatory contexts expressed as % of total words	a. Total no. Words in sample. b. Total no. Omissions	% Article obligatory context unrealised = (b / a) x100%
	Omission of subject +/or object of a verb: %AF with omission	a. total no. AF b. total no. AF with omitted subject +/or object	% AF with omission = (b / a) x100%
	Proportion of nominal AF: (i.e. Contain no verb)	a. total no. AF b. total no. AF that are nominal-only	% AF that are nominal-only = (b / a) x100%