RESEARCH REPORT

To the sentence and beyond: a single case therapy report for mild aphasia.

Julie Hickin[1 2], Beejal Mehta and Lucy Dipper[1]

[1] Division of Language and Communication Science, City University London, UK

[2]School of Allied and Public Health, Australian Catholic University, Melbourne, Australia

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Background: Mild aphasia has received limited attention in the research literature, with few published treatment studies despite significant disruption of communication reported by affected individuals. This includes difficulty understanding and producing grammatically complex language, and consequent discourse and/or conversational difficulties. The limited research may be due to a lack of clarity regarding the deficits underlying the disorder, with

linguistic and/or cognitive impairments implicated, as well as limited research and treatment resources being targeted at those with more severe deficits.

Aims: This single case study investigated the effectiveness of a multifaceted treatment approach designed to improve the complex sentence and discourse production of a young woman with mild aphasia.

Methods & Procedures: The participant, BM, was a 22 year old female with mild aphasia following a left sided embolic CVA approximately two years prior to the study. She participated in 16 sessions of impairment-based treatment on a weekly basis. The study used a multiple baseline design across time and behaviours. Due to the lack of published assessments suitable for mild aphasia, the study included informal outcome measures comprising linguistic analysis of Cinderella narratives, as well as the picture description tasks of the Comprehensive Aphasia Test (Swinburn, Porter & Howard, 2004).

Outcomes & Results: BM's picture description demonstrated modest improvements in spoken language production immediately post treatment. Her Cinderella narrative gave further indications of improvements in complex sentence production. Analysis of her functional language output at the end of treatment indicated that improvement was most evident in written narrative production using voice recognition software.

Conclusions: This study provides some preliminary evidence that impairment-based treatment for mild aphasia can improve complex sentence and discourse production. Given the multicomponent nature of treatment, it is not possible to identify what aspects of treatment were (most) effective. However, the study highlights the potential effectiveness of impairment–based treatments for high level language deficits, and of multimedia technology both as therapy software and in the form of assistive technologies. The development of

assessments suitable for mild aphasia and potential future directions for research are discussed.

Keywords: mild aphasia; complex sentences; narrative; treatment; multimedia technology.

It is now recognised that people with mild aphasia can experience significant limitations to their communication with consequent effects on activity, participation and well-being (e.g. Cruice, Worrall, & Flickson, 2006; Hilari & Northcott, 2006; Teasdale & Engberg, 2005). However it remains largely neglected in the research literature (e.g. Armstrong, Fox and Wilkinson, 2013). Typical presenting symptoms include mild word-finding problems, a reduction in word fluency, difficulty understanding and producing grammatically complex language, and discourse and/or conversational difficulties. In the research literature there is uncertainty about the deficits underlying mild aphasia. Whilst the presenting symptoms may appear to reflect linguistic difficulties, recent research has explored the potential role that cognitive deficits may also play, for example impairments of attention (e.g. Hunting Pompon, Silkes, Kendall, & Bacon Moore, 2010; Murray, Holland, & Beeson, 1998; Murray, Keeton, & Karcher, 2006), memory (e.g. Francis, Clark & Humphries, 2003) and executive functioning (e.g. Frankel, Penn & Ormond-Brown, 2007).

The likely complexities of the aetiology underlying mild aphasia may account for the relatively sparse literature on the subject and for the very few treatments which have been proposed. In addition, clients with mild aphasia are often not seen as priorities for therapy, with limited services being targeted at those with a more severe deficit. This is despite evidence of the complexity of the relationship between aphasia severity and its impact on a person's quality of life (e.g. Cruice, Worrall, Hickson, & Murison, 2003; Ross & Wertz, 2002).

AETIOLOGY

There is conflicting evidence about the role of linguistic and/or cognitive deficits in mild aphasia. The overt symptoms point to mild linguistic difficulties in terms of, for example, impairment of word retrieval for later acquired, more abstract, longer and less frequent

words, and impaired ability to both understand and formulate complex rather than simple sentences (Ross & Wertz 2004a; Fox, Armstrong & Boles, 2009). Frankel et al. (2007) note it is possible that decreased syntactic complexity in output may also reflect "the adaptation of the aphasic speaker to the demands of the communicative environment by minimising syntactic demands in order to reduce or avoid communication breakdown (p.820)." Nevertheless the likely significance of the underlying linguistic deficit in mild aphasia is indicated by recent research. Kroenke, Kraft, Regenbrecht & Obrig (2013) taught novel words to 30 participants with mild aphasia using either gesture plus repetition or repetition alone and found that whilst participants with lesser lexico-semantic impairment benefited more from the gesture condition, those with better preserved segmental phonological abilities responded best to repetition alone. Despite this there is a surprising absence of research exploring the precise nature of linguistic difficulties in mild aphasia, with a concentration on the role of cognitive deficits instead.

Indeed, Hunting Pompom et al. (2010) state their belief that the underlying deficit/s in mild aphasia may be cognitive. They compared the performance of 14 people with mild aphasia to age and education matched nonaphasic controls on a visuospatial task, with and without linguistic interference (i.e. a simultaneous reading task). Participants with aphasia showed impairment of selective attention in the linguistic interference condition. The authors advocate the need for detailed neuropsychological investigation of people with mild aphasia in order to identify the possible contribution of cognitive deficits to their difficulties with communication.

Frankel et al. (2007) combined conversation analysis with neuropsychological assessment to explore the contribution of deficits in executive functioning to the communication difficulties of a woman with mild aphasia. Armstrong et al**.,** (2013) also implicate deficits in executive functioning in the conversational difficulties experienced by

their client in conversation with her husband. Murray et al., (1998) explored the impact of divided attention on the language produced by mildly aphasic participants in a picture description task. In comparison to an age-matched control group whose language remained unaffected by attention levels as they shifted from isolation to divided-attention conditions, the aphasic participants produced fewer syntactically complete and complex utterances, fewer words, and demonstrated poorer word-finding accuracy, whilst in pragmatic terms, their communication was considered less successful and less efficient. Murray et al. (2006) explored the impact of attention training on attention and memory in a man with mild conduction aphasia. Although they found improved performance on specific assessments, neither the participant nor his wife reported any noticeable improvement in his daily attention or communication abilities.

THE EFFECTS OF MILD APHASIA ON COMMUNICATION

There is limited research investigating the impact of mild aphasia on communication. In a rare detailed investigation of the impact of mild aphasia at the level of discourse, Armstrong, Fox and Wilkinson (2012) highlight its effect on the ability to participate in the sort of robust discussion typical of so many of our interactions with family and friends. They recorded four 10 minute conversations between a mildly aphasic woman and her husband discussing topics upon which they disagreed, but about which they enjoyed talking. Significant difficulties emerged for the aphasic woman in developing her argument and subsequently retaining the conversational floor. Armstrong et al. state that "individual 'word-finding difficulties' could not always account for her propositional simplification and non-specificity" (Discussion, para. 2) hinting at the potential interaction of a number of factors underlying this. They also point out "the potential usefulness of multi-level analysis and complex (discourse)[1] tasks

when assessing someone with mild aphasia and planning intervention" (Discussion, para. 4) a topic which will be revisited.

In a subsequent paper based on the same case study, Armstrong et al. (2013) use Systemic Functional Linguistics (SFL) to explore in more detail the difficulties experienced by their client in participating in discussions - in formulating arguments and counter arguments. Indeed difficulty in participating in discussion was a key concern for the client discussed here, and this is a common complaint of people with mild aphasia.

The wider effects of mild aphasia - on activity, participation and well-being - have begun to be explored in recent years. Cruice et al. (2003) established that the relationship between severity of impairment in aphasia and its impact at the other levels of the World Health Organisation International Classification of Functioning Disability and Health (WHO-ICF, 2001) is not straightforward, with mild impairments having the potential to produce severe impact. In this regard, another common difficulty reported by people with mild aphasia is limited "flexibility" in language such that their choices in how to express a desire, thought or opinion are limited. This can impair the ability to express subtle differences in meaning or intention. As a result people with mild aphasia report concern about, or the experience of, being misunderstood or offending others because they have communicated a message more directly than intended, with consequent effects on relationships with family and friends. This is borne out by descriptions in the literature such as that of Sheila (Pound, Parr, Lindsay & Woolf, 2000), Jasvinder and Sue (Parr, Duchan & Pound, 2003). All of these individuals illustrate the devastating effects of a "mild" impairment on career, family relationships, identity, self-efficacy and confidence.

ASSESSMENT OF MILD APHASIA

When trying to assess the deficits underlying mild aphasia, the clinician is confronted by the problem of finding sufficiently sensitive assessments. This problem is referred to by Ross and Wertz (2004a and 2004b) who note the difficulties of differentially diagnosing mild aphasia from the changes to language associated with normal ageing. Hunting Pompon et al. (2010) also note that people with mild aphasia who, "often score within normal limits on traditional assessments of language function . . . . are often underdiagnosed and underserved" as a result (Introduction).

The lack of sensitivity of assessments to mild aphasia may be because most of the clinical tests at the level of impairment do not mirror the complexity of producing language in a naturalistic context, instead separating out linguistic levels in order to test the integrity of skills (e.g. word to picture matching). This is a valid aim but means the tests do not replicate the online processing load of producing language in everyday conversation, and it is often only in conversations which place a particularly high processing load on the aphasic interlocutor (e.g. group conversations, phone conversations and conversing in noisy, distracting conditions) that people with mild aphasia report the manifestation of aphasia. Presumably this is because it is only under these more exacting conditions that their mildly impaired linguistic and/or cognitive processing systems begin to overload.

Another reason for the lack of sensitivity may be that assessment tasks do not require the use of complex language and thus may not expose the difficulties of mild aphasia. Nippold (2010) discusses this in relation to her work with secondary (high) school aged children with specific language impairment (SLI). She states that students are most likely to use complex language when they are genuinely interested in and knowledgeable about the topic under discussion, genuinely motivated to talk about it, and talking about complex matters. It is not clear that these conditions are met by the tests we might ask people with mild aphasia to perform and so we may not detect the difficulties being experienced.

A somewhat similar issue arises in relation to the aphasia tests which aim to measure the impact of aphasia on wellbeing. The majority of these tests are perhaps more geared to those with moderate to severe aphasia (e.g. the Communication Disability Profile [Swinburn & Byng, 2006]) in that many of the items assess the transactional and functional aspects of communication rather than the interactional aspects. The former are unlikely to be affected in mild aphasia; the latter are likely to be. For someone with mild aphasia, what are needed are instruments which capture the more subtle impacts of the communication disability, such as feelings about the ability to communicate and the impact of this on identity, confidence and self-efficacy.

TREATMENT

Clients with mild aphasia are often not seen as priorities for therapy due to limited services being targeted at those with a more severe deficit. One of the few published therapy studies designed for this client group is reported by Deborah Graham (2006). Graham worked with a man, KB, who initially presented with moderate aphasia. Following intervention this evolved into a milder impairment and the therapy given at this stage provided both inspiration and ideas for treatment described here. Graham comments that "it can be difficult to locate therapy resources at this level" (p.65) and her tailor-made therapy involved a hierarchy of tasks designed to enable her client to develop his ability to construct a narrative. Initial activities involved giving the client two simple sentences and asking him to combine them as a compound/complex sentence. Subsequent stages involved giving a series of sentences with the task of linking them as a narrative using appropriate connectives, and bringing to conscious awareness aspects of the planning of language such as perspective taking and the number of ideas to be expressed. In doing this, Graham's approach targeted the interaction of linguistic and cognitive deficits which may ultimately be the essence of mild aphasia.

McCall, Virata, Linebarger & Berndt (2009) used SentenceShaper® software in a single-case treatment study which explicitly targeted multi-clause constructions, focussing on the connectives *because*, *before* and *after*. Therapy focussed on the semantics of the connectives; their role in signifying causal and temporal relationships between events in order to encourage a multi clause response. Practice tasks used questions containing the targeted connective and sentence frames containing the first clause of the target response. By contrast, numerous other studies using the same software report cases where SentenceShaper® is used to 'scaffold' production without explicit input from a therapist. The software is designed to support sentence production in individuals with nonfluent aphasia, on the assumption that agrammatic sentence production is due, at least in part, to insufficient processing resources (Linebarger, Schwartz, & Kohn, 2001). It allows the user to record short utterances in his or her own voice and to combine them using a desktop workspace on which the audio files of each utterance are represented by abstract icons. Several papers (e.g., Linebarger, McCall, Virata, and Berndt, 2007; Linebarger & Schwartz, 2005) report improvements in both sentence structure and narrative content, despite the lack of explicit intervention. Although not aimed at people with mild aphasia, these studies are of relevance here because of their potential for the remediation of the high-level sentence and discourse problems characteristic of mild aphasia.

Finally, Marshall & Cairns (2005) discuss the difficulty of enabling clients to generalize clinical improvements in language production to real-life communication, including narrative. They theorise that this may relate to difficulties at the macroplanning level, that is, "an ability to sequence a series of propositions and so direct the focus of the listener over the developing discourse."(p.1018) They gave their client EM a second phase of therapy which provided her with "strategies for thinking about multiple and complex events . . (and which) . . . extended her gains (from phase 1)[1] to more open speaking situations"

(p.1018). Whitworth (2010) also used an intervention based on narrative structure to help two clients generalize improvements in word and sentence production to real-life conversation. Once again, whilst these treatments were not carried out with people with mild aphasia, they have potential to improve difficulties with complex language production as manifested in this type of aphasia.

METHOD

This therapy study was carried out at the City University London Aphasia Research Clinic during 2010 and 2011. The design was a single case study using a multiple baseline across time and behaviours. Ethical approval was obtained from the CITY University Ethics Committee (Division of Language and Communication Science).

Participant

BM is a right handed female who had a left embolic CVA in November 2008 aged 22 when she was on holiday in India, and 18 months after she had completed her undergraduate degree to qualify as a health professional. She initially presented with a severe nonfluent aphasia and right sided hemiparesis affecting her arm and leg. No information on scans taken at this time is available. She returned home to the UK as soon as possible and was hospitalised for 1 week, subsequently receiving services via the community rehabilitation team for 6 months which included speech and language therapy, physiotherapy and occupational therapy. BM was independently mobile but at the start of the study was occasionally assisted by the use of a walking aid.

BM self-referred to the clinic around two years post-stroke in 2010. She presented with fluent but hesitant speech characterised by mild word finding difficulties, some difficulty producing multisyllabic words and limited use of complex sentences. Performance

in the written modality was similar, however her writing and typing skills were further hindered by a dense hemi-paresis of her dominant right hand. BM is British Asian and has some comprehension of Gujarati, however her main language has always been English. She has a close and supportive family and network of friends. Her interests include films, fashion and shopping. BM had begun to study some foundation courses in psychology in the hope of retraining as a psychologist.

BM was aware that she had made a "good" recovery but reported frustration and reduced self-confidence in her communication. In particular, she described difficulties in professional communication with colleagues and clients, as well as in group interaction with family and friends. For example she reported that she was no longer able to participate in discussions with friends about films in the same way: pre-stroke she had been known as the group's "film buff" but she no longer felt able to express this aspect of her personality/interests effectively, consciously limiting her language to avert the possibility of it breaking down, and the potential embarrassment that might ensue from this. She addressed these difficulties partly by socialising less and also by communicating with friends via multimedia technology e.g. texting and using Facebook.

Regarding written communication, BM wrote and typed using her non-dominant left hand. She reported that her written language was fine for informal purposes. Formal writing was problematic however, with BM reporting that essays took twice as long to write as they had pre-morbidly. Regarding reading, BM stated that she needed to read text through more than once to understand it, but wondered if her difficulties were more in terms of attention rather than language. In summary BM showed considerable insight and described many of the difficulties classically associated with mild aphasia.

Design

The single case design used in this study included a pre-treatment phase of approximately 12 weeks during which background assessments were administered to elucidate the extent of the communication difficulty and the underlying deficits. A range of outcome measures were also administered at the beginning and end of this period. This allowed us to monitor both stability of performance over time as well as the effect of "therapist charm" since there was weekly contact with the therapist during this time, mirroring the pattern used during the treatment period. Treatment comprised sixteen weekly sessions of approximately 1 hour, with BM carrying out home practice as often as her busy schedule allowed. Outcome and control measures were repeated immediately post-treatment.

Outcome measures included the Comprehensive Aphasia Test (CAT) (Swinburn, et al., 2004) with a focus on the spoken and written picture description subtests, and narration of the Cinderella story (e.g. Bird & Franklin, 1996). BM was also asked a set of quality of life questions before and after treatment (Cruice, Hill, Worrall, & Hickson, 2010). Control measures were difficult to find because the mild nature of BM's difficulties meant that she performed at ceiling level on many of the tests undertaken. However, some subtests of the CAT on which BM did not score 100% were repeated post-treatment.

Background Assessment

BM's cognitive skills were initially screened using the cognitive subsection of the CAT when she scored 100% on tests of semantic and recognition memory. Further assessment was carried out using the Wisconsin Card Sorting Test (Grant & Berg, 1993) which also indicated good cognitive functioning (e.g. Total Number of Errors: 12 [SS = 104]; Percent Errors: 17 [SS = 101]; Number of Categories Completed: 6 [Percentile Range >16]).

BM's communication skills were assessed in a number of ways. Language impairment was assessed using the Language Battery of the CAT. Her performance on this

was within normal limits for people without aphasia for all subtests except naming of objects (raw score = 41, T score = 60) and naming of actions (raw score = 8, T score = 59) pointing to word retrieval difficulties. Also of interest was her performance on the spoken and written picture description tasks (insert table 1 about here). For spoken picture description, BM scored a total of 39 (T score = 62), but was outside normal limits on syntactic variety (raw score = 3, T score = 53) and speed (raw score = 2, T score = 48). Analysis of her description pointed to problems with complex sentence production, with a limited variety of conjunctions used, and predominant use of "and" to create compound sentences, or to concatenate them. The result was a lack of complex, embedded sentence structure. Written picture description (insert table 2 about here) BM showed less reliance on "and" (possibly because writing with her non-dominant hand slowed down her output and allowed more monitoring/processing time) but again her description showed a very limited variety of syntactic structures. This was replicated in an essay which BM had written for a psychology course (which was typed on her computer).

BM was also asked to retell the story of Cinderella (Bird & Franklin, 1996) and to discuss topics of interest to her, and these were transcribed and subjected to linguistic analysis. The expectation was that these tasks would place a greater processing load on both her linguistic and cognitive skills, as well as being more stimulating to discuss. A transcription of a sample of BM's pre-treatment Cinderella narrative is given in Appendix A, and a transcription of her pre-treatment description of the most recent film she had seen is given in Appendix B. Analysis of these samples provided further evidence of BM's difficulties producing complex sentences and gave some useful pointers for therapy (see next section). Furthermore, the Cinderella narratives produced pre- and post- therapy were compared for evidence of improvement using the following outcome measures: quantitative production analysis (Saffran, Berndt and Schwartz, 1989); local coherence analysis (Glosser

& Deser, 1990); global coherence analysis (Wright, Koutsoftas, Fergadiotis, and Capilouto, 2010); story grammar (Ulatowska, Freedmam Stern, Weiss Doyel, Macaluso-Haynes, and North, 1983).

To explore the impact of BM's mild aphasia on her life, she was asked a set of Quality of Life questions (Cruice et al., 2010). The enormous impact of her communication difficulties was evident from her responses to these questions: for example, when asked "Does communication have an impact on the quality of your life?" BM said "Yes – everyday - every single second of everyday." These questions stimulated discussion which revealed that BM's primary concerns were 1) the limitations in her ability to participate in conversations both professionally and with family and friends: she wanted, as she said, "to be able to express my character more in discussions, to be able to elaborate my ideas and have more influence on the discussion" 2) she was concerned about her ability to complete written work for the psychology courses she was taking with regard to both speed and the content of her written language: she wanted to complete essays quicker and to use more complex language within them.

These concerns were identified as the main therapy goals for BM and represented part of a collaborative approach to the setting of goals that were SMARTER (Shared, Monitored, Accessible, Relevant, Transparent, Evolving and Relationship-centred) as advocated by Hersh and colleagues (Hersh, Worrall, Howe, Sherratt & Davidson, 2012). Common to both of BM's goals was the need to produce more complex language. It was hoped that improvement in this would also result in improved confidence in her ability to communicate.

Therapy

Given the lack of published treatment studies and therapy resources for mild aphasia, the approach used was eclectic. It was based on clinical research in the fields of both aphasia

therapy and therapy with secondary school students with SLI. Inspiration was drawn from materials used in Teaching English as a Foreign Language (TeFL) - for example a website which explains the differences between simple, compound and complex sentences (http://www.eslbee.com/sentences.htm) and to source pictorial material suitable for a person of BM's age to stimulate discussion. We also explored how we could use multimedia technology (MMT) in BM's therapy, as this was a particular focus of our work at the Research Clinic (e.g. Hickin, Caute & Woolf, 2012).

The overall structure for the language therapy programme was based on Graham (2006). We aimed to increase the complexity of BM's spoken language by encouraging production of a wider variety of discourse connectives to address her dependence on "and" (see Appendix A and B). This would expand the types of meanings she could convey within a narrative, for example by using additive conjunctions (e.g. but), adversative conjunctions (e.g. however, although) and temporal ones (e.g. since, while). It was hypothesized that as a result of therapy there would be a reduction in the number of compound sentences produced using "and" combined with an increase in compound sentences using different connectives, and complex sentence production.[2]

We started with highly structured tasks (e.g. we gave BM two simple sentences [two clauses] and asked her to combine them as a complex sentence using provided target connectives). At this early stage we also used colour coding (e.g. Byng, 1988; Ebbls & van der Lely, 2001) to address the difficulty BM sometimes demonstrated in mapping events in the correct order in relation to a connective (e.g. putting the causative event after "because" but before "therefore"). In addition, treatment at this stage involved discussion of the different functions connectives could serve in a narrative such as establishing the timing of events (e.g. next, before), causality (e.g. because, therefore) and to discuss and debate (e.g. however, although).

We gradually increased the complexity of therapy tasks: for example by providing not just two sentences but a series and asking her to link them as a narrative. An example of a task at the next stage would be to show BM picture sequences and ask her to produce a narrative description. Sessions towards the end of treatment required her to produce spontaneous narratives about a topic of interest such as the current storyline in her favourite soap opera or the latest film she had seen. In these later sessions BM was encouraged to be more ambitious in language output, and it was noted that as her ability to use a wider range of connectives improved and she attempted to convey more complex ideas, she was having some difficulties structuring her narratives. A Story Grammar Outline (e.g. Nippold, 2007; Whitworth, 2010) was therefore introduced to help her organise her narrative and express her ideas more clearly (e.g. by first establishing the setting and the main characters of her narrative).

As well as paper exercises, we used MMT in BM's therapy. Once paper-based exercises had raised BM's awareness of how she could use a wider variety of connectives in her discourse, and to what purpose, SentenceShaper® therapy software was introduced. This gave BM the opportunity to record and reflect upon her spoken language as she experimented with the different connectives. Initially BM worked on the D series workbooks which use pictures to depict a series of events and are designed to train the production of "because" clauses. BM then went on to use the blank workbooks (E series) which do not have pictures and can therefore be used to create free narratives on topics of the client's (or therapist's) choosing. The cue buttons along the side of the screen contained some of the connective words that were the target of treatment to support BM's narrative production if required. Verbal feedback was provided by the therapist and written prompts such as list of different types of connectives were also provided to help scaffold BM's attempts at producing more complex language. Twelve of the sixteen therapy sessions involved BM producing narratives

using SentenceShaper® in this context. BM also had a copy of SentenceShaper® on her own computer which meant that she could practice this part of her therapy independently. The amount of home practice varied due to BM balancing her part-time job with her studies. However, she completed 6 sessions, three producing narratives using SentenceShaper® and three completing paper based-exercises.

It was hoped that any improvements in BM's spoken language would generalize to written language production thus addressing her second therapy goal. However, an additional problem for BM was the speed at which she could type. Therefore WriteOnline® (a specialist assistive software package designed to promote literacy development in primary - secondary school aged children) was trialed with her as it had a number of features which could potentially help. These features included word prediction and word banks. The latter allow the user to create banks of words relevant to the topic they are writing about, display them on screen and to select and enter them into the text with one key stroke. Both of these features could speed up written language production by assisting with BM's mild anomia, and also importantly by reducing the number of keystrokes required. BM responded well to the trial but unfortunately statutory funding available to support her in her retraining could only be used to purchase prescribed software which did not include WriteOnline®. It had been planned to trial Dragon Naturally Speaking® voice recognition software with BM as another means of addressing the issue of typing speed, and this was funded. Therefore she now proceeded to set this software up on her laptop at home. As she had good oral reading skills BM was able to train the software to recognize her voice successfully, and so the entire focus of therapy was now on improving BM's spoken language production, not only to improve her participation in discussions professionally and socially but also to input to Dragon® and thus improve her written language also.

RESULTS

Transcriptions of and scores for BM's post treatment CAT (Swinburn, et al., 2004) spoken and written picture descriptions are given in tables 3 and 4 respectively (insert tables 3 and 4 about here). These show that BM's spoken picture description improved post-treatment (see figure 1 – insert figure 1 about here). This improvement was mainly as a result of an increase in the number of appropriate information carrying words she produced, although rating of syntactic variety increased to 4.5 post-treatment (from 3 and 3.5 at pre-treatment assessments 1 and 2 respectively). Her written picture description remained stable possibly because this was a time limited task so that BM could not write more, especially given the use of her non-dominant hand.

Evidence of an improvement in BM's spoken language also came from her post-treatment Cinderella narrative (see Appendix C). QPA analysis revealed that, pre-therapy, BM had retold the Cinderella story using 329 narrative words in 41 complete sentences, and had used 7 embeddings. In contrast, after therapy BM retold the same story using 835 narrative words in 74 complete sentences, and had used 29 embeddings. Figure 2 shows this increased use of embedding reflected in a decrease in the production of simple unconnected sentences which was statistically significant (χ^2 =18.2824, $p < 0.001$), as was the decrease in compound sentences using "and" ($\chi^2 = 6.7431$, $p < 0.01$). This was accompanied by a statistically significant increase in the production of compound sentences using other connectives (use of "so" $\chi^2 = 9.4347$, $p < 0.005$; use of "whilst" $\chi^2 = 4.329$, $p < 0.05$) and an increase in relative clause production which was not however significant ($\chi^2 = 2.1661$, $p = > 0.05$) (insert figure 2 about here). This is in line with changes predicted pre-treatment.

The gains BM made with connectives were not matched by gains on macrostructural measures. Pre therapy, the Cinderella narrative scored 3.7 for local coherence (Glosser & Deser, 1990); 4 for global coherence (Wright et al., 2010) , and BM used 8 story grammar

elements in her story (Ulatowska et al., 1983). Post therapy the results were similar: local coherence scored 3.8, global coherence scored 4, and 9 story grammar elements were used.

Further evidence of improvements in spoken language production came from BM's responses to the discussion tasks used as informal measures of her functional improvement throughout the therapy programme. These included discussing films. In the last session of treatment, BM was asked to describe one of her favourite films - Toy Story - dictating her description into Dragon®. BM was directed not to edit this during production and did not overtly look at the text produced, particularly as she was struggling to remember the plot (see Appendix D for the text produced as a result). This is unedited so contains some lexical recognition errors on the part of the software which are underlined. BM subsequently edited what she had produced and brought this version to the next session (see Appendix E). Qualitatively, both samples show a decrease in the production of compound sentences using "and" and simple unconnected sentences, and an increase in the production of complex (relative) clauses. A type and token count of connectives used in the pre and post-treatment film descriptions is given in Table 5 and demonstrates a five-fold increase in the types of connectives used by BM at the end of treatment (insert table 5 about here) including ones specifically targeted in impairment-based treatment. For example, she writes the sentence "Woody was the leader of the pack, hence he brought all of the other toys together" (paragraph 2, Appendix E) which contains an embedded clause linked to the main clause with the connective 'hence', a connective explicitly targeted in therapy. It is acknowledged that Toy Story is a simpler film to describe than Inception and that this may have affected the language BM used. It is also acknowledged that the end of treatment film descriptions are examples of aided language production and so are not directly comparable to the film description pre-treatment which was unaided. However, they are of interest because they demonstrate the functional improvement in BM's language production as a result of

impairment-based treatment combined with assistive software, and BM continued to use this combination of assistive software followed by a process of editing to successfully complete essays for her psychology degree which was one of her therapy goals.

With regard to the wider impact of her improved spoken language, BM reported some positive changes in response to the set of quality of life questions (Cruice et al., 2010) post-treatment. For example, at the beginning of treatment BM had described the quality of her life as "OK", and at the end of treatment she described enjoying friends and family and how close they were. She said that pre–treatment she had found it difficult to talk to someone she didn't know and had felt like "a little child" talking with her friends as she only contributed about 10% to discussions. At the end of treatment she felt the balance was much more even, because she was able to contribute about 40% to conversations and also reported that she felt much better about talking to strangers. Finally, at the end of treatment BM reported that she was due to give a presentation at a conference the following week, and now felt confident enough to do this using bullet points. This compared to a presentation she gave during the pre-therapy assessment phase when she used a script.

As stated earlier, it was difficult to find control tasks which were not at ceiling because of the mild nature of BM's difficulties. However, some subtests of the CAT on which BM did not score 100% were repeated post-treatment. The results for these are given in the table 6 (insert table 6 about here). BM's performance on the CAT subtests shows some stable performance, and some slight improvements. Given that she was already within normal limits on all of these subtests at pre-treatment baseline 2, it is difficult to draw any firm conclusions from this pattern of performance. In addition, it was difficult to predict what might remain stable/unaffected by treatment given that we were working on both written and spoken output. This involved encouraging BM to be more ambitious in her language production (which might have been expected to also improve word retrieval) and involved

her monitoring her own output closely (which might have been expected to also improve input).

DISCUSSION

This study provides some preliminary evidence to support the fact that impaired complex language production in mild aphasia can be treated. The study also demonstrates the profound impact that the so-called "mild" deficits of this type of aphasia can have on activity, participation and well-being, and that impairment-based treatment can do something to ameliorate this. The factors which may have contributed to the success of treatment will now be discussed.

The treatment approach used with BM was unashamedly eclectic because of the lack of published and evidence-based therapy programmes for mild aphasia. The main aim of therapy was to enable BM to use a greater variety of connectives and thus to increase sentence complexity with the ultimate aim of allowing her to convey a greater variety of meanings – "to be able to express my character more" as BM put it. The approaches used to achieve this raised her metalinguistic awareness of her linguistic deficits first of all at a microstructural level (e.g. colour coding). She was also encouraged to be more ambitious in her use of language and this was scaffolded by introducing a Story Grammar Outline later in therapy (e.g. Nippold, 2007; Whitworth, 2010) thereby increasing her metalinguistic awareness at a macrostructural level. Here therapy could also be argued to have targeted so-called "thinking for speaking" as advocated by Marshall and Cairns (2005).

BM made significant gains in terms of her use of targeted connectives but this improvement was not reflected in gains in the three macrostructural measures used here. However because scores on these measures were high pre-therapy, and the range of achievable scores was narrow (0-4 for both coherence measures), significant change could

not be expected. Future research is needed to investigate the best methods for capturing change at a macrostructural level. Nevertheless, it is perhaps this interaction of therapies aimed at both a micro and macro linguistic levels that gave BM the tools to regain some of the flexibility with language that she had prior to her aphasia. In combination with encouragement and perhaps a little more confidence in her language skills, this may have had something of a "snowball effect" so that BM produced not only a wider variety of connectives and more complex sentences, but also produced more language, including more content and elaboration in her narrative post treatment, as demonstrated by the linguistic analysis. All of these approaches, both at the micro and macro structural level, merit further investigation.

The use of multimedia technology may have complemented these metalinguistic approaches in a number of ways. Sentenceshaper® software may have addressed any mild cognitive impairment present as it may "reduce the impact of processing limitations by allowing repeated refreshing of working memory and by increasing the opportunity for aphasic subjects to monitor their own speech" (Linebarger et al., 2007 p.53). Indeed, BM commented explicitly on the monitoring benefits of Sentenceshaper®. Dragon® software may have reinforced this by also supporting BM's memory and self-monitoring, allowing her to edit and elaborate her written output. The use of technology in treatment may have had additional benefits similar to those reported in a number of other studies including increased client satisfaction with therapy as a result of the client having autonomy in its delivery (e.g. Wade, Mortley & Enderby, 2003).

In relation to the use of MMT, it was disappointing that WriteOnline® software could not be used because of funding issues. It seems possible that this may have been more effective than Dragon® because 1) word banks and word prediction may have improved BM's (albeit) mild word finding difficulties, and this may have had knock-on effects in terms

of "freeing up" processing capacity for other aspects of language production such as complex sentence formation 2) the process of typing into WriteOnline® and producing written language directly followed by the process of reading and editing the written text may have complemented the same process which was occurring in relation to spoken language via paper exercises and the use of SentenceShaper,® thus producing greater therapy effects. Finally, BM reported some continued post-treatment difficulties with Dragon® making word recognition errors due to her aphasia (as was evident in Appendix D and has been previously reported for people with aphasia e.g. Estes and Bloom, 2011). This would not have occurred with WriteOnline® and it would be useful to further explore the potential of this software to assist people with aphasia to write.

Another important factor underlying the effectiveness of treatment may have been that therapy goals and the content of therapy materials were based on an intimate understanding of the impact of BM's aphasia on her life. Thus they were both functional and motivating. This was achieved through detailed assessment and discussion with BM as part of a collaborative approach to goal planning to set SMARTER goals (Hersh et al., 2012). Indeed it was this collaborative process that revealed the pervasive and profound effect of BM's "mild" aphasia on her life – to the difficulties she experienced "expressing her character" in her personal life and the problems with written language in her professional life and academic studies - and consequently to impairment-based language therapy being at the core of the therapy design. The approaches and materials used in therapy were chosen with particular care to reflect and target her interests (e.g. popular TV shows), activities (e.g. writing essays) and participation (e.g. discussing films), with a dual focus on spoken and written language production (via Dragon) to mirror her therapy goals.

The study has a number of limitations. These include the lack of follow up assessments to monitor whether improvements observed immediately post-treatment were

maintained. This was as a result of the treating clinician (first author) emigrating before the study was complete. Limitations also arise from the lack of published, standardised assessments suitable for this client group such that the study largely relied on informal outcome measures to detect change. It was also difficult to find control measures which were not at ceiling level for our client, which means they may not have been sensitive to any spontaneous recovery which may have occurred.

In relation to the assessment of mild aphasia, one challenge is to develop tasks which require the use of complex language and thus are sensitive to the high level difficulties of mild aphasia. It is not clear that these conditions are always met by tests we might currently use. Indeed, this may well have been the case in relation to BM's CAT picture descriptions which showed little change post treatment, whereas the (presumably more demanding and motivating) Cinderella narrative did. In assessing a person with mild aphasia we therefore need to consider whether the tasks we use are likely to elicit complex language and thus expose the deficits we are searching for, an issue also raised by Armstrong et al., (2012).

Another challenge is to develop tasks which are sensitive to the potential interaction between linguistic and cognitive deficits which may underlie the communication impairment observed in mild aphasia. The pioneering work of Murray et al. (1998) points to how this might be achieved. They demonstrated the negative impact of divided attention on the language production of participants with aphasia. Conducting assessments under conditions which mimic those cited by people with aphasia as problematic (e.g. communicating against background noise) may be informative in exposing difficulties masked under normal test conditions.

An additional limitation arises from the use of an eclectic approach to treatment. This meant it was not possible to identify which elements of the treatment were (most) effective. There is a clear need for further research to establish this, including investigation of

impairment-based approaches such as those used here to target our client's linguistic deficits, impairment-based treatment of cognitive deficits (e.g. Murray et al., 2006) and indirect approaches arising from the use of conversation analysis and systemic functional linguistics currently being explored by Armstrong and colleagues (Armstrong et al., 2013; Fox et al., 2009). The potential for multimedia technologies to help people with mild aphasia is also under-researched in terms of technologies which are specifically designed for people with aphasia such as SentenceShaper® and those which are not such as Dragon® and WriteOnline®.

Finally, it seems fitting to end with the thoughts of BM herself about her treatment: this study would not have been possible without her immense courage, insight and generosity of spirit which taught the clinicians and students who worked with her much about the lived experience of mild aphasia.

"The ideas that you gave me were just what I needed! I haven't been able to do that much on it as yet because I've been busy, however, what little I have done on it has worked really well. I found it challenging on one part but I felt a sense of accomplishment being able re-jig and put my own interpretation on the sentences that I couldn't have done a year, or even 6 months ago. And I know if I 'put my own spin' on the sentences for this whole summer, then hopefully, I should be more prepared for my Uni course which starts in oct at the least if not many other things as well!" (Sent from her Blackberry).

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APPENDIX A: TRANSCRIPTION OF BM'S PRE-TREATMENT CINDERELLA NARRATIVE*

1. There was a girl ~~called sti~~ called Cinderella
2. ~~**and**~~ she lived with her dad
3. ~~**and**~~ he died
4. ~~**and**~~ ~~he had~~ she had a step mum with two step sisters *who* also lived there ~~but~~
5. *when* her dad died her step-mum looked after them all ~~and~~
6. her step-mum was nice to those two sisters *but* wasn't nice to her
7. ~~**and**~~ she was like a like a servant for them
8. ~~*so*~~ ~~she she~~ she grew up
9. ~~**and**~~ ~~whilst being a servant and~~ she had a kingdom ~~and everything~~
10. ~~*but*~~ she was a servant in it
11. ~~**and**~~ one day ~~a~~ a man came to the house to say *that* you are all invited ~~to~~ to the prince's ball like thing ~~yeah~~
12. you should come
13. ~~**and**~~ he's going to pick a princess ~~**and** everything like that~~
14. ~~**and** yeah~~ the step sisters found out about it and were excited about it and everything and were choosing their outfits ~~**and** everything like that~~
15. ~~and oh my God yeah *but*~~ Cinderella couldn't go *because* her step mother locked her in the cellar or something
16. ~~**and** yeah~~ she wanted to go
17. ~~*but*~~ she didn't ~~didn't~~ have enough money to get a new outfit or anything like that
18. ~~**and** *so*~~ this fairy godmother magically appeared to her
19. ~~**and**~~ ~~said~~ you shall go to the ball
20. ~~**and**~~ she dressed her in an outfit ~~and everything~~
21. ~~**and**~~ ~~she~~ they had a big pumpkin ~~like~~
22. she made it into a carriage

23. ~~**and**~~ she made the mice *that* were in the cellar into horses
24. ~~**and**~~ she went off into the night to the ball
25. ~~yeah the prince~~ the step mother and step sisters and the prince couldn't recognise her *because* she looked so pretty
26. ~~**and**~~ she looked so made-up
27. ~~**and**~~ he really liked her
28. ~~*but* she but~~ he didn't know her name or anything like that
29. ~~*so* when her~~ at 12 o'clock the spell ~~had broke had~~ was going to finish
30. ~~**and** *so*~~ she ran out of the ball ~~t~~
31. ~~to *so*~~ she wouldn't ~~she wouldn't~~ be seen to ~~to~~ be like ~~a~~ a servant in the ball
32. ~~*so*~~ she ran out
33. ~~**and**~~ she left her ~~glass~~ glass slipper behind
34. ~~**and** *so*~~ the prince ran after her
35. ~~*but* she but~~ she ran too fast or something
36. ~~**and**~~ the prince only found her glass slipper
37. ~~*so*~~ the next day ~~he~~ he like searched ~~for~~ for the person *who* wore the glass slipper ~~and everything~~
38. ~~**and**~~ her two sip' sisters tried them on
39. ~~*but* they were~~ their feet were too big
40. ~~**and** finally~~ Cinderella tried it on
41. ~~**and**~~ it fit
42. ~~**and** yeah and the rest is history~~

*The crossed through words are non-narrative utterances (as defined in Saffran, Berndt & Schwartz 1989). Use of "and" is emboldened to highlight the lack of variety. The use of other connectives and relative pronouns is italicized.

APPENDIX B: TRANSCRIPTION OF PRE-TREATMENT FILM REVIEW

BM verbally reviewed this film without the aid of any software.

Inception*

erm I last saw Inception about yeah, that totally mind boggling yeah I sawed it about 2 weeks ago on DVD it's about yeah erm erm yeah it's hard to describe *first of all* **and** yeah basically there is a Leonardo Decaprio is in it **and** he is playing a umm a dream erm

erm it's all about erm getting it's all about these dreams erm we are all people *who* have dreams

and erm there is a dream within a dream **and** *then* there is a dream within a dream

and *then* a dream within a dream **and** erm yeah Leanardo Decaprio is playing the erm the erm the controller, not controller exactly *but* erm, he is the head of the dream or something erm **and** he is like a he can like change the dreams or something like that.. erm yeah,

its sort of all about that really erm yeah

erm no not exactly *but* like a erm underneath the God like character erm like a prophet of something like that anyway erm yeah he yeah he's in between us and erm the God like character, so to speak erm *so* it's all about that that's the only way I can explain it

* Use of "and" is emboldened to highlight the lack of variety. The use of other connectives and relative pronouns is italicized.

APPENDIX C: TRANSCRIPTION OF A SAMPLE OF BM'S POST-TREATMENT CINDERELLA NARRATIVE*

1. ~~*So*~~ Cinderella was ~~set in a~~ set in a faraway land of magical beauty
2. ~~**and**~~ the characters were Cinderella ~~obviously~~ and also her step mother and her two ugly step sisters and the prince ~~and yeah that was it really~~
3. ~~**and**~~ the plot was Cinderella and her two step sisters were living in a house
4. ~~**and**~~ she had a father and a step mum *who* lived there ~~also~~
5. her father died of a heart attack or something else
6. ~~**and** *so*~~ she was bought up by her step mum and ~~yeah~~ her two step sisters
7. ~~**and** she was~~ she was made into being a servant for her two step sisters and her step mum *because* she was prettier than them
8. ~~**and**~~ she was ~~she was~~ more caring than them
9. ~~**and**~~ they didn't like her *because* they didn't see her as their family
10. ~~**and** *so*~~ she was made to be a servant
11. ~~**and**~~ she did all the housework and all the yard work and all the cooking and cleaning and stuff like that ~~anyway~~
12. ~~**and**~~ she made friends with all the other servants and with the little mice and with the birds and everything else with all the animals ~~yeah~~
13. ~~until **and**~~ that was her life *until* she was about 18 or something ~~yeah~~
14. ~~and **and** *then* the~~ there was this prince *who* was about 18 or 20 or 21 or something *who* was a little bit older than her *who* had never heard of her or her sisters or her step sisters or anything like that
15. ~~*but*~~ he was looking for a bride
16. ~~**and** *so* he~~ he was throwing ~~a big wedding a big wedding~~ a big party
17. ~~**and**~~ he wanted to invite ~~all the~~ all the young ladies ~~who were ready for marry yeah who were ready for to to~~ *who* were ready to be approached to get married ~~or something like that anyway~~
18. ~~**and** *so*~~ there were hundreds of young ladies in there
19. ~~**and**~~ *whilst* this was all going on *before* the party she had met the prince ~~I can't remember the story~~

20. she met the prince *whilst* she was wearing her sister's clothes

21. ~~*so* she was~~ she was prim and proper and stuff like that

22. ~~she showed~~ she showed the prince *that* not only was she prim and proper and everything she was also caring and kind and lovely

23. she had a sense of humour and everything

24. ~~**and**~~ he eventually ~~she~~ fell in love with her on the first sighting of her

25. ~~*but*~~ she didn't tell him her name

26. ~~*so*~~ he went to ~~all the~~ all the young ladies ~~and~~ to find her

27. ~~**and**~~ he didn't

28. ~~**and** *then*~~ *when* the party was ~~was~~ approaching ~~yeah there were like~~ ~~there were so her sisters so~~ her two ugly step sisters were very excited about the party *because* they thought *that* they would obviously ~~be~~ be set for marriage to the prince

29. ~~**and** no yeah she yeah and~~ there was no doubt about it

30. ~~**and** *so*~~ they got ready and dressed and everything

31. ~~**and** she and~~ the invitation said all the women of the house

32. ~~*so* that~~ she was also invited

33. ~~*but*~~ her step mum didn't let her go

34. she locked her in the store room cupboard and wouldn't let her out *until* the party was over

35. ~~**and** *so* they went~~ her step mum and her step sister went to the party ~~yeah~~

36. ~~**and**~~ she stayed at home

37. ~~*but*~~ the servants and the animals and everything was saying to her to go to the party and everything

38. ~~**and**~~ she actually had three fairy godmothers *who* came to her

39. ~~**and** she said~~ I have nothing to wear

40. ~~*as* they they~~ they gave her something to wear

41. it was a lovely dress

42. ~~**and** she~~ said ~~I have~~ I have nowhere to go there

43. ~~**and** *so* and so they gave her~~ there were like three little mice *who* were miraculously turned into three horses by the fairy god mothers

44. ~~and the there was a pumpkin~~ there was a huge pumpkin *which* was actually turned into a carriage

45. ~~**and** she said~~ I have ~~no nothing~~ no shoes to wear as well

46. ~~**and** *so*~~ they gave her two glass slippers ~~yeah~~

47. ~~so~~ she was all ready and set and everything

48. ~~*but*~~ the spell would end at midnight

49. ~~*so* yeah she said yes so she says yes~~ I'll be back by midnight

50. ~~*so*~~ she went along ~~to the prince's house~~ to the prince's palace

51. ~~**and** *whilst* he was looking at he was~~ he was looking or thought about all the young ladies *who* were there he couldn't stop thinking about the Cinderella *which* he had met previously

52. ~~and~~ *once* she ~~once she~~ got into the palace he knew *that* it was her he wanted to be with her ~~yeah~~

53. he fell in love with her

54. ~~**and**~~ he wanted to be with her forever

55. ~~*but*~~ *by then* it was 12 o'clock at night

56. ~~**and**~~ she had to go

57. ~~*so*~~ she went

58. ~~*but*~~ she went down the palace steps and everything on the outside

59. ~~*but then* she~~ she forgot her glass slipper ~~during her~~ *during* her quick paced out of there

60. ~~*so*~~ that was the only thing he had to go on *that* she was wearing beautiful glass slippers and the shoe size

61. ~~**and** *so*~~ *in the morning the next day* her step mother and her sister and her step sisters didn't know that she'd gone out

62. they thought *that* ~~she~~ she stayed at home in the locked cupboard and everything

63. ~~*but* yeah~~ the prince ~~came~~ went to every young woman's house to find her

64. ~~**and** *so*~~ he took the glass slipper with him

65. ~~**and**~~ he tried it on every young lady's foot

66. ~~**and**~~ it didn't fit any of them
67. ~~**and** *eventually*~~ he tried it on her two step sisters
68. ~~**and**~~ their feet were too big
69. ~~*but* there was a little~~ he thought there was a ~~little servant girl a little servant woman~~ a little servant young lady *who* was there
70. ~~**and** *so*~~ he tried it on her as well
71. ~~**and**~~ it fit
72. ~~**and** *so*~~ he knew that she was the one ~~yeah the rest is history (laughs)~~
73. ~~**and** *so* they all~~ he married her
74. ~~**and** they lived happily ever after and~~ the step mum and the step sisters were unhappy to say the least
75. ~~*but*~~ they just had to deal with it

*The crossed through words are non-narrative utterances (as defined in Saffran et al 1989). Use of "and" is emboldened to highlight the lack of variety. The use of other connectives and relative pronouns is italicized.

APPENDIX D: TRANSCRIPTION OF POST-TREATMENT SPOKEN DESCRIPTION

This test represents the immediate output from Dragon voice recognition software, before BM made any edits

Toy story *

The setting, or where it took place, was in this little boy's, called Andy, bedroom.

The setting *where all the Toy's came to life* was in a little boy's, called Andy, bedroom. Andy was about 6 or 7 news old, **and** he had a little sister *which was about 2 or 3 years old*, **and** he had a mom and dad. *But* the story is not really about them. The main characters where his Toys.

First of all there was Woody, *who was a cowboy action figure*, **and** Andy's favourite toy *since he was a baby. And then* there was Mr Potato head, a dinosaur, Little Bo Peep, a dog *which was also a slinky*, and many others. They all would come to life *when the humans were not around* **and** they all had their own individual personalities. Woody was the leader of the pack *so* he showed more confidence and leadership and intellectual skills **and** he was just a nice guy.

However then on Andy's 8th birthday he had a big party. **And** he invited a lot of his friends **and** they brought with them a whole lot of presents. The Toys were anxious about the presents. *Because* they thought *that they were going to be replaced. So* there was a mission to get all of the Army guys to do a surveillance on the presents, **and** it was like all kinds of lunchboxes, and towels, and a telescope, and is games, **and** none of them seem to be replaced. *But then* all of a sudden his mom brought a large present towards them **and** that ended up being Buzz light year!

Buzz Light year was a astronaut action figure *who had technology up to the Ying Yang*, like he had a laser beam, and he had wings *that could fly* etc **and** at the start he got along great with the toys **and** he as well showed much leadership **and** confidence **and** high self-esteem **and** is he was in nice guy also. And Woody was threatened. *Because* Woody wasn't technologically advanced. Woody only had a string on his back *which when you pulled it* he would say a few words, **and** that was it.

There was a yard sale at their house. **And** by mistake bars and Woody got solves to the next neighbour's house. Sid. *Now* said was a little boy *who was about Andy's age* barks he'll lose dangerous to say the least. He liked to blow stuff up, he liked diamond mine is **and** fireworks **and** fire. He is set especially liked to blow his toys up. **And** bars and Woody when no exception. *So* they were scared. Byatt's bar at *but* in actual fact they bonded over their nervousness about is being blown up, **and** they both realised *that Andy know that there was room in Naas for them both.* **And** they eventually, after a lot of mishaps, got outs of the net so neighbours house **and** got back home.

So I think toy story has lasted for 10 years or more no 10 or 20 years or more *because* underneath it all it is all about friendship. About friendship and loyalty and insecurity **and** coming through it all **and** being stronger. **And** it also has lots of humour, it is multilayered, it has magnificent effects like CGI, **and** the actors *who play Woody and Andy Woody and Buzz* are just brilliant. They really made the characters come to life.

* Use of "and" is emboldened to highlight the lack of variety. The use of other connectives and relative pronouns is italicized.

APPENDIX E: TRANSCRIPTION OF POST-TREATMENT SPOKEN DESCRIPTION

This test represents the output from Dragon voice recognition software which has subsequently been edited by BM

Toy story *

The place *where all the Toy's came to life*, was in a little boy's, called Andy, bedroom. Andy was about 6 or 7 years old, he had a little sister *who was about 2 or 3,* and he had a mum and dad. *But* the story is not really about them. The main characters were his Toys.

First of all there was Woody, *who was a cowboy action figure*, and Andy's favourite toy *since he was a baby. And then* there was Mr Potato head, a dinosaur, Little Bo Peep, a dog *that was also a slinky*, and many others. They all came to life *when the humans were not around* and each toy would have their very own personalities, characteristics and sense of humour. Woody was the leader of the pack, *hence he brought all of the other toys together* and they were working towards the same goal. He showed much leadership and authoritarian skills *as well as* sensitivity and he was just an all round nice guy.

On his 8th birthday Andy decided to have a big party. *So* he invited a lot of his friends and *consequently* they brought with them a whole heap of presents. *However* the toys had always been anxious about getting new presents *because if Andy got given new toys* they were afraid *that they were going to be replaced*. And so they were on a mission. There mission was to get all the Army guys to do a secret surveillance on the presents! *However* they needn't have worried *because the presents were anything but toys for example it was all kinds of lunchboxes, games, and one kid even brought a telescope*! *So* none of them seem to be replaced. *But then*, all of a sudden, his mum brought a large present towards him and that ended up being Buzz light year!

Buzz Light-year was an astronaut action figure *who had technology up to the Ying Yang*. He had a laser beam, an open and shut helmet *as well as* wings *that could fly*, and at the start he got along great with all the other toys as well. *Additionally*, he as well showed much leadership and high self-esteem *and also* he showed that he as well was a really nice guy. *Because* of that Woody felt threatened. Woody wasn't as technologically advanced, *in fact* he only had a string on his back *which when you pulled it* he would say a few words, and that was it, *so* its fair to say that he was a bit jealous.

There was a yard sale at Andy's house. And in all the upheaval by mistake Buzz and Woody got sold to the next-door neighbour's house, they got sold to a boy named Sid. *Now* Sid was a little boy *who was about Andy's age but* he was dangerous to say the least. Dangerous in the way *that he liked to blow stuff up*, he liked anything *that would set something alight* such as dynamite or fireworks etc. and he especially liked to blow up his toys, **and** Buzz and Woody were no exception. *So* they were terrified *as anyone would be in that situation. But in actual fact* they bonded over their mutual apprehension about being blown up, and they both eventually realised *that there was room enough for them both in Andy's affections. Additionally*, after an awful lot of mishaps, they got out of the next-door neighbour's house and got back home.

I think toy story has lasted for 10 or 20 years or more *because underneath it all*, it about friendship. It's about camaraderie and loyalty and also insecurity *but in the end* coming through all the challenges and obstacles and being stronger for it. *Furthermore,* it also has lots of humour! Multilayered humour, *so that* people of all ages can like it and be impressed by it. *In addition*, it has magnificent special effects such as CGI, and the actors who play Woody and Buzz are just brilliant. They really made the characters come to life.

TABLE 1 Comprehensive Aphasia Test Spoken Picture Descriptions Pre-treatment

CAT Spoken Picture Description Pre-Treatment 1				
Score (A – B) + C + D + E = **39** (T score = 62)				
A Appropriate ICWs = 29 (T score = 61)	**B** Inappropriate ICWs = 1 (T score = 56)	**C** Syntactic Variety = 3 (T score = 53**)	**D** Grammatical Well-Formedness = 6 (T score = 64)	**E** Speed = 2 (T score = 48**)
*The bald man is sleeping on the sofa **and** erm the books on the shelf are falling on him **and** the baby with a car is crying erm **and** the cat on the shelf is erm looking at the fishbowl underneath it on the shelf as well **and** there is a plant on the shelf erm above erm above the fishbowl **and** erm there is a stereo erm on the shelf erm below the fishbowl **and** erm the man is erm putting his feet up on a a table erm on some magazines **and** erm he had a erm he had a tea or coffee erm there is a book erm under the table on the lower shelf				
CAT Spoken Picture Description Pre-Treatment 2				
Score (A – B) + C + D + E = 39.5 (T score = 63)				
A Appropriate ICWs = 29 (T score = 61)	**B** Inappropriate ICWs = 1 (T score = 56)	**C** Syntactic Variety = 3.5 (T score = 58)	**D** Grammatical Well-Formedness = 6 (T score = 64)	**E** Speed = 2 (T score = 48**)

Erm there are three shelves erm a cat is on the shelf erm on the /dɒp/ on the top shelf erm **and** there are books falling off the top shelf as well erm **and** they are erm falling on a man on a bald man *who* is sleeping on a couch erm he is wearing a tie erm he is putting his feet up on the table erm on a coffee table erm there is a glass on the coffee table **and** there is a book underneath it **and** err he is looking after a young boy *who* is playing with a car **and** erm there is also erm on the second shelf erm there is also a fishbowl **and** on the third shelf there is also a big hi-fi system as well **and** yeah on the top shelf there is a plant a potted plant hmm the man is wearing a shirt and tie as well **and** that's about it

** outside of normal limits for people without aphasia

TABLE 2 Comprehensive Aphasia Test Written Picture Description Pre-treatment

CAT Written Picture Description Pre-Treatment 1		
Score (A – B) + C = 20 (T score = 66)		
A Appropriate ICWs = 16 (T score = 65)	**B** Inappropriate ICWs = 2 (T score = 38)	**C** Grammatical Well-Formedness = 6 (T score = 70)
*The bald man is sleeping on the couch. There are 3 shelves. On the top shelf there is a cat *which* is touching some water in the fishbowl below it and there are a few books *which* are falling on the bald man.		
CAT Written Picture Description Pre-Treatment 2		
Score (A – B) + C = 22 (T score = 67)		
A Appropriate ICWs = 17 (T score = 66)	**B** Inappropriate ICWs = 0 (T score = 57)	**C** Grammatical Well-Formedness = 5 (T score = 62)
There are three shelves in this picture. On the first shelf is a plant, a cat and some books *which* are toppling over. On the second shelf there is a goldfish bowl and on the third shelf there is hi-fi system. There is a bald man sleeping on a		

*Overuse of "and" is emboldened and the use of "who" to create a relative clause is italicised

TABLE 3 Comprehensive Aphasia Test Spoken Picture Description Post-treatment

Score (A – B) + C + D + E = 48.5 (T score = 68)				
A Appropriate ICWs = 38 (T score = 67)	**B** Inappropriate ICWs = 2 (T score = 54**	**C** Syntactic Variety = 4.5 (T score = 63)	**D** Grammatical Well-Formedness = 6 (T score = 64)	**E** Speed = 2 (T score = 48**)
erm there are three shelves **and** on the first shelf there is a plant **and** next to it is a cat er *who* is bending down to look at a fishbowl erm **and** there are books erm falling erm **and** on the second shelf there is a fishbowl *which* the cat above is bending down to look at **and** on the third shelf erm there is a huge huge stereo erm **and** next to the bookshelf there is a man sitting in a chair erm sitting in sofa erm **and** he **and** he has some books on the shelf falling on top of him *but* he's asleep erm **and** he's sitting down lying back and putting his feet up on the erm table beside the chair **and** yeah the table beside the chair erm is he is putting his feet up on the er on the two pieces of paper anyway erm **and** he has a book under the second level of it **and also** has coffee cup on a coaster **and then** on the other side there's a baby *who* is playing with a car erm with a car erm on the floor				

*"Overuse of "and" to connect sentences (into compound ones) is emboldened. The use of other connectives, relative and dependent clauses is italicised"

**Outside of normal limits for people without aphasia.

TABLE 4 Comprehensive Aphasia Test Written Picture Description Post-treatment

Score (A – B) + C = 22 (T score = 67)		
A Appropriate ICWs = 16 (T score = 65)	**B** Inappropriate ICWs = 0 (T score = 57)	**C** Grammatical Well-Formedness = 6 (T score = 70)
In the picture there are 3 shelfs. On the first shelf there is a plant **and** next to it there is a cat. The cat is leaning over the second shelf *where* there is a fishbowl *with little fish in it* . On the top shelf there is also a heap of books.		

* "Overuse of "and" to connect sentences (into compound ones) is emboldened. The use of other connectives, relative and dependent clauses is italicised"

TABLE 5 Pre and post-treatment film descriptions: connectives types and tokens count

	Pre-treatment Film Description	**Post-treatment Film Description Unedited**	**Post-treatment Film Description Edited**
first of all	1		1
then	2		
and then		1	1
and also			1
but	2	2	1
but then		1	1
so	1	2	3
so that			1
however		1	2
because		3	1
now		1	1
furthermore			1
consequently			1
on his 8th birthday			1

as well as			1
in fact			1
but in actual fact			1
additionally			1
in addition			1
because underneath it all			1
but in the end			1
TYPES	**4**	**7**	**20**
TOKENS	**6**	**11**	**23**

TABLE 6 Pre and post–treatment control measures

CAT subtest	Pre-treatment 1		Pre-treatment 2		Post-treatment 3	
	Raw Score	T score	Raw Score	T score	Raw Score	T score
Word fluency	24	68	30	71	28	70
Comprehension of spoken words	26	53	28	58	28	58
Comprehension of written words	27	53*	29	59	30	65
Naming Objects	41	60*	44	62	48	66

Figure 1. Pre and post-treatment CAT Spoken Picture Description Scores

Figure 2. Simple and complex sentence production in Cinderella narratives pre and post-treatment.

Footnotes

1 Our parentheses

2 BM occasionally produced sentences including a relative clause (e.g. utterance 23 of her Cinderella narrative, Appendix A) and this could also have been a therapy target. However, we felt that encouraging the use of complex sentence production would be more functionally useful for BM at this stage. (Relative clauses were treated in a subsequent phase of therapy using the Complexity Account of Therapy Effectiveness [CATE] approach [Thompson, Shapiro, Kiran, & Sobecks, 2003] not reported here).

3 A therapy idea initially explored with BM was to use mind maps to help her organise her ideas prior to formulating the language to express them (see Whitworth, 2010). It was hypothesised that this would assist by bringing to conscious awareness the language planning process and that this might also, as a result, reduce her processing load. It was also theorised that mind maps might enable her to better structure her argument and produce a more elaborate and ambitious contribution to the discussion, as was her goal. However in discussing mind maps with BM, she felt that she knew what she wanted to say i.e. could formulate ideas, and it was translating these into sentences speedily that presented the difficulty. She therefore felt that mind maps would not be useful to her. She agreed however to reconsider this approach if we felt it might be beneficial as therapy progressed.

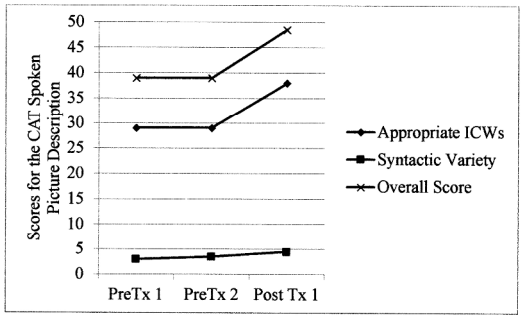

Figure 1. Pre and post-treatment CAT Spoken Picture Description Scores
297x420mm (300 x 300 DPI)

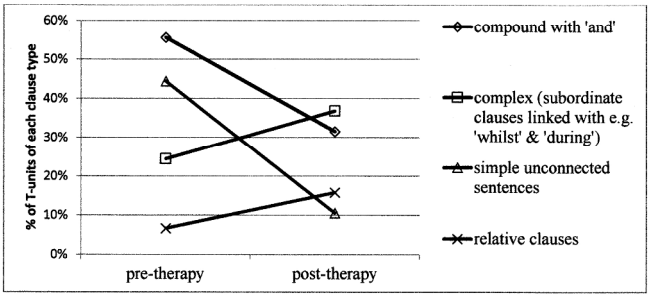

Figure 2. Simple and complex sentence production in Cinderella narratives pre and post-treatment.
297x420mm (300 x 300 DPI)