Investigating outcomes of impairment therapy and communication therapy for people with non-fluent aphasia

A thesis submitted to the University of Manchester for the degree of
Doctor of Philosophy
in the Faculty of Medical and Human Sciences

2012

Marcella Carragher

School of Psychological Sciences

Table of Contents

Thesis word count: 77,982

List of tables

List of figures

Abstract

University: The University of Manchester
Candidate: Marcella Carragher
Degree: Doctor of Philosophy
Degree title: Investigating outcomes of impairment therapy and communication therapy for people with non-fluent aphasia
Date: December 2012

The ultimate goal in any programme of aphasia rehabilitation is a social one – that behaviours targeted in therapy will generalise to everyday use for people with aphasia (PWA). Conversation is the most frequent communicative activity in daily life. While conversation provides a rich source of data for investigating a range of potential therapy effects, it presents methodological challenges to an experimental design. Thus, the effects of impairment-focused therapy on conversation have been investigated by only a handful of studies. This thesis aimed to contribute to the growing interest in measuring the effects of impairment-based therapies on everyday conversation. A sequential model of therapy was designed which targeted increasing levels of language production from verb retrieval, to syntactic construction and storytelling, with on-going sampling of conversation data. The effects of each therapy were tracked across contexts of decreasing constraint. Quantitative measures were developed that a) investigated stability of variables of interest in baseline conversation, b) compared changes on variables of interest in test/retest analysis, and c) were applicable to connected speech data and conversation. A case design was used in which nine participants with non-fluent aphasia took part in two empirical studies and four participants in a third study. Verb retrieval therapy consisted of semantic feature analysis (SFA), gesture production and phonemic cueing and targeted semantically light and heavy verbs as well as verbs which were personally relevant to each participant. Syntactic construction therapy included a mapping approach and reduced syntax therapy (REST). Both studies found strong effects of therapy on direct measures, with less clear patterns on indirect measures. Regarding baseline conversation data, analysis within both studies indicated a lack of statistically significant variability in behaviours of interest, but no evidence of change within the group following therapy. Analysis of individual participant's performance revealed post-therapy quantitative and qualitative changes for a subset of participants after receiving these therapy interventions. The final therapy incorporated the rich communicative environment of storytelling to draw upon and extend the work of the previous therapies (i.e., verb retrieval, grammatically-reduced verb phrases, gesture). An approach which combined both the PWA and their conversation partner was designed whereby the PWA received treatment targeting narrative production (through thinking for speaking and story grammar) and the conversation partner received treatment targeting their role in co-constructing the story (through conversation coaching). Both approaches within the final therapy utilised personalised therapy goals, modelling, video feedback and discussion. On post-therapy assessment, the performances of two couples demonstrated a quantitative change which was attributed to the therapy programme. For one of these couples, single case analysis revealed changes in how the conversation partner participated in the storytelling task before and after therapy, with similarities within conversation data before and after therapy. The thesis presents an argument in support of multi-component therapies and also explicit therapeutic focus on the generalisation of linguistic skills to an everyday communicative situation.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning

Copyright statement

i. The author of this thesis (including any appendices and/or schedules to this thesis) owns certain copyright or related rights in it (the "Copyright") and s/he has given The University of Manchester certain rights to use such Copyright, including for administrative purposes.

ii. Copies of this thesis, either in full or in extracts and whether in hard or electronic copy, may be made only in accordance with the Copyright, Designs and Patents Act 1988 (as amended) and regulations issued under it or, where appropriate, in accordance with licensing agreements which the University has from time to time. This page must form part of any such copies made.

iii. The ownership of certain Copyright, patents, designs, trade marks and other intellectual property (the "Intellectual Property") and any reproductions of copyright works in the thesis, for example graphs and tables ("Reproductions"), which may be described in this thesis, may not be owned by the author and may be owned by third parties. Such Intellectual Property and Reproductions cannot and must not be made available for use without the prior written permission of the owner(s) of the relevant Intellectual Property and/or Reproductions.

iv. Further information on the conditions under which disclosure, publication and commercialisation of this thesis, the Copyright and any Intellectual Property and/or Reproductions described in it may take place is available in the University IP Policy (see http://documents.manchester.ac.uk/DocuInfo.aspx?DocID=487), in any relevant Thesis restriction declarations deposited in the University Library, The University Library's regulations (see http://www.manchester.ac.uk/library/aboutus/regulations) and in The University's policy on Presentation of Theses.

Acknowledgements

I would like to express my sincere gratitude to my academic supervisors Dr. Paul Conroy and Dr. Karen Sage for their unwavering support and valued guidance throughout the PhD. I have benefited enormously from the generosity with which they shared with me their time and expertise. This research was made possible by funding awarded by the Stroke Association through the Junior Research Fellowship Award (TSA JRTF 2009/01). Thanks also go to Prof. Ray Wilkinson for supervision in the early stages of the PhD.

I am indebted to the participants and their families who generously gave up their time to take part in the studies. It was an honour to work with them, to learn their life stories and the impact of stroke, and to share in their tears and laughter. Specially remembered is participant BG, who passed away before the first therapy study. Warm thanks go to the many NHS speech and language therapists who played a crucial part in this research by identifying and referring suitable candidates.

Very special thanks go to my family – my parents Aidan and Lucia and sisters Natacha, Danielle and Nicole – for their encouragement and support throughout the PhD. Thanks also to Dr. Bronagh Blaney whose lectures during my undergraduate Speech and Language Therapy degree inspired my clinical and research interest in acquired communication disorders. Finally, my thanks go to my friends and to my peers within the Neuroscience and Aphasia Research Unit and to my partner Patrick for his patience, support and advice, and for putting up with it all.

Related presentations and publications

Portions of the content and text of this thesis appear in the following presentations and publications (listed chronologically):

Carragher, M., Conroy, P., Sage, K., Wilkinson, R. (2011). Can verb therapy impact on everyday conversation? Initial data from a lexical intervention for people with non-fluent aphasia. *Poster* presented at the British Aphasiology Society Conference, University of Reading (6-8th September 2011).

Carragher, M., Conroy, P., Sage, K., Wilkinson, R. (2012). Can impairment focused therapy change the everyday conversations of people with aphasia? A review of the literature and future directions. *Aphasiology,* 26 (7), 895-916.

Carragher, M., Sage, K., Conroy, P. (2012). The effects of lexical retrieval therapy on the conversations of people with chronic non-fluent aphasia. *Paper* presented at the British Aphasiology Society Therapy Symposium, City University London (6-7th September 2012).

Carragher, M., Sage, K., Conroy, P. (2012). Can a lexical retrieval therapy impact on conversation? Evidence from a multi-component therapy for people with non-fluent aphasia. *Poster* presented at the conference of the Royal College of Speech and Language Therapists, Research that changes clinical practice, Manchester (11-12th September 2012).

Carragher, M., Sage, K., Conroy, P. (2012). Can we capture and quantify the effects of verb retrieval therapy on everyday conversations? Evidence from people with non-fluent aphasia. *Paper* presented at the 15th International Aphasia Rehabilitation Conference & the Aphasia Symposium of Australia, Melbourne (7-10th October 2012).

Carragher, M., Sage, K., Conroy, P. (2012). The effects of lexical retrieval therapy for people with non-fluent aphasia: Can we capture and quantify change in conversation? *Poster* presented at the 50th Annual Meeting of the Academy of Aphasia, San Francisco (28-30th October 2012).

Conroy, P., **Carragher, M**., Hesketh, A. (2012). Complexity in Aphasia Therapy: the case of sentence and discourse production. *Invited* lecture to Annual Dutch Aphasia Conference, Rotterdam.

Carragher, M., Sage, K., Conroy, P. (accepted pending corrections). The effects of lexical retrieval therapy for people with non-fluent aphasia; Evidence across assessment tasks and conversation. Neuropsychological Rehabilitation.

Carragher, M., Sage, K., Conroy, P. (submitted). Outcomes from a multi-component therapy targeting syntactic construction: Evidence from people with non-fluent aphasia in assessment tasks and everyday conversation. Archives of Physical Medicine and Rehabilitation.

The author

I, Marcella Carragher, studied Speech and Language Therapy at the University of Ulster (Northern Ireland) and qualified as a Speech and Language Therapist in 2006. Following graduation, I worked as a Speech and Language Therapist across acute and community services in Lancashire, specialising in adult acquired neurology. Experience of working within a multidisciplinary community stroke team led to a special interest in chronic aphasia. In 2009, alongside Drs Paul Conroy, Ray Wilkinson and Karen Sage, I was awarded a Junior Research Fellowship Award by the Stroke Association and undertook this PhD at the University of Manchester.

List of abbreviations

AAT: Aachen Aphasia Test (Huber, Poeck, & Willmes, 1985)

BDAE: Boston Diagnostic Aphasia Examination (Goodglass, et al., 2001)

CA: conversation analysis

CAT: Comprehensive Aphasia Test (Swinburn, Porter, & Howard, 2004)

RCPM: Raven's Coloured Progressive Matrices (Raven, Raven, & Court, 1998)

IPNP: International Picture Naming Project (Bates, Andonova, D'Amico, Jacobsen, Kohnert, Lu, Székely, Wicha, Federmeier, Herron, Iyer, Pechmann, Devescovi, Orozco-Figueroa, Gutierrez, Hung, Hsu, Tzeng, Gerdjikova, Mehotcheva, & Pleh, 2000)

LVET: Light Verb Elicitation Test (Conroy, unpublished)

OANB: Object Action Naming Battery (Druks & Masterson, 2000)

PALPA: Psycholinguistic Assessments of Language Processing in Aphasia (Kay, Lesser, & Coltheart, 1992)

PWA: person/people with aphasia (singular or plural context-dependent)

REST: Reduced Syntax Therapy (Springer, Huber, Schlenck, & Schlenck, 2000)

TEA: Test of Everyday Attention (Robertson, Ward, Ridgeway, & Nimmo-Smith, 1994)

VAST: Verb and Sentence Test (Bastiaanse, Edwards, & Rispens, 2002);

Chapter 1: Introduction

This thesis consists of four papers concerned with investigating the effects of therapy for people with non-fluent aphasia across a range of outcome measures. An alternative thesis style has been adopted for the presentation of this thesis; as such, each chapter is presented as a self-contained paper with its own literature review and methods section. The nature of the alternative thesis style results in some repetition of information, such as background information and assessment.

1.1 Outline of thesis structure

This introductory chapter will briefly outline the relevant theoretical background to the thesis, specifically the symptoms of non-fluent aphasia, verb and sentence production and generalisation of treatment effects to untrained tasks and/or contexts. This chapter will conclude by establishing the research questions posed in the thesis and set out the structure of the thesis.

Chapter 2 outlines the recruitment procedure employed within the therapy studies and provides details on the participants recruited to the research. Chapter 3 sets out the background to the empirical studies within the thesis and contains a published review investigating the effect of impairment-focused therapy on everyday conversation. Based on critical discussion of relevant literature, a number of possible directions are outlined regarding future therapy studies. Chapters 4-6 present the three empirical studies of the thesis. Chapter 7 draws together themes addressed throughout the empirical chapters.

1.2 Non-fluent Broca's aphasia

The syndrome of non-fluent Broca's-type aphasia is characterised by effortful, dysprosdic spoken output (Saffran, Berndt, & Schwartz, 1989), impoverished verb retrieval relative to nouns (Bastiaanse & Jonkers, 1998), short utterance length and reduced syntactic complexity (Lee & Thompson, 2004) and omission of closed-class words (Bastiaanse & Jonkers, 1998), inflectional morphology and grammatical agreement (Faroqi-Shah, 2008). Non-fluent aphasia is often accompanied by a motor component, i.e., apraxia of speech (Ardila, 2010; McNeil, Robin, & Schmidt, 2008). Comprehension is relatively intact (Goodglass, 1976) but deteriorates on syntactically complex or semantically reversible sentences (e.g., Berndt, Mitchum, & Haendiges, 1996; Saffran & Schwartz, 1988b).

Presentation of Broca's-type aphasia does not necessarily implicate Broca's area (e.g., Dronkers, Shapiro, Redfern, & Knight, 1992) and has also been associated with infarcts in the insula and adjacent cerebrum (e.g., Davis, Kleinman, Newhart, Gingis, Pawlak, & Hillis, 2008). The association between ischemia in Broca's area and Broca's aphasia has been shown to be more reliable in acute rather than chronic stroke, because neural reorganisation and/or rehabilitation permit some resolution of the language deficits (Ochfeld, Newhart, Molitoris, Leigh, Cloutman, Davis, Crinion, & Hillis, 2010). Within a cohort of individuals who had experienced a first ischemic stroke, a European prospective study found that 60% of participants were classified as non-fluent, compared to 29% as fluent (Engelter, Gostynski, Papa, Frie, Born, Adhacic-Gross, Gutzwiller, & Lyrer, 2006). Individuals presenting with non-fluent aphasia tend to be young with relatively good prognosis for recovery (Van De Sandt-Koenderman, Bonta, Wielaert, & Visch-brink, 1997). Throughout the thesis, terms such as 'non-fluent aphasia' and 'Broca's aphasia' are used inter-changeably to reflect the audiences of journals to which the papers have been submitted.

1.2.1 Verb production in people with non-fluent aphasia

A paucity of verbs in production (relative to nouns) is characteristic of non-fluent aphasia (Bastiaanse & Jonkers, 1998). A verb retrieval deficit may reflect an underlying impairment of semantics (e.g., McCarthy & Warrington, 1985), phonology (e.g., Marshall, Pring, & Chiat, 1998), orthography (e.g., Caramazza & Hillis, 1991), morphology or syntax (e.g., Thompson, 2008) or, more broadly, cognitive resources (e.g., Silveri, Salvigni, Cappa, Della Vedova, & Puopolo, 2003) or event perception (e.g., Marshall, 2009); for a review, see Conroy et al. (2006). Verb retrieval is sensitive to psycholinguistic variables such as transitivity (whether or not the verb specifies a direct object), semantic weight (see below) and the number of arguments specified by the verb (i.e., valency). Individuals with non-fluent aphasia display a preference for production of verbs with one internal argument – e.g., to climb – or verbs without an internal argument – e.g., to cry (Thompson, Shapiro, Li, & Schendel, 1995). They also typically produce uninflected verbs, a lower range of lexical verbs compared to unimpaired speakers and/or a lower diversity of lexical verbs (Bastiaanse & Jonkers, 1998).

On a continuum of semantic weight, verbs have been distinguished as either 'light' or 'heavy', the former characterised as abstract and applicable in labelling a wide range of events (e.g., go, make; Gordon & Dell, 2003), the latter characterised as concrete and applicable to a smaller range of events (e.g., drive, bake; Maouene, Laakso, & Smith, 2011). While light verbs encode the core semantic features of heavy verbs (Kegl, 1995), their semantic representation are crucially under-specified (Gordon & Dell, 2003). In child

language acquisition, light verbs are considered to have a 'path-breaking' role with regards to learning verbs and grammar (e.g., Ninio, 1999): early acquisition of light verbs serves as a foundation of semantic knowledge to which more specific meaning can be added for concrete verbs (Pinker, 1989), so that light verbs can later be replaced by more specific verbs (Clark, 1978). In aphasia, the effect of semantic weight on verb retrieval has been debated, with conflicting experimental data presented. For example, Berndt et al. (1997d) reported increased use of light verbs in tasks of sentence production and narrative, which may reflect strategic use of high frequency verbs in cases of failure to retrieve more specific verbs. In contrast, Bencini and Roland (1996) and Breedin, Saffran and Schwartz (1998) demonstrated a retrieval advantage for heavy verbs, based on the premise of the vulnerability of less semantically specified lexical entries. Crucially, any potential advantage for light verbs has not been explored within therapy studies, where the features of light verbs (i.e., high frequency, applicability to a wide range of events) may make valid targets for therapy and generalisation.

Research into lexical retrieval and its treatment in aphasia has predominantly focused on noun or object naming, with verb processing and action naming treatment being somewhat under-represented (Conroy, et al., 2006; Wambaugh, Doyle, Martinez, & Kalinyak-Fliszar, 2002). Yet verbs play a crucial role in the planning and production of sentences and connected speech (Conroy, et al., 2006; Webster & Whitworth, 2012). Zingeser and Berndt (1990) suggest that verbs constrain "the assignment of retrieved lexical items to positions within the syntactic frame: poor access to verbs could cause widespread disruption of the specification of sentence structure during production" (p.16).

1.2.2 Syntactic construction in people with non-fluent aphasia

Individuals with non-fluent aphasia present with syntactic and morphological deficits in sentence production: any constructions produced which contain a verb tend to be syntactically simple subject-verb-object constructions (e.g., Saffran, et al., 1989); the arguments of the verb may be omitted or produced in the wrong order; and errors or omissions of grammatical morphology are common, such as verb inflection for tense and agreement (e.g., Bird, Franklin, & Howard, 2002).

The sentence production deficit in Broca's aphasia can be conceptualised using models of normal sentence production. For example, Garrett (1988) proposed a number of stages within sentence processing; at the conceptual level, an event is interpreted and a perspective is specified (Message level). At a subsequent grammatical encoding level (Functional level), the semantic information of the content words is accessed and the thematic roles are assigned

(i.e., who does what to whom). A further stage of grammatical encoding (Positional level) occurs in which the syntactic form is generated. The information from the Functional and Positional levels must be integrated (or mapped) before phonology is assigned and the sentence is realised. As with asyntactic comprehension, impaired sentence production in people with non-fluent aphasia may be indicative of a mapping deficit (Schwartz, Linebarger, Saffran, & Pate, 1987), i.e., impoverished thematic information stored within verb entries results in an inability to create a predicate argument structure (Saffran, Schwartz, & Marin, 1980). Marshall (1995) summarised two types of mapping deficit: firstly, a lexical mapping deficit relates to a loss of information contained within the verb, which specifies the grammatical arguments (e.g., subject, object, indirect object) expressed by the verb and the associated thematic roles, e.g., agent, patient, theme (Schwartz, Saffran, Fink, Myers, & Martin, 1994). A lexical mapping deficit manifests as impaired comprehension of even simple reversible sentences (e.g. *'the cow chased the dog')* where world knowledge in itself is not sufficient in order to parse the sentence. Secondly, a procedural mapping deficit relates to how thematic roles are assigned to argument structures (Marshall, 1995), e.g., subject, object, indirect object. This is particularly important for those sentences in which arguments have been moved from the canonical position of subject-verb-object (Saffran & Schwartz, 1988a). A procedural mapping deficit manifests as impaired comprehension of non-canonical sentences such as passives (e.g. *'the race was lost by the weary swimmer'*).

1.3 Therapy and the issue of generalisation

Much therapeutic attention has been focused on people with non-fluent aphasia. The effectiveness of intervention targeting production has been reported for a range of therapy programmes, i.e., effortful, dysprosdic spoken output (Saffran, et al., 1989), verb retrieval deficit (Bastiaanse & Jonkers, 1998), reduced syntactic complexity (Lee & Thompson, 2004), omission of closed-class words (Bastiaanse & Jonkers, 1998), and omission of inflectional morphology and grammatical agreement (Faroqi-Shah, 2008). Based on developments within models of sentence processing (see Marshall, 2002), treatment has targeted underlying deficits in order to improve sentence production, e.g., mapping treatments which target the integration of semantic-syntax mapping through sentence comprehension and/or production (e.g., Marshall, 1995; Rochon, Laird, Bose, & Scofield, 2005) and treatments which target the specification and realisation of argument structure (e.g., Webster, Morris, & Franklin, 2005). Other interventions have adopted a linguistic compensatory approach to impaired sentence production, for example, training the production of syntactically reduced constructions in order to minimise processing demands (Ruiter, Kolk, & Rietveld, 2010; Springer, et al., 2000) and use of a prosthesis to facilitate sentence construction (e.g., Linebarger, Romania, Fink, Bartlett, & Schwartz, 2008).

The issues of therapy effectiveness and generalisation go hand-in-hand; an effective therapy has been defined as one which, in targeting specific language behaviours, produces effects which endure over time and transfer to untrained language behaviours and contexts (Thompson, 1989). It has been argued that "the ultimate goal of aphasia rehabilitation is a social one: to optimize the communication between the person with aphasia and his or her environment" (van de Sandt-Koenderman, van der Meulen, & Ribbers, 2012, S1). Therefore the potential for behaviours which have been targeted in therapy to generalise to everyday situations of communication is key. However, making predictions as to the generalisation of therapy to everyday use is not straightforward. The patterns of language production in aphasia have been shown to be context-sensitive (Beeke, Wilkinson, & Maxim, 2003a, 2003c; Rose & Sussmilch, 2008) making it difficult to extrapolate implications for everyday communication based on results from task-based assessment. For example, in a task requiring description of spatial relations using morphological forms such as adjectives and prepositions, individuals with agrammatism produced a range of simplified constructions which were infrequently produced in conversation. These constructions included non-verb ellipses (e.g., "circle blue, square red, on top" rather than "blue circle on top of red square), predicative adjectives (e.g., "circle red" instead of "red circle') or intransitive prepositions ("on top of it" rather than "on") (De Roo, Kolk, & Hofstede, 2003; Ruiter, et al., 2010). Speakers with agrammatism downgraded their output to the lowest degree of elliptical complexity (i.e., non-verb elliptical utterances) when faced with high informational demands (De Roo, et al., 2003). This may be accounted for by adaptation theory (Kolk, 1995; Kolk & van Grunsven, 1985) which conceptualises agrammatism as a temporal disorder. Thus, the reduced capacity for language production in agrammatism leads to morpho-syntactic deficits and symptoms which (e.g., telegraphic style output, discrepancies in output across contexts) reflected a type of compensation by the speaker in order to manage his/her linguistic target within reduced processing capacity.

If the broad aim of all interventions is that behaviours targeted within therapy will generalise to everyday use, it is perhaps unsurprising that conversation, as the most frequency communicative activity of daily life (Davidson, Worrall, & Hickson, 2003), has gained interest as a context in which to measure therapy outcomes. To date, the evidence of generalisation from impairment therapy studies to everyday conversation has shown promise but has not been overwhelming (see Carragher, Conroy, Sage, & Wilkinson, 2012). Beeke, Maxim, Best, and Cooper (2011) suggested two reasons for the lack of evidence of generalisation from impairment-based therapy to everyday language: either outcome

measures fail to capture the changes in everyday language following impairment-based interventions, or impairment-based therapy does not affect changes in everyday language because of differences in demands and materials across clinical tasks and everyday conversation.

1.4 Study design

The therapy studies presented within this thesis employed a case-series design; this allowed for investigation of the effects of therapy both within- and between-participants. Case-series studies offer some of the advantages of single case studies and group studies – that is, detailed study of individual participants with the potential for investigation of the applicability of findings across the participant group (e.g., Linebarger, et al., 2008).

1.5 Research themes

The thesis addresses four broad, overarching themes:

1. Is it possible to develop quantitative measures to investigate stability of behaviours of interest in everyday conversation that will also serve to capture change following therapy?
2. Can therapy studies be designed which maximise the potential of generalisation to untreated contexts?
3. Can conversation data be used as an assessment method through which to investigate indirect effects of therapy?
4. Can a sequential model of therapy delivery be implemented which isolates specific discreet components of therapy and their effects on conversation while also facilitating an incremental, cumulative therapy method where skills can be focused on in a step-by-step manner?

See Appendix 1 for a summary of methods, assessments and outcome measures employed throughout the thesis.

1.6 Chapter 2: Participants

This chapter will outline details of the recruitment process and inclusion/exclusion criteria employed in the empirical studies that follow. A summary of each participant will also be presented, describing their performance on psycholinguistic and cognitive background assessment, as well as clinical observations of their communication in daily life.

1.7 Chapter 3: Can impairment-focused therapy change the everyday conversations of people with aphasia? A review of the literature and future directions

Background: The ultimate goal in any programme of aphasia rehabilitation is that behaviours targeted in therapy will generalise to everyday use for people with aphasia (PWA). The pervasiveness of conversation in everyday life has undoubtedly contributed to the recent interest in aphasiology regarding how we facilitate, and capture evidence of, change in conversation following therapy. Given the rich nature of conversation data, various analytical approaches have been utilised within impairment-focused therapy studies; however, much of this work has been carried out in isolation from other methodologies such as conversation analysis (CA)—a field which has historically concerned itself with conversation data. The result is a growing literature base which is dispersed in nature. For clinicians who are faced with the daily challenge of therapeutic management for a diverse population of PWA the literature on generalising therapy gains to everyday conversation may be too unwieldy to be of benefit to current clinical practice.

Aims: This paper aims to synthesise and critically review key papers from impairment-focused studies which have investigated the impact of therapy on the conversations of PWA. For the purposes of this review, conversation is defined as a dialogue between the person with aphasia and a conversation partner.

Main Contribution: First, the motivation to investigate conversation within aphasia assessment is discussed, with consideration of how conversation differs from, but ultimately complements, other forms of language assessment. Following this, five impairment therapy studies will provide a platform for discussion of methodological issues and analytical approaches relating to conversation data. Finally, consideration is given to how researchers and clinicians may build on current literature to develop the use of conversation as an outcome measure in aphasia intervention. Where appropriate, insights are drawn from interaction-focused therapy studies regarding the collection and analysis of conversation data.

Conclusions: There is emerging evidence that impairment-focused therapy can impact on the conversations of PWA. While these early findings are promising, investigations have been limited to naming therapies and the methods of data collection used have implications for ecological validity. Incorporating particular elements of interaction-focused approaches may help to inform data collection, investigations of therapy outcome, and issues for candidacy for specific treatments. Furthermore, combining therapeutic and analytic approaches is likely to be more closely akin to the clinical reality of aphasia intervention, where clinicians are likely to use all resources at their disposal in the rehabilitation of a speaker with aphasia.

1.8 Chapter 4: The effects of verb retrieval therapy for people with non-fluent aphasia; Evidence across assessment tasks and conversation

Background: Despite often impressive improvements on linguistic assessments, there is a lack of evidence of significant generalisation from impairment-focused aphasia therapy to everyday communication. The aim of the current study was to investigate the effect of a verb retrieval therapy across a range of levels of language production.

Methods and procedures: Nine participants with chronic non-fluent stroke aphasia were recruited into this case series. Baseline assessment included naming a range of verbs (i.e., action verbs, semantically light verbs and personally relevant verbs) and sentence production; multiple samples of conversation were collected from each participant and his/her partner. Consecutively failed verbs were divided across treatment and control sets, matched for salient psycholinguistic variables such as frequency, imageability and argument structure. A multi-component verb retrieval therapy was delivered, consisting of semantic feature analysis, gesture production and phonemic cueing.

Outcomes and results: Following therapy, participants demonstrated significant and sustained gains in naming treated verbs; more modest effects were seen in untreated verbs. Mixed patterns of generalisation were evident in assessment of sentence production. In conversation, while group analysis suggested a lack of change, individual analyses indicated increased verb retrieval for three participants and qualitative changes related to the syntactic contexts of verbs retrieved.

1.9 Chapter 5: Outcomes of treatment targeting syntactic construction in people with Broca's-type aphasia: Evidence from psycholinguistic assessment tasks and everyday conversation

Objective: To evaluate a theoretically-driven treatment focused on the language production skills of participants with Broca's aphasia after stroke and to compare outcomes from psycholinguistic assessment tasks and everyday conversation.

Design: A case series design was utilised with pragmatic selection of chronic participants undergoing the same assessment and treatment procedures.

Setting: Intervention programme for community-dwelling participants.

Participants: Nine participants with chronic Broca's aphasia and their main conversational partners took part in the study.

Intervention: Treatment targeted production of basic syntax through principles of mapping and reduced syntax treatment.

Main Outcome Measures: Syntactic well-formedness was assessed in samples of constrained sentence production, narrative retell and conversations.

Results: Treatment showed strong direct effects in trained and untrained sentence construction tasks, with some generalisation to narrative retell tasks. There was little evidence of change in everyday conversation.
Conclusion: Improvement in language production in constrained assessment tasks may not impact on everyday conversations. Implications for further treatment, such as the need for bridging interventions between impairment and functional measures, are discussed.

1.10 Chapter 6: The effects of treatment targeting transaction and interaction through storytelling: Quantitative and qualitative evidence from people with non-fluent aphasia

Background: Aphasia rehabilitation ultimately has a social goal of optimising the communication of the person with aphasia (PWA) within their typical environment. One important aspect of everyday communication relates to conveying new information and telling anecdotes/stories. Measures of transactional success in storytelling have previously demonstrated reliability and validity as an analytical method.
Aim: The study aimed to extend previous work on transactional success in storytelling to a programme of therapy targeting both the PWA and the conversation partner.
Methods and procedures: Four participants with chronic non-fluent aphasia and their conversation partners were recruited. A novel dual-focus treatment was administered: for the PWA, therapy targeted storytelling primarily through 'thinking for speaking' principles and story grammar; for the partner, therapy drew on the principles of conversation coaching to increase facilitative behaviours within storytelling to aid the construction of shared understanding. Quantitative and qualitative measures were used to investigate direct and indirect effects of treatment.
Outcomes and results: There were numerical gains in information exchange for three of four couples, where the conversation partner displayed improved understanding of the PWA's story, and a decrease for one couple. Evidence of likely direct effects of therapy across both simple and complex storytelling was consistent for two of the four couples. For one of these couples, an in-depth single case analysis indicated increased active participation in story construction and shared understanding, in line with his individual therapy goals. Within conversation, descriptive analysis indicated similar changes to those seen in the storytelling task.
Conclusions: The method of dual-focused therapy and outcome measurement outlined in this paper offers promise for targeting an important aspect of everyday communication in a standardised task. Potential for future investigation is discussed.

1.11 Chapter 7: Discussion

This chapter reflects on the research findings presented in the thesis in the context of the original research questions posed in Chapter 1, with subsequent consideration of implications for theory and clinical application as well as potential areas for future research.

Chapter 2: Participants

2.1 Recruitment procedure

Following ethical approval via standard UK protocols (NHS IRAS system) and research governance procedures, a total of twenty participants from across the North West region of England were visited by two members of the research team in order to screen for suitability for participation.

2.2 Inclusion criteria

Potential participants were identified via NHS speech and language therapy departments and stroke clubs. Selection of participants included those who presented with non-fluent aphasia following a stroke. Presentation of non-fluent aphasia was based on convergence of clinical consensus, the results of standardised lexical retrieval assessment (as indicated by an age-adjusted clinical score on the Boston Naming Test, Goodglass, et al., 2001), and evidence of impaired use of grammatical markers and syntactic structures in picture description (as indicated by a clinical score on the Boston Naming Test, Goodglass, et al., 2001). All participants were at least 6 months post-onset to reduce the likelihood of further spontaneous recovery. All participants presented with intelligible speech (as judged by two members of the research team); as aphasia often co-occurs with dysarthria and apraxia of speech (e.g., McNeil, et al., 2008), presence of apraxic errors did not form part of the exclusion criteria.

Exclusion criteria included presentation of fluent aphasic symptoms on picture description and in conversation, evidence of significant cognitive impairment (i.e., impaired cognitive skill of 1-2 centile across all domains tested), or participant reluctance to collect video data.

Ten participants were recruited via NHS speech and language therapy departments and stroke clubs. Written consent for participation was obtained separately for both the participants with aphasia and their main conversation partner (typically their husband/wife). One participant withdrew from the studies during background assessment due to illness. Nine participants took part in the first two therapy studies presented in Chapters 4 and 5; of the total group, four of these participants took part in the third therapy study presented in Chapter 6.

2.3 Summary of participants

An overview of demographic information relating to participants is presented in Table 1. Inter-participant variation existed for time post-onset, ranging from 8 months to 132 months

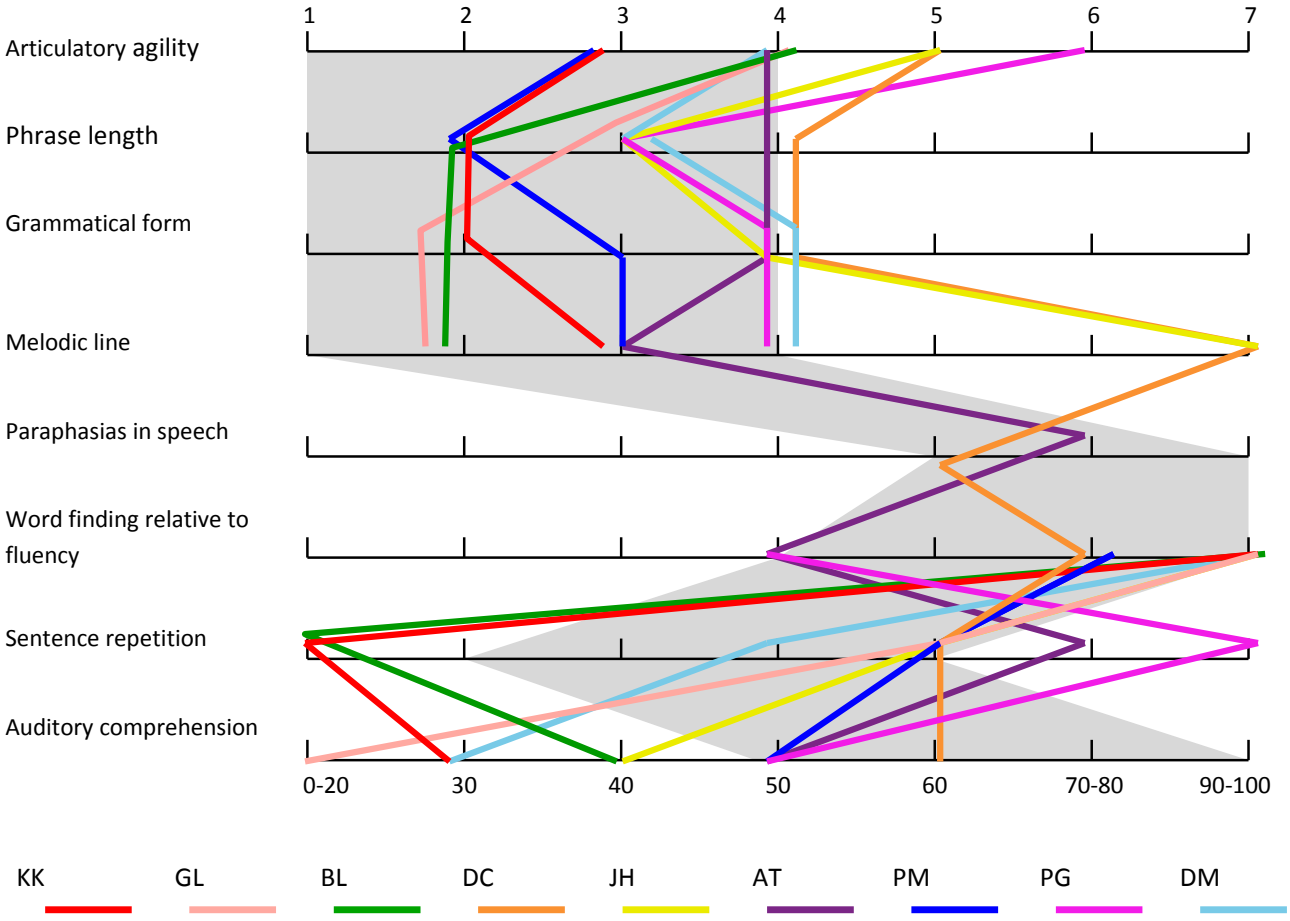
(mean: 44.8, St Dev. 39.3). The participants ranged in age from 36 – 68 years (mean: 53.2, St Dev. 11.9).

Table 1: Background information for nine participants

Participants	*Gender*	*Age of leaving education*	*Hand-edness*	*Occupation*	*Age at time of stroke*	*TPO (months)*
KK	Male	16	Right	Oil rig worker	46	24
GL	Male	16	Right	Driver / factory worker	46	12
BL	Male	16	Right	Pub manager	60	57
DC	Male	18	Right	Sales manager	34	72
JH	Female	23	Right	Teacher	36	8
AT	Female	16	Right	Secretary	62	15
PM	Male	16	Right	Businessman	64	47
PG	Male	18	Right	Architect	54	132
DM	Male	23	Right	Surveyor	45	36

Figure 1 illustrates the participants' performance on the Boston Diagnostic Aphasia Examination (BDAE; Goodglass, et al., 2001); the coloured lines depict each participants' performance on the BDAE compared to the grey shaded area which shows the expected profile for individuals with non-fluent aphasia. As expected, there is variability within the group; however, each participant broadly conforms to the pattern of performance which is typical for individuals with non-fluent aphasia.

Figure 1: Participants' performance on the BDAE (Goodglass, et al., 2001)



As part of the background assessment, all participants completed a battery of psycholinguistic and cognitive assessments; for a description of each assessment, see Appendix 3. The purpose of this battery of assessments was to i) profile the linguistic deficits, strengths and error patterns specific to each participant, ii) investigate the cognitive status of each participant, iii) allow for comparison of linguistic and cognitive assessment with presentation in conversation, and iv) facilitate measurement of outcomes following therapy on a number of parameters (e.g., lexical retrieval, sentence production). Noun and verb semantics were tested using the Pyramids and Palm Trees (Howard & Patterson, 1992) and Kissing and Dancing Test (Bak & Hodges, 2003). Single word lexical retrieval was assessed using the Boston Naming Test (Goodglass, et al., 2001), the Object Action Naming Battery (OANB, Druks & Masterson, 2000) and the Verb and Sentence Test (VAST, Bastiaanse, et al., 2002). Phonological output was assessed using the PALPA 9 and 31 tests (Kay, et al., 1992). Auditory comprehension of verbs and sentences were assessed using subtests from the VAST (Bastiaanse, et al., 2002). Cognitive assessment included executive functioning (Brixton Spatial Anticipation Test, Burgess & Shallice, 1997; Wisconsin Card Sorting Test, Grant & Berg, 1993), memory (Rey Complex Figure Test, Meyers & Meyers, 1995) and attention (Test of Everyday Attention, Robertson, et al., 1994).

On background assessment, inter-participant variation existed for severity: noun naming (Boston Naming Test, Goodglass, et al., 2001) ranged from 9 – 43 from a maximum score of 60 (mean: 26, St Dev. 12.22); verb naming (Object Action Naming Battery, OANB; Druks & Masterson, 2000) ranged from 17.5 – 84.5 from a maximum score of 100 (mean: 43.94, St Dev. 21.95). See Tables 2 and 3 for participant scores on linguistic and cognitive assessment.

The timeframe for assessment was as follows:

1. data collection for background assessments commenced once written consent had been obtained for each participant and his/her conversation partner
2. baseline outcome measures were collected within the month prior to commencement of therapy
3. post-therapy outcome measures were collected within the month following therapy (i.e., 1-week and 1-month post-therapy)
4. conversation data were sampled twice weekly for one month preceding and following each therapy study

Table 2: Background language assessments for nine participants

Assessment	*Max*	*Range*	*KK*	*GL*	*BL*	*DC*	*JH*	*AT*	*PM*	*PG*	*DM*
Boston Naming Test	60		9	19	27	19	16	21*	36	39	43
Pyramids and Palm trees	52	49-52	47	42	46	**51**	**50**	48	**49**	42	**50**
Kissing and Dancing	52	48-52	46	**48**	43	**50**	47	47	46	41	**51**
PALPA 9 (word repetition)	80	78-80	45	**80**	46	76	77	**78**	62	73	56
PALPA 9 (nonword repetition)	80	n/a	17	68	13	45	50	48	31	52	32
PALPA 31 (reading aloud)	80	79-80	12	35	34	63	43	70	60	76	60
OANB baseline 1	100	n/a	17	19	23	24	42	50	58	66	84
OANB baseline 2	100	n/a	18	25	38	36	43	40	60	63	85
VAST											
Verb comp	40	38-40	29	27	28	37	35	**39**	34	34	**39**
Sentence comp	40	39-40	28	15	19	25	26	27	37	20	20
Grammaticality judgement	40	37-40	25	32	27	30	36	23	36	34	25
Action naming	40	37-40	7	8	9	10	36	9	35	27	31
Naming finite verbs	10	8-10	0	0	0	0	1	0	2	1	0
Naming infinite verbs	10	8-10	0	1	6	2	2	1	**10**	5	3
Sentence construction	20	16-20	1	3	4	9	4	11	**17**	13	**18**
Sentence anagrams (pictures)	20	20-20	12	9	7	10	11	11	11	15	10
Sentence anagrams	20	20-20	9	8	4	11	9	11	10	16	10
Wh-questions	20	17-20	0	0	0	0	0	8	2	0	0
Light verb elicitation test	30	27-30	0	2	0	0	3	4	6	6	0
CAT gesture object use	12	9-12	**10**	**12**	8	**12**	**12**	**11**	7	6	**12**
CAT disability questionnaire											
Disability total: PWA's report	64	n/a	30	31	37	38	14.5	35	19	27	42
Disability total: partner report	64	n/a	25	33	31	27	22	37	26	-	35
Impact total: PWA's report	60	n/a	37	12	35	33	14	23	14	10	31
Impact total: partner report	60	n/a	50	29	30	35	22	25	17	-	38

Notes on Table 2:

- Participants are presented in order of average baseline verb retrieval scores on two administrations of the Object Action Naming Battery (OANB, Druks and Masterson, 2000). The OANB tests were administered approximately 4 weeks apart.
- Scores in **bold** indicate performance fell within normal ranges.

Table 3: Background cognitive assessments for nine participants

Assessment		*Max*	*KK*	*GL*	*BL*	*DC*	*JH*	*AT*	*PM*	*PG*	*DM*
Wisconsin no. of categories	score	6	-	**1**	**3**	**4**	**3**	0	0	**1**	**6**
	%tile		-	2-5	>16	11-16	2-5	≥ 1	≥ 1	11-16	>16
Wisconsin items to 1st cat.	score	0	-	41	36	21	14	129	129	21	15
	%tile		-	2-5	2-5	2-5	6-10	≥ 1	≥ 1	>16	6-10
Rey copy	score	36	**35**	-	**29.5**	**36**	**36**	**31**	**28**	**36**	**36**
	%tile		>16	-	2-5	>16	>16	11-16	2-5	>16	>16
Rey immediate recall	score	36	**22**	-	**4**	**25.5**	**27**	**18**	0.5	**14**	**22**
	%tile		62	-	<1	79	82	62	<1	46	62
Rey delayed recall	score	36	**26**	-	**10**	**28.5**	**23**	**14**	1.5	**15**	**22**
	%tile		88	-	7	93	54	27	<1	54	62
Brixton no of errors	score	54	13	23	22	13	28	29	22	16	27
	Cat.		High avg	Low avg	Low avg	High avg	Abnormal	Abnormal	Low avg	Avg	Abnormal
Raven's CPM accuracy	score	36	36	33	33	33	31	30	26	29	33
	%tile		-	-	-	-	-	-	50	90	-
TEA elevator counting	score	7	5	**7**	**7**	**7**	5	5	**7**	**7**	4
TEA elevator counting + distraction	score	10	**5**	**4**	**6**	**6**	**5**	3	2	2	2
	%tile		12.2-20.2	6.7-12.2	12.2-20.2	12.2-20.2	12.2-20.2	3.3-6.7	3.3-6.7	3.3-6.7	3.3-6.7

2.4 Description of individual participants

What follows is description of each participant, summarising their performance on psycholinguistic and cognitive background assessment, as well as clinical observations of their communication in daily life. Throughout the thesis (with the exception of Chapter 6), participants are presented in order of baseline verb retrieval scores on the Object Action Naming Battery assessment (OANB, Druks & Masterson, 2000).

2.4.1 KK

KK was a 48-year old who had been employed as an oil-rig worker and who lived with his wife and two children. He had sustained a CVA two years prior to entering the study which had resulted in a right-sided hemiplegia and subsequent early retirement. KK reported modest levels of disability associated with aphasia and a higher impact of aphasic symptoms on his daily life (reported on the CAT disability questionnaire, Swinburn, et al., 2004). Assessment indicated deficits in semantic and phonological processing with severe lexical retrieval difficulties for nouns and verbs, moderate comprehension impairment (mostly semantic errors) and severe sentence construction deficit. In particular, sentence production was at floor, with errors typically consisting of retrieving a related noun (e.g., target: 'the boy is catching the ball' → "football"), semantic paraphasias (target: 'the man is drinking a glass of wine' → "eating") and no responses. Where sentence fragments were produced, obligatory arguments were omitted and either a verb+locative construction (e.g., 'the man is running' → "running up the hill", 'the man is painting the woman' → "painting in here") or unrelated response produced (e.g., 'the boy is pushing the girl' → "she helps"). In conversation with his wife and children, KK's output was characterised by lengthy lexical searches, apraxic symptoms with groping for sounds, single word production as well as a number of stereotypical phrases (e.g., "is good that", "I cannot think so") and various strategies to pass the turn back to his conversation partner (e.g., laughing or closing down a topic with "never mind"). KK and his wife were very motivated to engage in therapy and often used conversation as a vehicle for KK to practise spoken production.

2.4.2 GL

GL was a 47-year old driver and factory worker who lived with his partner. Twelve months before joining the study, GL had experienced a CVA which had resulted in a right-sided hemiplegia and subsequent early retirement. Although independent for indoor mobility and daily activities, he continued to experience vestibular problems and pain associated with his affected limbs; this led to reduced social contact. GL often became frustrated and emotional regarding his expressive difficulties, although he rated the impact of his aphasic symptoms as very low (reported on the CAT disability questionnaire, Swinburn, et al., 2004). Assessment

indicated severe word-finding deficits for nouns and verbs, with mixed deficits in semantic and phonological processing. Sentence construction consisted of retrieving related nouns; if a verb was retrieved, it occurred in isolation (e.g., target: 'the girl is swimming' → "swimming"). Comprehension was impaired for single-word verbs (with an effect of frequency and transitivity) and deteriorated further on sentences (difficulty interpreting word order). In conversation with his partner, GL made use of his intact repetition skills to recycle words or phrases from his partner's speech but with morphological omissions (e.g., partner talking about an attic ladder: "it folds down", GL: "it fold down"). Output typically consisted of stereotypical constructions using an impersonal pronoun plus evaluative comment (e.g., "it fine", "it pleasant"), yes/no responses, finger spelling, pointing and iconic gestures.

2.4.3 BL

BL was a 64-year old pub manager who lived with his wife. He had sustained a CVA nearly five years prior to entering the study, resulting in a right-sided weakness and retirement from his job. Although he often experienced frustration related to his word retrieval difficulties he maintained, on the whole, a confident, easy-going manner and enjoyed attending two stroke groups. However, BL was aware of the limitations of his aphasic symptoms and reported a high score in terms of perceived disability and impact of the aphasia (reported on the CAT disability questionnaire, Swinburn, et al., 2004). BL presented with deficits in semantic and phonological processing, with impaired comprehension of verbs and sentences (the latter characterised by difficulty parsing the grammatical structure from non-canonical sentences) and severe lexical retrieval impairment for nouns and verbs (although markedly worst for verbs) resulting in mostly semantic errors. Performance on baseline administrations of the OANB (Druks & Masterson, 2000) indicated variable performance. In conversation with his wife, BL's output was limited to single words, a number of stereotypical phrases and yes/no responses. However, BL was a resourceful communicator and made effective use of nonverbal skills such as singing, pointing and drawing to supplement his limited spoken output, e.g., when he sang a particular song, his wife knew that he was talking about his time in the army.

2.4.4 DC

DC was a 40-year old salesman who lived alone. His CVA had been a result of complications following kidney surgery six years prior to the study. DC had right-sided weakness but was independent for all daily activities and was able to drive an adapted car; despite this, he reported a relatively high level of disability and impact association with his aphasic symptoms (reported on the CAT disability questionnaire, Swinburn, et al., 2004). Linguistic assessment indicated a predominately phonological deficit; DC presented with moderate word finding

difficulties for which phonemic cueing was effective and impaired sentence comprehension, with difficulty interpreting word order for canonical and non-canonical sentences. Sentence construction consisted of retrieving related nouns, sometimes alongside reported speech (e.g., target: 'the child is scratching the man' → "the man and… baby he or boy…he really really ouch ouch ouch"). In conversation with his parents (who lived nearby), DC made use of oral spelling to compensate for difficulties accessing phonology. Output was characterised by intact melodic intonation within short phrases, grammatically intact constructions using light verbs (e.g., "I got one… I got that one") and circumlocution (e.g., "got the… what they called… the big one").

2.4.5 JH

JH was a 36-year old teacher who lived with her husband and child. She had suffered a stroke eight months prior to entering the study, following the birth of her first child. JH had right-sided weakness but was independent in the house, although she required assistance with childcare. Although the CVA had resulted in early retirement and significant fatigue, JH attributed relatively low levels of disability and impact to her aphasic symptoms (reported on the CAT disability questionnaire, Swinburn, et al., 2004) and continued to maintain all previously-established social relationships as well as initiating new contacts. Cognitive assessment indicated 'abnormal' reasoning skills in the visual modality, but otherwise relatively intact skills across tested domains. Assessment suggested mixed semantic and phonological processing deficits, with islands of relatively intact functioning in repetition, verb comprehension and grammaticality judgement. Phonological output was impaired; JH's written naming was superior to spoken naming but she was not always able to access phonology through written input. Sentence construction was severely impaired, with performance on assessment characterised by labelling objects in the stimulus picture (e.g., target: 'the girl is sleeping' → "bed and then girl and then teddy and slippers"). When she did produce a verb, it was usually without accompanying obligatory argument (e.g., target: 'the child is scratching the man' → "scratching") or incorrect (e.g., target: 'the boy is hitting the girl' → "crawl no"). In conversation, JH was an effective communicator, making use of finger-spelling, facial expression, melodic intonation, and elaborate pantomime gestures to supplement her single word output. Within conversation, her husband was very skilled at making use of both their shared knowledge and JH's multimodal communication.

2.4.6 AT

AT was a 64-year old retired secretary who lived with her husband on a farm. She had suffered a CVA 15 months prior to the study, which had resulted in right-sided weakness. AT was relatively independent and, while she acknowledged a moderate level of disability

associated with her aphasic symptoms, she reported a low level of impact on daily life (reported on the CAT disability questionnaire, Swinburn, et al., 2004). Assessment indicated a predominantly phonological processing deficit with moderate lexical retrieval deficits. AT accurately identified her main linguistic difficulties as retrieving verbs and constructing sentences: on assessment, AT often omitted the verb from an otherwise intact sentence frame. Sentence comprehension indicated a mapping deficit, with AT struggling to interpret word order. Cognitive assessment suggested impairments of reasoning, selective attention and executive function, as defined as performance falling below the 3rd centile. In conversation with her husband, AT often attempted to resolve lexical failures by cueing herself with the initial target phoneme, a strategy that was not always effective. She occasionally achieved islands of grammatical output (e.g., "I think I'll go to bed") but more frequently her output consisted of difficulty establishing referents, isolated phrases connected by filled silences and continuation gestures (e.g., "sleeping… last… night… and it's just half an hour… and that's it you see… waking up"). She often made use of pointing and iconic gestures to support her spoken output.

2.4.7 PM

PM was a 68-year old retired business man who lived with his wife. Following a CVA nearly four years earlier, PM had right-sided weakness but was independent in his daily activities in the house and garden. He often relied on his wife to communicate on his behalf and became frustrated when not understood; however, PM enjoyed social interaction and attended a number of aphasia groups. Any frustration he experienced was often directed towards the failure of others not following his communication rather than his linguistic deficits; as such, his rating of the disability and impact associated with his aphasic symptoms was low (CAT disability questionnaire, Swinburn, et al., 2004). Cognitive assessment suggested impairment of abstract reasoning and selective attention (i.e., below the 3rd centile), with relatively intact cognitive functions of visual perception and sustained attention. PM presented with mixed deficits in semantic and phonological processing with a moderate word finding deficit. Errors on comprehension assessment related to semantically related distractors. Sentence construction fell within normal limits. In conversation with his wife, PM made use of light verbs, particularly 'going' and 'doing' (e.g., asking about his grandchildren: "[children's names] doing… doing sleepover?"). He displayed symptoms of limb apraxia and struggled to use gesture in a meaningful way.

2.4.8 PG

PG was a 65-year old retired architect who lived with his wife. He had suffered a CVA eleven years earlier as a result of surgical complications for an unrelated condition. PG presented

with a right-sided hemiplegia and symptoms of ideational apraxia; his wife was very supportive and had put in place various steps to maximise PG's independence. His wife reported that, within a group situation, PG often struggled to follow and contribute to the conversation. This was reflected in cognitive assessment, in which selective attention fell outside the normal range. While PG demonstrated awareness of the difficulties associated with his aphasic symptoms, he reported a low impact of aphasia (CAT disability questionnaire, Swinburn, et al., 2004). On assessment, semantic errors were a hallmark of PG's performance on receptive and expressive tasks (i.e., noun and verb retrieval). PG presented with difficulty interpreting word order on assessment of sentence comprehension. In expressive tasks, his output often hinted at a complex linguistic target which he subsequently struggled to realise (e.g., target: 'the girl is throwing the stick' → "the woman stick whos, the woman whos stick is also throwing…"). Performance on sentence construction assessment suggested difficulty retrieving a final-position argument (e.g., target: 'the baby is crawling' → "the baby who…") and impaired word order (e.g., target: 'the boy is hitting the girl' → "slapping the boy and the girl").

2.4.9 DM

DM was a 48-year old surveyor who lived with his wife and children. He did not present with physical deficits following the CVA, which he had experienced three years previously. Aphasia and dyscalculia had resulted in early retirement from his job. While DM associated his aphasic symptoms with a relatively high level of disability, he rated the impact on daily life as moderate (reported on the CAT disability questionnaire, Swinburn, et al., 2004); indeed, he independently attended and participated in volunteer work and aphasia groups. In conversation, DM presented with reliable comprehension but reported difficulty in situations with background noise or group interaction. This effect of increased load on auditory memory or processing capacity was reflected by receptive assessment, where verb comprehension was intact but comprehension deteriorated on interpreting reversible and non-canonical sentences. Furthermore, cognitive assessment suggested intact executive functioning and memory on visual tasks but sustained and selective attention on auditory tasks fell outside the normal range. Linguistic assessment revealed a predominantly phonological processing deficit, with a mild naming impairment and impaired sentence comprehension. Sentence construction was intact but here, DM achieved grammatical accuracy at the expense of melodic intonation and reduced rate of speech. In contrast, DM's output in conversation consisted mainly of telegraphic speech with a striking lack of verbs (e.g., telling his wife about someone with whom he played golf: "he… once… we match… match"). Despite this, DM achieved relative fluency in his output through a fast rate of delivery, few instances of lexical searches, repetition of key words and a highly skilled conversation partner (his wife).

Chapter 3: Can impairment-focused therapy change the everyday conversations of people with aphasia? A review of the literature and future directions

Carragher, Conroy, Sage, Wilkinson (2012). *Aphasiology*, 27(7), 895-916.

3.1 Abstract

Background: The ultimate goal in any programme of aphasia rehabilitation is that behaviours targeted in therapy will generalise to everyday use for people with aphasia (PWA). The pervasiveness of conversation in everyday life has undoubtedly contributed to the recent interest in aphasiology regarding how we facilitate, and capture evidence of, change in conversation following therapy. Given the rich nature of conversation data, various analytical approaches have been utilised within impairment-focused therapy studies; however, much of this work has been carried out in isolation from other methodologies such as conversation analysis (CA)—a field which has historically concerned itself with conversation data. The result is a growing literature base which is dispersed in nature. For clinicians who are faced with the daily challenge of therapeutic management for a diverse population of PWA the literature on generalising therapy gains to everyday conversation may be too unwieldy to be of benefit to current clinical practice.

Aims: This paper aims to synthesise and critically review key papers from impairment-focused studies which have investigated the impact of therapy on the conversations of PWA. For the purposes of this review, conversation is defined as a dialogue between the person with aphasia and a conversation partner.

Main Contribution: First, the motivation to investigate conversation within aphasia assessment is discussed, with consideration of how conversation differs from, but ultimately complements, other forms of language assessment. Following this, five impairment therapy studies will provide a platform for discussion of methodological issues and analytical approaches relating to conversation data. Finally, consideration is given to how researchers and clinicians may build on current literature to develop the use of conversation as an outcome measure in aphasia intervention. Where appropriate, insights are drawn from interaction-focused therapy studies regarding the collection and analysis of conversation data.

Conclusions: There is emerging evidence that impairment-focused therapy can impact on the conversations of PWA. While these early findings are promising, investigations have been limited to naming therapies and the methods of data collection used have implications for ecological validity. Incorporating particular elements of interaction-focused approaches may help to inform data collection, investigations of therapy outcome, and issues for candidacy for specific treatments. Furthermore, combining therapeutic and analytic approaches is likely to be more closely akin to the clinical reality of aphasia intervention, where clinicians are likely to use all resources at their disposal in the rehabilitation of a speaker with aphasia.

3.2 Introduction

The ultimate goal in any programme of aphasia rehabilitation is that behaviours targeted in therapy will generalise to everyday use for people with aphasia (PWA). Conversation is the most frequent communicative activity in daily life (Davidson, et al., 2003) and therefore represents a potentially daily situation in which PWA must manage their linguistic deficits. Most PWA have some frequent interaction with others, such as family, friends, neighbours, healthcare workers, shop assistants, or telephone callers. The range of interactions that PWA encounter will undoubtedly vary, yet all of these interactions share the fundamental features of being dyadic, online, and interactive in nature: that is, the dyadic nature of conversation necessarily implicates at least two people (in contrast to, for example, a monologue elicited as part of a connected speech assessment). Secondly, the online nature of conversation makes necessary and relevant immediate responses, with little or no time for pre-planning turns. Finally, conversation is interactive in that the current speaker's turn is typically built to be understood in relation to other participants' prior turns and also in that turns may be co-constructed by more than one speaker (Sacks, Schegloff, & Jefferson, 1974). These features mark conversation as distinct from many "traditional" forms of outcome measurement which elicit a monologue from the PWA, e.g., picture description.

From a psychosocial perspective the importance of social interaction has long been recognised (e.g., Lubinski, 1978-1979; Ryan, Giles, Bartolucci, & Henwood, 1986). Nearly two decades ago Sarno (1993) flagged up the need for psychosocial aspects to be considered within aphasia research, arguing that the conceptualisation of aphasia as solely a neurological or linguistic deficit does not represent the full range of the condition. Furthermore, Erber (1994) argued that social isolation leads to reduced life satisfaction in older adults, particularly those in residential settings. Thus, as a form of social interaction, everyday conversation would appear to be a valid target for aphasia assessment, intervention, and outcome measurement.

3.2.1 Differences of language use in task-based assessment and in everyday conversation

There is much debate surrounding the issue of language use in task-based assessment compared to everyday conversation with regard to how closely behaviour in one context mirrors behaviour in the other context. Fisher and Glenister (1992) argue for the validity of confrontation naming assessments, pointing out the need for accurate, fast naming ability for efficient, fluent use of spoken language in everyday life. Furthermore, Herbert, Hickin, Howard, Osborne, and Best (2008) found a significant relationship between performance on picture-naming test and conversation when conversational (rather than lexical)

parameters were applied, i.e., when analysis incorporated conversational denominators (i.e., number of turns or substantive turns), a significant relationship was found between lexical retrieval on assessment and in conversation; lexical denominators (i.e., speech units) did not indicate a significant relationship between retrieval on assessment and in conversation.

Other researchers point to the discrepancy between performance on confrontation naming assessment and retrieval in connected speech tasks (e.g., Manning & Warrington, 1996; Wilshire & McCarthy, 2002). For example, Mayer and Murray (2003) found performance on confrontation naming tasks to be a strong predictor of aphasia severity but not naming ability in connected speech tasks. This led the authors to conclude that single word naming in response to picture stimuli on assessment may differ from the "online, multifaceted word retrieval required during conversation" (Mayer & Murray, 2003, p.482). Furthermore, contextual factors may play a role in lexical retrieval, with word finding in connected speech benefitting from a priming effect and the "probabilistic lexical co-occurrence of words" (Pashek & Tompkins, 2002, p.228). Such contextual factors may also influence syntactic opportunities: in contrast to task-based assessment, choice of syntax in everyday conversation is more likely to be influenced by pragmatic factors such as communicative context (e.g., Biber, Conrad, & Reppen, 1998).

Beyond the level of single word naming, processing demands also vary between tasks of connected speech. Picture description stimuli may provide more support to the speaker than less constrained tasks such as narrative or conversation. For example, picture description stimuli provide the references or concepts of the message to be communicated, around which the speaker can formulate sentences (Marshall, 2002); this inherent scaffolding in picture description stimuli may free up resources for additional linguistic processing (Boo & Rose, 2011). In contrast, speakers in everyday conversation "are often confronted with all their linguistic, cognitive and emotional problems simultaneously" (Springer, et al., 2000, p.287). Moreover, the nature of conversation as a dialogue means that the PWA is faced with the added challenge of engaging with a conversation partner, while the online nature of conversation places demands on speed of processing. Thus, everyday conversation places demands on linguistic and cognitive processing abilities that may be difficult to replicate in task-based monologue assessment.

Beyond the level of constrained assessment, some studies have collected data of the PWA in interaction with the researcher/clinician (e.g., Mayer & Murray, 2003). One reason for using the researcher in the role of interlocutor may be to achieve a common thread or standardisation across participants' data (e.g., controlling variables such as topics, topic

initiation, and opportunities for specific types of lexical items or constructions). While these data certainly tap into interactional aspects of communication (in comparison to, for example, monologue narrative production), such methodological control on conversation data may have implications for the ecological validity of the data (Mayer & Murray, 2003). Certainly evidence suggests that interactions which involve a person acting in a work-related capacity are systematically different to those consisting of "peers" such as friends and family members (Hutchby & Wooffitt, 2008). Thus it cannot be assumed that data involving the researcher/clinician represent the PWA's linguistic behaviours in conversation with family and friends.

It seems apparent that constrained language assessments offer clear benefits to clinical and research practitioners (e.g., comparison across participants on a standard task, comparison to normative data) and the outcomes are valid within this context. Everyday conversation presents a very different paradigm to that of task-based assessment: conversation is not constrained by salient psycholinguistics variables or the entrenched roles of researcher/clinician and patient. The effect of different assessment contexts is illustrated by Beeke, Wilkinson, and Maxim (2003a, 2003c), who report how a participant with non-fluent aphasia presented with differential grammar on task-based language assessment compared to conversation. A crucial point of difference may be that the linguistic behaviours displayed by the PWA in conversation are indicative of not only their linguistic deficits and residual resources but also their reaction to meet certain interactional demands such as a minimising of errors, omissions, repair, and delay within conversation, as well as wider issues such as minimising the visibility of aphasia as a social disability.
Thus it seems likely that task-based language assessments and assessments of conversation tap into contrasting aspects of language and each offers its own advantages: the former enables clinicians and researchers to assess language across lexical, semantic, syntactic, and morphological levels with stimuli that are carefully matched for important psycholinguistic variables; while the latter allows for the investigation of the "functional consequences" of aphasic linguistic symptoms (Jordan, Ward, & Cremona-meteyard, 1997, p.878). The collection and analysis of language output in conversation alongside traditional task-based assessment may offer a holistic profile of a PWA's linguistic impairments and capabilities (Hernández-Sacristán & Rosell-Clari, 2009).

3.2.2 Creating and capturing change in the conversations of PWA

Impairment-based therapy enjoys a substantial evidence base which demonstrates the efficacy of intervention for improvements in picture naming accuracy (e.g., see Nickels, 2002a), production of trained items in constrained connected speech tasks (e.g., Conroy,

Sage, & Lambon Ralph, 2009a) and sentence production (e.g., Webster & Gordon, 2008). Yet capturing evidence of generalisation to everyday speech has proved to be less straightforward (Byng & Lesser, 1993), with PWA often continuing to face deficits of functional language despite gains made during therapy (Page & Harnish, 2012). Beeke, Maxim, Best, and Cooper (2011) postulate two reasons for the lack of evidence of generalisation to everyday speech: either interventions such as sentence therapy do generalise to conversation but outcome measures have failed to capture such change, or the lack of evidence of generalisation may reflect the difference between demands and materials across clinical tasks and everyday conversation.

Difficulty capturing change in everyday conversations may also relate to the wide range of variables which impact on how the PWA presents in conversation, e.g., the relationship with the conversation partner, or how interested or knowledgeable they are regarding the topic under discussion, as well as an unmeasured load on their comprehension and cognitive skills. Despite these challenges it remains true that a key goal of aphasia treatment is for the effects of therapy to generalise to everyday use. It follows, therefore, that it is necessary to investigate whether gains demonstrated on task-based assessment are sufficiently robust to generalise to the complex and multifaceted environment of everyday conversation.

3.3 Aims of this review

This paper aims to synthesise and critically review key papers from impairment-focused approaches which have investigated the impact of therapy on the conversations of PWA. Consideration is given to how researchers and clinicians may build on current literature to develop the use of conversation as an outcome measure in aphasia intervention. Where relevant, insights will be drawn from interaction-focused therapy studies, which make use of qualitative analysis to identify changes in post-therapy data.

3.4 Method: Search criteria

Using the Web of Science (a comprehensive search engine which includes databases from the sciences and social sciences), a search was conducted for aphasia intervention studies that collected and analysed conversation data (key word search included "aphasia" in various combinations with "therapy", "conversation", "everyday", and "spontaneous"). The search was not restricted to a specific therapy aim, i.e., naming, syntactic structures, discourse, etc. Relevant papers were identified based on reading abstracts in order to eliminate those studies which did not include conversation data as an outcome measure. A second search method was carried out based on the references cited by relevant papers

within the Web of Science search results. Studies were included if conversation data were collected and analysed as an outcome measure of the intervention, with conversation defined as a dialogue between the person with aphasia and a conversation partner. Studies which collected data from monologues only (e.g., story retell) were not included; see Boyle (2011) for a review of studies which investigated the effect of discourse intervention on word retrieval. In order to expand the scope of the review, the definition of a 'conversation partner' was expanded to include both personal and professional interlocutors. Articles written in languages other than English were excluded from this review paper. Furthermore, only data from the stroke population were reviewed; data from persons who sustained a traumatic brain injury, such as road traffic accidents, were not included in this review. The studies selected are representative of current impairment-focused therapy studies which have investigated outcomes of intervention on conversation data (see Table 4).

Table 4: Impairment-focused therapy studies which have investigated outcomes in conversation data

Authors	No. of participants	Type of aphasia	Study design	Therapy	Outcomes on assessment	Outcomes in conversation	Other outcomes
Boo & Rose (2011)	2	Moderate and severe Broca's	Multiple-baseline across contrasting therapies	Four therapy phases targeted at verb retrieval: repetition, semantic, combined semantic+ gesture, with a final participant-specific phase, i.e., gesture-only (participant PF) and repetition only (participant GF)	Picture naming: significant gains in naming treated verbs Generalisation: no change on untreated verbs or object naming Maintenance: some evidence for both participants Picture description: GF improved on informativeness (%CIUs), verbs per CIU and substantive verbs. PF demonstrated more modest lexical improvements as well as syntactic improvements (well-formed sentences and mean length of	Lexical measures: decreased lexical diversity of verbs; modest increases in production of verbs per CIU and substantive verbs Informativeness of speech output (% CIUs): both participants improved (although more modestly for PF)	La Trobe Communication Questionnaire (2011; Douglas, O'Flaherty, & Snow, 2000): mixed results. GF reported significant positive changes; however, this was not supported by her daughter's reports. PF reported no change in perception of communication. For PF, changes in the Aphasia Quotient (AQ,

Authors	No. of participants	Type of aphasia	Study design	Therapy	Outcomes on assessment	Outcomes in conversation	Other outcomes
					utterance)		WAB) reached clinical significance
del Toro et al. (2008)	14	Non-fluent (n=11) Fluent aphasia (n=3)	Multiple baselines across contrasting therapies	Participants received two phrases of either semantic-phonologic treatment (n=6) or a gestural + verbal treatment (n=8) Each phrase of therapy targeted noun and verb retrieval	No data provided	Noun production: no significant change Verb production: significant decrease Sentence type: significant reduction in minimal sentences Lexical specificity: improved for nouns (Lehnen, Anderson, Raymer, Blonder, & Rothi, 2006) Lexical diversity: no change New information: increased	No data provided
Greenwood et al. (2010)	1	Moderate anomia	Single case study	Targeted noun retrieval in constrained tasks and connected speech	Picture naming: significant improvement (including multisyllabic and	Increase in production of content words Reduced content word errors	Communication Disability Profile (Swinburn & Byng, 2006):

Authors	No. of participants	Type of aphasia	Study design	Therapy	Outcomes on assessment	Outcomes in conversation	Other outcomes
				Phase 1: combined phonological and orthographic cues Phase 2: generalisation of targeted words in connected speech and conversation	personally relevant words). Phonological errors were closer to the target phonology Cinderella retell: no clear pattern in type-token ratio for nouns; reduced repeated attempts at naming but did not reach significance		improved self-report on activity, participant and emotional domains Control tasks: no change Untreated items: no information given
Hickin et al. (2006)	2	Broca's aphasia (N=1) and anomic aphasia (N=1)	Larger study based on a case series design (Herbert, Best, Hickin, Howard, & Osborne, 2003)	Participants received two phases of therapy Phase 1: lexical therapy targeting noun retrieval Phase 2: communicative use of treated items in tasks up to the level of structured conversation	Picture naming: one participant demonstrated generalisation of improved naming to untreated items Noun production in everyday conversation (Herbert, et al., 2003): no significant improvement	Phase 1: both participants produced more errors following Phase 1 Maintenance: error production decreased for both participants Nouns per substantive turn: one participant improved; no change in the	Communication questionnaire: poor reliability (Herbert, et al., 2003) Control tasks: stable performance across participants in a test of short-term memory. Unstable for two participants

Authors	No. of participants	Type of aphasia	Study design	Therapy	Outcomes on assessment	Outcomes in conversation	Other outcomes
						second participant Content words per substantive turn: no clear change	for sentence comprehension
Rose et al. (2002)	1	Mild conduct-ion aphasia	Single-case, multiple baseline design	Three contrasting naming therapies: verbal, gesture and combined verbal + gesture	Naming: improvement for all three treatment conditions gesture The combined verbal + gesture condition more efficient treatment than gesture treatment alone The stability of item acquisition significantly greater for the combined treatment condition	Reduced frequency of phonological naming errors	Stable performance on non-linguistic control tasks

3.5 Review of impairment-focused therapy studies

The field of aphasia intervention is in its infancy in demonstrating that aphasia therapy can create change in everyday conversations of PWA. To date, therapy effects in conversation have been investigated for lexical intervention for both noun retrieval (del Toro, Altmann, Raymer, Leon, Blonder, & Gonzalez Rothi, 2008; Greenwood, Grassly, Hickin, & Best, 2010; Hickin, Herbert, Best, Howard, & Osborne, 2006; Rose, Douglas, & Matyas, 2002) and verb retrieval (Boo & Rose, 2011; del Toro, et al., 2008). In all of these studies conversation data formed part of a range of outcome measures. Importantly, the studies reviewed below represent the first attempts to investigate the effect of impairment-focused therapy on everyday conversation.

3.5.1 Greenwood et al. (2010)

In this single-case study, therapy consisted of phonological and orthographic cues to improve the lexical retrieval of an individual with anomia (TE), with a second phase of intervention aimed at facilitating generalisation of lexical gains to connected speech and conversation. Greenwood et al. (2010) recorded a 10-minute conversation between TE and a typical conversation partner, with the middle 5 minutes of this recording being used for analysis using POWERS [1] (Herbert, et al., 2008). Conversation data were collected at five points in total: two samples were obtained at baseline, one following each therapy phase, and a final sample 2 months after therapy. Unfortunately one baseline sample was excluded from analysis as it was felt to be a poor representative of typical conversation. Results are reported for two outcome measures in conversation, namely content words per turn and total word errors per content words. In post-therapy data TE displayed variable performance: content word production increased after the Phase 1 therapy (cueing intervention), decreased slightly after the Phase 2 therapy (connected speech intervention), before markedly increasing on follow-up assessment 2 months later. The second behaviour of interest, error production, decreased after Phase 1 therapy, decreased further after Phase 2 therapy, and finally returned to the level achieved after Phase 1 on follow-up assessment.

Regarding the variability with the post-therapy conversation data, Greenwood et al. (2010) draw on findings from picture naming and Cinderella narrative to corroborate and support the changes in conversation. However, given the differences in processing demands between connected speech assessments and conversation (see earlier points), it may be difficult to use assessment data to explain changes seen in everyday conversation. An alternative

[1] POWERS (Herbert et al., 2008) uses conversation analysis concepts to quantify lexical retrieval in conversation and capture change in conversation with regards to word-finding, errors, turn-taking and repair

solution may be to increase the number of samples of conversation obtained prior to therapy and following each therapy phase. Multiple sampling of conversation at key points would allow for investigation of the stability of behaviours and compensate for natural variability within everyday conversations (relating to linguistic factors and non-linguistic factors such as fatigue, mood, lack of interest in the topic being discussed, etc.).

Although small and subject to variability, the changes seen in TE's conversations post-therapy present some preliminary evidence that impairment-focused therapy can affect lexical retrieval in conversation. However, further sampling of conversation data would add weight to the argument that these changes relate to the effect of therapy rather than natural variability within everyday conversation. Importantly, the authors took various steps in order to capture a maximally representative sample of everyday conversation, such as, the participation of a typical conversation partner, as well as excluding from analysis the first 5 minutes of the data recorded (in order to minimise participant orientation to the recording).

3.5.2 Hickin et al. (2006)

Hickin et al.'s (2006) study has similarities to that of Greenwood et al. (2010) in terms of targeting noun retrieval with phonological and orthographic cueing and facilitating generalisation to tasks of decreasing constraints. Two individuals with aphasia participated in this therapy study and conversation data varied across the participants: one participant ("HM") was recorded in conversation with a fellow resident within her sheltered accommodation, while the second participant ("PH") was recorded in conversation with a key worker from his day centre.

Hickin et al. (2006) hypothesised that the lexical interventions would have the effect of increasing content words and nouns per substantive turn, and reduce other measures such as proportion of speech units that are word errors, proportion of content words that are errors, and word errors per turn. Findings for the two participants were mixed: HM improved in production of nouns per substantive turn but displayed variable performance on content words per substantive turn. HM produced more errors following Phase 1 of treatment, but this was much reduced on follow-up on two of three measures. The second participant PH did not improve in measures of noun production. PH produced more errors following Phase 1 (on two of three measures) before declining following Phase 2. Interestingly HM, who improved in production of nouns per substantive turn in conversation, had also demonstrated generalisation effects to untreated items on lexical assessment; conversely, PH did not demonstrate improved noun production in

conversation, nor did she show generalisation effects on lexical assessment. These findings may tentatively indicate a relationship between generalisation to untreated items on assessment and generalisation to conversation.

The variation demonstrated in both participants in measures of noun and content word retrieval may point to the poor reliability of an outcome measure based solely on the frequency of lexical production in conversation. Thus the addition of a measure of error frequency may help to capture evidence of more strategic use of available lexical resources and/or improved self-monitoring of errorful production. Given the problems faced in ensuring opportunities for use of specific lexical items in naturally occurring conversation, it may be necessary to combine, as standard, the practice of measuring lexical retrieval with error production.

The conversations recorded with each participant involved conversation partners acting in different capacities, i.e., a fellow resident and an individual acting in a work-related role. The inclusion of a conversation partner who is participating in a work-related capacity (such as the key worker in this instance) has been described as institutional in nature (Hutchby & Wooffitt, 2008) and is distinguishable from everyday conversations with family and friends, e.g., the key-worker in Hickin et al.'s (2006) study may have adopted more of an interviewer role, such as initiating topics and questions within the conversation. Although for many PWA conversations with professionals may represent a large proportion of their social interactions (or even their only social interactions), changes in such data cannot be assumed to be representative of conversations between the PWA and a family member, friend or fellow resident. Therefore, there is a tension between ecological validity and the practicalities of the relationship between PWA and typical conversation partners.

3.5.3 del Toro et al. (2008)

del Toro et al. (2008) collected samples of conversation data for 14 people with fluent and non-fluent aphasia in conversation with a caregiver and also in conversation with the examiner, with topics standardised across interactions. Therapy consisted of two contrasting treatments (semantic-phonologic or gestural + verbal treatment). Conversation data were transcribed and coded using the Systematic Analysis of Language Transcripts (Miller & Chapman, 2000; 1991) and grammatical measures from the Quantitative Production Analysis (Berndt, Wayland, Rochon, Saffran, & Schwartz, 2000; Saffran, et al., 1989). As well as analysing lexical and grammatical measures in conversation data (i.e., word classes, sentence type, and lexical range), del Toro et al. also investigated

measures of information by way of mean length of utterance and type–token ratio. Furthermore, communicative value was measured using a unit of new information (UNI), defined as "a coherent, relevant utterance providing information not previously given in the conversation" (del Toro et al., 2008, p. 886).

Following the interventions, del Toro et al. (2008) found no significant effect on noun production in conversation, and verb production significantly decreased from baseline to post- intervention assessment phases. In post-intervention data there was also a dissociation between the semantic specificity for nouns and verbs, with production of specific nouns improving but production of heavy verbs remaining unchanged (as investigated in a separate analysis by Lehnen, et al., 2006). In contrast, UNI production increased while measures of lexical diversity did not show improvement (i.e., mean length of utterance and type-token ratio). Taken together, the authors argue that such findings may indicate an improved quality of production in conversation in the face of a lack of improvement in quantity of production; that is, participants were more successful in using a limited lexicon to convey information in conversation. This raises an interesting hypothesis: although the participants did not improve on the quantity or diversity of lexical production in conversation (albeit improved noun specificity), therapy may have had a more subtle effect in facilitating use of linguistic resources to introduce new information to the conversation. This argument (combined with positive anecdotal evidence from the families of the PWA) points to the potential of impairment-focused intervention to have meaningful impact on everyday conversations. However, given the complexities and subtleties of conversation, quantitative outcome measures alone may struggle to capture the range and extent of changes in behaviours and quality in conversation.

Promisingly, the UNI measure used by del Toro et al. (2008) was found to have high reliability values within and between raters. Within the discourse literature, other measures have been developed but have demonstrated poor reliability when applied to conversation data; for example, the correct information unit (CIU, Nicholas & Brookshire, 1993). For further discussion of discourse measures see, for example, del Toro et al. (2008), Armstrong (2000), Sherratt (2007), and Larfeuil and Le Dorze (1997).

3.5.4 Boo and Rose (2011)

Boo and Rose (2011) compared the effects of four phases of therapy on verb retrieval for two individuals with Broca's aphasia. Each participant received therapy phases of repetition, semantic, combined semantic+gesture focus, with a final participant-specific phase (participant PF received a gesture-only phase while participant GF received a

repetition-only phase). A 20-minute sample of conversation data was collected at pre- and post-therapy points. Conversation data were analysed alongside picture description and Cinderella retell narrative using the Quantitative Production Analysis (QPA, Saffran, et al., 1989). Analysis included percentage measures of lexical and morphosyntactic skills as well as more communicative measures, i.e., the correct information units measure (CIUs, Nicholas & Brookshire, 1993) was used to calculate both informativeness (i.e., proportion of words classed as CIUs) and semantic efficiency (i.e., number of CIUs per minute).

In post-therapy data, while some improvements were seen on confrontation naming and connected speech samples (i.e., significant improvement for treated verbs on assessment, increased proportion of verbs in connected speech), unfortunately these findings were not entirely realised in the conversation data. In post-therapy conversation, increases in verb production were modest and neither participant demonstrated a significant improvement in verb diversity (measured by the type–token ratio) or specificity (as measured by percentage of substantive verbs). One participant (PF) improved on syntactic measures on the picture description task, i.e., the percentage of well-formed sentences produced and mean length of utterance; however, these findings did not hold for either the narrative task or conversation. Despite the lack of improvement on frequency of verb proportion, verb diversity or specificity, both participants demonstrated increased production of CIUs in conversation (although more modestly for PF), suggesting an increase in informativeness of spoken output (Boo & Rose, 2011). The authors speculate that these findings may indicate a trade-off between semantic specificity and complexity (Gordon, 2008), as part of an adaptation of linguistic resources for wider communicative gain (Kolk, 1995). Information of the statistical significance of the changes in conversation is not available.

Despite large therapy effects for both participants in test data (i.e., picture naming) only narrow change was seen in conversation. However, this may be related to the rich nature of verbs, which convey not only semantic and grammatical information but also specify the content of their surrounding environment, i.e., the number of arguments required and the subsequent phrasal categories (Bastiaanse, Edwards, Mass, & Rispens, 2003). Thus, for individuals with Broca's aphasia to generalise improvements of verb retrieval as single words to production in conversation, more direct work may be required to focus on production of verbs within syntactic structures.

The narrative measure of CIUs was useful here in tapping into how the PWA used their linguistic resources to increase verbal informativeness. Such changes may have implications for efficiency of verbal output in conversation or frequency of communication

breakdown and repair between the PWA and the conversation partner. However, CIUs require further investigation as an outcome measure given previous findings of poor reliability within conversation data (Oelschlaeger & Thorne, 1999). Boo and Rose (2011) provide few details regarding the nature of the conversation data collected. The dynamics of the conversation data are potentially important, e.g., a naturally occurring conversation vs an interview-type dialogue, as is the relationship between the PWA and the conversation partner (i.e., whether a typical conversation partner participated in the conversation or whether the researcher acted in this capacity).

3.5.5 Rose et al. (2002)

One of the aims of Rose et al.'s (2002) study was to investigate the comparative effects of three treatments (gesture, verbal, and combined verbal+gesture) on word production in a single case multiple baseline design. Conversational data were collected as part of a "semi-structured conversation" (p. 1021) between the researcher and AB (participant with aphasia). Conversational data was sampled once before therapy and at two points after therapy (i.e., 1 month and 3 months post-therapy).

For conversational data, findings are reported for error frequency and rate (see the full paper for details of outcomes in picture naming and error type). Following lexical treatments, the frequency of AB's production of phonological errors fell from 17 (27%) in pre-therapy conversation to 6 (5.4%) errors post-therapy; this was maintained at 3 month follow-up. The rate of error production also fell from pre-therapy level o 3.46/minute, to 0.62/minute post-therapy, and 0.48/minute on follow-up. The authors point out that this decrease in error production was not related to AB's improved retrieval of the specific items targeted in the interventions, but rather a broader improvement of AB's specific deficit (impaired phonological access and encoding). Alternatively, reduced error frequency may be indicative of the AB's more strategic use of a limited range of nouns or increased use of gesture to carry the communicative burden.

Measures relating to error production (i.e., frequency, type of error, rate of error production) are useful in the context of conversation data, especially in the evaluation of lexical retrieval therapies where opportunities may not easily arise in which the participant can make use of specific trained items in a conversational context. However, further contextual information may be useful in interpreting these findings; for example, the total number of words produced by the PWA in each conversational sample to rule out the possibility of error frequency and rate declining as a result of decreased output.

Although collection of conversational data was limited to one sample per time point (i.e., at baseline, post-therapy, and follow-up), the marked difference in the behaviours of interest adds credit to the argument that, for AB, therapy effects generalised to this untreated condition. However, as the conversational sample involved AB responding to open-ended questions asked by the researcher in a semi-structured environment, it is difficult to ascertain how closely this represents AB's typical conversations with family and friends. Heeschen and Schegloff (2003) found such dynamics within conversation to have a significant effect on the PWA's verbal output, i.e., the interlocutor acting as an examiner and withholding assistance. Thus, an interlocutor acting more like an examiner rather than a typical conversation partner, and using pre-determined questions to elicit verbal output from AB, may impact on AB's performance, e.g., to a certain extent the PWA may have some idea that the interaction will involve the interviewer asking questions, that the PWA will be required to answer questions, and that the PWA will not have the responsibility to initiate topics. Caution is needed in interpreting AB's changes post-therapy to be indicative of changes in her everyday conversation.

3.6 Discussion

As highlighted in this review paper, conversational outcomes have been investigated for lexical intervention for retrieval of nouns (del Toro et al., 2008; Greenwood et al., 2010; Hickin et al., 2006; Rose et al., 2002) and verbs (Boo & Rose, 2011; del Toro et al., 2008). Only those studies which investigated outcomes of therapy in conversational data were included in this study. Thus, studies have not been included in which therapy outcomes are based solely on tasks of picture description production (e.g., Edmonds, Nadeau, & Kiran, 2009), monologue production (e.g., Wambaugh & Ferguson, 2007), structured interview-type data (e.g., Herbert, et al., 2003) or standardised functional measures, such as Communication Abilities in Daily Living (CADL, Holland, 1980) or the Communicative Effectiveness Index (CETI, Lomas, Pickard, Bester, Elbard, Finlayson, & Zoghaib, 1989). As discussed previously, the inclusion criteria for this review paper are based on several arguments for treating conversation data differently from outcomes of task-based assessment. For instance, standardised assessments generally focus exclusively on the PWA, omitting the important role played by the conversation partner and the interactional dynamics at play between both (Ramsberger & Menn, 2003).

The five studies reviewed in this paper are representative of the first attempts to investigate the effect of impairment-focused therapy on everyday conversation. Given the early nature of research in this area, it is promising that an effect of therapy was found in conversation on a number of measures, i.e., increased production of content words (Greenwood et al., 2010) and increased semantic specificity of nouns (del Toro et al., 2008). Measures that tap into informativeness appear to offer promise for capturing change in conversation, e.g., increased production of new information (del Toro et al., 2008), increased informativeness of speech output (Boo & Rose, 2011), and increased semantic specificity (del Toro et al., 2008). Measures of error production also appear to capture evidence of a more subtle or indirect effect of therapy compared to frequency of content word production (e.g., Greenwood et al., 2010; Hickin et al., 2006; Rose et al., 2002).

While promising, most of the findings discussed are based on small participant numbers and few samples of conversation. In many cases the statistical significance of changes in post-therapy conversation data were not investigated, making it difficult to interpret the reliability of findings. More research is required in order to replicate the findings of these early studies, with particular emphasis on the question of reliability and validity of measures used. Table 5 outlines the reliability data available to date regarding use of conversation as an outcome measure. Three of the studies reviewed in this paper

investigated reliability of the analysis of conversation data and achieved high levels of inter-rater reliability (Boo & Rose, 2011; del Toro et al., 2008; Rose et al. 2002). This suggests that, with clearly defined measures, conversation data can offer a reliable source with which to investigate the effectiveness of impairment-focused therapy.

Table 5: Reliability data reported by the impairment-focused therapy studies

Study	**Reliability**
Boo and Rose (2011)	Over 90% agreement by two raters based on investigation of the transcription and scoring of 10% or randomly selected treatment sessions for each participant
del Toro et al. (2008)	Conversation data were transcribed by a person who was blinded to the study's aims Raters (blind to treatment condition) investigated the reliability of rating grammatical measures. The raters were blind to the treatment conditions, 93.4% inter-rater agreement for grammatical coding; 93.3% for intra-rater reliability
Greenwood et al. (2010)	Reliability investigated by Herbert et al. (2008): relatively high intra- and inter-rater reliability for coding speech units and turns whilst reliability was comparatively lower for content words.
Hickin et al. (2006)	See Herbert et al. (2008)
Rose et al. (2002)	Inter-rater reliability was investigated for 20% or responses from baseline and treatment sessions: 99.3% agreement was reached

Regarding sample size, three of the impairment therapy studies reviewed here used a single case design for either one or two participants (Boo & Rose, 2011; Greenwood et al., 2010; Rose et al., 2002). The group studies report a number of measures in which improvement was not seen, e.g., noun and verb production, lexical diversity, and production of one-word or elliptical responses (del Toro et al., 2008) and content words per substantive turn (Hickin et al., 2006, forming part of a larger study reported by Herbert et al., 2003). Such findings may indicate a need to further develop measures which are sufficiently sensitive to capture effects of therapy at group level. Furthermore, such mixed responses in the group studies may suggest the impact of such factors as type of aphasia and severity of the impairment, which are likely to be more diverse in a group study. In addition, the role of cognition has been implicated in predicting outcomes in anomia therapy (Conroy, Sage, &

Lambon Ralph, 2009d; Fillingham, Sage, & Lambon Ralph, 2005a; Fillingham, Sage, & Lambon Ralph, 2005b; Fillingham, Sage, & Lambon Ralph, 2006; Hinckley & Carr, 2001; Lambon Ralph, Snell, Fillingham, Conroy, & Sage, 2010). Similarly, cognitive abilities such as working memory, switching, and executive functions may be implicated in generalisation of therapy effects to everyday conversation.

3.7 Possible future directions

Over the past decade, impairment-focused therapy studies have begun to explore outcome measures in the context of conversation data. This is an important advance in the field of aphasiology given that both empirical knowledge (Beeke, et al., 2003a, 2003c) and clinical experience suggests that PWA demonstrate different uses of language in different contexts. It has long been recognised that language abilities do not always relate to communicative effectiveness (e.g., Goodwin, 1995). However, the methodologies used to investigate therapy outcomes in conversation have often been developed in isolation from other methodological approaches, with opportunities for potential cross-fertilisation going unrealised. Armstrong (2000) summarises the gap in our current knowledge as a ". . . lack of connections made between conversational behaviours, text macrostructure and text units and the actual wording/grammar of a text" (p. 880).

For an alternative viewpoint, we can consider how the analysis of conversation data is approached by interaction-focused therapy studies which use Conversation Analysis (CA)—a field that has historically concerned itself with the collection and (qualitative) analysis of conversation data. Interaction-focused studies have focused therapy on the conversation partner in order to affect change in conversations with PWA (Boles, 1997; Booth & Perkins, 1999; Booth & Swabey, 1999; Cunningham & Ward, 2003; Fox, Armstrong, & Boles, 2009; Simmons-Mackie, Kearns, & Potechin, 2005); more recent studies have sought to include the PWA as a target for therapeutic change (Beeke, et al., 2011; Wilkinson, Bryan, Lock, & Sage, 2010; Wilkinson, Lock, Bryan, & Sage, 2011).

3.7.1 Limiting the constraints placed on conversation data

Impairment-focused therapy studies have often sought to standardise and place controls on the data; for example, with the researcher/clinician acting as the conversation partner rather than a family member or friend (e.g., Rose et al., 2002). Certainly, variables relating to the conversation partner (e.g., education, insight, monitoring, and empathy) impact on conversation (Brady & Armstrong, 2007) and may be difficult to manage within an experimental design. However, such methodological control may impact on the validity of conversation (Mayer & Murray, 2003). An alternative option is to limit the constraints placed on conversation data in order to obtain a representative sample of everyday conversation; for example, using a typical conversation partner in the collection of conversation data (see Beeke et al., 2011; Hickin et al., 2006).

3.7.2 The role of the conversation partner

The conversation partner has not typically been considered within the remit of impairment-focused therapy; however, the importance of this role has been highlighted elsewhere (e.g., see Beeke, Wilkinson, & Maxim, 2007; Booth & Perkins, 1999; Horton, 2007). It is possible that some of the behaviours used by conversation partners originate from therapy sessions where the clinician used techniques such as cueing, modelling, and repetition. However, used by the conversation partner in the context of conversation, these behaviours may unintentionally mask the competence of the PWA, restricting them to answering questions rather than initiating new topics, or leading to frustration related to practising articulation (Simmons-Mackie, et al., 2005; Wilkinson, et al., 2010). Regardless of the success of any programme of therapy, the PWA must ultimately put the trained skills into use with everyday conversation partners. Given the influence of the conversation partner on the PWA's output in interaction, future impairment therapies might consider incorporating conversation partners into intervention as a method of facilitating generalisation of trained skills in everyday conversation. The nature of this involvement might be the subject for future research.

3.7.3 Multiple sampling of conversation data

The number of samples of conversation data collected before and after therapy requires consideration. For purposes of demonstrating reliability of data, most of the studies reviewed in this paper obtained multiple samples of linguistic behaviours before and after therapy, but obtained only one sample of conversation at each time point. While Boles and Bombard (1998) demonstrated that 10 minute samples of conversation data were adequate for capturing aspects of repair and verbal efficiency (i.e., words per minute, words per utterance, utterance per minute), multiple samples of conversation may be necessary in order to account for the variability inherent in everyday conversation (Perkins, Crisp, & Walshaw, 1999). Multiple baselines across a time frame would provide for a more stable sample in which to measure patterns/outcomes, and satisfy concerns that the behaviour of interest occurs consistently and not by chance (e.g., see Beeke et al., 2011). The time implications of obtaining multiple samples of conversation data mean that such a method of collecting data is likely to be out of reach for most practising speech and language therapists; however, at this early stage of investigating generalisation to conversation, multiple samples allow for the investigation of the stability of behaviours of interest across time and across individual participant factors (e.g., fatigue, lack of interest in the topic under discussion, level of input from the conversation partner, etc.). The results of such investigations could then be used to inform more clinically driven applications of collecting and analysing conversation data.

3.7.4 Bridging the gap

Future research might include drawing on other methodological approaches in order to bridge the gap between the linguistic output of PWA on assessment and everyday conversation. This work could take the form of including microlinguistic measures of linguistic behaviours and error production of PWA in conversation data alongside broader measures of communication efficiency and informativeness (see e.g., Boo & Rose, 2011) and conveying new information (del Toro et al., 2008), with still broader measures to analyse how these changes fit into the wider landscape of conversation in terms of repair, turn-taking, topic initiation (e.g., Beeke et al., 2011; Cunningham & Ward, 2003; Wilkinson et al., 2011; see POWERS measure, Herbert et al., 2008). The systematic collection of such data would enable holistic investigation of the effects of impairment-focused therapy. In the early stages of investigating how impairment therapy generalises to conversation, an element of qualitative analysis might serve to illustrate the interactive benefits of impairment therapy; for example, improved word retrieval might reduce the frequency of communication breakdown and repair, and ultimately result in more efficient, effective conversation for PWA. The broader analytic perspective of CA might present a vehicle for investigation of how linguistic behaviours of interest (e.g., nouns, verbs, grammatical markers, gesture) are used to accomplish the everyday communicative activities most people take for granted, such as telling a joke, giving directions, or correcting a misunderstanding in the conversation. The use of conversation data (particularly incorporating quantification) offers a fruitful avenue for future studies, with a delicate line between achieving a degree of ecological validity and facing the demands of a quantitative paradigm.

3.7.5 Other therapy aims in impairment intervention

To date, the use of conversation data as an outcome measure has been limited to lexical therapies. This is a useful starting point: naming therapies are common in both clinical and research settings and are relatively efficient to set up and administer. Thus, an outcome in conversation following naming therapy has potentially important implications for clinical practice. With the accumulation of evidence, it would be useful to extend analysis of conversation data to interventions targeting the level of syntactic structures or discourse.

3.7.6 Raters

A further direction for work in this area may include the use of raters to identify changes in post-therapy conversation data (e.g., Beeke et al., 2011; Simmons-Mackie et al., 2005). Even relatively short extracts of 3- or 5-minutes of conversation data can be sufficient for accuracy of judgement (Correll, van Steenbrugge, & Scholten, 2010). Using raters who are

blind to the data sample point (i.e., pre- or post-therapy data) may complement quantitative analysis of changes in, for example, proportions of verbs or nouns, by providing a broader perspective of change in conversation data, which is perceptible to objective, naïve listeners.

3.7.7 Normative data

Finally it may also be possible to make use of normative data in order to compare certain behaviours of PWA in conversation with measures from interlocutors without communication impairment in interaction (e.g., see Jordan, et al., 1997). Such normative data from specific interactive contexts could be used as a guide to identify deviation from normative ranges, in a similar way to the use of normative data in confrontation naming. Further research is required in order to define salient behaviours/measures against which to benchmark clinical performance.

3.8 Conclusion

Generalisation to everyday communication is arguably a key goal of any aphasia programme of therapy. Thus it is important to investigate whether the effects of therapy are sufficiently robust to infiltrate into the multifaceted, online nature of conversation with family or friends. Results of such investigations will have far-reaching implications for service provision, and inform knowledge about candidacy for specific treatments and how to design our therapies to facilitate generalisation for gains in everyday life.

There is emerging evidence that impairment-focused therapy can have an effect on the conversations of PWA. While the question of generalisation of impairment- focused therapy to conversation has not been conclusively answered, there appears to be sufficient evidence to continue this line of investigation. However, current studies of generalisation to conversation have been limited to lexical therapy. Furthermore, methodologies from other relevant therapy approaches have not been utilised and constraints placed on conversation data might affect its validity as representing the PWA's everyday conversation, e.g., constraints on topics discussed, the researcher acting as the conversation partner, etc. Multiple sampling of conversation data may be necessary (at least initially) in order to investigate the stability and distribution of behaviours both before and after therapy.

Combining impairment-focused therapy with elements from an interaction-focused approach is not straightforward or without difficulty, given the different conceptual foci of attention and methodologies of each. However, there are a number of issues common to both: (i) interest in how we facilitate the carryover of behaviours/skills/strategies targeted in therapy to everyday use; (ii) interest in capturing evidence of generalisation; and (iii) interest in finding reliable, valid outcome measures. Future work might consider "topping up" decontextualised language assessment and intervention with findings from interaction-focused studies (Armstrong & Ferguson, 2010) to advance therapeutic management and theories of generalisation and help to identify suitable candidates for various therapy approaches.

Aphasia can be a devastating long-term condition that affects not just the individual but also their family, their ambitions in life, their employment prospects, their role in society, etc. The robust and systematic investigation of (a) how to design therapy so as to facilitate change in conversation, and (b) the development of measures to capture such changes, represents one way in which we can continue to add to our evolving knowledge about aphasia and how we can ultimately best assist those living with aphasia.

Chapter 4: The effects of verb retrieval therapy for people with non-fluent aphasia; Evidence across assessment tasks and conversation

Carragher, Sage, Conroy (accepted pending revisions). *Neuropsychological Rehabilitation*

4.1 Abstract

Background: Despite often impressive improvements on linguistic assessments, there is a lack of evidence of significant generalisation from impairment-focused aphasia therapy to everyday communication. The aim of the current study was to investigate the effect of a verb retrieval therapy across a range of levels of language production.

Methods and procedures: Nine participants with chronic non-fluent stroke aphasia were recruited into this case series. Baseline assessment included naming a range of verbs (i.e., action verbs, semantically light verbs and personally relevant verbs) and sentence production; multiple samples of conversation were collected from each participant and his/her partner. Consecutively failed verbs were divided across treatment and control sets, matched for salient psycholinguistic variables such as frequency, imageability and argument structure. A multi-component verb retrieval therapy was delivered, consisting of semantic feature analysis, gesture production and phonemic cueing.

Outcomes and results: Following therapy, participants demonstrated significant and sustained gains in naming treated verbs; more modest effects were seen in untreated verbs. Mixed patterns of generalisation were evident in assessment of sentence production. In conversation, while group analysis suggested a lack of change, individual analyses indicated increased verb retrieval for three participants and qualitative changes related to the syntactic contexts of verbs retrieved.

4.2 Introduction

The ultimate goal of impairment-focused aphasia therapy is to improve language in everyday communication. Despite evidence of often impressive improvements on measures such as confrontation naming, there is a lack of evidence of significant generalisation to everyday communication (Boo & Rose, 2011). The systematic investigation of communication in everyday life would represent "the strongest possible evidence that treatment makes a difference" (Boyle, 2011, p. 1324). Conversation is the most frequent communicative activity for both people with aphasia (PWA) and those without language impairment (Davidson, et al., 2003). Thus, it is encouraging that impairment-focused studies have begun to investigate the effect of intervention on conversational data (for a review, see Carragher, et al., 2012).

While ecologically valid, conversation data are not without challenges. Everyday conversations vary regarding the topic, participants' interest in and/or knowledge of the topic, and the skill and empathy of the conversation partner. It is therefore unsurprising that samples of elicited connected speech are more prevalent in outcome measurement (i.e., tasks such as retelling a narrative, which are controlled and constrained in comparison to spontaneous conversation). However, there is a lack of consensus regarding the extent to which change in one measure predicts change on other measures (e.g., see Herbert, et al., 2008; Wambaugh & Ferguson, 2007). Important differences exist between the linguistic and cognitive demands of controlled assessment methods and conversation. For example, picture stimuli used in connected speech tasks may facilitate language production by setting out the references of the target message, which can be used by the PWA to formulate sentences (Marshall, 2002); thus, the scaffolding inherent in picture stimuli may free up resources for additional linguistic processing (Boo & Rose, 2011). In contrast, everyday conversation may offer little in the way of facilitation or linguistic scaffolding; rather, conversation places simultaneous demands on a speakers' linguistic, cognitive and emotional capacities (Springer, et al., 2000). Furthermore, tests of connected speech typically consist of the PWA producing a monologue with ample time to construct and repair their utterances. In contrast, conversation consists of a dialogue between at least two people, with inherent pressure to respond quickly and minimal opportunity to prepare utterances.

Task-based language assessments and conversation place different linguistic and cognitive demands on PWA and, while both are valid forms of data collection, they ultimately tap into different aspects of language use. While assessment of connected speech has important advantages – i.e., quantifiable, replicable, comparison to normative data– the data elicited do not necessarily reflect how language is used in the social environment of everyday communication (Ramsberger & Menn, 2003). Weinrich, Shelton, McCall and Cox (1997)

highlight the 'Catch-22' situation in which researchers find themselves, whereby analysing language under experimental conditions compromises the natural context of everyday language, yet measuring language in everyday contexts creates methodological problems such as uncertainty regarding the individual's target. While it appears that the principles of ecological validity and experimental control are currently mutually exclusive, the different patterns of production elicited by PWA in different discourse tasks (Beeke, et al., 2003a, 2003c; Heeschen & Schegloff, 1999; Rose & Sussmilch, 2008) make it difficult to extrapolate implications for everyday conversation based on results from monologic speech samples.

4.2.1 Non-fluent aphasia

Impairment-focused therapy studies have reported clear and robust gains on assessment tasks (e.g., for outcomes in connected speech, see Conroy, et al., 2009d; naming outcomes, see Nickels, 2002c; sentence production, see Webster & Gordon, 2008). A number of recent studies have reported an effect of impairment-focused therapy in conversational data for people with non-fluent aphasia (Boo & Rose, 2011; del Toro, et al., 2008; Hickin, et al., 2006). Non-fluent aphasia is typically characterised by effortful, dysprosdic output (Saffran, et al., 1989) with reduced length of utterance and syntactic complexity (Lee & Thompson, 2004), impaired verb retrieval relative to nouns (Bastiaanse & Jonkers, 1998) and omission of closed-class words (Bastiaanse & Jonkers, 1998). Comprehension is relatively intact (Goodglass, 1976) but deteriorates on syntactically complex or semantically reversible sentences (e.g., Berndt, et al., 1996; Saffran & Schwartz, 1988b). Verbs are complex entities which convey not only semantic and grammatical information, but also specify the content of the surrounding semantic-syntactic environment, i.e., the number of arguments required and the subsequent phrasal categories (Bastiaanse, et al., 2003). Verb retrieval is sensitive to psycholinguistic characteristics such as transitivity, semantic weight and valency. People with nonfluent aphasia display a preference for production of verbs with one internal argument – e.g., to climb – or verbs without an internal argument – e.g., to cry (Thompson, et al., 1995) and use a lower range of lexical verbs compared to unimpaired speakers (Bastiaanse & Jonkers, 1998); see Conroy, Sage and Lambon Ralph (2006) for an extensive review. Semantic weight may further influence verb processing; semantically light verbs share the core semantic features of semantically heavy verbs (Kegl, 1995) but, crucially, encode under-specified semantic representations (Gordon & Dell, 2003). For example, a light verb such as 'go' is defined by the semantic feature of motion, while a comparable heavy verb such as 'drive' encapsulates not only the feature of motion but also the manner of the action, that is, via a vehicle. The implications of semantic weight in the retrieval of verbs are debated, with

conflicting experimental data cited as evidence for and against ease of retrieval for individuals with verb impairments. For example, Berndt et al. (1997d) reported increased use of light verbs in tasks of sentence production and narrative, which may be indicative of a strategic use of high frequency verbs in cases of lexical failure for more specific verbs. In contrast, Bencini and Roland (1996) and Breedin, Saffran and Schwartz (1998) demonstrated an advantage for retrieving heavy verbs, based on the premise that less semantically specified lexical entries are more vulnerable to damage. Any potential advantage for light verbs has not been explored within therapy studies, where the features of light verbs (i.e., high frequency, less constrained by semantic context) may make valid targets for therapy and generalisation.

4.2.2 Verb retrieval therapy

Whilst verb therapy studies are relatively sparse (Conroy, et al., 2006; McCann & Doleman, 2011; Rose & Sussmilch, 2008), a growing evidence base suggests that verbs are responsive to a range of therapy approaches; for example, training verbs within elliptical utterances (Ruiter, et al., 2010) as well as targeting verb retrieval via relevant thematic roles (Edmonds, et al., 2009). Importantly, verbs have been found to be as treatable as nouns, particularly for PWA with less severe impairments (Conroy, Sage, & Lambon Ralph, 2009e). A number of therapy approaches from noun retrieval literature (for a review, see Nickels & Best, 1996) have been modified to accommodate verb retrieval. For example, semantic therapies (e.g., naming to definition, odd-one-out judgements, matching words-to-pictures) have been modified for verb retrieval (e.g., Edwards, Tucker, & McCann, 2004; Marshall, et al., 1998), with subsequent improvements for treated verbs but little or no carryover to untreated verbs (e.g., Edwards, et al., 2004; Marshall, et al., 1998; Raymer & Ellsworth, 2002; Reichman-Novak & Rochon, 1997). Phonemic cueing has also been successfully used within treatment for verb retrieval deficits (e.g., Conroy, et al., 2009d; Raymer & Ellsworth, 2002). However, generalisation to sentence production has been inconsistent, with some studies reporting improved sentence production with treated verbs (Conroy, Sage, & Lambon Ralph, 2009c; Marshall, et al., 1998; Raymer & Ellsworth, 2002) and others reporting no change (Reichman-Novak & Rochon, 1997). Generalisation to connected speech samples has not been routinely investigated following lexical therapy for verbs (e.g., Raymer & Ellsworth, 2002; Webster & Gordon, 2008); where data are available, reports of generalisation effects have been mixed (e.g., Conroy, Sage, & Lambon Ralph, 2009b; Edwards, et al., 2004; Reichman-Novak & Rochon, 1997). Importantly, any generalisation of improved lexical retrieval on picture naming may be subject to an effect of elicitation context from picture-supported to unsupported contexts; that is, the fewer constraints inherent within an elicitation task, the greater the linguistic options for avoiding retrieval of specific verbs (see Conroy, et al., 2009b).

Semantic feature analysis (SFA) was originally developed to target noun retrieval (see Boyle & Coelho, 1995; Coelho, McHugh, & Boyle, 2000) and later modified to accommodate verbs (Wambaugh & Ferguson, 2007). SFA is a lexical retrieval therapy in which the semantic properties and associations of a target word are systematically identified in order to improve access to already existing semantic networks (Massaro & Tompkins, 1992). SFA works on the premise of the spreading activation theory of semantic processing: that is, the semantic network is organised on the basis of semantic relatedness, with more closely related concepts represented by more links between the two nodes (Collins & Loftus, 1975). Activation of the nodes which are local to the target word may increase activation of the target word to threshold level, thereby improving the likelihood of successful retrieval (Collins & Loftus, 1975). Lexical retrieval is improved as a result of enhanced activation of intact parts within the semantic network (Coelho, et al., 2000; Falconer & Antonucci, 2012). A secondary benefit may be increased communicative effectiveness (Antonucci, 2009); that is, the process of semantic circumlocution may provide the listener with sufficient information to guess the target word despite lexical retrieval failure. The effect of SFA has been supported by neuroimaging data; for example, Marcotte, Adrover-Roig, Damien et al. (2010) reported maximum integration in and between networks identified as active in word-learning in control participants. SFA has been successful in improving retrieval of treated words (Boyle & Coelho, 1995; Coelho, et al., 2000). Generalisation to untreated words varies, with some studies reporting carryover to untreated semantically-related words (e.g., Boyle, 2004; Coelho, et al., 2000; Conley & Coelho, 2003; Peach & Reuter, 2010) and others reporting no generalisation (e.g., Rider, Harris-Wright, Marshall, & Page, 2008; Wambaugh & Ferguson, 2007). While generalisation of therapy effects to connected speech varies (Cameron, Wambaugh, Wright, & Nessler, 2006), positive findings have been reported for a number of measures, e.g., improvements in the number of correct information units (CIUs) (Antonucci, 2009; Boyle, 2004), percentage of noun retrieval (Antonucci, 2009), CIUs per minute (Coelho, et al., 2000; Wambaugh & Ferguson, 2007), words produced per minute (Coelho, et al., 2000; Wambaugh & Ferguson, 2007), and use of trained words in connected speech (Hahimoto & Frome, 2011; Rider, et al., 2008). Implemented within a discourse treatment, SFA has also shown improvements of reported improved verbal productivity and informativeness in connected speech for two individuals with anomic aphasia (Peach & Reuter, 2010).

A further avenue within lexical retrieval therapy relates to gesture therapy. The much-debated role of gesture has been neatly summarised by Rose (2006), who outlined the hypothesised roles of gesture as i) enhancing communication (e.g., Kendon, 1994), ii) contributing to

cognitive processes (such as spatial memory) and/or lexical retrieval (e.g., Hadar & Butterworth, 1997; Morsella & Krauss, 2004) and iii) competing for processing resources with speech (e.g., Feyereisen, 1997). Gesture may serve primarily communicative purposes whilst simultaneously facilitating lexical retrieval (de Ruiter, 2000). Therapy may focus on either compensation, facilitation of verbal output or a combination of both (Rose, 2006). There is strong evidence that gesture therapy effects lexical retrieval for PWA (Code & Gaunt, 1986; Marangolo, Bonifazi, Tomaiuolo, Craighero, Coccia, Altoè, Provinciali, & Cantagallo, 2010; Raymer, Kohen, Blonder, Douglas, Sembrat, & Rothi, 2007; Raymer, Singletary, Rodriguez, Ciampitti, Heilman, & Gonzalez Rothi, 2006; Rose & Douglas, 2008; Rose, et al., 2002; Rose & Sussmilch, 2008), with individuals with phonological impairments benefitting more than those with semantic impairments (Raymer, et al., 2007; Rose & Douglas, 2001; Rose, et al., 2002). Evidence of generalisation is mixed, with some evidence of generalisation to untrained gestures (Raymer, et al., 2007) but a lack of generalisation to untrained words (Raymer, et al., 2007; Raymer, et al., 2006).

In summary, despite evidence of impressive improvements in trained verbs, there is a lack of significant generalisation to untrained verbs (Conroy, et al., 2006) or to tasks of connected speech and conversation (Boo & Rose, 2011). As the language production of PWA is context-sensitive (Mayer & Murray, 2003; Pashek & Tompkins, 2002; Rose & Sussmilch, 2008), therapy effects in confrontation naming may not reliably predict outcomes in other measures (Wambaugh & Ferguson, 2007). Although investigation of therapy effects beyond the treatment tasks has previously been inconsistent (Cameron, et al., 2006), an emerging trend concerns examining lexical retrieval therapy effects in conversation (see Carragher, et al., 2012). Word-finding difficulties are a distressing and frequently reported feature of aphasia (Marangolo, et al., 2010); consequently, therapies targeting lexical retrieval are common within clinical and research settings. Given its prevalence, it is important to investigate whether lexical retrieval therapy impacts on everyday conversation. Verb retrieval is a useful place to focus, as verbs play a central role in the planning and production of sentences (Bastiaanse, et al., 2003). Furthermore, as people with non-fluent aphasia present with a paucity of verbs in production, increasing retrieval of verbs may substantially maximise their linguistic resources in everyday life. A multi-component therapy approach – consisting of key elements from promising verb retrieval therapies – may offer a therapeutic method to target verb retrieval and maximise opportunities for generalisation to conversation.

4.3 Aims of the study

The aim of the current study is to investigate the effect of a multi-component verb retrieval therapy (consisting of semantic feature analysis, phonemic cueing and gesture) across various levels of language production. We aimed to answer the following research questions:

1. Do participants show an effect of therapy at the lexical level (i.e., trained verbs, untrained verbs and semantically light verbs)?
2. Do participants show an effect of therapy at the level of sentence production?
3. Do participants show an effect of therapy at the level of conversation?

4.3 Method

Following NHS IRAS ethics approval, nine participants with stroke-induced chronic non-fluent aphasia were recruited into the case-series. These seven men and two women were recruited via Speech and Language Therapy services and various aphasia community groups throughout North West England. Establishing the presentation of non-fluent aphasia was based on convergence of clinical consensus, the results of standardised lexical retrieval assessment (as indicated by an age-adjusted clinical score on the Boston Naming Test, Goodglass, et al., 2001), and presentation of impairment on picture description (Goodglass, et al., 2001) – that is, structurally impoverished output with a paucity of verbs in relation to nouns, reduced length and complexity of utterances and omission of grammatical morphology (see Appendix 2). Inter-participant variation existed for time post-onset as well as aphasic severity. All participants presented with a stable neurological profile (i.e., at least 6 months post-onset) to decrease the likelihood of spontaneous recovery as a source of any change following therapy. As apraxia of speech often co-occurs with aphasia (e.g., McNeil, et al., 2008), presence of apraxic errors did not form part of the exclusion criteria. Table 6 presents background information on the participants, arranged in order of baseline verb retrieval scores on the Object Action Naming Battery (OANB, Druks & Masterson, 2000).

Table 6: Background information for nine participants

Participants	*Gender*	*Age of leaving education*	*Hand-edness*	*Occupation*	*Age at time of stroke*	*TPO (months)*
KK	Male	16	Right	Oil rig worker	46	24
GL	Male	16	Right	Driver / factory worker	46	12
BL	Male	16	Right	Pub manager	60	57
DC	Male	18	Right	Sales manager	34	72
JH	Female	23	Right	Teacher	36	8
AT	Female	16	Right	Secretary	62	15
PM	Male	16	Right	Businessman	64	47
PG	Male	18	Right	Architect	54	132
DM	Male	23	Right	Surveyor	45	36

4.4.1 Background assessment

A comprehensive battery of assessments was administered in order to profile the linguistic and cognitive deficits and strengths specific to each participant. The results of background assessment are shown in Tables 7 and 8 (see Appendix 3 for a brief description of each assessment).

Table 7: Background language assessment for nine participants

Assessment	*Max*	*Range*	*KK*	*GL*	*BL*	*DC*	*JH*	*AT*	*PM*	*PG*	*DM*
Boston Naming Test	60		9	19	27	19	16	21*	36	39	43
Pyramids and Palm trees	52	49-52	47	42	46	**51**	**50**	48	**49**	42	**50**
Kissing and Dancing	52	48-52	46	**48**	43	**50**	47	47	46	41	**51**
PALPA 9 (word repetition)	80	78-80	45	**80**	46	76	77	**78**	62	73	56
PALPA 9 (nonword repetition)	80	n/a	17	68	13	45	50	48	31	52	32
PALPA 31 (reading aloud)	80	79-80	12	35	34	63	43	70	60	76	60
OANB baseline 1	100	n/a	17	19	23	24	42	50	58	66	84
OANB baseline 2	100	n/a	18	25	38	36	43	40	60	63	85
VAST											
Verb comp	40	38-40	29	27	28	37	35	**39**	34	34	**39**
Sentence comp	40	39-40	28	15	19	25	26	27	37	20	20
Grammaticality judgement	40	37-40	25	32	27	30	36	23	36	34	25
Action naming	40	37-40	7	8	9	10	36	9	35	27	31
Naming finite verbs	10	8-10	0	0	0	0	1	0	2	1	0
Naming infinite verbs	10	8-10	0	1	6	2	2	1	**10**	5	3
Sentence construction	20	16-20	1	3	4	9	4	11	**17**	13	**18**
Sentence anagrams (pictures)	20	20-20	12	9	7	10	11	11	11	15	10
Sentence anagrams	20	20-20	9	8	4	11	9	11	10	16	10
Wh-questions	20	17-20	0	0	0	0	0	8	2	0	0
Light verb elicitation test	30	27-30	0	2	0	0	3	4	6	6	0
CAT gesture object use	12	9-12	**10**	**12**	8	**12**	**12**	**11**	7	6	**12**
CAT disability questionnaire											
Disability total: PWA's report	64	n/a	30	31	37	38	14.5	35	19	27	42
Disability total: partner report	64	n/a	25	33	31	27	22	37	26	-	35
Impact total: PWA's report	60	n/a	37	12	35	33	14	23	14	10	31
Impact total: partner report	60	n/a	50	29	30	35	22	25	17	-	38

Table 8: Background cognitive assessment for nine participants

Assessment		*Max*	*KK*	*GL*	*BL*	*DC*	*JH*	*AT*	*PM*	*PG*	*DM*
Wisconsin no. of categories	score	6	-	**1**	**3**	**4**	**3**	0	0	**1**	**6**
	%tile		-	2-5	>16	11-16	2-5	≥ 1	≥ 1	11-16	>16
Wisconsin items to 1st cat.	score	0	-	41	36	21	14	129	129	21	15
	%tile		-	2-5	2-5	2-5	6-10	≥ 1	≥ 1	>16	6-10
Rey copy	score	36	**35**	-	**29.5**	**36**	**36**	**31**	**28**	**36**	**36**
	%tile		>16	-	2-5	>16	>16	11-16	2-5	>16	>16
Rey immediate recall	score	36	**22**	-	**4**	**25.5**	**27**	**18**	0.5	**14**	**22**
	%tile		62	-	<1	79	82	62	<1	46	62
Rey delayed recall	score	36	**26**	-	**10**	**28.5**	**23**	**14**	1.5	**15**	**22**
	%tile		88	-	7	93	54	27	<1	54	62
Brixton no of errors	score	54	13	23	22	13	28	29	22	16	27
	Cat.		High avg	Low avg	Low avg	High avg	Abnormal	Abnormal	Low avg	Avg	Abnormal
Raven's CPM accuracy	score	36	36	33	33	33	31	30	26	29	33
	%tile		-	-	-	-	-	-	50	90	-
TEA elevator counting	score	7	5	**7**	**7**	**7**	5	5	**7**	**7**	4
TEA elevator counting + distraction	score	10	**5**	**4**	**6**	**6**	**5**	3	2	2	2
	%tile		12.2-20.2	6.7-12.2	12.2-20.2	12.2-20.2	12.2-20.2	3.3-6.7	3.3-6.7	3.3-6.7	3.3-6.7

4.5 Intervention

4.5.1 Stimuli

Therapy items were drawn from three sources of verbs:

1. The OANB (Druks & Masterson, 2000) was used to assess participants' retrieval of action verbs. Criteria for inclusion of items in the intervention were lexical failure on two administrations of the assessment. Those participants who achieved high scores on the OANB also completed repeated assessment of low-frequency, highly specific verbs sourced from a larger corpora of picture stimuli from the CRL-IPNP (CRL International Picture-Naming Project, Bates, et al., 2000).
2. The Light Verb Elicitation Test (Conroy, unpublished) was used to assess participants' retrieval of ten light verbs within cloze sentences (see Appendix 4). Each light verb occurred three times within the test, giving a total potential score of thirty. Control data from non-impaired, native English speakers indicated a cut-off for accuracy at 27/30. Verbs for which participants demonstrated consistent lexical failure were included in intervention.
3. Personally relevant (PR) verbs were identified in discussion with the PWA and his/her conversation partner as being lexical items which would be of most value in everyday situations, e.g., verbs regarding a participant's hobby such as gardening or an everyday activity such as caring for children or preparing dinner. Picture stimuli were sourced or developed to convey each PR verb. Items on which participants demonstrated consecutive lexical failure were included in intervention.

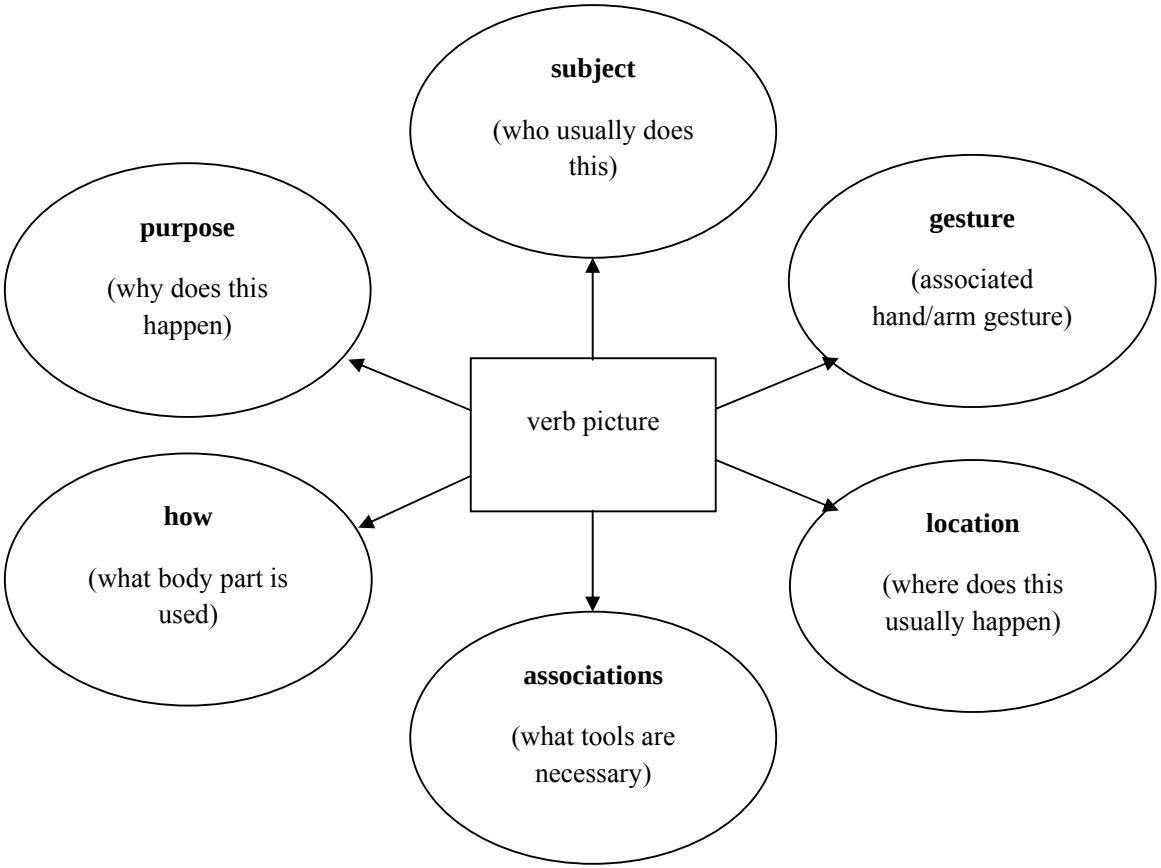
A set of eighty verbs was selected from each participant's consecutively failed items (from the OANB, IPNP, LVET and PR verbs, see Appendix 16). These were divided into a treatment set (n = 40 verbs) and a control set (n = 40 verbs). Within the treatment and control sets, verbs were included from the categories of action verbs (n = 30), light verbs (n = 5) and PR verbs (n = 5). The verbs across the treatment and control sets were matched so that no significant differences existed relating to key psycholinguistic variables that may impact on retrieval or production, i.e., frequency, age of acquisition, syllables, imageability (Druks & Masterson, 2000; Kemmerer & Tranel, 2000), semantic weight and argument structure (i.e., balance of one- and two-place argument verbs represented in each list); see Appendix 5 for stimuli matched across treatment and control sets. Some researchers have argued that a zero baseline might increase the likelihood of any changes being related to a regression to the mean, i.e., "a statistical phenomenon that can make natural variation in repeated data look like real change" (Barnett, van der Pols, & Dobson, 2005, p. 215). However, the use of items from consecutive zero baselines allows for clear comparison of change between pre- and post-

therapy data and has precedence within aphasia therapy literature (e.g., Conroy & Scowcroft, 2012; Crofts, Nickels, Makin, Taylor, & Moses, 2004). To reduce the possibility of natural varaibiltiy, two samples of verb retrieval were taken prior to therapy, as recommended by Barnett, et al., (Barnett, et al., 2005).

4.5.2 Therapy procedure

The aim of therapy was to improve participants' retrieval of targeted verbs in response to picture stimuli to maximum level of accuracy. A multi-component therapy approach was used, consisting of elements from existing lexical retrieval therapies, i.e., SFA, gesture production and phonemic cueing; see Appendix 6 for an in-depth description of the therapy protocol. A visual diagram of semantic features was used to facilitate participants' generation of concepts that were semantically related to the target verb, i.e., the subject of the verb, the purpose of action, the part of body or tool used to carry out action, a corresponding gesture of the action, as well as where and why the action would usually occur (see Figure 2). All gestures were modelled single-handedly. Participants were taught to use standard gestures to represent the semantically light verbs targeted in therapy; where possible, these gestures were derived from Makaton communication programme (www.makaton.org). Participants expressed the semantic features verbally or nonverbally (spoken production of the semantic features was not the target of therapy). In order to discourage rote learning and to maximise semantic activation, participants generated exemplars of semantic features for each target verb, i.e., identify a number of acceptable agents, patients, tools, etc. Discussion of semantic features was completed prior to retrieval of the target verb. Once the semantic features and corresponding gesture had been stimulated (with facilitation from the therapist where necessary), the therapist recapped on the features discussed and then the participants was asked to name the target verb. If the participant struggled to name the verb, increasing phonological and orthographic cues were offered until successful retrieval was achieved. On accurate production, the participant produced three repetitions of the target verb alongside the accompanying gesture.

Figure 2: Visual aid used within therapy to facilitate verb retrieval



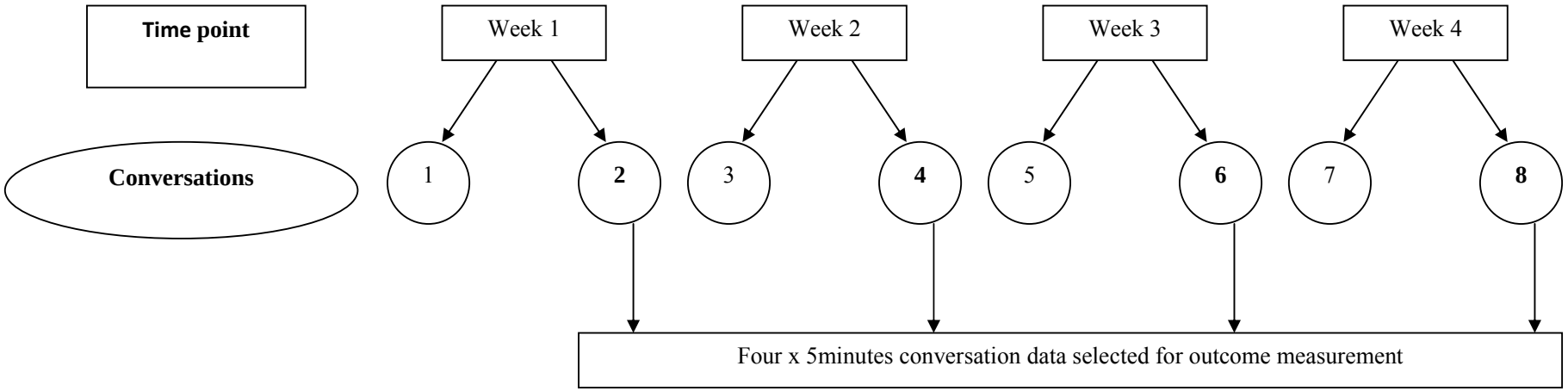
4.5.3 Therapy regime

Treatment consisted of weekly sessions of approximately one hour duration, over the course of eight weeks (total = 8 hours). Therapy was delivered by the first author who is a registered speech and language therapist. Structured homework sheets were given to facilitate practice outside of the sessions; the homework mirrored the therapy session and participants recorded how much time they spent on homework. Following therapy, participants were reassessed on outcome measures 1-week and 1-month later.

4.5.4 Outcome measures

Spoken sentence production was assessed using a subtest from the Verb and Sentence Test (VAST, Bastiaanse, et al., 2002) where participants are asked to construct sentences to match picture stimuli. In scoring sentence production, one point was awarded for retrieval of a relevant verb, agent, patient/theme (where relevant) and correct word order, with a maximum of thirty points for intransitive verbs and forty points for transitive verbs. Given the variability in everyday conversation, multiple samples of conversation data were obtained before and after therapy for each participant and his/her conversation partner. Each participant and his/her conversation partner video-recorded 10-15 minutes of conversation at a time when they usually had a conversation, e.g., during a meal. A minimum of 80 minutes of conversation data were collected for each participant, consisting of twice weekly sampling over a 4-week period. For the purpose of outcome measurement, analysis of conversation data was confined to a pre-determined selection from the total sum of data for each participant; a 5-minute segment was selected from each couple's second conversation per week, resulting in approximately 20-minutes of conversation data for each couple both pre- and post-therapy (see Figure 3). The selected data were transcribed by individuals who were blind to the aim of therapy and the time point (i.e., pre- or post-therapy); the accuracy of all transcripts was checked and corrected (as necessary) by the first author.

Figure 3: Process of selecting conversation data for therapy outcomes



4.5.5 Data analysis

Pre- and post-therapy data were analysed at a group and individual level to investigate an effect of therapy at a lexical, syntactic and conversation levels. In scoring assessment of verb naming and sentence production, self-corrections were accepted, as were phonemic errors that shared at least 50% of the target phonology. Conversation data were coded for type of word class; excluded from coding/analysis were minimal turns (e.g., "mhmm"), one-word responses consisting only of yes/no, non-linguistic output (e.g., laughter, singing), output elicited following phonemic cueing, neologisms, stereotypical phrases specific to each participant, and any words or utterances marked as unclear by the transcriber (as a standard measure, these ambiguities were depicted in the transcripts in brackets). In the remaining data, participants' retrieval of main (lexical) verbs were analysed in comparison to their total word production. This lexical verb measure used proportional rather than raw data to allow for comparison of multiple data samples of varying total word counts. Non-main verbs were excluded from analysis, such as all auxiliary verb forms including aspect verbs such as 'have' and 'be' (as in 'We *have* spoken', and 'He *is* laughing'), and modal verbs such as 'would', 'could' and 'must'. Phonemic paraphasias which deviated by one phoneme from the target word or which were understood by the conversation partner were included in coding/analysis. Quantitative analyses were carried out firstly to investigate the stability of verb retrieval in baseline conversation data and subsequently to compare pre- and post-therapy verb retrieval. This was subsequently supplemented with analysis of qualitative changes within verb retrieval. This decision was motivated by a number of factors: firstly, the direction of change following lexical retrieval therapy may not be straightforward; while a definition of improvement is usually restricted to an increase in word production, changes in either direction (i.e., increase or decrease) could be indicative of generalisation due to reduced error production (Bauer & Auer, 2009) or strategic use of syntactically simpler constructions (Armstrong, 2000). However, the aim of therapy in the current study was to increase participants' access to and retrieval of a range of verbs; therefore, outcome measurement focused on frequency of verb retrieval.

4.6 Results

4.6.1 Do participants show an effect of therapy at the lexical level (including trained verbs, untrained verbs and untrained light verbs)?

4.6.1.1 Trained verbs

From a zero baseline pre-therapy, eight participants significantly improved in naming treated verbs in post-therapy assessment (McNemar, 1-tailed, $p<.003$, range = .000 - .002) (see Table 9). The mean score for the group at 1-week post therapy was 15/40, which represented a significant improvement from baseline (Wilcoxon's matched pairs test, Ws+ = 0, 1-tailed, $p = .0046$). This improvement was maintained on follow-up assessment (McNemar, 1-tailed, $p<.0006$, range = .000 - .0005). The mean score for the group at 1-month post therapy remained 15/40, which represented a significant improvement from baseline (Wilcoxon's matched pairs test, Ws+ = 0, 1-tailed, $p = .0045$). One participant (DC) demonstrated improvement which did not reach significance (McNemar, 1-tailed, $p = .0625$). For all participants, naming of treated items was stable across post-therapy assessment points, i.e., immediate and follow-up assessment (McNemar, 2-tailed, $p>.0625$, range = .0625 – 2.0).

Table 9: Comparison of participants' verb retrieval scores pre- and post-therapy verb retrieval

		Trained verbs		Untrained verbs	
Participants	Pre-therapy	1-week post-therapy	1-month post-therapy	1-week post-therapy	1-month post-therapy
KK	0	9*	12*	3	3
GL	0	15*	11*	4	5
BL	0	14*	16*	2	5
DC	0	4	4	5	5
JH	0	10*	13*	8*	10*
AT	0	16*	21*	8*	8*
PM	0	26*	22*	10*	8*
PG	0	17*	12*	7*	8*
DM	0	24*	24*	6*	9*
Mean	0	15*	15*	6*	7*

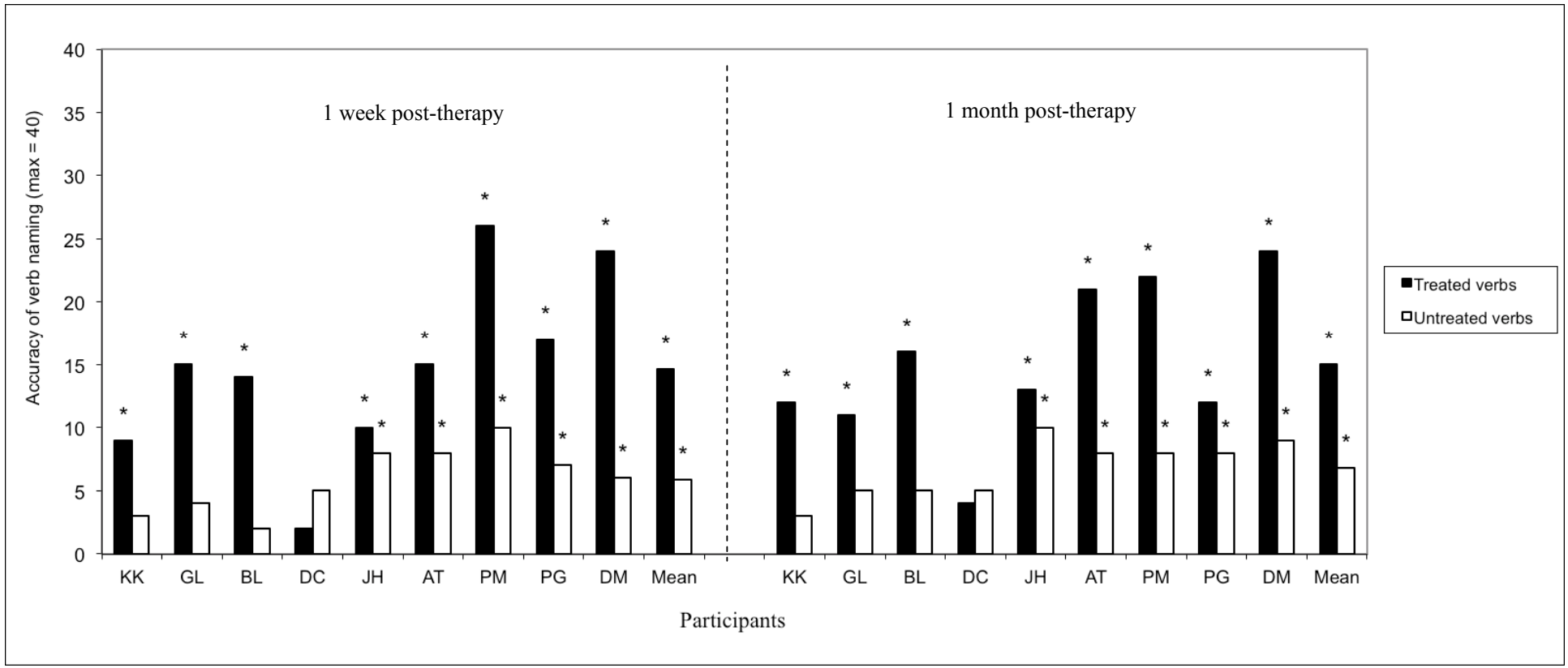
* = significant change, defined as $p < .05$

4.6.1.2 Untrained verbs

The five participants with the highest scores on baseline verb retrieval (JH, AT, PM, PG, DM) demonstrated significant improvement on untrained items immediately following therapy (McNemar, 2-tailed, $p<.0314$, range = .002 - .0313) (see Table 9). This significant improvement for untrained verbs was maintained on follow-up assessment 4 weeks later (McNemar, 2-tailed, $p<.0079$, range = .002 - .0078). For the remaining participants (KK, BL, GL, DC), there was no significant difference on naming untrained verbs immediately after therapy (McNemar, 2-tailed, $p>.063$, range = .0625 - .5) or 1 month later (McNemar, 2-tailed, $p>.063$, range = .0625 - .25).

The mean score for the group at 1-week post therapy was 5.9 out of a total of 40, which represented a significant improvement from baseline (Wilcoxon's matched pairs test, Ws+ = 0, 2-tailed, $p = .0091$). This significant improvement from baseline was maintained 1-month post-therapy (Wilcoxon's matched pairs test, Ws+ = 0, 2-tailed, $p = .0087$). Performance on naming untreated items remained stable for all participants between post-therapy assessment points (McNemar, 2-tailed, $p>.26$, range = .25 – 2.0) (see Figure 4).

Figure 4 Participants' naming of treated and untreated verbs at two time points following verb retrieval therapy



NB: post-therapy comparisons are made against a baseline score of zero (see 'Methods' section for further explanation); notations of significance (*) relate to comparison with baseline scores

4.6.1.3 Trained vs. untrained verbs

For six participants, there was a significant difference between naming trained vs. naming untrained verbs on immediate post-therapy assessment (GL: $\chi^2 = 6.82$, $df = 1$, $p = .009$; BL: $\chi^2 = 9.33$, $df = 1$, $p = .002$; AT: $\chi^2 = 3.86$, $df = 1$, $p = .05$; PM: $\chi^2 = 11.22$, $df = 1$, $p = .001$; PG: $\chi^2 = 4.76$, $df = 1$, $p = .029$; DM: $\chi^2 = 15.22$, $df = 1$, $p = .00$). On follow-up assessment, five participants continued to demonstrate a significant difference between naming trained and untrained verbs (KK: $\chi^2 = 5.19$, $df = 1$, $p = .023$; BL: $\chi^2 = 6.38$, $df = 1$, $p = .012$; AT: $\chi^2 = 7.69$, $df = 1$, $p = .006$; PM: $\chi^2 = 8.9$, $df = 1$, $p = .003$; DM: $\chi^2 = 9.98$, $df = 1$, $p = .002$).

The group data were analysed with a two-way, repeated-measures ANOVA, the factors being condition (treatment or control) and time of testing (baseline, immediately following therapy or follow-up 4 weeks later). The ANOVA showed a main effect of condition, the global mean treatment accuracy score = 14.8 /40 vs. global mean control accuracy score = 6.3 /40: $F(1,8) = 19.48$, $p = .002$. There was a main effect of time, global mean accuracy at baseline = 0 /40 vs. global mean accuracy score at immediate assessment = 10.27 /40 vs. global mean accuracy at follow-up assessment = 10.88 /40: $F(2, 16) = 50.47$, $p < .001$. This effect of time reflected the substantial increase in accuracy scores for treated items, combined with a more modest increase for the control items. It also reflected a high level of maintenance of therapy effects between the two post-therapy assessment points, in that any decrease did not cancel out the initial increases. There was also a significant interaction between condition and time: $F(2,16) = 14.55$, $p < .001$.

4.6.1.4 Light verbs

One participant (AT) demonstrated generalisation of therapy effects to retrieval of light verbs, with significant improvement 4 weeks after therapy (McNemar, 2-tailed, $p = .002$). The remaining eight participants demonstrated no change in light verb retrieval (McNemar, 2-tailed, $p = >.26$, range = .25 – 2.0); see Table 10.

Table 10: Comparison of participants' scores pre- and post-verb retrieval therapy on two assessments: the Light Verb Elicitation Test (Conroy, unpublished) and the VAST sentence construction test (Bastiaanse, et al., 2002)

	Light verb retrieval (max = 30)		**Sentence construction test (max = 70)**	
	Pre-therapy	**Post-therapy**	**Pre-therapy**	**Post-therapy**
KK	0	1	6	15*
GL	2	0	12	11
BL	0	0	15	19
DC	0	1	36	24*
JH	3	6	15	19
AT	4	14*	40	51*
PM	6	1	60	41*
PG	6	-	44	32.5*
DM	0	0	63	57*

* = significant change, defined as $p < .05$

4.6.2 Do participants show an effect of therapy at the sentence level?

One week after therapy, two participants (AT and KK) demonstrated significant improvement in sentence production (AT: Wilcoxon's matched pairs test, Ws+ = 8, 1-tailed, $p = .007$; KK: Ws+ = 8, 1-tailed, $p = .0404$); see Table 10. This significant improvement was maintained for one participant on follow-up assessment (KK: Ws+ = 19.5, $p = .0138$). Four participants showed no significant change in sentence production scores from baseline to post-therapy (BL: Ws+ = 7.5, 1-tailed, $p = .149$; GL: Ws+ = 24, 1-tailed, $p = .203$; JH: Ws+ = 18, 1-tailed, $p = .165$; DM: Ws+ = 17.5, 1-tailed, $p = .0647$). For three participants, performance on sentence production significantly decreased after therapy (DC: Ws+ = 80, 1-tailed, $p = .0399$; PG: Ws+ = 73, 1-tailed, $p = .0212$; PM: Ws+ = 139.5, 1-tailed, $p = .0013$). On follow-up assessment, four participants demonstrated significant reduction in sentence construction compared to baseline scores (DC: Ws+ = 51.5, 1-tailed, $p = .007$; DM: Ws+ = 21, 1-tailed, $p = .0153$; PG: Ws+ = 115, 1-tailed, $p = .0051$; PM: Ws+ = 61, 1-tailed, $p = .0065$).

4.6.3 Do participants show an effect of therapy at the level of conversation?

We identified a behaviour of interest in conversation data related to the aim of therapy, namely, lexical verbs as a proportion of the total words produced by the PWA. Firstly, we investigated the stability of verb retrieval in baseline data using the four samples of baseline

conversation available for each participant (see Appendix 7). Variance within baseline conversation data was analysed using a one-way, repeated measures ANOVA, with the factor being time of testing (with all four baseline data points). The ANOVA indicated variance within-participants was not significant, but was approaching significance: $F(3,24) = 2.929$, $p = .054$. Visual inspection of the group means at each baseline data point indicated that the first data point differed from the remaining three data points and this was the source of variance. A subsequent analysis of the stable points of the baseline data was carried out using a one-way, repeated measures ANOVA (i.e., the second, third and fourth data points). No significant difference in variance within participants' verb retrieval was found: $F(2,16) = .077$, $p = .926$.

The lack of variance within the baseline conversation data enabled us to compare verb retrieval behaviours in conversation pre- and post-therapy. A 2*3 repeated measures ANOVA was conducted on the stable data points, the factors being condition (i.e., pre- and post-therapy) and sample time (i.e., three stable data points within each condition). See Appendix 7 for raw data within conversation data. The ANOVA showed a non-significant effect of condition: $F(1,8) = 2.413$, $p = .159$. There was also a non-significant effect of sample time: $F(2,16) = .155$, $p = .858$. The lack of an effect of condition reflects the lack of change in verb retrieval for the group in post-therapy conversation data. The absence of an effect of sample time was expected and reflects a lack of variance in verb retrieval across points of data collection points. Although not significant, the global mean of verb retrieval increased in post-therapy conversation: from .1117 (St Dev .041) in baseline conversation to .1356 (St Dev .063) after therapy.

In order to supplement the group-level analyses, conversation data were analysed at the level of individual participants (see Table 11 for a comparison of participants' mean verb retrieval pre- and post-therapy). The data in Table 11 were striking in that participants' mean retrieval of verbs across multiple samples of conversation data did not correspond to retrieval on assessment. For example, KK achieved the lowest score on verb retrieval assessment before therapy but one of the group's highest score for verb retrieval in conversation; the converse is true for participant DM (see 'Discussion'). In line with the group analysis, six participants did not demonstrate a change in verb retrieval greater than 5% in either direction following therapy (BL, DC, JH, AT, PM, PG; see Table 11). However, for three participants, verb retrieval after therapy increased by more than 5% (KK: +9.9%; GL: +5.7%; DM: +6.5%; see Table 11). All participants demonstrated retrieval of trained verbs within the untrained context of conversation; however, the relationship between retrieval of trained verbs and total verb retrieval was not straightforward. For example, while participants PM and AT

demonstrated relatively high retrieval of trained verbs following therapy, this did not markedly impact on their overall total verb retrieval in post-therapy conversation, which remained close to pre-therapy levels. Conversely, KK's (relatively) high frequency of retrieving trained verbs caused a marked increase in his overall verb retrieval from pre-therapy levels.

Table 11: Individual participants' mean retrieval of verbs (as a proportion of total words produced) in conversation before and after verb retrieval therapy

	Mean % verbs retrieved pre-therapy	**Mean % verbs retrieved post-therapy**	**Difference**	**% of post-therapy verbs which were trained**
KK	12.3%	22.2%	+9.9%	27%
GL	5.6%	11.3%	+5.7%	8%
BL	9.7%	6.1%	-3.6%	6%
DC	16.5%	16.8%	+0.3%	20%
JH	12.5%	10.5%	-2.0%	4%
AT	9.5%	8.3%	-1.2%	24%
PM	10.6%	11.2%	+0.6%	37%
PG	8.9%	10.7%	+1.8%	12%
DM	8.6%	15.1%	+6.5%	6%

Based on the range of responses to therapy by individual participants, we were interested in investigating any qualitative changes in verb retrieval. We therefore selected for further analysis a subgroup of participants (KK, GL, BL, AT, DM); these participants were selected to represent the range of aphasic symptoms and responsiveness to therapy across the group. Participants KK, GL and BL scored within the lower range on baseline assessment of verb retrieval and presented with mixed impairments of semantic and phonological processing. Background assessment suggested relatively similar levels of impairment for these three participants on tests of verb comprehension, verb retrieval and sentence construction. Following therapy, KK, GL and BL all increased their retrieval of verbs without a syntactic frame (see Table 12) which was similar to the isolated verb retrieval targeted in therapy. Moreover, they demonstrated structural changes in verb retrieval: GL and KK both reduced their production of verbs with an argument but made slight gains in producing a verb with a comment (e.g., GL: "it wet… raining… again"); BL showed the opposite pattern, with

increased retrieval of verbs within a one-argument structure and decreased use of 'verb + comment' structures. Thus, although BL did not demonstrate quantitative changes in mean verb retrieval following therapy, there were qualitative changes in the structural context in which he produces a verb. KK and GL both showed quantitative gains in verb retrieval following therapy, although this was achieved in different ways: KK increased his retrieval of trained light verbs (go, do, have, get), rising from 15% of all lexical verbs in baseline conversation data to 27% following therapy. GL's increased verb retrieval was driven by more frequent retrieval of mentalistic verbs (e.g., know, think), doubling from 15% of all lexical verbs in baseline conversation to 32% following therapy.

Table 12: Analysis of the context in which a verb was production by a subgroup of participants, before and after verb retrieval therapy

	Verb in isolation		**Verb + 1 argument**		**Verb + 2 arguments**		**Verb + >3 arguments**		**Verb + comment**	
	Pre-therapy	**Post-therapy**	**Pre-therapy**	**Post-therapy**	**Pre-therapy**	**Post-therapy**	**Pre-therapy**	**Post-therapy**	**Pre-therapy**	**Post-therapy**
KK	10.2%	35.7%	62.7%	44.6%	22.0%	12.5%	0.0%	0.0%	5.1%	7.2%
GL	15.0%	26.3%	65.0%	50.0%	0.0%	0.0%	0.0%	0.0%	20.0%	23.7%
BL	14.3%	36.8%	35.7%	47.4%	0.0%	0.0%	0.0%	0.0%	50.0%	15.8%
AT	15.9%	9.6%	56.8%	73.8%	27.3%	16.6%	0.0%	0.0%	0.0%	0.0%
DM	58.5%	40.7%	34.0%	53.5%	3.7%	0.0%	0.0%	0.0%	3.8%	5.8%

On baseline assessment of verb retrieval, participants AT and DM presented around the mid- and upper range respectively within the group. Both AT and DM presented with impaired phonological processing. Furthermore, they retrieved a similar quantity of verbs in pre-therapy conversations (see Table 11) and both had demonstrated generalisation to untrained verbs in post-therapy assessment (see Table 9). Analysis of qualitative changes relating to verb retrieval suggested similar patterns of structural changes for AT and DM (see Table 12), i.e., increased retrieval of verbs within one-argument structures, and decreased retrieval of verbs in isolation and in more syntactically complex structures (i.e., verb + two-arguments). On a lexical level, AT made more use of trained verbs following therapy while DM's increased verb retrieval was related to increased retrieval of mentalistic verbs (e.g., know) rather than retrieval of treated verbs or a more diverse range of verbs used.

4.7 Discussion

Given the pervasiveness of word-finding difficulties in aphasia, capturing evidence of generalisation of the effects of lexical therapy into everyday conversation has important implications for clinical practice. The aim of the current study was to investigate the effect of lexical therapy on verb retrieval for people with non-fluent aphasia, through a range of levels of language production. Consisting of SFA, gesture production and phonemic cueing, this multi-component therapy was used to target semantically heavy and light verbs, and personally relevant verbs for each participant. We hypothesised that participants would demonstrate the strongest effects of therapy in naming treated verbs, with some generalisation to untreated verbs. As therapy targets were not designed to overlap with the verbs contained in the sentence construction test, we hypothesised modest generalisation to sentence production. Finally, we aimed to make preliminary explorations as to whether gains in verb retrieval would generalise to conversation.

Treated verbs showed a significant and lasting effect of therapy, reflecting the findings of previous lexical therapy studies using SFA (e.g., Coelho, et al., 2000; Conley & Coelho, 2003; Wambaugh & Ferguson, 2007), phonemic cueing (e.g., Nickels, 2002c) and gesture therapies (e.g., participants 2, 3 and 4 reported by Raymer, et al., 2007; Raymer, et al., 2006; KC and MW reported by Rose & Sussmilch, 2008). Considering the range of lexical retrieval deficits inherent within the group of participants, the strong gains in treated verbs may reflect the multi-component nature of the therapy. In a similarly complex therapy, Best and Nickels (2000) described a lexical retrieval therapy for four participants with aphasia, in which participants identified the initial letter of a target word and a computer aid subsequently generated a phonemic cue in order to facilitate naming (see Best, Howard, Bruce, & Gatehouse, 1997; Bruce & Howard, 1987). At the onset, only one of the four participants fulfilled the criteria thought to be necessary for benefitting from the aid yet, in post-therapy assessment, all four showed improved lexical retrieval for treated and untreated items. Best and Nickels (2000) speculated that the multi-component nature of therapy (i.e., semantics, phonology and orthography) might account for the unexpected results, as "different components of the treatment were important for different people" (p.243). In the therapy approach used in the current study, those participants who did not respond to semantic and/or gesture production elements subsequently received phonemic cueing in the presence of a picture. Alternatively, therapy may have encouraged the use of compensatory routes; for example, either by using intact semantic networks to boost activation of a specific verb, or using internal circumlocution.

The more modest effects seen in naming untreated verbs were also in line with previously reported findings from verb retrieval therapy studies (e.g., Coelho, et al., 2000; Raymer, et al., 2007; Rose & Sussmilch, 2008). The improvements in five participants in naming untreated verbs (JH, AT, PM, PG, DM) were interpreted as generalisation of therapy effects rather than a result of repeated attempts at naming; exposure to untreated verbs was restricted to pre- and post- therapy time points only, thus participants did not have repeated attempts at naming control items (see Howard, 2000; Nickels, 2002c). Furthermore, the significant difference between naming treated and untreated verbs is indicative of a specific therapy effect rather than generalised improvement. Generalisation to untreated verbs was confined to those participants with (relatively) less impaired verb retrieval on baseline assessment. Thus, it is possible that a minimum level of semantic and phonological processing is necessary in order for participants to capitalise on gains made during therapy and to subsequently generalise such gains to untrained items. Generalisation to untrained verbs may reflect improved semantic processing or a circumlocution-type strategy that results in increased drive from the semantic representation to phonological output (see participant AER reported by Nickels & Best, 1996). Furthermore, the inclusion of gesture production within therapy may also account for generalisation of therapy effects to untrained verbs. While the role of gesture in non-impaired speakers continues to be hotly debated (e.g., see Beattie & Shovelton, 2006; McNeill, 1985; Rose, 2006), gesture within a population of PWA is less equivocal, with growing evidence of the lexical facilitation effect of gesture (e.g., see Hadar & Krauss, 1999; Rose & Douglas, 2001). It might be argued that the multi-component nature of therapy (i.e., semantics, phonology, gesture) maximised the generalisation potential for participants with lexical retrieval deficits arising from different loci of impairment. Although phonological therapies have generally resulted in item-specific effects due to priming (e.g., see HW in Hillis & Caramazza, 1994; Miceli, Amitrano, Capasso, & Caramazza, 1996), the combined targeting of semantic and phonological representations in the current therapy may have served to activate (at least partially) and strengthen mapping between the two. Alternatively it may be argued that improvement in untrained verbs relates

Effects on sentence construction were mixed: while sentence construction remained unchanged for most participants, scores on assessment increased for two participants and decreased for four. Assessment of sentence construction was not designed to test trained and untrained verbs within sentence frames; its purpose was to explore the effects on production of verbs plus their arguments rather than a specific generalisation of treated verbs to sentence contexts. Participants KK and AT both improved in sentence production following therapy (although this was maintained for KK only). Sentence construction deficits for these two participants arose from different sources of impairment: KK's semantic and phonological

processing impairment resulted in semantic paraphasias and isolated verbs or nouns; where sentence fragments were produced, these consisted of verb+locative or unrelated constructions. KK's post-therapy improved score was fuelled by increased production of arguments in isolation or around the verb (e.g., target: 'the baby is crawling' → pre-therapy: no response; post-therapy: "baby's… crawling the… cupboard"). In contrast, in baseline assessment AT often omitted the verb from an otherwise intact sentence frame. Following therapy, she improved in her ability to retrieve verbs within sentence frames (e.g., target: 'the boy is pushing the girl' → pre-therapy: no response; post-therapy: "the man is pushing the lady"). When faced with a lexical retrieval deficit in post-therapy sentence construction, AT tended to produce an errorful verb rather than omit the verb outright; furthermore, her lexical choice displayed sensitivity to the transitivity of the target verb (e.g., target: 'the boy is catching the ball' → pre-therapy: "the man is… no"; post-therapy: "the man is swinging the ball"; target: 'the clown is smiling' → pre-therapy: no response; post-therapy: "the man is clowning").

The decrease in four participants' scores on sentence construction might reflect the nature of therapy; that is, retrieval of a target verb via generation of semantic features. The manifestation of this varied across participants: PM increased his production of verbs in isolation or fronted the verb in the construction, thereby losing points for word order (e.g., target: 'the child is crying' → pre-therapy: "the man is crying"; post-therapy: "crying"; target: 'the girl is swinging' → pre-therapy: "woman is swinging"; post-therapy: "swinging and having fun"); DM tended to omit the obligatory object argument from transitive verb constructions (e.g., target: 'the boy is catching the ball' → pre-therapy: "the boy is catching the ball"; post-therapy: "the boy is catching"; target: 'the girl is throwing the stick' → pre-therapy: "the woman is throwing the stick"; post-therapy: "the girl is throwing"); DC made increased use of circumlocution around the verb, thereby omitting relevant verbs and their arguments (e.g., target: 'the boy is hitting the girl' → pre-therapy: "the man and woman fighting"; post-therapy: "bang! Naughty that"; target: 'the clown is smiling' → pre-therapy: "the man laughing"; post-therapy: "circus… like funny"); and PG tended to omit obligatory arguments around the verb (e.g., target: 'the girl is swinging' → pre-therapy: "the girl swings"; post-therapy: "swinging the…"). Such patterns may suggest that these four participants generalised the demands and process of therapy to sentence construction.

The mixed effects on sentence production were in line with evidence for verb retrieval therapy, with reported outcomes ranging from no improvement in sentence production (e.g., Mitchum & Berndt, 1994; Reichman-Novak & Rochon, 1997), to improved sentence production utilising treated verbs (e.g., Raymer & Ellsworth, 2002) and untreated verbs

(Marshall, et al., 1998). Webster and Gordon (2008) have argued that improved sentence production may be associated with therapy protocols which explicitly focus on syntactic structure, such as those targeting argument structure (Fink, Martin, Schwartz, Saffran, & Myers, 1991) and mapping (e.g., Jones, 1986). In contrast, the therapy protocol applied in the current study focused on verb retrieval. Thus, the lack of generalisation to sentence production for most participants, despite strong results for confrontation naming, may be indicative of additional sentence production deficits which were not addressed by this treatment (Webster & Gordon, 2008). The findings from this study may therefore present an argument for targeting lexical retrieval within a treatment that explicitly focuses on sentence production (for those with such deficits).

At the level of conversation, group level analysis indicated that verb retrieval (as a proportion of the total words produced by the PWA) was a feasible comparator measure as there was no significant variance in baseline data. In comparing stable data points before and after therapy, an upward (although non-significant) change was evident in the descriptive statistics, but there was a lack of significant change in behaviours relating to verb retrieval. Group-level analysis was supplemented with analysis of individual participants: this indicated increased verb retrieval following therapy for three participants (KK, GL, DM), while the remainder of participants displayed minimal differences in either direction.

A theme which was addressed throughout the findings related to contrasts in linguistic performance across different assessment methods, most markedly between verb retrieval at the single word level and verb use in conversation. An unexpected and interesting outcome was that pre-therapy verb retrieval scores did not reflect verb retrieval in baseline conversations, e.g., DM achieved the highest scores on picture-naming assessment of verb retrieval but presented with one of the lowest rates of verb retrieval in baseline conversation. This difference between formal assessment and conversation contexts derived from the use of high frequency verbs in everyday conversation, such as light verbs and mentalistic verbs, which were low in imageability and are not routinely assessed. Furthermore, in conversation, PWA are presented with more options such as recycling lexical items or syntactic structures from their conversation partner; such occurrences are likely to be discounted on formal assessment.

Analysis of individual participants indicated a number of qualitative changes following therapy: firstly, evidence suggested that all participants retrieved trained verbs within conversation after therapy. Generalising trained verbs to everyday conversation was not related to verb retrieval ability on baseline assessment, nor was it limited to those participants

who had demonstrated generalisation effects from trained to untrained verbs on post-therapy assessment. Thus, for the participants presented in this case-series, severity of lexical retrieval impairment predicted generalisation to untrained verbs on assessment but not generalisation to an untrained context. Secondly, retrieval of trained verbs alone did not account for increased verb retrieval following therapy; analysis of a subgroup of participants suggested increased metalinguistic awareness of verbs as a lexical resource, with participants such as KK, GL and DM increasing production of verbs that were not trained in therapy, especially light verbs and mentalistic verbs. Crucially, such verbs are high frequency and thus may be advantageous to people with non-fluent aphasia in order to achieve a degree of fluency in their output. The interactional consequences of increased retrieval of semantically lights verbs warrants further investigation. Analysis of the subgroup of participants indicated post-therapy structural changes in how participants retrieved verbs, with participants with more severe lexical and structural impairments increasing their retrieval of verbs in isolation (KK, GL, BL), while participants with less severe impairments increased their retrieval of verbs within a syntactic frame. These qualitative changes in conversation are in line with conversational outcomes reported from other lexical retrieval interventions (see Carragher, et al., 2012). The results of the current study suggest that generalisation of improved verb retrieval is not limited to those participants with higher baseline ability, nor to those who are able to generalise improved lexical retrieval to untrained items. Furthermore, targeting verbs in therapy produced qualitative changes in how the subgroup of participants produced verbs in conversation after therapy. Further research is warranted regarding the 'ingredients' necessary for generalisation of gains to conversation.

The use of conversation data as an outcome measure is not without its challenges and further refinement is required. Armstrong (2000), Kirmess and Lind (2011) and others have highlighted the difficulty in interpreting changes beyond the level of the single word; while there is a tendency to view only an upward direction of change in word production as an improvement, changes in either direction (i.e., an increase or a decrease) could be indicative of a generalisation effect. That is, word production could increase due to improved word activation, while decreased word production could indicate a reduction in errorful activation patterns (Bauer & Auer, 2009) or strategic use of simpler syntactic constructions by the PWA (Armstrong, 2000). Our findings suggest that analysis of the context of verb retrieval in conversation data may reveal important changes that are not apparent from solely comparing the quantity of verbs produced pre- and post-therapy. The varied patterns of generalisation displayed by participants with non-fluent aphasia on a constrained sentence production task suggests that generalisation of therapy gains to conversation are likely to be subtle and personal to each individual. Therapy outcomes may be sensitive to factors such as type and

severity of aphasia (Faroqi-Shah & Virion, 2009; Kirmess & Maher, 2010), intensity of treatment (Code, 2001), personal relevance of stimuli (Code, 2001), cognitive abilities (Lambon Ralph, et al., 2010), as well as individuals' motivation, mood, fatigue, level of social support, psychosocial adjustment and individual talking style (e.g., Code, 2001; Kirmess & Lind, 2011). It seems likely then that these factors and others (e.g., baseline style of verbal output, see Ruiter, et al., 2010) influence how individuals' make use of therapy gains in conversation.

The ultimate goal of impairment-focused aphasia therapy is to improve an aspect of language in everyday communication. Currently, impairment-focused therapy is in its infancy in capturing evidence of change in everyday conversation (Carragher, et al., 2012). In this study, a multi-component therapy was implemented to maximise treatment effects for verb retrieval for participants with non-fluent aphasia. Furthermore, we piloted a methodology for quantifying verb retrieval within multiple samples of everyday conversation, which was complemented with analysis of qualitative changes in the syntactic context of verb retrieved by individual participants within conversation data.

Chapter 5: Outcomes of treatment targeting syntactic construction in people with Broca's-type aphasia: Evidence from psycholinguistic assessment tasks and everyday conversation

Carragher, Sage, Conroy (accepted pending revisions). *Archives of Physical Medicine and Rehabilitation*.

5.1 Abstract

Objective: To evaluate a theoretically-driven treatment focused on the language production skills of participants with Broca's aphasia after stroke and to compare outcomes from psycholinguistic assessment tasks and everyday conversation.

Design: A case series design was utilised with pragmatic selection of chronic participants undergoing the same assessment and treatment procedures.

Setting: Intervention programme for community-dwelling participants.

Participants: Nine participants with chronic Broca's aphasia and their main conversational partners took part in the study.

Intervention: Treatment targeted production of basic syntax through principles of mapping and reduced syntax treatment.

Main Outcome Measures: Syntactic well-formedness was assessed in samples of constrained sentence production, narrative retell and conversations.

Results: Treatment showed strong direct effects in trained and untrained sentence construction tasks, with some generalisation to narrative retell tasks. There was little evidence of change in everyday conversation.

Conclusion: Improvement in language production in constrained assessment tasks may not impact on everyday conversations. Implications for further treatment, such as the need for bridging interventions between impairment and functional measures, are discussed.

5.2 Introduction

Over the past decades, treatment for people with Broca's aphasia has received much attention. Typically, these individuals tend to be young with relatively good prognosis for recovery (Van De Sandt-Koenderman, et al., 1997). Much therapeutic attention has focused on the production deficits which characterise this subtype of aphasia, i.e., effortful, dysprosodic spoken output (Saffran, et al., 1989), impoverished verb retrieval relative to nouns (Bastiaanse & Jonkers, 1998), short utterance length and reduced syntactic complexity (Lee & Thompson, 2004), and omission of closed-class words (Bastiaanse & Jonkers, 1998), inflectional morphology and grammatical agreement (Faroqi-Shah, 2008). Based on developments within models of sentence processing (see Marshall, 2002), treatment has targeted underlying deficits in order to improve sentence production, e.g., mapping treatments which target the integration of semantic-syntax mapping through sentence comprehension and/or production (e.g., Marshall, 1995; Rochon, et al., 2005) and treatments which target the specification and realisation of verb argument structure (e.g., Webster, et al., 2005). Other interventions have adopted a linguistic compensatory approach to impaired sentence production, for example, training the production of syntactically reduced constructions in order to minimise processing demands (Ruiter, et al., 2010; Springer, et al., 2000) and use of a prosthesis to facilitate sentence construction (e.g., Linebarger, et al., 2008).

The lack of evidence regarding transfer of linguistic skills learnt in treatment to everyday communication has been highlighted elsewhere (e.g., Boo & Rose, 2011; Edmonds, et al., 2009).To date, investigations of generalisation to everyday conversation have been limited to naming treatments (Carragher, et al., 2012), yet conversation is the most frequent communicative activity for both people with aphasia and those without language impairment (Davidson, et al., 2003). The output of people with aphasia has been shown to be context-sensitive (Beeke, et al., 2003a, 2003c; Rose & Sussmilch, 2008) making it difficult to extrapolate implications for everyday conversation based on results from task-based assessment. The symptoms of Broca's aphasia may have implications for everyday language production such as grammar (e.g., indicating temporal information by marking tense), perspective (e.g., foregrounding specific events while backgrounding others, Marshall, 2009), social issues (e.g., lack of fluency may increase the time and effort devoted to the interaction with consequences for face and identity, Goffman, 1955) and the interlocutor (e.g., the communicative burden of 'parsing' impaired spoken output). Given that impaired verb retrieval and sentence production are common within aphasia (e.g., Berndt, Haendiges, Mitchum, & Sandson, 1997b; Berndt, et al., 1997d), there are strong theoretical and clinical motivations to investigate whether treatments which go beyond the single word production level impact on everyday conversation.

5.2.1 Verb and sentence production deficits in people with Broca's aphasia

Verb retrieval is sensitive to psycholinguistic variables such as transitivity, semantic weight and the number of arguments specified by the verb. People with Broca's aphasia display a preference for production of verbs with one internal argument – e.g., to climb – or verbs without an internal argument – e.g., to cry (Thompson, et al., 1995). Furthermore, people with non-fluent aphasia produce uninflected verbs, a lower range of lexical verbs compared to unimpaired speakers and/or a lower diversity of lexical verbs (Bastiaanse & Jonkers, 1998); see Conroy, Sage and Lambon Ralph (2006) for an extensive review.

Verbs not only convey semantic and grammatical information but project these properties onto the surrounding structure, i.e., specifying the number of arguments required, the thematic roles assumed by nouns within the construction and the phrasal categories which follow the verb (Bastiaanse, et al., 2003; Mitchum & Berndt, 2008; Thompson, et al., 1995). Each of these syntactic functions has been associated with patterns of impairment in aphasia (Mitchum & Berndt, 2008). Impairments of verb retrieval and sentence production are common within aphasia (e.g., Berndt, et al., 1997b; Berndt, et al., 1997d); however, although they often co-occur (Berndt, et al., 1997d), the symptom pattern is not absolute. For example, Caramazza and Hillis (1991) reported an individual who presented with intact sentence production despite a verb retrieval impairment, while Berndt, Haendiges and Wozniak (1997a) reported evidence of impaired sentence production but intact verb retrieval. Such findings undermine the likelihood of a common deficit underlying impaired verb retrieval and sentence production. According to the lexical hypothesis (Saffran, et al., 1980), impaired sentence processing reflects a deficit in accessing the information stored within verb representations, which is necessary for sentence production. The lexical hypothesis accounts for intact verb retrieval accompanied by impaired sentence production but is unable to account for impaired verb retrieval in the absence of a deficit in sentence production (Marshall, et al., 1998). A variation of the lexical deficit hypothesis has suggested that the level of the deficit in impaired verb retrieval may be important in sentence processing; thus, a semantic impairment would result in a greater effect on sentence production than a phonological impairment, since the semantic information contained within a verb entry is necessary for production of a predicate argument structure (Berndt, et al., 1997b; Berndt, et al., 1997d). However, Marshall et al. (1998) described an individual with non-fluent aphasia for whom intact semantics but impaired access to phonology resulted in a sentence production deficit. Marshall et al. (1998) suggested that a verb's phonological representation may supply prosodic information which is essential in constructing syntactic frames, thereby concluding that both semantics and phonology are crucial in sentence production.

The sentence production deficit in Broca's aphasia can be conceptualised using models of normal sentence production. For example, Garrett (1988) proposed a number of stages within sentence processing. At the conceptual level, an event is interpreted and a perspective is specified (Message level). At a subsequent grammatical encoding level (Functional level), the semantic information of the content words is accessed and the thematic roles are assigned (i.e., who does what to whom). A further stage of grammatical encoding (Positional level) occurs in which the syntactic form is generated. The information from the Functional and Positional levels must be integrated (or mapped) before phonology is assigned and the sentence is realised. As with asyntactic comprehension, impaired sentence production in people with non-fluent aphasia may be indicative of a mapping deficit (Schwartz, et al., 1987), i.e., impoverished thematic information stored within verb entries results in an inability to create a predicate argument structure (Saffran, et al., 1980). Marshall (1995) summarised two types of mapping deficit: firstly, a lexical mapping deficit relates to a loss of information contained within the verb, which specifies the arguments expressed by the verb and the associated thematic roles, e.g., agent, patient, theme (Schwartz, et al., 1994). A lexical mapping deficit manifests as impaired comprehension of even simple reversible sentences (e.g. *'the cow chased the dog')* where world knowledge in itself is not sufficient in order to parse the sentence. Secondly, a procedural mapping deficit relates to how thematic roles are assigned to argument structures (Marshall, 1995), e.g., subject, object, indirect object. This is particularly important for those sentences in which arguments have been moved from the canonical position of subject-verb-object (Saffran & Schwartz, 1988a). A procedural mapping deficit manifests as impaired comprehension of non-canonical sentences such as passives (e.g. *'the race was lost by the weary swimmer'*).

5.2.2 Treatment targeting sentence production: the effects of verb retrieval treatment on sentence production

While verbs play a central role in sentence production (Bastiaanse, et al., 2003), sentence production is "not simply a matter of verb availability" (Mitchum, Greenwald, & Berndt, 2000, p.325). As such, there have been mixed results relating to the effect of verb retrieval treatments on sentence production, with positive outcomes (Marshall, et al., 1998; Raymer & Ellsworth, 2002) alongside reports of little to no change (Carragher, Sage, & Conroy, accepted pending revisions-a; Mitchum & Berndt, 1994; Reichman-Novak & Rochon, 1997). Improvements in sentence production (and/or connected speech) have been reported following verb-focused mapping treatment (e.g., Byng, Nickels, & Black, 1994; Jones, 1986), verb and noun association treatment (see second phase of intervention reported by Webster &

Gordon, 2008) and verb and argument structure treatment (Fink, et al., 1991; Webster, et al., 2005).

5.2.3 Treatment targeting verb argument structure

Treatments which explicitly target the pairing of nouns and verbs may activate the processing of predicate-argument relations (Mitchum & Berndt, 2001). Fink et al. (1991) targeted verb argument structure using two contrasting treatments: one in which the participant practised identifying the verb, agent and theme in response to picture stimuli and subsequently constructed a corresponding sentence, and a second phase in which spoken sentences were presented to the participant in order to prime verb use in a novel sentence task. Webster et al. (2005) targeted predicate argument structure (PAS) through a series of tasks focusing on single word verb retrieval, verb and noun association and finally, sentence generation. Webster and Gordon (2008) implemented a phase of treatment which targeted sentence structure in which the participant was presented with an action picture and asked to select the target verb, agent and patient from a choice of written responses, before constructing a sentence to correspond to the picture (within grammatical constraints). Verb Network Strengthening Treatment (VNeST, Edmonds, et al., 2009) is based on the premise that a verb's meaning is dependent on its corresponding thematic roles (Druks, 2002; Ferretti, McRae, & Hatherell, 2001). Evidence suggests bidirectional priming of verbs and associated thematic roles (Ferretti, et al., 2001; McRae, Hare, Elman, & Ferretti, 2005), i.e., a verb primes corresponding agents (chopping/chef), patients (chopping/carrots) while agents and patients prime corresponding verbs. Webster and Gordon (2008) argued that the focus on pairing nouns and verbs, which is explicit in argument structure treatments, may explain the more widespread gains in sentence production compared to, for example, tasks of sentence completion (e.g., Edwards, et al., 2004; Marshall, et al., 1998).

5.2.4 Verb and argument structure treatment

Therapies targeting verbs and argument structure have consistently demonstrated evidence of improved retrieval of treated verbs (Fink, et al., 1991; Webster & Gordon, 2008; Webster, et al., 2005) and, despite lack of generalisation to untrained verbs, there is evidence of generalisation of trained items to sentence production (Edmonds, et al., 2009; Webster & Gordon, 2008; Webster, et al., 2005) and connected speech (Edmonds, et al., 2009; Fink, et al., 1991; Webster, et al., 2005). Thus treatments targeting verb/argument structures improved sentence production by improving metalinguistic awareness of the role of verbs and providing a strategy to generate arguments around the verb (Webster, et al., 2005).

5.2.5 Mapping treatment

Mapping is common to both comprehension and production (Rochon, et al., 2005); mapping treatments have typically targeted comprehension with outcomes predicted in production. For example, Jones (1986) reported impressive gains in sentence production despite output being "actively discouraged" during treatment (p.75). Through training to improve identification of verbs and their thematic relations within sentences, the participant increased his metalinguistic awareness of verbs, thematic roles and how the latter map onto sentence structures. Mapping treatment has also explicitly targeted sentence production; for example, Mitchum and Berndt (1992) targeted production of verbs marked for tense within subject-verb-object sentences. Following treatment, the participant with aphasia was able to produce untrained verbs within sentences; similar outcomes were seen in written output (Mitchum, Haendiges, & Berndt, 1993). Positioning verb retrieval treatment within a syntactic frame is key to facilitating generalisation of gains to sentence production (Mitchum, et al., 2000). Mapping treatment has produced mixed results regarding generalisation to untrained structures, with gains noted (e.g., Byng, 1988; Schwartz, et al., 1994) alongside reports of no change (e.g., Fink, Schwartz, & Myers, 1998; Mitchum, et al., 1993). There are mixed results too regarding generalisation to untrained contexts, with generalisation to untrained contexts reported (e.g., Beveridge & Crerar, 2002; Byng, 1988; Schwartz, et al., 1994) alongside reports of limited or no generalisation (e.g., Byng, 1988; Nickels, Byng, & Black, 1991; Schwartz, et al., 1994). The effect of mapping treatment has been supported by neuroimaging data; e.g., Wierenga, Maher, Moore et al. (2006) reported increased activation in the inferior frontal gyrus post-treatment for two individuals with non-fluent aphasia.

Treatments focusing on argument structure and verb-focused mapping treatments have led to similar results in sentence production (Webster & Gordon, 2008); both approaches improve metalinguistic awareness of verbs and their arguments/thematic roles, resulting in improved specification of argument structures (Webster, et al., 2005).

5.2.6 Treatment targeting linguistic compensation

Springer et al. (2000) observed that speakers with agrammatism often improve on assessment tasks such as picture description and narrative production (e.g., Thompson, Shapiro, & Roberts, 1993) but revert back to telegraphic speech in conversation. Such discrepancies might be accounted for by adaptation theory (Kolk, 1995; Kolk & van Grunsven, 1985) which conceptualises agrammatism as a temporal disorder: reduced capacity for language production leads to morpho-syntactic deficits. Adaptation theory hypothesises that the symptoms of agrammatism (e.g., telegraphic style output, discrepancies in output across contexts) reflect a type of compensation by the speaker to manage his/her linguistic target within reduced processing capacity. Springer et al. (2000) argued that the symptoms of severe agrammatism

are an adaptation to recruit intact right hemispheric functions to compensate for impaired syntactic functions in the left hemisphere. Reduced Syntax Therapy (REST, Schlenck, Schlenck, & Springer, 1995) aims to maximise compensation by tapping into the non-dominant hemisphere's language capacities; participants with agrammatism are trained to produce and expand elliptic utterances, i.e., constructions with a non-finite verb form or where the verb is omitted altogether. By avoiding production of morphologically well-formed structures, participants learn to produce constructions that are informative without draining processing resources. The effect on processing is supported by evidence from neuroimaging data: Indefrey, Brown, Hellwig, Amunts et al. (2001) found a processing advantage for ellipses relative to full sentences, the latter requiring more linguistic processing.

Springer et al. (2000) reported outcomes from a semi-structured interview following REST intervention for eleven participants with agrammatism (as part of the Aachen Aphasia Test, AAT; Huber, et al., 1985). Although treatment did not target spontaneous speech, outcomes within the semi-structured interview included structural changes (nine participants produced significantly more 2- and 3-consitituent utterances and significantly less 1-consitituent utterances), increased verb retrieval (eight participants produced more verbs after treatment) and morpho-syntactic changes (four participants increased production of closed class words; three participants increased production of a specific noun phrase). These findings were expanded by Ruiter et al. (2010) who used different outcome measures and a range of data contexts, i.e., picture description, a 'Happy Families' game and a semi-structured interview taken from the AAT (Huber, et al., 1985). Post-treatment, participants demonstrated significant increases in frequency and average length of ellipses, production of a verb within elliptic utterances and communicative efficiency (i.e., production of information units). On six-month follow-up assessment, significant changes were maintained for frequency of ellipses and verb-centred ellipses. With regards to the question of generalisation to everyday use, post-treatment improvements (i.e., frequency and length of ellipses as well as communicative efficiency) were confined to task-based contexts of picture description and 'Happy Families' game and did not generalise to the less constrained task of semi-structured interview (AAT, Huber, et al., 1985). On six-month follow-up assessment, the effects of treatment were most robust in the picture description task.

5.3 Summary

There is growing evidence of the effectiveness of syntactic production treatment; less is known about the extent to which gains on elicited assessment outcomes reflect generalisation to everyday conversation. The sensitivity of language production to the assessment context (e.g., Mayer & Murray, 2003) necessitates cautious extrapolation of implications for everyday conversation based on task-based assessments. Important differences exist in the processing demands faced by people with aphasia in constrained tasks when compared to everyday conversation, with the latter encompassing simultaneous presentation of linguistic, cognitive and emotional problems (Springer, et al., 2000).

An emerging trend within impairment-focused treatment concerns the investigation of lexical retrieval treatment to outcomes in conversation (see Carragher, et al., 2012). The typical characteristics of reduced syntactic complexity in speakers with Broca's-type aphasia (Lee & Thompson, 2004), coupled with the observation that improved spoken output is the desired outcome of treatment for most people with aphasia (Nickels, 2002b), suggests there are strong theoretical and clinical motivations to investigate generalisation from sentence production treatment to everyday conversation. The current study set out to devise a defined, theoretically-driven treatment which represented a synthesis of approaches to target syntactic construction for people with Broca's aphasia. Crucially, the intention was to 'track' generalisation effects across assessment contexts; from highly constrained tasks resembling the treatment (i.e. sentence production tasks) to untrained, yet constrained production tasks (namely monologic narrative retell), through to unconstrained data (i.e., everyday conversation between the participants with aphasia and their typical interlocutors).

5.4 Study Aims

The study aimed to investigate the effect of treatment targeting syntactic construction by evaluating outcomes from a novel 'hybrid' intervention which represented a synthesis of theoretically-based approaches in the literature and to answer the following questions:

- Do participants show effects of treatment at the syntactic level (i.e., trained constructions, untrained constructions and sentence comprehension)?
- Do participants show effects of treatment at the level of elicited connected speech?
- Do participants show effects of treatment at the level of everyday conversation?

5.5 Method

5.5.1 Participants

Following ethical approval via standard UK protocols (NHS IRAS system), nine participants with stroke-induced chronic Broca's aphasia were recruited into this case-series study. These seven men and two women were recruited via Speech and Language Therapy services and aphasia community groups throughout North West England. Presentation of Broca's aphasia was based on convergence of clinical consensus, the results of standardised lexical retrieval assessment (as indicated by a clinical score on the Boston Naming Test, Goodglass, et al., 2001) and impaired use of grammatical markers and syntactic structures in picture description (Goodglass, et al., 2001). The participants had previously taken part in a treatment study targeting verb retrieval (Carragher, et al., accepted pending revisions-a) and were included in the current study based on evidence of structurally impoverished output during picture description, with a paucity of verbs in relation to nouns, reduced length and complexity of utterances and omission of grammatical morphology (see Appendix 2). All participants were at least 6 months post-onset, reducing the likelihood of further spontaneous recovery. As apraxia of speech often co-occurs with aphasia (e.g., McNeil, et al., 2008), presence of apraxic errors did not form part of the exclusion criteria.

5.5.2 Background assessment

Inter-participant variation existed for time post-onset, ranging from 8 months to 132 months (mean: 44.8, St Dev. 39.3). The participants ranged in age from 36 – 68 years (mean: 53.2, St Dev. 11.9). Inter-participant variation existed too for severity; noun naming (Boston Naming Test, Goodglass, et al., 2001) ranged from 9 – 43 from a maximum score of sixty (mean: 26, St Dev. 12.22); verb naming (Object Action Naming Battery, OANB; Druks & Masterson, 2000) ranged from 17.5 – 84.5 from a maximum score of 100 (mean: 43.94, St Dev. 21.95). Background assessments were administered following recruitment to the studies and after written informed consent had been obtained. These assessments were administered over a 1-month period during weekly visits. Further details of the participants and their performance on a battery of linguistic and cognitive assessments are provided in Chapter 2.

5.5.3 Treatment Stimuli

Treatment items were drawn from participants' attempts at sentence construction in response to picture stimuli from the OANB (Druks & Masterson, 2000) and the International Picture Naming Project (IPNP, Bates, et al., 2000). Sentences were assessed for baseline accuracy in two administrations (see Appendix 8 for scoring criteria). From these assessment data, forty items were selected (treatment set N = 20, control set N = 20) which spanned a range of

accuracy scores on baseline assessment, typically ranging from 30% - 50% of the maximum score; this reflected the viability of working on structural production alongside a clinical need for therapeutic intervention. Treatment and control sets were matched for baseline accuracy as well as a number of psycholinguistic factors relating to the target verb: frequency, transitivity and valency (i.e., the number of arguments specified by the verb); see Appendix 9 for stimuli matched across treatment and control sets. Where possible, noun-verb (e.g., *to drink, a drink*) homophones were avoided.

5.5.4 Treatment design

Treatment was designed to facilitate a range of speakers with Broca's aphasia to produce syntactic constructions, supported by a hierarchy of progressive syntactic complexity (see Table 13). Drawing on the principles of mapping treatments (e.g., Marshall, 1995), the treatment programme targeted participants' knowledge and mapping of thematic roles to syntactic positions within a hierarchy. Rather than following normative sentence production, the treatment encouraged participants' generation of morphologically-simplified structures (Springer, et al., 2000). The final level of treatment introduced production of adjuncts (i.e., adverbial phrases); this was limited to higher-level participants given the higher computational expense of adjuncts relative to arguments of the verb (Thompson, et al., 1995).

Table 13: Hierarchy of syntactic construction treatment tasks

Level	**Part a) tasks ***	**Part b) tasks**	**Criterion for progression**	**Generalisation tasks**
1. Two-part constructions	Establish one thematic role alongside the verb	Produce 2-part reduced constructions	60% accuracy	Produce exemplar constructions: insert alternative agent or verb
2. Three-part constructions	Establish two thematic roles alongside the verb	Produce 3-part reduced constructions	60% accuracy	Produce exemplar constructions: insert alternative agent, verb and patient
3. Expanding the syntactic frame	N/A	Expand syntactic constructions (e.g., adverbs depicting manner or time)	N/A	Produce exemplar constructions: insert alternative agent, verb, patient and slot for extra information

* Comprehension task used only at the start of Levels 1 and 2 in order to familiarise participants with the 'slots' within the sentence frame and to introduce the production task

The treatment approach offered several advantages: firstly, it encouraged production of different lexical exemplars within slots in the syntactic frame which reinforced the participants' production of thematic roles around the verb, i.e., the type of words that can be assigned to the 'agent' slot as opposed to the 'verb'. Furthermore, the variability of producing exemplars might increase participant engagement while also reducing the potential of teaching linguistic stereotypes (Springer, et al., 2000), as participants were continually challenged to generate new syntactic constructions. Participants were encouraged to produce full lexical forms as well as proforms (e.g., '*the man'* or '*he'*) and light verbs in addition to heavy verbs (e.g., '*doing the dishes'* or '*washing dishes'*). Secondly, use of the reduced syntactic constructions might 'free up' processing resources so that that spared capacity might be channelled into conversation (Springer, et al., 2000). The reduced syntactic constructions were not morphologically well-formed; thus, any gains in processing resources came at the expense of grammaticality, representing a valid trade-off for economy of effort and potential generalisation beyond the treatment sessions. Thirdly, the development of a hierarchy of increasing syntactic complexity allowed for the inclusion of participants with a range of symptom severities. The treatment hierarchy was designed to target mapping of thematic roles to syntactic positions, with a final level introducing adverbial phrases which conveyed time/manner information.

5.5.5 Treatment procedure

A comprehension task was used to familiarise participants with the 'slots' within a syntactic structure; this task consisted of facilitating participants to identify the verb, agent and patient/theme across types of sentence - active, passive, subject cleft and object cleft sentences. The comprehension task was administered once only at the beginning of Levels 1 and 2 (see Table 13). Subsequently, Level 1 targeted production of 2-part reduced constructions (i.e., agent-verb); participants were presented with an action picture alongside an empty written sentence frame (marking the agent and verb) and asked to produce a reduced syntactic construction. On successful production, the reduced syntactic construction was repeated three times; otherwise, a cueing protocol was implemented to facilitate syntactic construction (see Appendix 10). Participants were then asked to produce further syntactic constructions with an alternative agent and verb. In cases where the participant's first production included a heavy verb, he/she was encouraged to use a light verb in production of an exemplar construction. Participants were encouraged to produce a personally relevant agent (i.e., family member or friend) in the second exemplar of each target sentence. Level 2 largely replicated Level 1, targeting 3-part reduced structures with the addition of a patient/theme. Level 3 expanded the 3-part constructions with the addition of adverbial phrases; participants were presented with a written list of adverbs conveying time (e.g.,

yesterday, last year, next week, today) or manner (e.g., quickly, slowly, loudly, softly). Slots were added to the (now familiar) 3-part construction frame to facilitate participants in adding the adverb either at the beginning or the end of the construction.

The first author, a registered speech and language therapist, delivered the treatment which consisted of eight weekly sessions, each of approximately one-hour duration. Structured homework sheets were given to facilitate practice outside of the sessions; participants kept written records of all practice completed. At the end of the treatment, participants completed evaluations of the treatments at 1-week and 1-month post-treatment.

5.5.6 Outcome measures

There were three levels of analysis for syntactic production: sentence level (trained and untrained stimuli); connected speech level (picture-supported narratives); and unconstrained conversation. Production of trained and untrained/control syntactic structures constituted the direct measure of treatment effects. Connected speech samples were elicited via picture description of the 'Cookie Jar Theft' (Goodglass, et al., 2001) and recall of the Cinderella narrative in the absence of picture stimuli (Berndt, et al., 2000); these were recycled from post-lexical therapy assessments. Everyday conversations between participants and a typical conversation partner were video recorded in the absence of the researcher (again, recycled from post-lexical therapy collection of conversation data). Multiple samples of conversation data were obtained before and after treatment for each participant, to enable investigation of stability of behaviours relating to syntactic production. Participants were trained on using a camcorder and asked to record 10-15 minutes of everyday conversation at a time when they usually had a conversation, e.g., during a meal, etc. A minimum of 80 minutes of conversation data were collected for each participant, i.e., twice weekly sampling over a 4-week period. For the purpose of outcome measurement, analysis of conversation data was confined to a pre-determined selection from the total sum of data for each participant; a 5-minute segment was selected from each couple's second conversation per week, resulting in approximately 20-minutes of conversation data for each couple, both pre- and post-treatment. The selected data were transcribed by individuals who were blind to the aim of treatment and the sampling point; the first author verified accuracy of all transcripts.

5.5.7 Protocol for analysis of connected speech and conversation data

Connected speech and conversation data were coded for type of verbal output. Excluded from coding/analysis were minimal turns (e.g., "mhmm"), one-word responses consisting only of yes/no, non-linguistic output (e.g., laughter, singing), output elicited following phonemic cueing, neologisms, stereotypical phrases specific to each participant and any words or

utterances marked as unclear by the transcriber (as a standard measure, these ambiguities were depicted in the transcripts in brackets). All remaining verbal output was coded as i) a verb produced in isolation, ii) content word produced in isolation, iii) verb phrase, or iv) non-verb phrase. Only lexical (main) verbs were included in the coding; auxiliary verbs were excluded. Phonemic paraphasias which deviated by one phoneme only from the target word or which were understood by the conversation partner were included in coding/analysis. Utterances were defined as output consisting of at least two words, which were semantically and/or prosodically linked. Incomplete utterances containing an auxiliary verb (e.g., "the boy is…") were coded as an isolated content word. Grammatical completeness did not feature in the coding or analysis, e.g., errors related to omission of arguments or incorrect word order. See Appendix 11 for further information relating to coding connected speech data and conversation data.

Pre- and post-treatment data were analysed as a group and individually to investigate an effect of treatment across tasks of sentence production, connected speech and conversation. One-tailed Wilcoxon's matched-pairs (non-parametric) tests were used to examine the effects of treatment on syntactic construction in assessment tasks (i.e., trained and control constructions). Within connected speech and conversation data, two behaviours of interest were identified: namely, i) verb phrases as a proportion of the total utterances produced by the participant with aphasia produced within phrases and ii) verbs produced in isolation as a proportion of other content words produced in isolation. Proportional rather than raw data were used to allow for comparison of across data samples of varying lengths (e.g., Best, Grassly, Greenwood, Herbert, Hickin, & Howard, 2011; Perkins, et al., 1999). Reliability of coding was assessed by a second rater (the third author), who scored 25% of randomly selected data for all participants. In order to minimise the effects of experimenter expectancy, the second rater was blind to the sample point of the data (i.e., pre- vs post-treatment data). Point-to-point inter-rater agreement averaged 93.6% for connected speech data and 94% for conversation data.

At the group level, a one-way repeated measures ANOVA (time of testing) was used to investigate the stability of verb phrases and isolated verb in baseline data across connected speech tasks and conversation respectively. For pre- and post-treatment comparisons, a 2*3 ANOVA examined condition (i.e., pre- and post-treatment) and sample time (i.e., three stable data points within each condition). Individual participants' data were analysed for any change in frequency of behaviours of interest. Based on results from group-level analysis, further investigation was carried out on the type of verb phrases produced by participants in connected speech tasks pre- and post-treatment.

5.6 Results

All nine participants completed the treatment programme; after eight weeks of treatment, 3 participants remained at Level 1, 3 participants had progressed to Level 2 and 3 to Level 3 (see Table 13). One participant (GL) experienced a worsening of his vestibular symptoms during treatment, which negatively impacted on his potential to benefit from treatment.

5.6.1 Did participants show an effect of treatment at the syntactic level?

5.6.1.1 Trained syntactic constructions

There was no significant difference for any participant between the two baseline assessments of syntactic construction, suggesting stability in baseline syntactic performance (Wilcoxon's matched pairs test, Ws+ = 8 – 40, 1-tailed, p = .0908 - .4435); see Table 14.

There was a statistically significant improvement in the production of trained syntactic constructions for eight participants after treatment (Wilcoxon's matched pairs test, Ws+ = 0 – 22.5, 1-tailed, p = .0000 - .0018); see Table 14. For GL, who became ill during the treatment, post-treatment assessment indicated no change in his trained syntactic construction (GL: Ws+ = 37, 1-tailed, p = .4521).

Table 14: Comparison of treated syntactic constructions before and after treatment

	Pre-therapy		**Post-therapy**	
	baseline 1	**baseline 2**	**1 week**	**1 month**
KK	16	13	65 *	46 *
GL	20	23	23	17
BL	17	20	68 *	62 *
DC	39	39	69 *	59 *
JH	26	42	73 *	54 *
AT	48	41	76 *	69 *
PM	44	57	93 *	93 *
PG	45	34	66 *	41
DM	73	72	94 *	97 *

Statistical significance is demonstrated by * ($p \leq .05$) in comparison to pre-therapy accuracy

One month later, the effects of treatment were maintained for seven of the eight participants (Wilcoxon's matched pairs test, Ws+ = 0 – 23, 1-tailed, p = .0000 - .0033); see Table 14. For the remaining participant (PG) construction of trained items at 1-month post-treatment returned to near baseline levels (Ws+ = 56, 1-tailed, p = .4203). Participant GL, who had not

demonstrated change immediately after treatment, predictably continued to show a lack of change 1-month post-treatment (Ws+ = 69, 1-tailed, p = .153). Due to lack of change on trained stimuli, GL was excluded from further analysis.

5.6.1.2 Untrained syntactic constructions

For the control set, there was also no significant difference between the two baseline assessments of syntactic construction for seven participants, suggesting syntactic stability at baseline (Wilcoxon's matched pairs test, Ws+ = 16 – 85, 1-tailed, p = .076 - .4143). For one participant, the baseline assessments were not stable, with significant differences between the two baseline assessments (DC: Ws+ = 0, 1-tailed, p = .0005); see Table 15.

One week after treatment, there was a significant improvement in untrained syntactic constructions for six participants (Wilcoxon's matched pairs test, Ws+ = 8 – 26, 2-tailed, p = .0028 - .05). Two participants did not show significant improvement in untrained constructions (Wilcoxon's matched pairs test, AT: Ws+ = 40, 2-tailed, p = .0841; PM: Ws+ = 38, 2-tailed, p = .0693); see Table 15.

One month later, the effects of treatment were maintained for five of the eight participants who had shown an immediate effect of treatment (Wilcoxon's matched pairs test, Ws+ = 13.5– 31, 2-tailed, p = .0075 - .05). For three participants, there was no significant difference in the construction of untrained syntactic items from baseline (mean) to 1-month post-treatment (JH: Ws+ = 26, 2-tailed, p = .0546; PG: Ws+ = 53.3, 2-tailed, p = .0962; DM: Ws+ = 48, 2-tailed, p = .0996); see Table 15.

Table 15: Comparison of untreated syntactic constructions before and after treatment

	Pre-therapy		**Post-therapy**	
	baseline 1	**baseline 2**	**1 week**	**1 month**
KK	23	11	30 *	33 *
BL	20	23	40 *	43 *
DC	29	48 *	55 *	55 *
JH	38	35	54 *	52
AT	68	55	71	75 *
PM	50	61	69	82 *
PG	22	30	68 *	43
DM	68	76	88 *	74

Statistical significance is demonstrated by * ($p \leq .05$) in comparison to pre-therapy accuracy

Treatment gains were consistent across the two post-treatment assessments for seven participants (Wilcoxon's matched pairs test, Ws+ = 14 – 69.5, 2-tailed, p = .627 - .9709). One participant (PM) continued to improve between the two post-treatment assessments (PM: Ws+ = 4, 2-tailed, p = .0418).

5.6.1.3 Sentence comprehension

Pre-therapy, participants' sentence comprehension was assessed twice within one month before therapy. There was no significant change for six participants between mean baseline and post-treatment assessment, suggesting stability in sentence comprehension (Wilcoxon's matched pairs test, Ws+ = 0 – 6, 2-tailed, p = .07 - 1.0). Two participants demonstrated different patterns in sentence comprehension: one performing worse at the second assessment (BL: Ws+ = 15, 2-tailed, p = .04), while the other performed significantly better at the second assessments (AT: Ws+ = 0, 2-tailed, p = .005); see Table 16.

Table 16: Comparison of participants' raw scores on VAST test of sentence comprehension (total score = 40)

	Pre-therapy			**Post-therapy**		
	1	**2**	**Average**	**1 week**	**1 month**	**Average**
KK	30	21	25.5	28	19	23.5
BL	17	27	22	15	19	17 *
DC	20	23	21.5	20	25	22.5
JH	23	29	26	29	31	30
AT	25	27	26	36	33	34.5 *
PM	39	39	39	37	40	38.5
PG	25	23	24	25	26	25.5
DM	21	19	20	21	21	21

Statistical significance is demonstrated by * ($p \leq .05$) in comparing average pre- and post-therapy accuracy

5.6.1.4 Generalisation to the related, untreated VAST sentence production task

There was no difference for any participant between the two baseline scores on this assessment, suggesting stability in baseline syntactic performance (Wilcoxon's matched pairs test, Ws+ = 10.5 – 48, 1-tailed, p = .0647 - .5).

One week after treatment completion, there was a significant improvement in untrained syntactic construction for six participants (Wilcoxon's matched pairs test, Ws+ = 0 – 21.5, 2-tailed, p = .0002 - .0278). Two participants did not show significant improvement in untrained constructions (Wilcoxon's matched pairs test, AT: Ws+ = 37, 2-tailed, p = .5724; PG: Ws+ = 67, 2-tailed, p = .2643).

One month later, the effects of treatment were maintained for six participants on untrained sentence construction (Wilcoxon's matched pairs test, Ws+ = 3.5 – 16.5, 2-tailed, p = .0008 - .0428). As predicted, participants AT and PG continued to show no significant difference for untrained syntactic stimuli (AT: Ws+ = 19, 2-tailed, p = .0655; PG: Ws+ = 68, 2-tailed, p = .4556).

Treatment gains were maintained across the two post-treatment assessments for seven participants (Wilcoxon's matched pairs test, Ws+ = 6 – 55.5, 2-tailed, p = .1875 - 1.0). The only participant for whom construction of untrained items was not stable after treatment was PM, who continued to make improvements between 1-week and 1-month post-treatment assessment (PM: Ws+ = 31.5, 2-tailed, p = .0411).

5.6.2 Do participants show an effect of treatment at the level of connected speech?

5.6.2.1 Group level investigation of generalisation to connected speech

Regarding stability in baseline data, a one-way, repeated measures ANOVA indicated a lack of variance across baseline assessment points within the group on the measure of verb phrases as a proportion of total utterances: F (2,14) = .307 p = .740. There was also a lack of significant variance across baseline assessment points for the measure of verbs produced in isolated as a proportion of total words produced in isolation: F (2,14) = 2.160 p = .152.

For comparison of pre- and post-treatment connected speech data, a 2*3 repeated measures ANOVA showed an apparent effect of condition which was approaching statistical significance: F (1,7) = 4.6301 p = .068 (likely to be related to treatment), on the measure of verb phrases as a proportion of total utterances. There was no effect of time of testing: F (2,14) = .858 p = .445. Although not significant, the global mean of verb phrases increased from .474 (St Dev .32) in baseline connected speech data to .611 (St Dev .29) following treatment.

For the second measure, isolated verbs as a proportion of total words produced in isolation, there was no effect of condition (F (1,7) = 1.925 p = .208), nor was there an effect of time of testing (F (2,14) = 1.976 p = .175). Although not significant, the global mean of verbs

produced in isolation decreased from .271 (St Dev. .29) in baseline connected speech data to .160 (St Dev. .17) following treatment.

5.6.2.2 Individual responses to generalisation to connected speech

Six participants (KK, BL, DC, PM, PG, DM) increased the proportion of verb phrases within connected speech tasks after treatment (see Table 17); improvement in verb phrases production averaged 21% (St Dev. 11.9).

Table 17: Data across individual participants for verb phrases as a proportion of total utterances produced in connected speech tasks pre- and post-treatment targeting syntactic construction

	Pre-therapy				Post-treatment				
	1	**2**	**3**	**Average**	**1**	**2**	**3**	**Average**	**Difference**
KK	0.00	0.00	0.00	0.00	0.20	0.00	0.80	0.33	0.33
BL	0.00	0.00	0.33	0.11	0.50	0.22	0.00	0.24	0.13
DC	0.71	0.50	0.57	0.59	0.63	0.70	0.71	0.68	0.09
JH	0.40	0.67	0.60	0.56	0.40	0.40	0.40	0.40	-0.16
AT	0.91	0.67	0.93	0.84	0.86	0.70	0.83	0.80	-0.04
PM	0.33	0.67	0.67	0.56	0.80	0.64	0.75	0.73	0.17
PG	0.75	1.00	0.27	0.67	1.00	0.66	0.89	0.85	0.17
DM	0.40	0.60	0.40	0.47	1.00	0.58	1.00	0.86	0.39

In order to investigate qualitative changes in verb phrase production, verb phrases were categorised on complexity of the thematic structure; that is, verbs with one argument (e.g., *she run*); two arguments (e.g., *he carry box*); three arguments (e.g., *boy give salt to girl*) or verbs with non-obligatory constituents (*run fast*); see Figure 5.

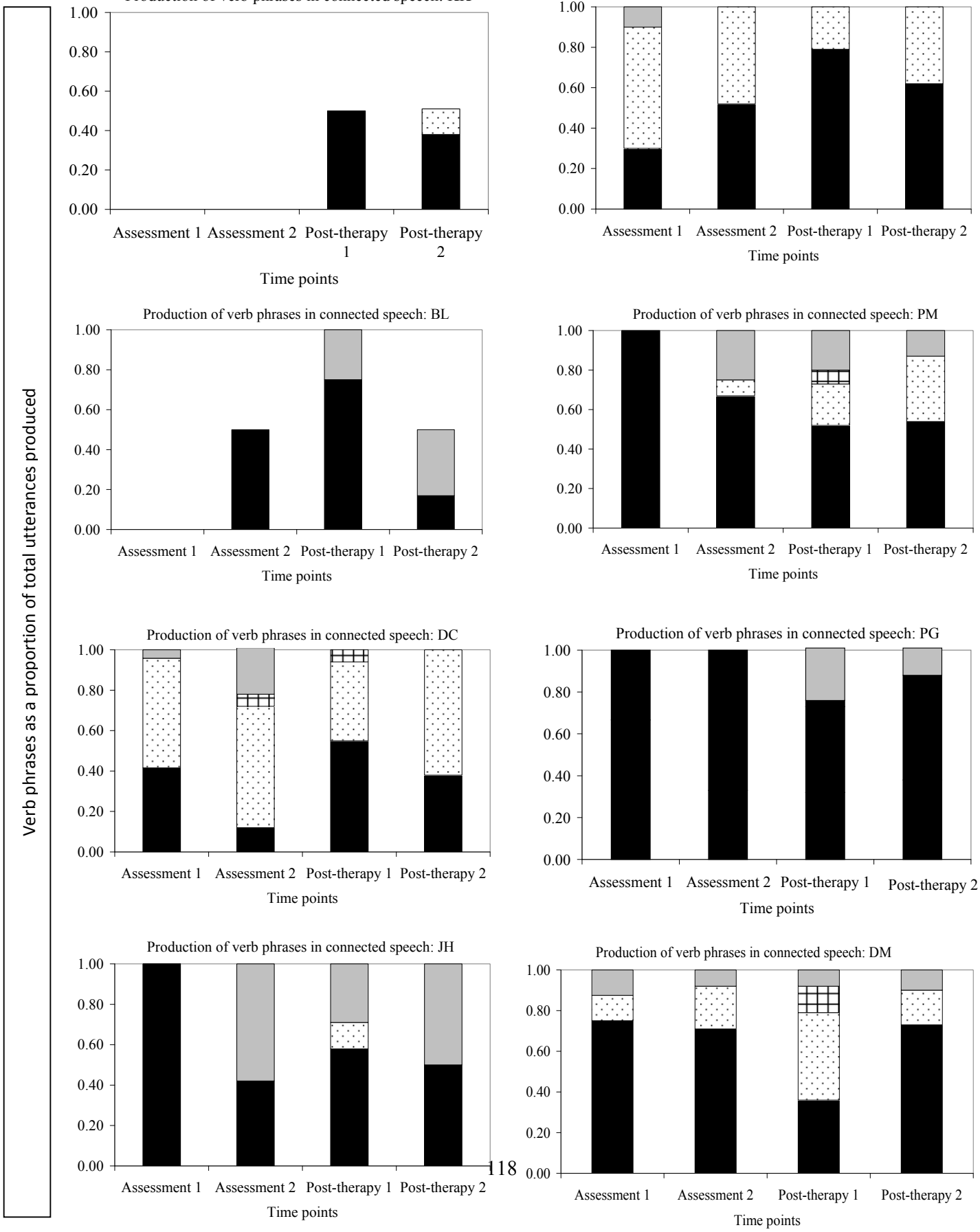


Figure 5: Changes in type of verb prhases produced by participants' in connected speech tasks (averaged across two administrations) pre- and post-treatment targeting syntactic construction

- KK did not produce any verb phrases in baseline assessment; in post-treatment connected speech samples, he produced a limited range of verb phrases (e.g., in response to the Cookie Jar Theft picture: "woman wash", "cookies… coming"). The type of post-treatment verb phrases produced corresponded with the treatment level to which he progressed in treatment, i.e., two-part structures (Level 2, Table 13).
- Post-treatment, BL demonstrated an increased frequency of producing 1-argument verb constructions and also increased the diversity of verb phrases types by producing verb phrases with non-obligatory arguments (e.g., Cinderella retell: "sweeping up"). This was not in line with his treatment level, which remained at structures consisting of one-argument verbs.
- DC increased production of structures consisting of a verb plus one argument in post-treatment connected speech samples (e.g., Cookie Jar Theft: "cookie jar open"; Cinderella: "Cinderella was brushing", "had a lovely time"); this corresponded to the level to which he progressed in treatment (Level 1, Table 13). He also increased production of obligatory arguments, with a reduction in verb phrases consisting of a verb plus non-obligatory argument.
- For JH, there was some evidence of increased diversity of verb phrase type (e.g., Cookie Jar Theft: "turn itself off", "drop down"; Cinderella: "and then run out"). Furthermore, JH demonstrated less reliance on phrases consisting of verbs plus one argument; this corresponded to the level to which she progressed in treatment (Level 2, Table 13).
- In post-treatment connected speech samples, AT maintained a range of verb constructions (e.g., Cinderella: "Cinderella is sweeping the carpet", "it fits"). She increased production of 1-argument verb phrases (e.g., "and the prince is gone", "ringing the changes") despite having progressed to Level 2 (Table 13) in treatment.
- Following treatment, PM demonstrated a more diverse range of verb phrase types, with increased thematic complexity as evidenced by increased production of verb phrases with two and three arguments (e.g., Cookie Jar Theft: "child is getting a biscuit"; Cinderella: "godmother is taking her outside"). Within the treatment programme, PM had progressed to Level 3 (Table 13).
- Post-treatment, PG demonstrated increased diversity of verb phrase types; in particular, PG's production of verb phrases with non-obligatory constituents (e.g., Cookie Jar Theft: "drip down") corresponds to the level he obtained within treatment, i.e., Level 3 (Table 13).
- Immediately after treatment, DM demonstrated greater thematic complexity, producing verb structures with three arguments (e.g., Cookie Jar Theft: "sink pour water or floor"). One month later, his output returned to the baseline tendency of verb phrases with 1- or 2-arguments, or with non-obligatory arguments.

Five participants reduced the number of verbs produced in isolation (see Table 18); this reduction averaged 24.4% (St Dev. 18.2%). Three participants produced more verbs in isolation after treatment; increases in isolated verb production averaged 10.6% (St. Dev. 5.5).

Table 18: Data across individual participants for isolated verbs as a proportion of isolated content words produced in connected speech tasks pre- and post-treatment targeting syntactic construction

	Pre-therapy				Post-therapy				
	1	**2**	**3**	**Average**	**1**	**2**	**3**	**Average**	**Difference**
KK	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.17	0.17
BL	0.14	0.18	0.14	0.16	0.20	0.00	0.00	0.07	-0.09
DC	0.26	0.75	0.60	0.54	0.00	0.00	0.08	0.03	-0.51
JH	0.29	0.00	0.00	0.10	0.00	0.38	0.15	0.18	0.08
AT	0.25	1.00	0.13	0.46	0.00	0.25	0.38	0.21	-0.25
PM	1.00	0.50	0.00	0.50	0.00	0.33	0.25	0.19	-0.31
PG	0.00	0.33	0.00	0.11	0.33	0.00	0.20	0.18	0.07
DM	0.35	0.43	0.17	0.32	0.25	0.29	0.24	0.26	-0.06

5.6.3 Do participants show an effect of treatment at the level of conversation?

5.6.3.1 Group level investigation of generalisation to conversation

A one-way, repeated measures ANOVA suggested a lack of variance across baseline assessment points within the group on the measure of verb phrases as a proportion of total utterances: F (2,14) = .179 p = .838. Lack of significant variance across assessment points at baseline also held for the measure of verbs produced in isolation as a proportion of total content words produced in isolation: F (2,14) = .616 p = .554.

In comparing pre- and post-treatment conversation data, a 2*3 repeated measures ANOVA suggested no significant effect of condition: F (1,7) = 1.082 p = .333 for the measure of verb phrases as a proportion of total utterances, and a lack of significant effect of time of testing: F (2,14) = .214 p = .810. For the measure of isolated verbs as a proportion of total words produced in isolation, there was no effect of condition: F (1,7) = .08 p = .785; furthermore, there was no effect of time of testing: F (2,14) = .364 p = .701.

5.6.3.2 Individual investigation of generalisation to conversation

Three participants increased the proportion of verb phrases produced in conversation after treatment (see Table 19); this increase averaged 7.9% (St. Dev. 2.8). Five participants produced fewer verbs phrases after treatment, averaging 9.9% (St Dev. 10.1).

Table 19: Data across individual participants for verb phrases as a proportion of total utterances produced in conversation pre- and post-treatment targeting syntactic construction

	Pre-therapy					**Post-therapy**					
	1	**2**	**3**	**4**	**Average**	**1**	**2**	**3**	**4**	**Average**	**Difference**
KK	0.933	0.875	0.917	0.833	0.890	0.875	0.516	0.684	0.429	0.626	-0.264
BL	0.667	0.500	0.000	0.263	0.357	0.500	0.500	0.500	0.250	0.438	0.080
DC	0.786	0.905	0.889	0.714	0.823	0.853	0.816	0.725	0.848	0.811	-0.013
JH	0.625	0.647	0.467	0.625	0.591	0.722	0.600	0.591	0.655	0.642	0.051
AT	0.682	0.500	0.750	0.684	0.654	0.526	0.760	0.568	0.500	0.589	-0.065
PM	0.563	0.789	0.467	0.533	0.588	0.667	0.700	0.750	0.667	0.696	0.108
PG	0.400	0.500	0.469	0.917	0.571	0.500	0.571	0.583	0.500	0.539	-0.033
DM	0.462	0.667	0.500	0.455	0.521	0.222	0.571	0.500	0.296	0.397	-0.123

Five participants decreased the proportion of isolated verbs produced in conversation after treatment (see Table 20); this decrease averaged 6.2% (St. Dev. 3.5). The remaining three participants produced more verbs in isolation after treatment; increases in isolated verb production averaged 7.7% (St. Dev. 3.1).

Table 20: Data across individual participants for isolated verbs as a proportion of total content words produced in isolation in conversation pre- and post-treatment targeting syntactic construction

	Pre-therapy					**Post-therapy**					
	1	**2**	**3**	**4**	**Average**	**1**	**2**	**3**	**4**	**Average**	**Difference**
KK	0.643	0.500	0.250	0.333	0.432	0.333	0.333	0.385	0.333	0.346	-0.085
BL	0.231	0.111	0.000	0.105	0.112	0.176	0.250	0.091	0.286	0.201	0.089
DC	0.333	0.455	0.000	0.111	0.225	0.222	0.000	0.000	0.500	0.181	-0.044
JH	0.063	0.000	0.048	0.133	0.061	0.160	0.100	0.045	0.341	0.162	0.101
AT	0.556	0.000	0.063	0.000	0.155	0.100	0.111	0.130	0.000	0.085	-0.069
PM	0.333	0.375	0.300	0.000	0.252	0.429	0.250	0.000	0.500	0.295	0.043
PG	0.091	0.000	0.286	0.167	0.136	0.000	0.000	0.500	0.000	0.125	-0.011
DM	0.280	0.217	0.167	0.289	0.238	0.059	0.163	0.250	0.083	0.139	-0.100

5.7 Discussion

The current study devised and evaluated a novel, theoretically-driven treatment targeting the production skills of participants with Broca's aphasia. This treatment represented a synthesis of approaches to optimise the likelihood of generalisation from direct measures to the ecologically important context of conversation. Treatment effects were tracked across a range of output tasks from highly constrained assessment tasks to unconstrained everyday conversation. This novel hybrid treatment drew on the principles of mapping treatment (e.g., Marshall, 1995) to target participants' awareness and mapping of thematic roles to syntactic positions, as well as the principles of REST (Springer, et al., 2000) to target production of simplified verb-centred phrases supported by a hierarchy of progressive syntactic complexity. A further component incorporated from the REST studies (Ruiter, et al., 2010; Springer, et al., 2000) included the addition of adverbial phrases. The treatment programme targeted production of a range of potential exemplar agents, patients/themes and alternated between semantically heavy and light verbs.

Improvements in syntactic construction were defined as retrieval of an appropriate verb, generation of relevant arguments around the verb and accurate word order. The trained syntactic items showed a significant and lasting effect of treatment. Across a range of severities, eight participants improved significantly on syntactic construction of trained items after treatment; this improvement was maintained on follow-up assessment for seven participants. The participants had previously completed a verb retrieval treatment, after which only two participants demonstrated improvements to sentence production (Carragher et al., accepted pending corrections); the results of the current study indicate that treatment which explicitly targeted production of verbs within syntactic structures was necessary in order to affect change in sentence production (for similiar arguments, see Mitchum, et al., 2000). The absence of change in sentence comprehension may be related to differences in stimuli: treatment targeted canonical structures only while the sentence comprehension test included canonical and non-canonical sentences. The sequential order of current treatment may also be important; that is, syntactic treatment followed a prior verb retrieval treatment (Carragher et al., accepted pending corrections). Thus the current study capitalised on participants' increased metalinguistic awareness of verbs as a lexical class and thus was able to expand metalinguistic awareness towards verb arguments to improve participants' specification of argument structure (Webster, et al., 2005).

Improvements were also seen in untrained syntactic constructions (i.e., matched control stimuli and on the related but untreated VAST sentence production subtest). In contrast to the trained items, the maintenance of these improvements was less robust on follow-up

assessment one month after treatment. Previous mapping treatments have produced mixed results on untrained structures (e.g., Byng, 1988; Fink, et al., 1998; Mitchum, et al., 1993; Schwartz, et al., 1994) and a previous verb retrieval treatment for the current participants mirrored this finding (Carragher et al., accepted pending corrections). The results from the current study strongly suggest that generalisation to untrained constructions was directly attributable to the treatment approach used (see Carragher et al., accepted pending corrections). Thus the results presented in the present study provided support for Mitchum et al.'s (2000) argument that sentence production is not solely anchored on the availability of the verb and that targeting verb retrieval within a syntactic frame is necessary to achieve generalisation to sentence production.

Investigation of generalisation focused on behaviours hypothesised to relate to the treatment task, i.e., production of verb-centred phrases and verbs produced in isolation. These measures were investigated in connected speech data and everyday conversation data in order to track the effects of treatment across contexts of decreasing constraint. Within post-treatment connected speech data, there was an apparent effect of treatment on the measure closest to the focus of treatment, i.e., production of verb phrases. Subsequent individual analyses revealed that six participants demonstrated increased frequency of verb phrases post-treatment. Qualitative changes in production of verb phrases (increased range of verb phrases produced and thematic complexity) were also noted. Moving from production of simple syntactic structures in response to picture stimuli to connected speech placed linguistic (and cognitive) demands on participants that were not targeted in treatment; however, the results from the current study suggest that participants were able to generate verb-centred phrases in a task that was less constrained than the treatment task and which provided fewer cues to assist them, e.g., picture stimuli.

Investigation of everyday conversation revealed a lack of change on the measure closest to the treatment task, that is, production of verb phrases. While not the desired outcome of treatment, this result has echoed elsewhere; speakers with agrammatism have been noted to maintain telegraphic-style speech in conversation despite improvements on samples of elicited connected speech (Springer, et al., 2000). Evidence from previous treatment targeting reduced syntactic construction suggests the effects of treatment have been less robust in contexts of decreased constraint (Ruiter, et al., 2010). In the lexical retrieval paradigm, conflicting evidence has been reported on the relationship between confrontation naming assessment and naming in connected speech and conversation (Herbert, et al., 2008; Mayer & Murray, 2003). Taken together, the evidence suggests that, for the participants in the current

study, change on connected speech samples were a poor indicator of change in everyday conversation.

An absence of change in conversation, despite effects in syntactic production and in connected speech, may be accounted for by a number of factors. Firstly, the lack of constraint within conversation makes possible strategic behaviours (e.g., avoiding difficult words, Mayer & Murray, 2003) which are designed to maintain a degree of fluency (Vermeulen, Bastiaanse, & Van Wageningen, 1989); thus, behaviours of interest may be obscured by more pragmatically and socially-driven motivations. Secondly, speakers with agrammatism may downgrade their output to the lowest degree of elliptical complexity (i.e., non-verb elliptical utterances) when faced with high informational demands (De Roo, et al., 2003; Ruiter, et al., 2010). If output in speakers with agrammatism reflects compensation for reduced processing capacity - as purported by the telegraphic adaptation theory (Kolk, 1995; Kolk & van Grunsven, 1985) - the results from the current study suggest that syntactic production treatment should be supplemented by a programme of treatment that addresses their use during the demands of everyday conversation. Thirdly, the conversation samples collected were not constrained by potentially influential variables (e.g., verb frequency, opportunities for production of syntactic structures). Evidence from a lexical retrieval study (Mayer & Murray, 2003) has indicated an effect of elicitation context on grammatical class, with a significant difference between retrieval of verbs (but not nouns) across composite naming and conversational data. In the current study, lack of constraint within conversation data was necessary in order to maintain the ecological validity of the conversation data (similar to Mayer & Murray, 2003); thus, potentially influential variables were free to vary. Whilst such lack of constraint is methodologically challenging, a meaningful implication of the multiple sampling pre- and post-treatment is that the conversation data collected represented typical language production in everyday life for these participants. Fourthly, participants' current style of output may have been entrenched in daily conversation (e.g., corrective or preventative, Ruiter, et al., 2010) perhaps through learned non-use (Pulvermuller & Berthier, 2008), or reinforced (consciously or otherwise) by conversation partners. In particular, the influence of conversation partners on the language production and interaction of people with aphasia has been noted (e.g., Simmons-Mackie, et al., 2005); thus, the level of skill of the conversation partner in creating opportunities for the person with aphasia to make use of their improved linguistic skills may be a confounding variable in finding evidence of an effect of treatment in conversation. Finally, the analysis within the current study focused on the participants' spoken production of verb phrases; a potential avenue of interest relates to gesture production, a component within the current study and the previous verb retrieval study.

Participants within the current study demonstrated flexible improvement in language production skills. The combination of increasing the participants' metalinguistic awareness of and mapping of thematic roles onto syntactic positions within syntactically reduced verb phrases that avoided draining cognitive resources resulted in changes on tasks closely related to treatment and generalisation to connected speech tasks. The lack of generalisation to conversation highlights the challenge for PWA to transfer skills from treatment to everyday communication, a process which traditionally has been assumed to occur without explicit facilitation or treatment. The findings of the present study have strongly indicated the need for 'bridging interventions' to facilitate use of enhanced production skills in conversation through working with both PWA and conversation partners in order to ensure sufficient conversational space within which PWA can utilise greater linguistic resources.

5.8 Study Limitations

The analysis within the current study focused on the participants' spoken production of verb phrases in connected speech tasks and everyday conversation. The analysis was constrained to verbal production of verb phrases in order to reflect the aim of treatment. A potential avenue for future research relates to gesture production; gesture was an important component within the current study. As such, future research may include analysis of gesture in participants' connected speech and conversation data, such as changes in frequency of gesture produced, the quality of gesture produced, or coupling gesture with verbally-produced agents/themes to substitute for or facilitate verb retrieval. This would complement the analysis of verbal output and ultimately yield a more rounded, holistic set of results relating to the effects of treatment on everyday conversation.

Furthermore, participants' performance on background assessments was used to profile their linguistic and cognitive deficits and strengths; baseline conversation data was used only for the purpose of outcome measurement. In future research, it may be useful to extend the use of Ruiter et al.'s (Ruiter, et al., 2010)1) categorisation of participants with agrammatism across a continuum of corrective to preventative styles of output. This framework may shed light on the patterns of generalisation demonstrated by individual participants to connected speech data; furthermore, this framework may be useful in designing impairment therapy to maximise potential for generalisation to daily conversation.

Chapter 6: The effects of treatment targeting transaction and interaction through storytelling: Quantitative and qualitative evidence from people with non-fluent aphasia

Carragher, Sage, Conroy (in preparation). *International Journal of Language and Communication Disorders.*

6.1 Abstract

Background: Aphasia rehabilitation ultimately has a social goal of optimising the communication of the person with aphasia (PWA) within their typical environment. One important aspect of everyday communication relates to conveying new information and telling anecdotes/stories. Measures of transactional success in storytelling have previously demonstrated reliability and validity as an analytical method.

Aim: The study aimed to extend previous work on transactional success in storytelling to a programme of therapy targeting both the PWA and the conversation partner.

Methods and procedures: Four participants with chronic non-fluent aphasia and their conversation partners were recruited. A novel dual-focus treatment was administered: for the PWA, therapy targeted storytelling primarily through 'thinking for speaking' principles and story grammar; for the partner, therapy drew on the principles of conversation coaching to increase facilitative behaviours within storytelling to aid the construction of shared understanding. Quantitative and qualitative measures were used to investigate direct and indirect effects of treatment.

Outcomes and results: There were numerical gains in information exchange for three of four couples, where the conversation partner displayed improved understanding of the PWQ's story, and a decrease for one couple. Evidence of likely direct effects of therapy across both simple and complex storytelling was consistent for two of the four couples. For one of these couples, an in-depth single case analysis indicated increased active participation in story construction and shared understanding, in line with his individual therapy goals. Within conversation, descriptive analysis indicated similar changes to those seen in the storytelling task.

Conclusions: The method of dual-focused therapy and outcome measurement outlined in this paper offers promise for targeting an important aspect of everyday communication in a standardised task. Potential for future investigation is discussed.

6.2 Introduction

Therapy for people with aphasia (PWA) encompasses a wide range of aims and methodologies, from targeting the linguistic impairment (e.g., accepted pending revisions-a; Carragher, Sage, & Conroy, accepted pending revisions-b), to strategic compensation to optimise communication (e.g., Hopper, Holland, & Rewega, 2002), interaction (e.g., Beeke, et al., 2011) and vocational rehabilitation (e.g., Morris, Franklin, Menger, & GD, 2011). One unifying area of interest across treatment type relates to the generalisation of behaviours targeted in therapy to untrained tasks and contexts, particularly those related to everyday communication. Conversation, as the most common type of daily communication (Davidson, et al., 2003), is gaining interest in terms of its role in measuring the effects of therapy. To date, the evidence of generalisation from impairment therapy studies to everyday conversation has shown promise but has not been overwhelming (see Carragher, et al., 2012). Several reasons have been suggested: lack of an outcome measure tool that is sufficiently sensitive to capture evidence of generalisation, or differences between linguistic behaviours targeted in therapy and assessment tasks compared to linguistic patterns in daily use (Beeke, et al., 2011). Another potentially influential factor may relate to the linguistic level targeted within therapy; often, treatment programmes do not explicitly target the transfer of skills from therapy tasks to communication in a structured manner, resulting in withdrawal of therapy before the PWA has realised their full potential. (Whitworth, 2010). Furthermore, generalisation of behaviours to everyday conversation is likely to be influenced by factors relating to the conversation partner (e.g., Cunningham & Ward, 2003).

The context in which generalisation is assessed is important; the linguistic demands, constraints and scaffolding inherent within the task influence patterns of language production for PWA. Evidence of sensitivity to task context has been demonstrated for individuals with non-fluent aphasia (e.g., Salis & Edwards, 2004), fluent aphasia (e.g., Mayer & Murray, 2003) and traumatic brain injury (e.g., Tu, Togher, & Power, 2011). This issue of validity can be circumvented by directly sampling everyday communication. Conversation analysis (CA) has formalised the sampling, description and analysis of what individuals say and do (e.g., Atkinson & Heritage, 1984). In its application to the field of aphasia, the value of CA lies in its ability to add different information to that gleaned from standardised assessment (e.g., Damico, Oelschlaeger, & Simmons-Mackie, 1999). However, CA does not easily lend itself to providing quantitative measures of the effect of therapy. Given that one important aspect of conversation lies in the conveying ideas and information, Ramsberger and Rende (2002) suggest a measure of transactional success to capture the collaborative success of PWA and their conversation partner with storytelling. While Davidson et al. (2003) found that conversation was the most frequent form of communication in daily life, this does not

preclude assessment of therapy outcomes in other genres; indeed, the same authors noted the multifaceted nature of everyday communication and how it spans both interactional and transactional purposes. Transactional success is difficult to capture within everyday conversation for a number of reasons: lack of external criteria on which to judge transactional success (Ramsberger & Rende, 2002); potential lack of clarity regarding a speaker's target word or meaning (Armstrong, 2000); potential for a dissociation between the information expressed by the speaker and how this is understood by the conversation partner (Ramsberger & Rende, 2002); as well as the opportunity for speakers to draw on shared knowledge which may not be expressed explicitly. Thus, in order to measure transactional success, it is necessary to use a context that shares similarities to conversation but, crucially, offers potential for externally-set criteria and standardisation. One such context is storytelling. As a discourse genre, storytelling is a means of self-expression (McAdams, 2001), of displaying and experiencing an evolving identity (Birren, Kenyon, Ruth, Shroots, & Svendson, 1996), and of making sense of the world (Riessman, 1993). Within the aging population, the relevance of storytelling, sharing life stories and reminiscing has been highlighted (Baltes & Baltes, 1990); narratives and life narratives play a central role in engaging with others and passing on life experience and wisdom (e.g., Randall, 2001). For PWA, there is evidence of lower frequency of storytelling in daily life compared to healthy controls (Davidson, et al., 2003); thus, storytelling presents a clinically valid context for treatment and outcome measurement. Whitworth (2010) argues that the skills involved in narrative at the level of macrolinguistics (e.g., the planning and sequencing of information within a structured framework and tailored towards the listener's perspective) and mircolinguistics (i.e., semantic and syntactic aspects of production) resonate throughout many language production activities in daily life. Thus, one possible avenue for future research is to measure transactional success within storytelling, whereby the PWA interacts with the conversation to explain a story, which the conversation partner later reports in his/her own words (Ramsberger & Rende, 2002).

Interactive storytelling offers a method of standardising interaction whilst maintaining many features of typical conversation; the conversation partner is blind to the stimulus content, simulating a real-life communicative situation in which the PWA is imparting new information/sharing an anecdote. Storytelling is ecologically valid (Lasker & Beukelman, 1999) and offers several advantages over sampling conversation: potential for standardisation across participants, replicable, offers face validity and an opportunity for comparison of performances across individuals (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002). Like everyday conversation, interactive storytelling offers data on speakers' turn-taking and negotiating the 'point' of the story (Norrick, 2000). Storytelling data offer the potential to

quantify transactional success (reflecting the PWA's ability to convey new information) and to investigate the couple's ability to negotiate towards shared understanding. Furthermore, the nature of complex narrative stimuli, which are rich with options as to what will be communicated, leaves many choices open to the PWA regarding expression of story events through verbal and/or nonverbal means, compared to more traditional language assessment which places constraints on possible linguistic responses and syntactic constructions (Hernández-Sacristán & Rosell-Clari, 2009). This study builds on previous work within storytelling (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002) by extending interactive storytelling to a therapy task.

6.3 Aims of the study

The current study aimed to investigate the effect of dual-focused therapy targeting interactive storytelling and to answer the following research questions:

- Is there an effect of therapy on conversation partners' reporting of narratives?
- In a single case analysis focusing on a specific couple, what behaviours drive the change in interactive storytelling?
- In a single case analysis, is there evidence of an effect of therapy within everyday conversation?

6.4 Method

6.4.1 Participants

Following ethical approval via standard UK protocols (NHS IRAS system), four participants were recruited to the current study. This study formed the third in a series of therapy studies targeting incremental levels of language output in individuals with non-fluent aphasia. As part of a larger group of participants (N = 9), these four participants had taken part in previous therapy studies targeting verb retrieval (Carragher, et al., accepted pending revisions-a) and syntactic construction (Carragher, et al., accepted pending revisions-b). All participants presented with stroke-induced, chronic non-fluent aphasia. Presentation of non-fluent aphasia was confirmed on the basis of converging evidence from clinical consensus, the results of standardised lexical retrieval assessment (as indicated by a clinical score on the Boston Naming Test, Goodglass, et al., 2001), and impaired use of grammatical markers and syntactic structures in picture description (Goodglass, et al., 2001). Participants were at least 6 months post-onset, reducing the likelihood of further spontaneous recovery. As apraxia of speech often co-occurs with non-fluent aphasia (e.g., McNeil, et al., 2008), presence of apraxic errors did not form part of the exclusion criteria. Inter-participant variation existed for time post-onset, ranging from 8 months to 57 months (mean: 31.8, St Dev. 23.9). The participants ranged in age from 36 – 68 years (mean: 57.8, St Dev. 14.7); Table 21 provides background information on the four participants with aphasia. In each case, the conversation partner was the PWA's husband/wife, had known the PWA prior to the stroke and had no history of neurological impairment. Throughout the paper, the participants with aphasia are referred to using initials, while conversation partners are given pseudonyms.

Table 21: Background information for four participants

Participants	*Gender*	*Age of leaving education*	*Hand-edness*	*Occupation*	*Age at time of stroke*	*TPO (months)*
BL	Male	16	Right	Pub manager	60	57
JH	Female	23	Right	Teacher	36	8
AT	Female	16	Right	Secretary	62	15
PM	Male	16	Right	Businessman	64	47

6.4.2 Background assessment

Inter-participant variation existed for severity: noun naming (Boston Naming Test, Goodglass, et al., 2001) ranged from 16 – 36 from a maximum score of sixty (mean: 26.3, St Dev. 10.0); verb naming (Object Action Naming Battery, OANB; Druks & Masterson, 2000) ranged from 30.5 – 59 from a maximum score of 100 (mean: 44.3, St Dev. 11.7). Further details of the participants and their performance on a battery of linguistic and cognitive assessments are provided in Carragher et al. (accepted pending revisions-a).

6.4.3 Intervention

Therapy drew upon the principles of thinking for speaking (e.g., see Marshall, 2009), story grammar (e.g., Rumelhart, 1975) and conversation coaching (e.g., Hopper, et al., 2002). Hence, intervention focused on the transactional and interactive behaviours of both the PWA and conversation partner (see Figure 6). Participants received six therapy sessions of approximately 1.5 hours, administered once a week. Within each session, up to 45 minutes was dedicated to working with the PWA, up to 30 minutes to working with the conversation partner, and the remainder of the session used for video feedback and discussion with the couple. The first therapy session targeted each couple's awareness of their interactive practices in the baseline storytelling tasks and focused on agreeing goals for therapy; subsequent therapy sessions (i.e., 2 – 6) provided practical opportunities of storytelling for the PWA and facilitation for the partners. For the purposes of stimulating storytelling within therapy, video clips were sourced from YouTube (www.youtube.com) and viewed by participants on an iPad. Video clips were selected on the basis of containing newsworthy details and minimal (or no) use of spoken or written language. See Appendix 12 for an example of the type of video stimuli used in therapy sessions.

Figure 6: Overview of the how the focus of the therapy sessions differed within storytelling intervention

Therapy session 1		**Therapy sessions 2 - 6**		
Video feedback from assessment and reflection	Agreement of goals	*Focus*: PWA *Task*: practising storytelling	*Focus*: conversation partner *Task*: shaping facilitative behaviours	*Focus*: couple *Task*: video feedback and discussion

What follows next is a detailed description of:

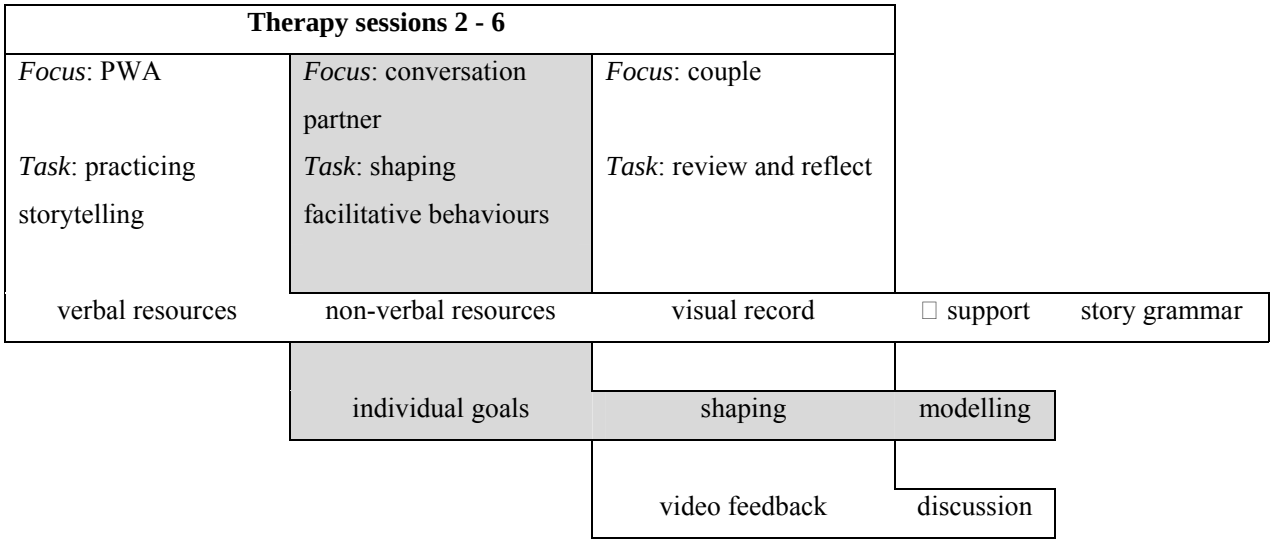
- the reflective therapy session (session 1)
- the practical therapy sessions for the PWA (sessions 2 – 6)
- the practical therapy sessions for the conversation partner (sessions 2 – 6)

The first treatment session focused on encouraging the PWA and their partner to reflect on their interactions from the baseline storytelling data and to begin to increase their awareness of various strategies and choices within interaction. Video feedback was used to facilitate discussion of the consequences of specific behaviours seen in the data, such as strategies used by the PWA to convey the events, strategies used by the conversation partner to clarify information or elicit further explanation, displays of negative emotion such as frustration, alternative options to strategies seen in the video data and, more broadly, sharing of the communicative burden and the overall effectiveness/success of the interaction. Couples were encouraged to extend their reflections beyond the recorded interactive narratives to their everyday conversations. During this initial session, therapy goals specific to each couple were suggested, based on analysis of pre-therapy interactive storytelling (see Appendix 13). The goals were given brief descriptive labels (e.g., 'Drip drip' and 'Pinpoint' – see Appendix 13 for definitions) to facilitate participants to remember their individual goals and also to aid discussion of specific strategies within the therapy sessions. For the participants with aphasia, therapy goals related to components of story grammar (Rumelhart, 1975), such as introducing key referents.

The practical sessions (2-6) began with the PWA viewing a video clip in the absence of their partner (see Figure 7, column 1). The video clip was repeated as often as requested (participants usually requested a maximum of three repeated viewings). The researcher

facilitated the PWA to segment the narrative into main events, broadly conceptualised as the beginning, middle and end sections of the story. Where relevant, the PWA was prompted to begin by introducing the story (the 'Set the scene' goal) by stating the main referent as well as other contextual information such as location or tone of the story (e.g., funny, sad). Throughout this process, the PWA was supported in his/her conceptualisation of the story through a visual record; the researcher used this to record the on-going story construction, writing down words/phrases produced by the PWA and depicting gesture through drawing. The visual record served as a useful anchor by which the PWA could monitor their progression through component sections of the story.

Figure 7: Practical therapy sessions focused individually on the PWA, the conversation partner, and then the couple



Having established the first episode of the story, the PWA was prompted to think about what happened next (corresponding to the 'Chunk it up' and 'Drip drip' goals). This involved establishing the referent (or introducing a new referent) and describing key information relating to that referent. In the case of an event, the PWA was encouraged to produce an agent-verb construction, with the verb produced verbally or through gesture, writing or drawing. The aim was to optimise (rather than correct) participants' output; therefore, any prompts or modelling provided by the researcher were carefully built on the participant's original output. For example, if the participant gestured 'running', the researcher prompted "Who?" followed by the gesture, with the aim of prompting the participant to produce a more contentful construction incorporating both verbal and nonverbal output (related to the 'Show and Tell' goal). If the PWA produced a content word in isolation (e.g., "hungry"), the researcher used wh-questions (e.g., "*who* is hungry?") and modelling (e.g., "bird hungry") to facilitate the PWA's production of argument structure. In line with a previous therapy study (Carragher, et al., accepted pending revisions-b), all modelling of syntactic constructions involved morphologically reduced structures. The PWA was also guided to use direct reported speech (Hengst, Frame, Neuman-Stritzel, & Gannaway, 2005) to depict characters' reactions within the story and to produce evaluative comments in grammatically simplified ways.

As the PWA progressed through the telling of each episode within the story, the segmentation of the story was reinforced visually through the use of the visual record, i.e., clearly marking the first, second, third, fourth etc. episodes of the story. This process was repeated until the complete story had been discussed and sketched out in the visual record. Throughout the story construction, the PWA was prompted to think selectively in terms of what details to include or omit from the story to ultimately facilitate their partner's comprehension of the story; in particular, the PWA was encouraged to consider whether a particular event or detail was key to understanding the story or more peripheral (issue of selectivity raised by Marshall & Cairns, 2005).

By the end of this part of the session, the participant had produced the story three times in total, with incremental withdrawal of support from the researcher. During the first telling, the PWA was maximally supported to segment the story into events, to prioritise establishing key referents and to combine verbal output with gesture, drawing and writing. In the second telling, participants were prompted to use the visual record to construct the story; moderate support was given to remind the participants about the strategies discussed and developed during the first story telling. Also, at this stage, participants were facilitated to link together the various events within the story either verbally (e.g., "and then") or nonverbally (e.g.,

using gestures or fingers to indicate first, second, third, etc). During the third telling of the story, the visual record was removed and participants encouraged to construct the story independently, with the researcher providing feedback or requesting clarification where necessary.

When the conversation partner re-joined the therapy session, he/she was instructed that the purpose of the session was to learn about the video clip from the PWA; the conversation partner now became the focus of therapy intervention (see Figure 7, column 2). The researcher prompted the conversation partner to recall the therapy goals agreed at the start of the intervention; as therapy progressed over a number of weeks, this discussion expanded to include topics that had arisen in earlier sessions. As the PWA retold the story, if a trouble source arose that the conversation partner struggled to resolve, the researcher offered a diagnosis of the problem (i.e., relating to a lexical search, confusion regarding a referent, or more meta-interactional issue regarding which part of the story was currently being discussed) and asked the conversation partner if any of the agreed goals would be useful for them to employ. If the partner struggled to select a strategy, the researcher suggested an appropriate strategy. The researcher then modelled the behaviour for the conversation partner to copy. Regarding the storytelling, the researcher did not intervene if the PWA omitted important details of the story or confirmed details about the story that were incorrect; the goal of therapy related to communication of the story between the couples rather than conveying specific details.

Once the conversation partner had indicated completion of the storytelling task, the final part of the session focused on played the video recording of the task to facilitate both the PWA and conversation partner in off-line evaluation of the strategies employed within the task (Figure 7, column 3). Discussion focused on the agreed goals for each individual; where relevant, discussion included any novel issues that had arisen during the session and goals were agreed for each couple to focus on in the homework task and in the subsequent therapy session. A cumulative approach was adopted whereby any issues that arose within therapy sessions could also be discussed and targeted in subsequent sessions.

6.4.4 Outcome measures

Therapy aimed to improve transactional communication by targeting interactive storytelling as a shared task between each couple; transactional communication was defined as conveying information and measured as the number of main ideas successfully communicated within each couple as reflected in the partner's verbal summary of the story to the researcher. A similar measure of transactional success in storytelling has demonstrated high validity and reliability as a method of analysis (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002). Pre- and post-therapy assessment consisted of collecting narrative and conversation data, with the former representing a direct measure of therapy outcome. Narratives were elicited using specific video stimuli which had not been used in therapy. The pre- and post-therapy stimuli were not the same, although they were based on the same comic character. At each time point, the PWA watched a video clip in the absence of the conversation partner; the conversation partner then returned to the room and the PWA recounted the narrative. The only instructions issued to the partner was that the PWA had viewed a video narrative, they were asked to find out what happened in the narrative and that they would later report their interpretation of it to the researcher. Participants were not instructed to use any particular interactional devices (e.g., making guesses, drawing). Assessment at each time-point (pre- and post-therapy) included a simple and complex narrative using two video clips from 'Mr Bean' DVD footage, chosen for their minimal spoken language content, thereby minimising the linguistic scaffolding available to the participants with aphasia in telling the story (Mr Bean is a socially inept character who gets himself into embarrassing, comic scenarios, such as becoming frightened in front of others on a high diving board in a swimming pool). Cultural familiarity was a further factor in the selection of assessment stimuli – 'Mr Bean' clips contain highly familiar/imageable concepts and humorous content which is watched by adults as well as children; similar to daily communication, once the referent of Mr Bean had been established, the conversation partner would have access to some shared knowledge about the protagonist (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002). Conversation partners were not told in advance the subject or nature of the narrative topics in the assessment video stimuli.

Drawing on Weinrich, McCall, Boser and Virata's criteria (2002), simple narratives were defined as video clips that involved only 1-2 actors, 1-2 complicating actions and a resolution; complex narratives were defined as video clips that involved more than 2 actors, 4 complicating actions and a resolution. Video stimuli used for post-therapy assessment employed novel video clips, in order to minimise memory or practice effects. Pre- and post-therapy simple/complex video stimuli were matched for number of events based on data from control participants. Control data were collected from eight unimpaired, native English speakers describing the assessment video stimuli. The control participants were not matched

with the participants with aphasia in the current study; however, they represented a varied control sample with respect to age (mean: 42 years old; range: 17 - 64), years of full-time education (mean: 16 years; range: 11 – 21) and gender (four male, four female). Verbal output from the control participants were analysed to identify the crucial parts of story structure, i.e., setting, complicating actions and resolution (Labov, 1972). Within each component of the story structure, content words produced by each control participant were identified and analysed for frequency of occurrence across the group. Content words that were produced by at least 50% of control participants were used to construct a model narrative component for each video clip (see Appendix 14).

6.4.5 Data analysis

Three levels of analysis were carried out:

- transactional success in interactive storytelling was analysed based on the story retellings by the four conversation partners;
- a case study analysis investigated the specific behaviours that contributed to changes in transactional success;
- within the case study, CA was used to investigate change to everyday conversation.

These analyses are described in greater detail in the section below. Direct and indirect measures of therapy focused on the role of the conversation partner. Although the focus of therapy included both the PWA as well as the conversation partner, there are a number of reasons to focus analysis on the conversation partner. Firstly, previous therapy studies which have targeted the conversation partner have reported evidence of change not only in the behaviours of the conversation partner (see Turner & Whitworth, 2006) but also the person with aphasia (Wilkinson, et al., 2010). Secondly, "the sequential nature of turn taking in conversation means that they [the behaviours of the PWA and partner] are inextricably intertwined" (Beeke, et al., 2011, p.227); thus, it might be artificial to attempt to categorically separate the behaviours of speakers' changes (e.g., into the behaviour of the conversation partner and the PWA). How the conversation partner initiates repair on something that the PWA has said may affect how that speaker responds, thereby directly influencing the trajectory of the repair (Beeke, et al., 2011).

6.4.5.1 Analysis 1: Transactional success in interaction storytelling across participants

The subset of content words most frequently reported by control participants was used as a measure of transactional success. Scoring the conversation partners' retelling of the assessment stimuli on the basis of alignment with the subset of content words most frequently

produced by the control participants provided a quantitative measure of therapy effectiveness (see Appendix 14).

6.4.5.2 Analysis 2: Case study of the specific behaviours driving changes in interactive storytelling

Data from the conversation partner who demonstrated the largest mean improvement on story retelling was investigated further to provide a more nuanced analysis of change within storytelling. Rather than approach the storytelling data using a traditional linguistic approach, the focus was on the conversation partner's role in the accomplishment of the task (i.e., constructing shared understanding). Similar to Duff, Mutlu, Byom and Turkstra's (2012) work on communication as socially distributed cognition, the level of analysis was shifted from the language-impaired individual to the wider perspective of how the conversation partner managed his wife's language disorder within a functional task.

An *a priori* taxonomical approach to the data resulted in two levels of analysis: the conversation partner's specific behaviours were quantified into one of seventeen types, such as the use of test questions, open class repair, and use of summary; these specific behaviours were subsequently classified as four broader categories, i.e., display of a lack of knowledge/understanding, explicit display of understanding, reference to story structure and other behaviours peripheral to the aim of therapy (see Appendix 15). Reliability of coding was assessed by a second rater (the second author), who scored 25% of randomly selected data within the case study. In order to minimise the effects of experimenter expectancy, the second rater was blind to the sample point of the data (i.e., pre- vs post-treatment data). Point-to-point inter-rater agreement averaged 86.2% for the broader categories behaviours and 67.8% for the specific behaviours.

6.4.5.3 Analysis 3: Case study of the indirect effects of therapy

The case study approach was extended in order to investigate the effect of therapy on everyday conversation. The PWA and conversation partner recorded typical conversations at home in the absence of the researcher. Twice weekly sampling over a 4-week period resulted in approximately 80 minutes of video data at both pre- and post-therapy time points. It was hypothesised that instances of repair would represent environments of possible occurrence for the strategies targeted in therapy. An identification/scoping exercise was carried out in order to identify all instances of repair across the conversation data, thereby documenting the range of trouble sources, repair work, facilitative and non-facilitative behaviours that typically arose in the couple's conversations (e.g., Perkins, et al., 1999). Instances of repair within conversation data were transcribed. The conversation data were then analysed qualitatively

using CA methodology (see Hutchby & Wooffitt, 2008); this involved a process of repeated viewings of the video data and examination of written transcripts.

6.5 Results

6.5.1 Were there direct effects of therapy in conversation partner's reporting of narratives?

Content words produced by the conversation partners were scored for their similarity to those produced most frequently by control participants (see Appendix 14). Following therapy, content word analysis revealed numerical improvements for three conversation partners on the simple narrative ('Peter', 'Paula' and 'Noel') and for two conversation partners on the complex narrative (Peter and Paula); see Table 22. One partner ('Eve') demonstrated a decrease in the number of salient content words reported after therapy.

Table 22: Comparison of percentage salient content words reported by the conversation partners in pre- and post-therapy narratives

Conversation partners	**Simple narratives**			**Complex narratives**			**Mean difference between pre- and post-therapy**
	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference	
Peter	60.00%	69.23%	9.23%	14.81%	51.61%	36.8%	23.02%
Paula	26.67%	53.85%	27.18%	7.41%	25.81%	18.4%	22.78%
Noel	66.67%	92.3%	25.63%	62.96%	58.06%	-4.9%	10.37%
Eve	66.67%	53.85%	-12.82%	48.15%	41.94%	-6.21%	-9.52%

Given the inherent variability in sampling phenomena such as information exchange, and the use of proportional rather than raw data to allow for comparisons of narratives of varying lengths/different totals of content words, it was not possible to carry out statistical analyses to determine which of the changes noted were statistically significant. However, on the basis of the substantial gains in content words conveyed and the consistency of gains across simple and complex narratives, there appeared to be some evidence for direct effects of therapy driving some of these gains for two conversation partners. Specifically, these were most consistent for Paula (gain in simple narrative: 27.18%, complex: 18.4%, mean difference: 22.78%), and strongest overall for Peter (simple narrative: 9.23%, complex 36.8%, mean difference: 23.02%).

The data from the other two conversation partners was less clear. Noel showed a note-worthy gain of 25.63% for the simple narrative, but this was reduced in the mean score of 10.37% by a complex narrative score of -4.9%. Eve was consistent across simple and complex with depleted scores for both (-12.82%; -6.21%; mean: -9.52%). Given that the therapy was unlikely to reduce information exchange between couples, this negative score suggests there may have been a lot of noise in these data and caution is required when interpreting positive therapy effects. Furthermore, both Eve and Noel had the highest scores in baseline storytelling possibly suggesting a ceiling effect. On the tentative finding that Peter and Paula showed evidence of likely direct effects of therapy, data from the conversation partner (Peter) who demonstrated the largest mean improvement on story retelling was investigated further in a single case analysis.

6.5.2 In a single case study, what specific behaviours drove the change in interactive storytelling?

Firstly, in terms of overall contribution, Peter's output in pre- and post-therapy data was investigated regarding his overall contribution to the interactions (see Table 23); his contribution increased substantially following therapy, from a mean of 41 actions pre-therapy (St Dev: 2.83) to 138.5 post-therapy (St Dev: 38.89).

Table 23: Peter's contribution to storytelling pre- and post-therapy (raw data)

	Pre-therapy	Post-therapy
Simple story	43	111
Complex story	39	166
Mean	**41 (SD 2.83)**	**138.5 (SD 38.89)**

Given the differences in the Peter's contributions before and after therapy, proportional data were used to compare behaviours across story type (simple and complex) and time (pre- and post-therapy). Proportional data consisted of specific behaviours (such as behaviours displaying a lack of understanding) divided by the total number of behaviours (total range of specific figures displayed in Figure 9). As demonstrated in Figure 8, decreases were observed in the conversation partner's display of a lack of understanding and 'other' behaviours (the latter including test questions, claiming understanding, passing turns and acknowledging AT's linguistic difficulties). Increases were observed in proactive behaviours categorised as displaying understanding and referring to the story structure; raw and proportional data for the broad categories are shown in Table 24.

Figure 8: Changes in Peter's contribution to storytelling across four broad categories pre- and post-therapy (proportional data)

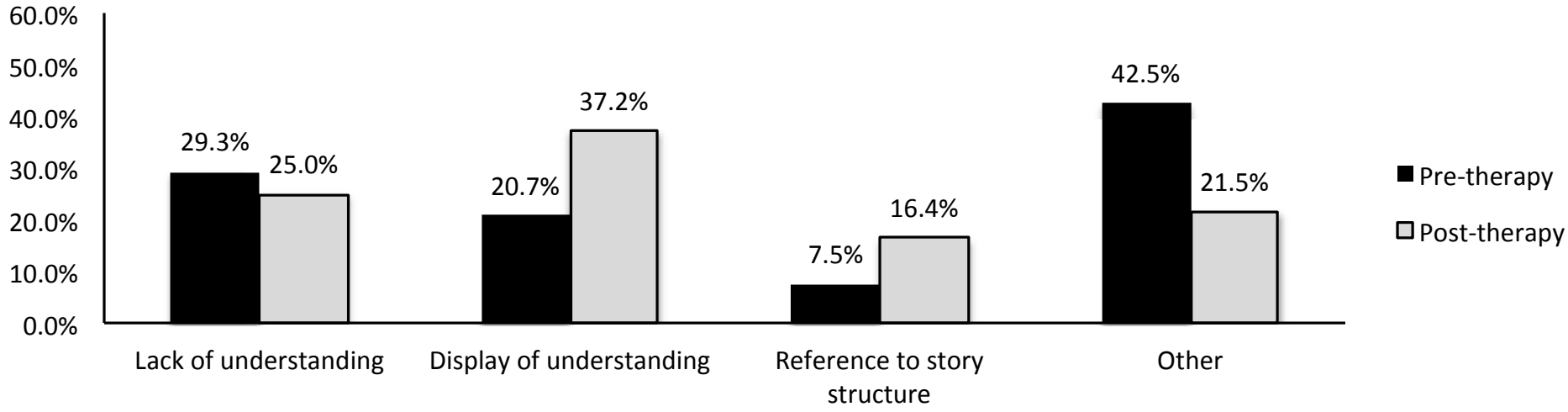
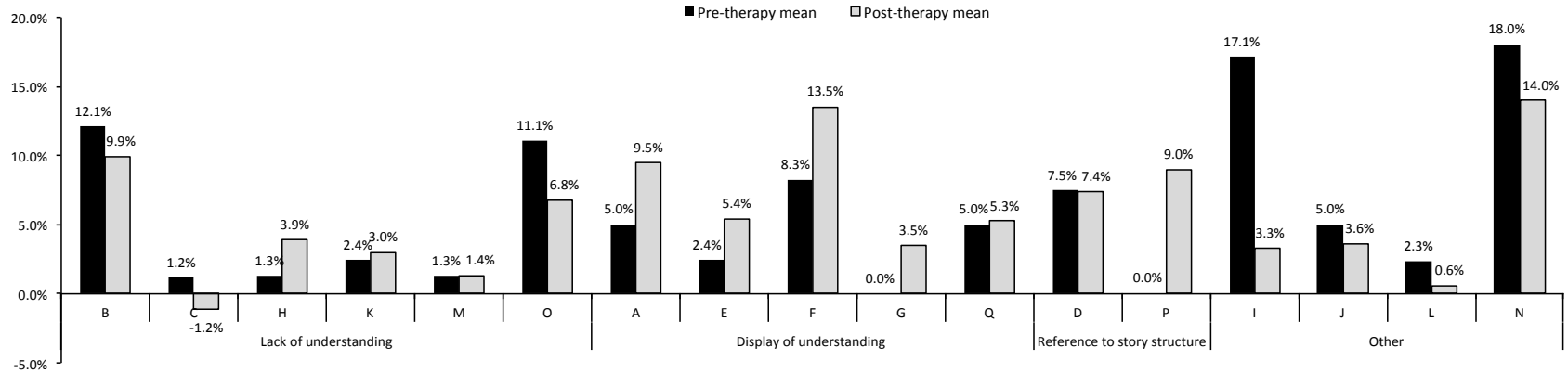


Table 24: Analysis of Peter's interactional behaviours across four broad categories pre- and post-therapy (proportional data depicted in brackets beside the raw data)

Time:	Pre-therapy				Post-therapy			
Behaviour:	Simple story	Complex story	Total	Mean	Simple story	Complex story	Total	Mean
Lack of understanding	12 (27.9%)	12 (30.8%)	24 (58.7%)	12 (29.3%) St dev: 0 (2%)	30 (27.1%)	38 (22.8%)	68 (49.9%)	34 (25%) St dev: 5.7 (2.9%)
Display of understanding	9 (20.9%)	8 (20.5%)	17 (41.4%)	8.5 (20.7%) St dev: 0.7 (0.3%)	37 (33.3%)	68 (41%)	105 (74.3%)	52.5 (37.1%) St dev: 21.9 (5.4%)
Reference to story structure	2 (4.7%)	4 (10.3%)	6 (14.9%)	3 (7.5%) St dev: 1.4 (4%)	19 (17.1%)	26 (15.7%)	45 (32.8%)	22.5 (16.4%) St dev: 4.9 (1%)
Other	20 (46.5%)	15 (38.4%)	35 (85%)	17.5 (42.5%) St dev: 3.5 (5.7%)	25 (22.5%)	34 (20.5%)	59 (43%)	29.5 (21.5%) St dev: 6.4 (1.4%)

Finally, specific behaviours used by Peter in the interactive storytelling data were analysed for changes in the frequency of use (see Figure 9). Following therapy, Peter displayed an increased role in co-constructing the story, as indicated by increased frequency of reformulations (mean 4.5% increase), summaries (mean 5.2% increase) and controlling the pace of AT's storytelling (mean 9.0% increase). Decreases in the use of specific behaviours were observed for passing turns (mean 13.8% decrease), checking questions (mean 4.3% decrease) and claiming understanding (mean 4% decrease).

Figure 9: Analysis of Peter's specific behaviours in pre- and post-therapy narrative data



Key:

Lack of understanding		G:	display of understanding the humour of the story
B:	other-initiated repair	Q:	explicit display of understanding
C:	open class repair	Reference to story structure	
H:	'do you mean' construction	D:	'what happened next?' question
K:	explicit display of understanding difficulty	P:	controlling the pace of storytelling
M:	complaint as a form of other-initiated repair	Other	
O:	checking question or checking for more information	I:	passing turn
Display of understanding		J:	acknowledgement of PWA's linguistic difficulties
A:	reformulation	L:	test question
E:	inference	N:	claim of understanding
F:	summary		

These changes reflect behaviours targeted in therapy:

- increased use of summaries and controlling the pace of storytelling was facilitated through the 'Stop and check' goal (i.e., punctuating AT's storytelling by summaries what he had understood so far);
- increased use of summaries and reformulations was facilitated through the 'Move along' goal (i.e., during a lengthy and unproductive lexical search by AT, using summaries to reinforce help move the story along);

The behaviours which decreased post-therapy (i.e., passing turns and claiming understanding) were not directly targeted in therapy. However, these changes reflect Peter taking a more active role in constructing the story and subsequently he became less reliant on more passive behaviours such as claiming understanding and passing the floor back to AT.

Other behaviours that were targeted in treatment did not show change in analysis of the proportional data. For example, part of the goal 'Stop and check' included Peter contributing to the progression of the story by prompting AT with "What happened next?" questions. Analysis of the proportional data shows no change on this behaviour (7.5% pre-therapy and 7.4% post-therapy); however, the raw data indicate that the behaviour increased from a mean of 3 pre-therapy to a mean of 10.5 post-therapy. Peter greatly increased his participation and collaboration within the storytelling after therapy; thus, percentage change may be obscured by the fact that the conversation partner's contributions are much greater post-therapy.

6.5.3 In a single case study, were there effects of therapy within everyday conversation?

Phenomena of interest related to Peter's strategies within repair sequences are presented below.

6.5.3.1 Open class repair initiators

In pre-therapy conversation, a recurring pattern of other-initiated repair related to open class repair initiators (see Drew, 1997): AT produced a turn that was problematic for Peter to understand and, in response, he initiated repair using an open class repair token (e.g., 'what?' 'sorry?'). Five instances were identified in pre-therapy conversation of Peter using an open-class repair in response to an incomplete turn by AT; for reasons of spaces, one example is provided in Extract (1):

Extract (1) pre-therapy

1		A	Oh I'll have to go, (.) the basics	***trouble source***
2			(1.0)	
3	→	P	Hmm?	***open class repair***

4		A	I'll have to go	
5			(1.5)	
6		A	Cos it's it's ehm (.) the the ehm (0.8) this one it's very lo::ng	
7			(1.2)	
8		A	Very lo::ng	
9			(2.0)	
10		P	Which one	***other-initiated repair***

Peter's use of an open class repair initiator created interactional work for AT as this type of repair initiator does not identify what part of the prior turn the speaker is struggling to hear or understand (Drew, 1997). Schegloff, Jefferson and Sacks (1977) proposed a hierarchy of other-repair initiators based on their relative strength to identify a repairable item. Within this order, open class repairs, such as the one used by Peter in extract (1), constitute the weakest form of other-initiated repair as they leave open the nature and location of the trouble source in the prior turn (Drew, 1997). Perkins, Crisp and Walshaw (1999) highlight the principle of least collaborative effort, whereby speakers seek to "minimize the work in achieving a mutual understanding of a turn sufficient for the current purpose of the conversation" (p.261). In conversation where one speaker has aphasia, the necessity of collaborating with the non-language impaired partner is likely to be greater in order to resolve trouble within conversation, as the linguistic impairment which led to the trouble source in the first instance may also impede the person with aphasia from repairing their own turn (Perkins, et al., 1999). Thus, if both speakers collaborate in repair work, the result is an efficient resolution of trouble and minimal disruption to the conversation (Perkins, et al., 1999). In this light, Peter's use of open repair initiators in pre-therapy conversation data can be seen as non-collaborative as he does not identify the trouble source in AT's prior turn.

The open class repair initiated by Peter (Extract 1) made it difficult for AT to identify the specific source of the trouble; thus, she responded with a partial repetition of her prior turn. Regarding the trajectory of the repair work, Peter's open class repair initiator did not always result in efficient completion of the repair. For example, in extract (1), AT produced three turns following Peter's open class repair; however, these turns were not sufficient to resolve the trouble as Peter again initiated repair to establish the referent of AT's turn: "Which one?".

In post-therapy conversation data, there were no examples of Peter using an open class repair initiator in response to a problematic turn produced by AT. This is in line with the broad aim of therapy; that is, to provide practical ways in which Peter could contribute to repair work, for

example, punctuating AT's turns with questions to clarify and check understanding and avoid a build-up of frustration for Peter as a conversation partner, help maintain progressivity within the conversation when AT experienced a lexical retrieval failure, establish referents and use of summaries to specify what has been understood and what has not been understood.

6.5.3.2 Complaint-type behaviours

In pre-therapy conversations, Peter employed repair initiators that contained a direct complaint-like element; for example, extract (2). Complaints may be direct or indirect in nature (D'Amico-Reisner, 1985), contingent upon whether or not the "addressee is held responsible for the perceived offense" (Boxer, 1996, p.219). As a form of repair initiator, these compliant-type behaviours explicitly highlighted the trouble within the conversation and placed responsibility upon AT to repair independently the trouble source. For example, in Extract (2), Peter and AT were discussing the finances of their son's business; in line 5, AT produced an utterance which was semantically and syntactically underspecified (later in the conversation it is revealed that she was providing an example of one of the money-saving costs their son implemented - using a cheaper type of paint; therefore, her original target utterance in line 5 may be akin to "He's/they're saving money on the paint"). She attempted a self-repair (line 6) by specifying the type of paint ("long paints" and "all paint, white paint"). In line 7, Peter came in, in overlap, to initiate repair, marked by a complaint. As a result, the trajectory of the repair work was lengthy, necessitating multiple turns from AT to attempt to repair the trouble. Furthermore, such complaint behaviours highlighted AT as a non-competent speaker (Lindsay & Wilkinson, 1999).

Extract (2) pre-therapy

1		P	And they've got an expense limit [there's only so much] in the bank	
2		A	[Oh well, yeah.]	
3		A	That yeah well that fair enough	
4		P	Yeah, that's right.	
5		A	Well, it, it, it's saving, em (.) the, the em (1.6) paints, you know,	***trouble source***
6			that long paints and, you know, it was all paint, [white paint]	
7	→	P	[I don't know]	***complaint***
8			what you're talking about you're rambling now I don't know what	
9			you're on about	
10		A	Well they have half the size well	
11		P	Right we've had paint paper half the size I don't know what	
12			you mean	

13			(1.5)	
14		A	Well paint [paint]	
15		P	[Which paint] which paint	

In post-therapy conversations, there was evidence of Peter's continued use of complaint-type behaviours; however, these instances differed qualitatively from pre-therapy conversation. For example, in line with the therapy goals, Peter took a more active role in resolving understandability problems; subsequently, any complaint-type behaviour was quickly followed by a more facilitative contribution to resolving the trouble source. In Extract (3), Peter and AT were discussing their grandchildren staying overnight with them; Peter asked AT if their daughter-in-law 'Mamie' was going away somewhere. Instead of replying with the name of the location, AT began explaining *who* Mamie was going away with (later revealed to be a neighbour called 'Diane' whom Peter does not know) but this became problematic. After a lengthy sequence in which Peter undertook a lot of interactional work to establish who Diane was and how she was known to Mamie, he complained in lines 3-4 "You getting a bit (1 syllable) getting me a bit mixed up". However, he immediately took another turn (initially in overlap with AT) to progress the talk and assist with repairing the trouble source by summarising what he understood (therapy goal 'Move along') and what remained unclear (therapy goal 'Pinpoint').

Extract (3) post-therapy

1		P	Are Diane's children at the unit you mean	***'you mean'***
2		A	I don't know (.) I don't [know]	
3		P	[Right] well (.) you getting a bit- (1 syllable)	***compliant***
4			getting me a bit mixed up	
5		A	[Well just]	
6	→	P	[All you're say]ing is look the (.) they're going away on holiday	***summary***
7			aren't [they]	
8		A	[Yeah]	
9		P	for a couple of days (.) what's this got to do with fortnight ago a::nd	
10			Ofted and all this business	
11			(0.5)	
12		A	Len (1.0) o- ofs- you- you- Ofsted	
13			(0.5)	
14	→	P	Yeah they got their Ofsted [result] which is [good] right	***reformulation***

6.5.3.3 Facilitative behaviours

In pre-therapy conversations, Peter demonstrated evidence of adapting to AT's aphasic symptoms by using facilitative repair behaviours such as guessing her target, reformulating her turn using 'you mean' constructions and checking his understanding. Such behaviours displayed ways in which Peter contributed to the repair work generated by AT's aphasic symptoms without highlighting the linguistic deficit. For example in Extract (4), Peter asked AT what she was planning to wear to an upcoming formal event (line 1). After initial silence and AT stating that she did not know, she then produced a morphologically incorrect noun phrase (line 9). Rather than draw attention to this aphasic error, Peter immediately reformulated AT's response into a grammatically well-formed version (line 10) and later expanded on her response to specify the type of trousers (line 13). Peter's reformulation and inference enabled AT to quickly, and without difficulty, confirm his approximation of her original turn. Thus, the conversation was able to progress quickly, despite the ungrammatical nature of AT's original turn.

Extract (4) pre-therapy

1		P	What would you like to wear	
2			(1.2)	
3		P	Tell me	
4			(5.6)	
5		A	I don't know	
6			(2.5)	
7		P	Oh well (0.8) women's a woman's privilege isn't it	
8			(2.8)	
9		A	A trouser and eh (1.3) mmm	***trouble source***
10	→	P	Some trousers?	***reformulation***
11		A	Yeah	
12			(0.5)	
13	→	P	Smart trousers eh	***inference***
14		A	Yeah	
15		P	Mmmm	

Peter also made use of another type of construction to contribute to progressivity of the conversation in the face of a problematic turn produced by AT; in Extract (5), he provided a

guess of AT's target framed in a "you mean" construction (line 6) in order to offer a candidate understanding that she can quickly and effortlessly confirm or deny.

Extract (5) pre-therapy

1			(lapse)	
2		A	So is it now eh this:: (2.0) ehm (2.0) six month? (2.4) and then ehm	***trouble source***
3			the (8.7) ((head in hand)) no, (3.8) June July	
4			(1.3)	
5		A	Is it	
6	→	P	Next year y[ou mean]	***'you mean'***
7		A	[Yeah]	
8			(1.7)	
9		P	Ehm::::: (1.1) I don't know I (.) I (2 syllables) six months I would	
10			think to eh pups isn't it	

In post-therapy conversations, Peter made increased use of facilitative behaviours that contribute to resolving the trouble source. Nine instances were identified in pre-therapy conversation of Peter using facilitative behaviours in response to AT's production of an incomplete turn or a lexical search, compared to 51 instances post-therapy. Furthermore, there is evidence of Peter using a new behaviour – that is, summarising what he has understood so far in response to AT's lexical retrieval failure or incomplete turn (therapy goal 'Move along'). As seen in Extract (3) and continued in Extract (6), trouble arose when Peter asked AT if their daughter-in-law ('Mamie') was going away the weekend, to which AT responded by explaining *who* Mamie is going away with (her neighbour 'Diane'). During a lengthy sequence, AT produced the referents 'Ofsted' and 'fortnight'; in line 1, Peter summarised what he understood so far and identified the specific gap in his understanding (two behaviours targeted in therapy). AT attempted to complete repair regarding the referent 'Ofsted' (line 7); when no further information was forthcoming (line 8), Peter used inference to expand on the relevance of 'Ofsted' in the story. After a silence in line 11, AT attempted to construct a turn with 'Diane' as the subject; turn construction was problematic and she withdrew (marked verbally and nonverbally with a sigh). In response, Peter again attempted to collaborate in the repair work by producing an extensive summary of what he's understood so far (lines 14, 15, 17, 19, 21, 23, 25, 28 30); he concluded by highlighting again the specific trouble in AT's prior turns (lines 32 – 34). Peter's collaboration with AT, employing a series of reformulations (lines 42, 46), contributed to resolving the understanding problems by inferring meaning (lines 54, 55, 58, 59, 61).

Extract (6) post-therapy

1	→	P	[All you're say]ing is look the (.) they're going away on holiday	***summary***
2			aren't [they]	
3		A	[Yeah]	
4		P	for a couple of days (.) what's this got to do with fortnight ago a::nd	***pinpoints gap in***
5			Ofted and all this business	***understanding***
6			(0.5)	
7		A	Len (1.0) o- ofs- you- you- Ofsted	
8			(0.5)	
9		P	Yeah they got their Ofsted [result] which is [good] right	***inference***
10		A	[Yeah] [and]	
11			(0.9)	
12		P	Good	
13		A	Diane's (1.0) Diane is eh (1.6) and then ((sighs)) oh I don't know	
14	→	P	Well think we just (.) just tell me (0.6) just (1.6) we've got the unit	***summary***
15			we've got Len with (0.4) Le[n a]nd	
16		A	[Yeah]	
17		P	she's going on holiday [Len's] coming here for a couple of days	
18		A	[Yeah]	
19		P	was co- (0.4) getting away for a couple of days la[st] weekend (.)	
20		A	[Yeah]	
21		P	with the children	
22		A	Yeah	
23		P	And then (0.4) we've now got this Diane lass	
24			(0.9)	
25		P	I've never heard of <u>her</u> before	
26			(1.9)	
27		A	Oh we[ll is]	
28		P	[Who a]pparently is (0.3) who lives opposite	
29		A	Yeah	
30		P	And they're going away [toget]her with the [child]ren	
31		A	[Yeah] [yeah]	
32	→	P	Right and that (.) but I don't (.) quite know what you mean	***pinpoints gap in***
33			about a fortnight and Ofsted I don't know what all that's to do	***understanding***

34			with we'll forget all that	
35			(0.8)	
36		A	Well last week (0.6) not (0.9) the week (0.6) befo:re last week	
37		P	Right what happened last week	***repair initiator***
38		A	Ofsted	
39			(0.4)	
40		P	Yeah we know that	
41			(0.5)	
42	→	P	They got the result of Ofted	***reformulation***
43		A	Yeah, (.) and the (.) then they came up	
44			(1.8)	
45		A	Eh (0.4) Linda and Vicky	
46	→	P	They came here yeah	***reformulation***
47			(0.9)	
48		A	And Len	
49		P	Yeah	
50		A	All together	
51		P	I kno:w that	
52		A	But wine's (0.9) was eh (0.5) the wine is flowing (0.9) for Mamie	
53			(0.8)	
54	→	P	Yeah and so Mamie had the night yeah (.) the night with her g-	***reformulation***
55			with her friends	
56		A	Yeah	
57			(0.4)	
58	→	P	Oh so what' you're t- yeah you're t- and Diane was one of the	***inference***
59			fr[iends] was she	
60		A	[Yeah]	
61		P	Right at last we [got it] right I'm with you now yeah	
62		A	[Yeah]	
63			(1.0)	
64		P	Yeah	
65			(0.8)	
66	→	P	So yeah (0.4) so now they decided they must have planned it to	***inference***
67			go away together	
68		A	No no (0.3) n[o]	

69	→	P	[D]iane and Mamie have planned to go away well they	***inference***
70			must have talked about [it]	
71		A	[Yeah]	
72		P	eh [when eh on the night out]	
73		A	[Oh yeah well yeah] yeah	
74		P	But the result is they're going away for a couple of days over Easter	

6.6 Discussion

The current study aimed to extend previous work on transactional communication in storytelling (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002) by investigating the effect of an intervention targeting transactional success within storytelling for people with non-fluent aphasia and their conversation partners. The study had the further aim of investigating indirect qualitative effects of therapy in repair work within everyday conversation. Drawing on the principles of thinking for speaking, the participants with aphasia were facilitated to segment video narrative into distinct events, to selectively highlight specific details of the story and to use a combination of verbal (e.g., syntactically reduced utterances, direct reported speech) and non-verbal resources (e.g., gesture, writing, drawing) in order to convey new information to their partner. Components of story grammar (e.g., setting the scene by introducing main characters) were used to facilitate narrative planning and production. For the partner, therapy drew on the principles of conversation coaching to educate partners on their role within the interaction and ultimately increase facilitative behaviours within storytelling. It was hypothesised that the sum of these three strands of therapy would be improved negotiation and construction of shared understanding within storytelling.

Direct effects of therapy were analysed by comparing simple and complex narrative data obtained at baseline and post-therapy. Transactional success was calculated on the conversation partner's retelling of the story. The simple and complex narratives used at baseline and post-therapy were broadly matched but crucially were different to each other and therefore novel narratives on first implementation. Drawing on Weinrich, McCall, Boser and Virata's criteria (2002), a simple narrative was defined as a video clip that involved only 1-2 actors, 1-2 complicating actions and a resolution; a complex narrative was defined as a video clip that involved more than 2 actors, 4 complicating actions and a resolution.

Where there was evidence for direct therapy effects, investigation focused on process of change whereby therapy tasks had facilitated gains in information exchange in the post-therapy narratives. Therefore, single case analysis focused on one conversation partner's behaviours within the storytelling task which were coded and analysed for frequency of use in order to track any changes of behavioural strategy. Finally, possible generalisation of therapy effects to conversation were investigated using a qualitative analysis of the same couple's conversations from pre- and post-therapy time points.

Regarding transactional success, three conversation partners demonstrated numerical improvement in mean storytelling post-therapy ('Peter', 'Paula' and 'Noel'). Given the variability inherent in interactional phenomena, it was prudent to only take very substantial

changes in information exchange, and to consider consistency of gains, as possibly reflecting a therapy effect. The conversation partners differed in relation to patterns of improvement across story complexity: for 'Peter', larger change was seen on the complex story, while for 'Paula' and 'Noel' the opposite was true with both performing better in retelling the simple story. The remaining partner ('Eve') was unique in demonstrating decreased accuracy of story retell after therapy. A conservative conclusion was drawn that two of four conversation partners (Peter and Paula) presented with sufficiently convincing evidence for direct effects of therapy in terms of more effective information exchange strategies deployed by the PWA, and more facilitative interactive strategies utilised by the conversation partner. The combination of these two strands appeared to converge in the positive outcomes of the conversation partner being able to convey a novel narrative with greater levels of detail relative to comparable narratives obtained at baseline. Further related research would be aided by establishing more precise measures relating to narrative complexity through closer matching of related narratives (e.g. ensuring that simple narratives are matched for identical numbers of complications, key words etc.) This could allow for use of non-parametric analyses of apparent differences between pre and post therapy narrative samples in order to more formally evaluate whether differences are statistically significant. That said, the tactic of evaluating conversation partners' retelling of a narrative to which they were blind, appeared to be a promising, innovative outcome measure, which was both engaging and of interest to all of these participants, and represented a middle ground between experimental controlled tasks for eliciting monologic aphasic data, and the more ecological but unconstrained sampling of conversation data.

A case study analysis was used to investigate further the conversation partner who had demonstrated the largest change on the transactional communication measure (Peter). In line with therapy goals, Peter demonstrated increased contribution and active participation in constructing shared understanding after therapy. This was indicated by an increase in overall contribution within the interactive storytelling task and increased use of facilitative behaviours targeted in therapy, specifically regarding use of reformulations, summaries and influencing the pace of storytelling. Although not directly targeted in therapy, Peter displayed reduced use of more passive behaviours such as passing turns and claims of understanding, thereby take a more active role within storytelling. The aim of the current study related to transactional communication; future research could include investigation of the effect of therapy on the PWA's perception of the effort or negative emotions encountered in storytelling. For example, did Peter's more active participation post-therapy equate to a perception by AT of a shared effort or of her being more successful in conveying new information? Such investigations could have implications for quality of life in the chronic stage of couples living with aphasia.

Changes in line with therapy goals were also seen in conversation data with Peter demonstrating increased use of facilitative behaviours post-therapy, i.e., reduction in open-class repairs, complaints (as a form of other-initiated repair) were followed up with a form of repair that was designed to contribute to repair completion and increased use of behaviours designed to facilitate story construction (i.e., reformulations and summaries). The results of this case study present preliminary evidence that targeting interaction through storytelling can impact on repair sequences in everyday conversation. A potential avenue for future studies relates to expanding the coding used within interactive storytelling to everyday conversation; notwithstanding the need to establish reliability within conversation, the coding system developed within the current study could offer the potential to quantify aspects of conversation for outcome measurement.

The current study also represented an attempt to develop some degree of standardisation of an interactive therapy protocol. Given the tradition of interactive and conversation analysis therapy methods (e.g., Wilkinson, et al., 2010) of having been highly data driven and individualised in terms of therapy focus, the method described here represents a development to a more template model of intervention delivery. Storytelling plays a vital role in making sense of the world, particularly in the wake of a traumatic life experience (Kellas & Trees, 2006). Evidence suggests PWA engage less in storytelling than their healthy counterparts (Davidson, et al., 2003); thus, storytelling presents a psychosocially and clinically valid context for therapeutic focus. The method evaluated within the current study has been characterised as a template consisting of a) working with the PWA, and b) working with the couple, in sequence around the task of conveying novel narrative details. While the precise advice and recommended strategies for a particular couple are tailored and individualised, this will be within the limits of the central task of information exchange. This move towards some flexible standardisation may support clinical application of this method, given that it is a defined protocol which can be applied in a time efficient manner without pre-planning. Similarly, use of first session information exchange measures can serve as baseline measures for subsequent post-therapy evaluation which has ease of use and real-world clinical plausibility.

While analysis with the current study focused on the conversation partner, this does not exclude the possibility that changes on outcome measures reflect changes in patterns of output by the PWA. It is plausible that such changes are driven (at least partially) by changes in the PWA's storytelling either at the level of communication (e.g., increased awareness of the burden on the conversation partner), macro-linguistics (e.g., segmentation of the story, selectivity regarding peripheral vs core details of the story, story grammar) or micro-

linguistics (e.g., designing output for maximum communicative effect by focusing on semantic specificity and forgoing grammaticality). For the purpose of this study, analysis focused on the conversation partner's behaviours for a number of reasons:

- although therapy targeted both the PWA and conversation partner separately, it was hypothesised that the sum of these two strands would be greater than the individual parts, i.e., improved negotiation and construction of shared understanding within storytelling and increased awareness of the resources at both speakers' disposal to create sharing understanding
- within interaction, speakers' turns are inextricably linked (Beeke, et al., 2011); thus, it may be inappropriate to attempt to distinguish ownership of specific changes with interaction. The methods used within this study represent a practical step towards quantifying aspects relating to the conversation partner's behaviours within storytelling. This does not, of course, preclude analysis of the PWA within storytelling in future work.

"The ultimate goal of aphasia rehabilitation is a social one: to optimize the communication between the person with aphasia and his or her environment" (van de Sandt-Koenderman, et al., 2012, S1). The range of aphasia therapies have been conceptualised as deficit-focused, functional/disability-focused or participant-focused (World Health Organization: International Classification of Functioning, Disability and Health (ICF), 2001). This study represents an attempt to combine elements from impairment-focused therapy (i.e., thinking for speaking) and a disability-focused therapy (i.e., conversation coaching targeting the partner) in order to target the ecologically valid context of storytelling. The inclusion of the conversation partner within therapy acknowledges the important roles played by both the PWA and the partner in constructing shared understanding. Employing therapy techniques from various approaches, in a complementary manner, reflects clinical practice where therapists combine all approaches at their disposal in supporting a PWA and their family through aphasia rehabilitation. Therapy stimuli were sourced from YouTube and viewed using an iPad, thus utilising widely available technology to create interesting, age-appropriate materials. Whilst further research is required to expand this model of treatment delivery and outcome measurement to a larger group of participants, the current study offers a novel approach whereby an important aspect of everyday communication – transaction of information – is targeted through the production patterns of the PWA and to facilitate behaviours of the conversation partner. Such intervention may have important implications for establishing and maintaining relationships, a sense of achievement for the PWA and conversation partner, and, more broadly, quality of life.

Chapter 7: Discussion

This final chapter is organised into two sections. Firstly, a synopsis of the findings from the thesis chapters is presented. Secondly, the findings from the empirical chapters are reviewed from the perspective of the overarching topics of interest outlined in the introductory chapter.

7.1 Synopsis of thesis findings

Chapter 3 described the themes relevant to language production across different contexts by reviewing the therapy studies which have investigated the effects of therapy on conversation. It also outlined potential directions for future study. The interest in conversation and its validity as a measure of the effects of therapy was driven by psychosocial, communicative and theoretical motivations. From a psychosocial perspective, the wide-reaching benefits of social interaction have long been recognised, with evidence of a link between social isolation and reduced life satisfaction in older adults (Erber, 1994) and detrimental physical and psychological effects in healthy populations (see Cohen, 2004). This, coupled with observational evidence that found conversation to be the most frequent communicative activity of daily life (Davidson, et al., 2003), demonstrated that conversation presents an ecologically valid context in which to measure the effects of therapy. As a measure of therapy effects, this validity was attractive given that, from a theoretical perspective, there had been debate about the extent to which task-based assessment reflects language production in everyday life. On the one hand, there have been discrepancies between lexical retrieval on confrontation naming tasks and connected speech, with reports of superior retrieval on naming assessment (Manning & Warrington, 1996; Wilshire & McCarthy, 2002) or in discourse (Mayer & Murray, 2003; Pashek & Tompkins, 2002). Contrasting performances have also been reported for lexical retrieval in the context of a composite picture description and conversational task (Mayer & Murray, 2003) and for grammar on specific task-based assessments and conversation (Beeke, Wilkinson, & Maxim, 2003b; Beeke, Wilkinson, & Maxim, 2003d). Collectively, such differences have been accounted for by the varying linguistic and non-linguistic demands inherent across contrasting contexts (Berndt, Mitchum, Haendiges, & Sandson, 1997c; Berndt, et al., 1997d; Penn, 2000), the priming effect on lexical retrieval of co-occurring words in connected speech (Pashek & Tompkins, 2002), as well as a response to interactional demands to decrease the possibility of interruption from others (Beeke, et al., 2003d). On the other hand, Fisher and Glenister (1992) have argued that accurate, fast lexical retrieval is needed for fluent spoken output in daily life. Herbert et al. (2008) found a significant relationship between performance on picture-naming test and conversation when conversational (rather than lexical) denominators were used. When

analysis incorporated conversational denominators (i.e., number of turns or substantive turns), a significant relationship was found between lexical retrieval on assessment and in conversation. Lexical denominators (i.e., speech units) did not indicate a significant relationship between retrieval on assessment and in conversation. Further research is warranted to investigate whether this finding holds for other lexical classes such as verbs (Mayer & Murray, 2003). For lexical retrieval at least, the evidence regarding how performance on naming assessment relates to retrieval in different contexts remains equivocal (Conroy, et al., 2009a).

Chapter 3 reviewed key papers from the impairment-focused therapy literature in which the effects of therapy within conversation had been investigated. Consideration of relevant studies was limited to those in which conversation data had been collected and analysed. Conversation was defined as a dialogue between the PWA and a conversation partner and therefore excluded analysis of monologue production (e.g., picture description). The five studies described all consisted of a lexical retrieval therapy targeting nouns and/or verbs. Chapters 5 and 6 addressed the gap in the literature about the effects of therapy beyond single word level. Quantitative measures of the effect of therapy within conversation included investigation of lexical retrieval, error production, syntactic construction, communication and interaction:

- Lexical:
    - proportion of verbs produced (Boo & Rose, 2011)
    - % substantive verbs (Boo & Rose, 2011)
    - production of verbs per CIU (Boo & Rose, 2011)
    - lexical diversity (Boo & Rose, 2011; del Toro, et al., 2008)
    - proportion of speech units that are word errors
    - errors as a proportion of content words (Greenwood, et al., 2010; Hickin, et al., 2006)
    - frequency of naming errors (Rose, et al., 2002)
- Syntactic:
    - measures of sentence type and well-formedness (QPA; Berndt, et al., 2000; Saffran, et al., 1989) employed by Boo and Rose (2011) and del Toro et al. (2008)
- Communicative
    - measure of new information (UNI; del Toro, et al., 2008)
    - informativeness calculated by the proportion of words classified as a CIU (Boo & Rose, 2011)

        - efficiency calculated by the number of CIUs per minute (Boo & Rose, 2011)
- Interactional.
        - content words/turn (Greenwood, et al., 2010)
        - number of nouns per substantive turn (Hickin, et al., 2006)
        - content words pre substantive turn (Hickin, et al., 2006)

Given the early nature of research in this area, it was promising that an effect of therapy was found in conversation on a number of measures tapping into lexical changes, improved informativeness and changes in error patterns (see above). Limitations of previous research (e.g., small participant numbers used in four of the five studies; analysis based on few samples of conversation; lack of data relating to measures of reliability) underlined the need for cautious interpretation of the findings. Clearly, further work was required to replicate and expand on the findings and methodologies of the studies discussed within the review paper. Taken together, however, the studies presented preliminary evidence of the potential for lexical retrieval therapy to impact on conversation.

The review paper in Chapter 3 concluded by outlining suggested directions for future research, some of were addressed in the subsequent empirical chapters presented here. Given that the relationship between language production on task-based assessment and patterns of language output in everyday conversation remains equivocal, it was prudent to limit the constraints placed on conversation data to maximise the validity of the data. This created methodological obstacles, particularly regarding potential for standardisation and judgement of performance on external criteria (this theme was addressed in Chapter 6). However, the result was a data sampling method which captured data which is most representative of typical conversation. This position is, of course, subject to further investigations of a correlation between a linguistic behaviour measures on assessment and produced within conversation (for example, Beeke et al. (2003d) found that the Cinderella story retell task contained, to some extent, the same grammatical resources used by a speaker with non-fluent aphasia in conversation). Multiple sampling of conversation data might be necessary in light of the natural variability within everyday conversations (Perkins, et al., 1999) and this was addressed in Chapters 4-6, where multiple samples of conversation data were collected pre- and post-therapy. Additionally, a recent study has explored the use of computer assistance in analysing data from individuals with aphasia and also unimpaired speakers (Hussman, Grande, Meffert, Chistoph, Piefke, Willmes, & Huber, 2012); this represents a fruitful avenue for future research.

Chapter 4 presented the first of three empirical studies contained within the thesis. This chapter described a therapy targeting verb retrieval via a multi-component intervention. Nine individuals with non-fluent aphasia participated in the verb retrieval therapy, which was administered for one hour per week over a total of eight weeks. Therapy consisted of SFA, gesture production and phonemic cueing. Stimuli consisted of a range of verbs, specifically: semantically heavy and light verbs and verbs selected for their personal relevance to each participant; the therapy and control sets were matched for verb type, frequency, imageability and argument structure. The effects of therapy were tracked across assessment contexts: from highly constrained tasks resembling therapy (i.e., verb naming to picture stimuli), to a non-trained yet constrained task (sentence production), through to unconstrained data (i.e., everyday conversation between the participants with aphasia and their typical conversation partner). For the dependent variable of accuracy of verb retrieval, as in previous therapy studies targeting verb retrieval (Coelho, et al., 2000; Nickels, 2002c; Rose & Sussmilch, 2008), the effect of therapy was evident across participants for treated verbs while improvement in naming untreated verbs was restricted to those participants with relatively higher verb retrieval scores on baseline assessment. Retrieval of light verbs remained largely unaffected by therapy; only one participant (AT) significantly improved in light verb retrieval. Whitworth (2010) has suggested that, because of their semantically under-specified representation, it might be more effective to incorporate light verbs within a more semantically rich therapeutic context such as narrative. Results within sentence production assessment were mixed, with a lack of change demonstrated by some participants, while other demonstrated significant increase or decrease in scores. Given that the verbs within the sentence production task were not the same as those targeted in therapy, it was difficult to speculate as to whether this reflected additional sentence-level deficits (McCann & Doleman, 2011; Mitchum & Berndt, 1994), increased task difficulty or lack of generalisation to an untrained context. In assessment of single word naming, five participants had demonstrated improved naming of control verbs, yet only two of these participants (AT, KK) subsequently transferred this improvement to sentence production. This might suggest that therapy predominately improved participants' metalinguistic awareness of verbs as well as activation of the phonological word form but did not impact semantic activation of thematic roles.

Chapter 3 highlighted the limited evidence to guide researchers and clinicians about quantifiable measures of therapy which could be applied to conversation. Novel measures were developed (in Chapters 4 and 5) to quantify behaviours in conversation that a) could be applied across assessment tasks, and b) related to the main aim of therapy. Within Chapter 4, although therapy was multi-component in nature and drew upon gesture production and phonemic cueing through a process of semantic activation and circumlocution, analysis within

conversation was constrained to examine the effects on verb retrieval in conversation. Proportional data were used to mitigate for the varying contributions by each PWA across conversations and provide a more comparable measure of participant performance (Herbert, et al., 2008; Perkins, et al., 1999). Group analysis suggested a lack of statistically significant variability in pre-therapy conversation. Following therapy; there was no significant change in verb retrieval at the group level; this echoes group analyses elsewhere in the literature (Best, et al., 2011; group analysis of noun production, but not verb production, by del Toro, et al., 2008). Analysis of individual participants indicated increased verb retrieval of greater than 5% for three participants.

The lack of change in conversation, despite improvement on the direct measure of therapy, might have reflected a number of factors. Firstly, the differences between retrieving the target verb to picture stimuli (following maximum semantic and gestural ramps as used in therapy) and retrieving a verb within conversation may have been too vast. The way in which verb selection was targeted and drilled in therapy did not necessarily reflect how those same behaviours were needed and utilised in everyday conversation. Furthermore, whilst the SFA component of the verb retrieval therapy tapped into thematic role information (e.g., the agent or theme of the verb), these features did not have to be verbally produced by the participants. Retrieval of the verb in isolation (and its accompanying gesture) was highlighted through the use of drill-type approach. However, unlike nouns, verbs might not as easily have occurred in isolation in conversation (regarding the naturalness of treating verbs in isolation or in sentences, see Webster & Whitworth, 2012). In conversation, the cost of retrieving a verb within a syntactic frame (i.e., which differs to the single word approach in therapy) might have outweighed the gain (potential problematic turn consisting of a verb without an agent or theme), resulting in maintaining the status quo of reliance on nouns. The issue of the context in which the verb occurred was further examined in Chapter 5.

From a broader perspective, any potential changes in verb retrieval may have been masked by interactional factors. For example, mean time post-onset for participants was 44.8 months (St Dev.: 39.3). Thus, it was feasible that many (if not all) participants and their conversation partners had established new patterns of interactions, such as the partner assuming the responsibility for maintaining the conversation while the PWA took the role of responding to questions. Alternatively, the PWA's competence (i.e., linguistic capabilities in ideal conditions) may not have been fully demonstrated in unconstrained tasks due to "diminished processing capacity, rapid decay and/or slow activation of linguistic information" (Linebarger, Romania, Kohn, Schwartz, & Locatelli, 1998, p.199), or strategically simplified grammar (Kolk, 1995). The methodological challenges posed by conversation data (e.g., Mayer &

Murray, 2003) might have included presenting the possibility for the PWA to adapt a relatively passive role, relying mostly on minimal turns while the partner provided the content of the conversation. Whilst this was valid data to collect/analyse, there was an implicit risk that any effects of therapy would be masked by the interactional motivations of the speakers within that interaction. Ramsberger and Menn (2003) have argued that there might be an incentive for the PWA to maintain a language-impaired identity: "A person with aphasia may rationally choose a role below what we see as her communicative potential; by choosing silence in some situations, she may even encourage others to see her as able to speak if she should choose to do so" (p.300). Thus, for an effect of lexical therapy to be apparent in conversation might have required a combination of improved linguistic resources, opportunity (provided by the conversation partner), the motivation to put into practice the trained behaviour and sufficient positive experiences which reinforced the new linguistic behaviours. This topic was considered in Chapter 6.

Building incrementally from the previous study, Chapter 5 presented a therapy study targeting syntactic construction for the same participants reported in Chapter 4. This study tracked the effects of therapy from highly constrained tasks resembling therapy (i.e., syntactic construction to picture stimuli for trained and untrained items) across contexts of diminishing constraint, specifically connected speech (picture description and narrative retell) and everyday conversation. A multi-component therapy was designed which facilitated participants to progress along a hierarchy of syntactic complexity. Therapy drew upon on the principles of mapping therapy (Marshall, 1995), i.e., targeting integration of thematic roles onto syntactic slots. Therapy also drew upon REST (Springer, et al., 2000), i.e., production of simplified verb-centred phrases with the addition of adverbial phrases in the last level of treatment. As in the study presented in Chapter 4, therapy was administered for one hour per week, over a total of eight weeks. Output in connected speech and conversation was coded as a single word (verb or other content word) or utterance (verb phrase or non-verb phrase). Novel measures were developed, which could be applied across tasks of connected speech and conversation. These measures captured a) production of verb phrases as a proportion of the total utterances produced by the PWA and b) verbs produced in isolation as a proportion of other content words produced in isolation.

For the dependent variable of accuracy of syntactic construction (scored on retrieval of a verb, its relevant arguments and correct word order), eight of nine participants showed significant and lasting improvement for treated items. For untrained constructions, six of eight participants improved on the matched control items, while six participants also improved on the unmatched, related stimuli from the VAST sentence production task (Bastiaanse, et al.,

2002). Five participants showed individual patterns of generalisation across contexts of syntactic construction. The different patterns of performance within the group clearly represented the various underlying impairment of individual participants and their varying responses to therapy. For example, AT demonstrated improved sentence construction following verb retrieval therapy; following syntactic construction therapy, improvements were limited to treated items. Background assessment of syntactic construction revealed evidence of argument structure in AT's production but that she often omitted the verb. Thus, AT's lack of generalisation to untreated syntactic construction may have indicated a predominately phonological impairment influencing outcomes.

Regarding generalisation of therapy effects to connected speech data, there was a lack of statistically significant variability in baseline data for the group. Following syntactic construction therapy, there was no significant change within the group on either measure of verb retrieval or frequency of verb-phrases. The measure that mostly closely reflected the therapy aim (production of verb phrases) approached significance. At the individual level, six participants demonstrated increased frequency of verb phrases post-therapy. A more fine-grained descriptive analysis of change in the types of utterances produced by participants indicated increased production of structures similar to those targeted in therapy for five participants (KK, DC, JH, PG, DM). For the remaining participants (BL, AT, PM), changes in type of construction produced after therapy were less clear and did not correspond to the structures targeted in therapy.

At the level of conversation, there was a lack of statistically significant variability in baseline data. Following syntactic construction therapy, there was no evidence of change in conversation data for any measure within the group data. Further analysis revealed individual patterns: proportion of verb phrases produced after therapy increased for three participants (BL, JH, PM); these three participants also demonstrated increased production of verbs without a sentence frame. The remaining five participants (KK, DC, AT, PG, DM) produced fewer verb phrases after therapy as well as fewer verbs in isolation.

While evidence of generalisation (increased frequency of verb phrases) was most evident in connected speech data, the data did not show significant change when subjected to statistical analysis and might therefore require some caution when interpreting the results for the wider aphasia population. Analysis of individual participants' production of verb phrases indicated differences in the context in which they were produced. There was an average increase of 21% in production of verb phrases in the connected speech data compared to a 7.9% increase in conversation data. This result has echoed elsewhere; evidence from previous treatment

targeting reduced syntactic construction suggested that the effects of treatment have been less robust in contexts of decreased constraint (Ruiter, et al., 2010). Furthermore, speakers with agrammatism have maintained telegraphic-style speech in conversation despite improvements on samples of elicited connected speech (Springer, et al., 2000).

The final empirical study was reported in Chapter 6, in which therapy targeted transaction and interaction through a storytelling paradigm. Four participants (BL, JH, AT, PM) from the previous therapy studies were recruited to take part. This reduced number was based upon availability (and motivation) for the conversation patterns to become a focus of therapy. The reduced number of participants also allowed the development of individualised therapy goals and programmes. This study built on previous work (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002) by extending storytelling to a therapy task and measuring the effects of that therapy. Chapters 4 and 5 suggested that there was potential for the PWA to under-perform in terms of displaying linguistic skill when in conversation and that this underperformance might be linked to interactional advantages for both the PWA and the conversation partner. The motivation to target storytelling within therapy and to measure outcomes in both contexts (i.e., story retell and conversation) was based on four main premises. Storytelling has been shown to be part of daily life and to represent an important way of making sense of the world (Riessman, 1993) but crucially featured less in the recorded everyday communications of PWA (Davidson, et al., 2003). Furthermore, storytelling has been shown to share key features of conversation whilst offering potential for standardisation, ecological validity (Lasker & Beukelman, 1999) as well as for the quantification and comparison of behaviours using externally-set criteria (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002). A novel dual-approach was devised in order to include both the PWA and his/her conversation partner within the intervention. For the PWA, therapy drew upon the principles of thinking for speaking (e.g., see Marshall, 2009) and story grammar (e.g., Rumelhart, 1975). For the conversation partner, therapy was based on a conversation coaching approach (e.g., Hopper, et al., 2002) as well individualised therapy goals, practical opportunities for trialling strategies, video feedback and discussion . For the direct measure of an effect of therapy, the conversation partners' retelling of the story was analysed for content words and compared to narratives produced by control speakers. Based upon these findings, a single case study analysis investigated a) the specific behaviours that contributed to changes in transactional success and b) evidence of change in conversation for one couple.

Following therapy, numerical improvements were observed in conversation partners' reporting of the story. Increased similarity to content words produced by control participants was interpreted as increased success of transactional communication, with the PWA and

conversation partner negotiating effectively to increase understandability. Given the methodological limitations (e.g., small sample size, lack of statistical analysis, variability within data), caution was exercised in the interpretations drawn from these numerical changes. The consistent improvements of two conversation partners (Paula, Peter) across simple and complex narrative were conservatively presented as evidence of a direct effect of therapy. Single case analysis of the conversation partner who displayed the strongest change (Peter) revealed a shift in how he engaged in storytelling after therapy. A novel measure of quantifying the type of contribution by the conversation partner was developed and indicated changes which corresponded to Peter's therapy goals, such as increased use of summaries, reformulations and controlling the pace of storytelling. Such changes represented Peter's more active involvement in storytelling after therapy, with a decrease in passivity (i.e., passing turns, claims of understanding) which placed the burden of communication onto the PWA. A qualitative analysis of Peter's contributions to repair work within conversation revealed similar changes, with increases in facilitative behaviours post-therapy; specifically, a reduction in open-class repairs and following complaints with a form of repair that contributed to repair completion. The study presented in Chapter 6 provided preliminary evidence from a small number of participants regarding the viability of targeting and measuring change in storytelling.

7.2 Research themes addressed in the thesis

This section considers the findings from the empirical studies in light of the overarching themes of the thesis.

7.2.1 Is it feasible to develop quantitative measures to investigate stability of behaviours of interest in everyday conversation that will also serve to capture change following therapy?

del Toro et al. (2008) pointed out that "the best methods for scoring and evaluating the microstructure of aphasia discourse has not been determined" (p.886). Chapter 3 highlighted a number of studies which have investigated the effect of impairment-based therapies on conversation. Following lexical retrieval therapy targeting nouns and/or verbs, these studies utilised measures which investigated change for lexical retrieval, error production, syntactic construction, communication and interaction. However, as most studies collected only a single sample of conversation at each time-point, investigation of the stability of baseline behaviours of interest was not possible. Notable exceptions have included Mason, Nickels, McDonald, Moses, Makin and Taylor (2011), who statistically analysed production of words targeted in therapy across baseline conversations and found a lack of significant variability. Additionally, whilst Best et al. (2011) did not report statistical investigation of behaviours in interest in baseline data for the group, the authors provide descriptive information on specific measures. For example, two variables (i.e., minimal turns/total turns; word errors per content words) fluctuated over baseline samples; the remaining variables appeared stable on visual inspection (i.e., word errors per turn; content words per substantive turn; nouns per substantive turn; total noun production). Within a case series analysis, Best et al. (2011) reported five significant changes after therapy for which there was stability in baseline data (see participants IK, GB, BG, KR, PH).

Within this thesis, quantitative measures (Chapters 4 and 5) were developed which were a) applicable across connected speech data and conversation, b) focused on the variable which was more closely related to the therapy aim, c) made use of proportional data in order to militate against the varying contributions of the PWA across different elicitation contexts and time-points and d) allowed for comparison of behaviours of interest within pre- and post-therapy data. The criteria for success used within these empirical studies (and often used within clinical practice) related to increased frequency of production of a targeted behaviour. In each study, investigation of therapy effects was constrained to behaviours that were hypothesised to represent most closely those behaviours targeted within treatment. Thus, in the first instance, this thesis was concerned with comparing frequency of behaviours of interest (i.e., verb retrieval, verb-phrase production) before and after therapy. This does not preclude wider analysis of change within conversation. Indeed, broader analysis could prove a rich

avenue for further work given that the therapy interventions were multi-component in nature. For example, further research may investigate the effects of each therapy (and the cumulative effect of the series of therapy studies) on gesture production (e.g., frequency or type), fluency (e.g., mean length of utterance), light verb constructions, or the effects of increased verb retrieval on repair within the data (see below for further discussion of this point). Within Chapters 4 and 5, the variables of interest demonstrated no significant variability in baseline the conversation data. This finding was in line with the statistical analysis of baseline conversation data conducted by Mason et al. (2011) and was important as it allowed for the possibility of capturing change in conversation after the different treatments. Furthermore, the measures which looked at whether two observers could identify behaviours of interest within conversation (reported in Chapter 5) obtained high inter-rater reliability. Taken together, these findings made it possible to isolate specific behaviours of interest within conversation data for quantitative analysis of baseline stability and, subsequently, changes in conversation following therapy.

Chapter 6 offered preliminary evidence of capturing quantitative and qualitative data related to the conversation partner's strategies and behaviours in baseline storytelling, as well as capturing how those behaviours changed following a programme of therapy. The measure of broad categories obtained high inter-rater reliability and, while reliability was lower for the more specific measures, it reached an acceptable level for this stage of preliminary analysis. Both measures were based on the storytelling data for one couple and would be strengthened by the addition of data from different conversation partners. Within Chapter 6, the quantitative measure was not extended to conversation data for a number of reasons. The storytelling stimuli placed the PWA in the powerful position of possessing new knowledge that the conversation partner was interested in discovering. While this exchange of new information mirrors some aspects of everyday communication, it was impossible to identify instances of the PWA telling a story within the conversation data and to confidently ascertain the level of the partner's knowledge. Thus, analysis of conversation data focused on instances of repair, which were more likely to present the conversation partner with opportunities to employ some of the strategies trained in therapy. Moreover, it was possible that the participants with aphasia (e.g., those within Chapter 6) systematically engaged in less storytelling or initiation of storytelling in the recorded conversation data (see Davidson, et al., 2003). This might have reflected factors other than underlying linguistic and narrative ability, e.g., level of independence and thus, opportunities to experience events within daily life that are worthy of relaying in conversation to their partner. Thus, one implication for clinical practice might be the need to ground linguistic or communication-focused therapy within the broader context of increasing communicative independence through, for example, vocational rehabilitation.

7.2.2 Can therapy studies be designed which maximise the potential of generalisation to untreated contexts?

Each empirical study presented within the thesis assimilated promising aspects of existing therapy approaches to create novel, multi-component interventions which were designed to maximise generalisation to untreated contexts (e.g., connected speech data, conversation). This was achieved in various ways; for example, the verb retrieval study (Chapter 4) employed a semantically rich approach through the use of SFA, bolstered by gesture production and phonemic cueing. In this way, it was possible to design and deliver a treatment which was suitable for participants who presented with different underlying causes of impaired verb retrieval, i.e., semantic or phonological. Different ingredients were likely to have been important for different participants (for a similiar discussion, see Best & Nickels, 2000). Within the verb retrieval therapy, stimuli included a small set of semantically light verbs, based on the hypothesis that those participants with intact sentence structure may be able to retrieve a light verb in conversation in the face of a retrieval failure for a more specific verb. Also included within therapy was a set of personally relevant verbs, based on the hypothesis that if improvements in verb naming did not generalise to untreated items, the treated items should have personal relevance for the individual (Conroy, et al., 2009a; Herbert, et al., 2003; Mason, et al., 2011). Within syntactic construction therapy (Chapter 5), multi-component therapy consisted of mapping (Marshall, 1995) and REST (Springer, et al., 2000). In particular, it was hypothesised that the morphologically reduced constructions would lessen the processing load and therefore maximise the likelihood of this pattern of production surviving within contexts of greater linguistic and processing demands (Ruiter, et al., 2010; Springer, et al., 2000). Another key factor within syntactic construction therapy related to the treatment hierarchy. This allowed each individual to progress at their own pace, while still challenging those participants with higher-level abilities. Across the two impairment-focused therapy studies (Chapter 4 and 5), while a drill-approach was used to reinforce correct production of the target verb or construction, exemplar productions were included within therapy sessions in order to reduce the focus on rote learning. This has implications for clinical practice: that is, multi-component therapies proved to be an efficient way to develop and administer therapy to individuals with differing underlying impairments. In particular, the hierarchy of syntactic complexity in Chapter 5 (linked to participant-success within each session) provided an element of individualisation and flexibility to each participant, allowing those with underlying syntactic deficits more time to focus on producing short agent-verb constructions, while including scope to challenge higher-level participants with longer constructions and the additional of adverbial phrases. Finally, within communication-focused therapy (Chapter 6), the intervention targeted a context that shares similarities with everyday

conversation and involved both the PWA and his/her conversation partner. Therapy goals were individually tailored to each participant, based on data from baseline interaction storytelling. Participants were presented with opportunities to imitate the therapist's model of a specific strategy, to trial different strategies and to receive and engage in video feedback and discussion about the effect of specific behaviours.

The multi-component design of the therapy studies presented in the thesis marked a shift away from traditional therapy studies in which one optimal method is investigated (e.g., Hickin, Best, Herbert, Howard, & Osborne, 2002). Such multi-component designs were not, however, without their limitations. One important disadvantage related to the increased number of potential variables of interest within the assessment and conversation data which were not then pursued for analysis, such as gesture production, error production, light verb constructions and use of circumlocution (Chapter 4); adverbial phrases, fluency and gesture production (Chapter 5), micro-linguistic and macro-linguistic variables related to the PWA's narrative production (Chapter 6). The measures and subsequent analyses within the thesis presented a focused and necessarily constrained picture of change following each intervention. Such an approach marked a deliberate decision to focus on a defined number of core behaviours, while side-lining more peripheral, yet no less interesting, questions for future analysis.

7.2.3 Can conversation data be used as an assessment method through which to investigate indirect effects of therapy?

There were compelling reasons for using conversation data as a context in which to investigate change following therapy. Conversation is the most frequent of all daily communicative activities (Davidson, et al., 2003) and therefore presents ecologically valid data for the purposes of outcome measurement. And yet, the findings of the empirical studies presented within this thesis have suggested equally compelling arguments for considering contexts other than conversation for the investigation of the indirect effects of therapy. The time-intensive nature of analysing conversation data has been previously noted (Bradley & Douglas, 2008; Prins & Bastiaanse, 2004) and presents a serious challenge to widespread application in clinical practice. Furthermore, there is natural variability inherent within conversation data relating, for example, to speakers' interest or knowledge in the topic under discussion, fatigue, mood, etc. (Carragher, et al., 2012). Such variability necessitates the collection of multiple samples in order to militate against such variability. Again, such methodological challenges place use of conversation data beyond reach for most clinicians (Carragher, et al., 2012). Perhaps most importantly is the opportunity provided to PWA to 'opt-out' of the conversation, allowing their conversation partner to carry the burden of communication and thereby under-represent their linguistic ability (for a similar discussion regarding competence and

performance, see Linebarger, et al., 1998). Regarding analysis, many options exist for quantifying patterns of production in baseline data and following therapy (see Carragher, et al., 2012), yet further investigations of reliability are required to move towards a consensus on how best to capture change. Qualitative analysis such as CA may be possible given that CA has provided rich findings, often unveiling subtle changes within post-therapy conversations (e.g., Beeke, et al., 2011); however CA is less helpful in capturing evidence of change succinctly and the time demands involved present real challenges to clinical feasibility (Bradley and Douglas, 2008).

Chapter 6 set out one helpful option which may be to hone in more narrowly, beyond the amorphous concept of conversation, to certain specific communicative behaviours which make up everyday conversational exchanges. Specifically, the social function of imparting novel information, whether described as anecdote-sharing or interactive storytelling, appears a potentially useful candidate for more focused assessment and therapy investigations. Interactive storytelling forms a bridge between existing literatures relating to traditional aphasia elicits tasks and conversation sampling. Beeke et al. (2003d) presented evidence of similarities in the grammatical resources used by one PWA in Cinderella retelling and everyday conversation. Adding the conversation partner to the storytelling paradigm may help in capturing a microcosm of some aspects of everyday communication such as conveying new information, negotiating understanding, managing repair, and dealing with issues of face (Goffman, 1955). Importantly, interactive storytelling offers a task that is replicable, can be judged against external criteria and enables comparison of performance across a group of participants. Placing the PWA in the position of possessing the 'sought-after' information avoids the possibility of 'opting out', thereby removing important potential barriers to measuring change following therapy. As an analytical method, this paradigm has been demonstrated as reliable (Ramsberger & Rende, 2002). Furthermore, Chapter 6 presented concrete examples of how storytelling therapy might work in practice and a potential quantitative measure for future comparison of performance across participants.

7.2.4 Can a sequential model of therapy delivery be delivered which isolates specific discreet components of therapy and their effects on conversation while also facilitating an incremental, cumulative therapy method where skills can be focused on in a step-by-step manner?

The thesis presented a series of therapy studies which targeted incrementally-increasing levels of production, from verb retrieval to syntactic construction to storytelling. There was a meta-linguistic advantage to targeting language production sequentially; beginning with targeting verb retrieval prepared the participants for a later focus on verb-centred phrases, particularly with regards to the mapping of arguments around the verb and differentiating between verbs

and other content words. For example, after the initial therapy targeting verb retrieval, AT, in particular, took the opportunity to highlight any instances of verb retrieval in any given conversation by exclaiming "-ing word". Each therapy study laid the foundation for the therapy that followed. This thesis poses interesting questions, such as 'Are all phases of therapy necessary or just specific ingredients within each therapy?', 'Which levels of intervention are important for which participants with aphasia?' and 'Is it possible to begin by targeting lexical retrieval and syntactic construction within a richer communicative context, rather than targeting these in somewhat artificial isolation?'. Encouragingly for clinical practice, all three therapy interventions involved a relatively small amount of therapy, yet delivered strong results on direct measures, with some evidence of generalisation to untrained contexts as the therapy level progressed (Chapters 5 and 6).

One limitation of the sequential nature of the therapy studies related to the protracted involvement of participants across the series of studies. This posed a problem for participant retention. One participant (BG) passed away prior to the first therapy study. A second participant (GL) experienced a worsening of vestibular stroke-related symptoms. This negatively impact on his mood and, while he was clear that he wished to continue with the therapy study, ultimately his illness had an adverse effect on his ability to respond to the treatment. In the case of a larger case series, the sequential nature of therapy presented within this thesis would be likely to result in more challenges to participant retention.

Even so, the range and sequential nature of therapy interventions presented within the thesis may represent the reality of clinical practice, where it is unlikely that individuals with non-fluent aphasia would receive, for example, verb retrieval therapy in isolation. Certainly, the findings from this thesis supported the need for therapy to build upon successes in production at the level of lexical retrieval, targeting verbs within more syntactically and communicatively rich and demanding contexts (Webster & Whitworth, 2012). One potential avenue for future research might involve statistical analysis of participant variables that are likely to be relevant in predicting therapy outcomes, such as baseline cognitive status, severity of the aphasic symptoms, self-monitoring and the skill of the conversation partner. The harnessing of multiple components within the therapy studies presented in the thesis ultimately mirrors clinical practice, where therapists are likely to use all resources at their disposal in the rehabilitation of an individual with aphasia (Carragher et al., 2012).

7.2.5 Learning points from the thesis and consideration of clinical implications

For clinical practice, the key learning points discussed above have outlined:

- the potential for multicomponent therapy to treat individuals with similar symptom profiles but with a range of underlying deficits
- the need to support generalisation of targeted linguistic behaviours across contexts of decreasing constraint

A further learning point relates to homework which was prescribed following each therapy study. Anecdotal evidence from the participants' experience of each therapy study presented within this thesis suggested that many participants enjoyed carrying out homework practice outside of the therapy session. Furthermore, homework tasks for the verb retrieval therapy (Chapter 4) and the syntactic construction therapy (Chapter 5) were easy for participants to carry out independently due to the consistency of delivery and linguistic targets across therapy sessions. However, the four couples who took part in the interactive storytelling therapy (Chapter 6) each reported difficulty in completing homework tasks. This may be explained by several reasons. Homework tasks in Chapters 4 and 5 mirrored exactly the task carried out within the therapy sessions. Thus, participants had clear expectations and experience of carrying out the task; some participants even carried out the homework tasks in the absence of their partner. The homework task in Chapter 6 seemed to pose problems for participants because a) the interaction was necessarily different each time and different from the exact interaction within the therapy session; b) that the interactions were different each time meant that participants and their partners could not plan exactly how to carry out the homework; c) a vital ingredient within the therapy sessions was the feedback provided by the researcher in order to increase self-monitoring and to facilitate and model useful strategies and behaviours. This support was not available within the homework tasks; and d) interactions within the therapy sessions were based on a short, pre-prepared video clip whereas practice interactions at home were based on experiences, memories or naturally occurring 'news-giving' anecdotes, i.e., not on visual stimuli. Attempting to carry out such a task in the absence of a researcher/clinician proved to place high demands on the couples. To apply this intervention to clinical practice and within future research, it may be beneficial to consider supplying each couple with video clips which they can use to practice specific strategies and behaviours at home. This might make the therapy process within independent more tangible and easier to replicate. This issue may be further addressed by working across a hierarchy of types of storytelling data within the therapy sessions, i.e., from video clips to personally relevant/individually generated narratives.

Novel use of technology

Within interactive storytelling therapy (Chapter 6), the use of an iPad and video footage from YouTube.com proved to be both practical for therapy administration and popular with participants. One possible obstacle to the use of an internet resource within therapy sessions related to having access to a reasonable internet connection across different sites (i.e., participants' homes). This potential problem was easily circumvented by pre-purchasing data, thereby avoiding possibly relying on participants' own internet access. As technology becomes ever more popular, this is likely to become less of a problem. The video footage selected often depicted a comical or unusual scene, thereby ensuring genuine motivation for participants to communicate the clip to their partners. This added an interesting layer/challenge for participants, i.e., providing an evaluation of the story. Olness (2007) highlighted the importance of evaluation in narrative arguing that, without it, there is no point to telling a story. This addition to the therapy protocol could have importance implications for use of the intervention within clinical practice or for future research, i.e., to embed evaluation within the PWA conveying of a story or anecdote. This more individual and personal addition to the story (rather than more simply relaying facts or events) might be key in facilitating generalisation of story grammar and structure from the therapy session to everyday communication.

References

Antonucci, S.M. (2009). Use of semantic feature analysis in group aphasia treatment. *Aphasiology, 23*(7 - 8), 854 - 866.

Ardila, A. (2010). A proposed reinterpretation and reclassification of aphasic syndromes. *Aphasiology, 24*(3), 363 - 394.

Armstrong, E. (2000). Aphasic discourse analysis: The story so far. *Aphasiology, 14*(9), 875–892.

Armstrong, E., & Ferguson, A. (2010). Language, meaning, context, and functional communication. *Aphasiology, 24*, 480 - 496.

Atkinson, M., & Heritage, H.E. (1984). *Structures of social action*. Cambridge, UK: Cambridge University Press.

Bak, T., & Hodges, J.R. (2003). Kissing and dancing – a test to distinguish lexical and conceptual contributions to noun/verb and action/object dissociation. Preliminary results in patients with frontotemporal dementia. *Journal of Neurolinguistics, 16*, 169 – 181.

Baltes, P.B., & Baltes, M.M. (1990). *Successful aging: Perspectives from the behavioural sciences*. New York: Cambridge University Press.

Barnett, A.G., van der Pols, J.C., & Dobson, A.J. (2005). Regression to the mean: what it is and how to deal with it. *International Journal of Epidemiology, 34*, 215 - 220.

Bastiaanse, R., Edwards, S., Mass, E., & Rispens, J. (2003). Assessing comprehension and production of verbs and sentences: The Verb and Sentence Test (VAST). *Aphasiology, 17*(1), 49 – 73.

Bastiaanse, R., Edwards, S., & Rispens, J.E. (2002). *The Verb and Sentence Test (VAST)*: Thames Valley Test Publishers.

Bastiaanse, R., & Jonkers, R. (1998). Verb retrieval in action naming and spontaneous speech in agrammatic and anomic aphasia. *Aphasiology, 12*, 951 – 969.

Bates, E., Andonova, E., D'Amico, S., Jacobsen, T., Kohnert, K., Lu, C.-C., . . . Pleh, C. (2000). Introducing the CRL International Picture-Naming Project (CRL-IPNP). *Center for Research in Language Newsletter, 12*(1), La Jolla: University of California San Diego.

Bauer, A., & Auer, P. (2009). Aphasie im Alltag. Retrieved from

Beattie, G., & Shovelton, H. (2006). A critical appraisal of the relationship between speech and gesture and its implications for the treatment of aphasia. *Advances in Speech–Language Pathology, 8*(2), 134 – 139.

Beeke, S., Maxim, J., Best, W., & Cooper, F. (2011). Redesigning therapy for agrammatism: Initial findings from the ongoing evaluation of a conversation-based intervention study. *Journal of Neurolinguistics, 24*, 222 - 236.

Beeke, S., Wilkinson, R., & Maxim, J. (2003a). Exploring aphasic grammar 1: a single case analysis of conversation. *Clinical Linguistics & Phonetics, 17*(2), 81 - 107.

Beeke, S., Wilkinson, R., & Maxim, J. (2003b). Exploring aphasic grammar 1: a single case analysis of conversation. *Clinical Linguistics and Phonetics, 17*, 81-108.

Beeke, S., Wilkinson, R., & Maxim, J. (2003c). Exploring aphasic grammar 2: do language testing and conversation tell a similar story? . *Clinical Linguistics & Phonetics, 17*(2), 109 - 134.

Beeke, S., Wilkinson, R., & Maxim, J. (2003d). Exploring aphasic grammar 2: do language testing and conversation tell a similar story? . *Clinical Linguistics & Phonetics, 17*(2), 109-134.

Beeke, S., Wilkinson, R., & Maxim, J. (2007). Grammar without sentence structure: A conversation analytic investigation of agrammatism. *Aphasiology, 21*, 256 - 282.

Bencini, G., & Roland, D. (1996). *Verb access difficulties in agrammatic aphasic narratives*. Paper presented at the 70th Annual Meeting of the Linguistic Society of America, San Diego, CA.

Berndt, R., Haendiges, A., & Wozniak, M. (1997a). Verb retrieval and sentence processing: Dissociation of an established symptom pattern. *Cortex, 33*, 99 - 114.
Berndt, R.S., Haendiges, A.N., Mitchum, C.C., & Sandson, J. (1997b). Verb retrieval in aphasia: II. Relationship to sentence processing. *Brain and Language, 56*, 107 - 137.
Berndt, R.S., Mitchum, C.C., & Haendiges, A.N. (1996). Comprehension of reversible sentences in "agrammatism": A meta-analysis. *Cognition, 58*, 289 – 308.
Berndt, R.S., Mitchum, C.C., Haendiges, A.N., & Sandson, J. (1997c). Verb retrieval in aphasia, 2. Relationship to sentence processing. *Brain and Language, 56*, 107 - 137.
Berndt, R.S., Mitchum, C.C., Haendiges, A.N., & Sandson, J. (1997d). Verb retrieval in aphasia: I. Characterising single word impairments. *Brain and Language, 56*, 68 - 106.
Berndt, R.S., Wayland, S., Rochon, E., Saffran, E., & Schwartz, M. (2000). *Quantitative Production Analysis (QPA)*. Philadelphia: Psychology Press.
Best, W., Grassly, J., Greenwood, A., Herbert, R., Hickin, J., & Howard, D. (2011). A controlled study of changes in conversation following aphasia therapy for anomia. *Disability and Rehabilitation, 33*(3), 229 – 242.
Best, W., Howard, D., Bruce, C., & Gatehouse, C. (1997). A treatment for anomia: combining semantics, phonology and orthography In S. Chiat, J. Law & J. Marshall (Eds.), *Language disorders in children and adults: Psycholinguistic approaches to therapy* (pp. 102 - 129). London: Whurr Publishers Ltd.
Best, W., & Nickels, L. (2000). From theory to therapy in aphasia: Where are we now and where to next? *Neuropsychological Rehabilitation, 10*(3), 231 - 247.
Beveridge, M.A., & Crerar, M.A. (2002). Remediation of asyntactic sentence comprehension using a multimedia microworld. *Brain and Language, 82*, 243 – 295.
Biber, D., Conrad, S., & Reppen, R. (1998). *Corpus Linguistics: Investigating language structure and use*. Cambridge, UK: Cambridge University Press.
Bird, H., Franklin, S., & Howard, D. (2002). Little words'–not really: Function and content words in normal and aphasic speech. *Journal of Neurolinguistics, 15*, 209 – 237.
Birren, J., Kenyon, G., Ruth, J.E., Shroots, J.J.F., & Svendson, J. (1996). *Aging and biography: Explorations in adult development*. New York: Springer.
Boles, L. (1997). Conversation analysis as a dependent measure in communication therapy with four individuals with aphasia. *Asia Pacific Journal of Speech, Language and Hearing, 2*, 43-61.
Boles, L., & Bombard, T. (1998). Conversational discourse analysis: Appropriate and useful sample sizes. *Aphasiology, 12*(7), 547 – 560
Boo, M., & Rose, M.L. (2011). The efficacy of repetition, semantic, and gesture treatments for verb retrieval and use in Broca's aphasia. *Aphasiology, 25*(2), 154 - 175.
Booth, S., & Perkins, L. (1999). The use of conversation analysis to guide individualised advice to carers and evaluate change in aphasia: A case study. *Aphasiology, 13*(4/5), 283-303.
Booth, S., & Swabey, D. (1999). Group training in communication skills for carers of adults with aphasia. *International Journal of Language & Communication Disorders, 34*(3), 291-309.
Boxer, D. (1996). Ethnographic interviewing as a research tool in speech act analysis: The case of complaints. In S. Gass & J. Neu (Eds.), *Speech acts across cultures* (pp. 217 - 239). Berlin: Mouton.
Boyle, M. (2004). Semantic feature analysis treatment for anomia in two fluent aphasia syndromes. *American Journal of Speech-Language Pathology, 13*(3), 236–249.
Boyle, M. (2011). Discourse treatment for word retrieval impairment in aphasia: The story so far. *Aphasiology, 25*(11), 1308 - 1326.
Boyle, M., & Coelho, C.A. (1995). Application of semantic feature analysis as a treatment for aphasic dysnomia. *American Journal of Speech-Language Pathology, 4*, 94–98.
Bradley, M., & Douglas, J. (2008). Conversation partner training - its role in aphasia. *Acquiring Knowledge in Speech, Language and Hearing, 10*(1), 18 - 21.

Brady, M., & Armstrong, L. (2007). Disordered communicative interaction: Current and future approaches to analysis and treatment. *Aphasiology, 21*, 251 - 255.
Breedin, S.D., Saffran, E.M., & Schwartz, M.F. (1998). Semantic factors in verb retrieval: An effect of complexity. *Brain and Language, 63*, 1 – 31.
Bruce, C., & Howard, D. (1987). Computer-generated phonemic cues: An effective aid for naming in aphasia. *International Journal of Language & Communication Disorders, 22*(3), 191 - 201.
Burgess, P., & Shallice, T. (1997). *The Hayling and Brixton Tests. Test manual*. Bury St Edmunds, UK: Thames Valley Test Company.
Byng, S. (1988). Sentence processing deficits: Theory and therapy. *Cognitive Neuropsychology, 5*, 629 – 676.
Byng, S., & Lesser, R. (1993). A review of therapy at the level of the sentence in aphasia. In M. Paradis (Ed.), *Foundations of aphasia rehabilitation* (pp. 319 - 362). Oxford: Pergamon Press.
Byng, S., Nickels, L., & Black, M. (1994). Replicating therapy for mapping deficits in agrammatism: Remapping the deficit? . *Aphasiology, 8*, 315 – 341.
Cameron, R.M., Wambaugh, J.L., Wright, S.M., & Nessler, C.L. (2006). Effects of a combined semantic/phonologic cueing treatment on word retrieval in discourse. *Aphasiology, 20*(2 – 4), 269–285.
Caramazza, A., & Hillis, A.E. (1991). Lexical organisation of nouns and verbs in the brain. *Nature, 349*, 788 - 790.
Carragher, M., Conroy, P., Sage, K., & Wilkinson, R. (2012). Can impairment-focused therapy change the everyday conversations of people with aphasia? A review of the literature and future directions. *Aphasiology, 26*(7), 895 - 916.
Carragher, M., Sage, K., & Conroy, P. (accepted pending revisions-a). The effects of lexical retrieval therapy for people with non-fluent aphasia; Evidence across assessment tasks and conversation.
Carragher, M., Sage, K., & Conroy, P. (accepted pending revisions-b). Outcomes from therapy targeting syntactic construction: Evidence from people with non-fluent aphasia in assessment tasks and everyday conversation
Clark, E.V. (1978). Discovering what words can do. In D. Farkas, W.M. Jacobsen & K.W. Todrys (Eds.), *Papers from the parasession on the lexicon* (pp. 34 – 57). Chicago, IL: Chicago Linguistic Society.
Code, C. (2001). Multifactorial processes in recovery from aphasia: Developing the foundations for a multileveled framework. *Brain and Language 77*, 25 – 44.
Code, C., & Gaunt, C. (1986). Treating severe speech and limb apraxia in a case of aphasia. *International Journal of Language & Communication Disorders, 21*, 11 - 20
Coelho, C.A., McHugh, R.E., & Boyle, M. (2000). Semantic feature analysis as a treatment for aphasic dysnomia: A replication. *Aphasiology, 14*(2), 133 – 142.
Cohen, S. (2004). Social relationships and health. *American Psychologist, 59*(8), 676 - 684.
Collins, A.M., & Loftus, E.F. (1975). A spreading activation theory of semantic processing. *Psychological Review, 82*, 407 - 428.
Conley, A., & Coelho, C.A. (2003). Treatment of word retrieval impairment in chronic Broca's aphasia. *Aphasiology, 17*(3), 203–211.
Conroy, P. (unpublished). *Light Verb Elicitation Test (LVET)*.
Conroy, P., Sage, K., & Lambon Ralph, M. (2009a). Improved vocabulary production after naming therapy in aphasia: can gains in picture naming generalise to connected speech? *International Journal of Language and Communication Disorders, 44*(6), 1036 - 1062.
Conroy, P., Sage, K., & Lambon Ralph, M. (2009b). Improved vocabulary production after naming therapy in aphasia: can gains in picture naming generalise to connected speech? *International Journal of Language & Communication Disorders, 44*(6), 1036 - 1062.

Conroy, P., Sage, K., & Lambon Ralph, M.A. (2006). Towards theory-driven therapies for aphasic verb impairments: A review of current theory and practice. *Aphasiology, 20*(12), 1159 – 1185.
Conroy, P., Sage, K., & Lambon Ralph, M.A. (2009c). A comparison of word versus sentence cues as therapy for verb naming in aphasia. *Aphasiology, 23*(462 - 482).
Conroy, P., Sage, K., & Lambon Ralph, M.A. (2009d). The effects of decreasing and increasing cue therapy on improving naming speed and accuracy for verbs and nouns in aphasia. *Aphasiology, 23*(6), 707 - 730.
Conroy, P., Sage, K., & Lambon Ralph, M.A. (2009e). Errorless and errorful therapy for verb and noun naming in aphasia. *Aphasiology, 23*(11), 1311 - 1337.
Conroy, P., & Scowcroft, J. (2012). Decreasing cues for a dynamic list of noun and verb naming targets: A case-series aphasia therapy study. *Neuropsychological Rehabilitation: An International Journal, 22*(2), 295 - 318.
Correll, A., van Steenbrugge, W., & Scholten, I. (2010). Judging conversation: How much is enough? *Aphasiology 24*(5), 612 - 622.
Crofts, B., Nickels, L., Makin, K., Taylor, C., & Moses, M. (2004). *A Comparison of the Effectiveness of 'Semantic' and 'Phonological' Tasks in the Facilitation of Word Production in Aphasia.* Paper presented at the 26th World Congress of the International Association of Logopedics and Phoniatrics.
Cunningham, R., & Ward, C. (2003). Evaluation of a training programme to facilitate conversation between people with aphasia and their partners. . *Aphasiology, 17*(8), 687-7007.
D'Amico-Reisner, L. (1985). *An ethnographic study of disapproval exchanges*. Unpublished PhD dissertation University of Pennsylvania.
Damico, J.S., Oelschlaeger, M., & Simmons-Mackie, N. (1999). Qualitative methods in aphasia research: Conversation analysis. *Aphasiology, 13*(9 - 11), 667 - 680.
Davidson, B., Worrall, L., & Hickson, L. (2003). Identifying the communication activities of older people with aphasia: Evidence from naturalistic observation. *Aphasiology, 17*(3), 243 - 264.
Davis, C., Kleinman, J.T., Newhart, M., Gingis, L., Pawlak, M., & Hillis, A.E. (2008). Speech and language functions that require a functioning Broca areas. *Brain and Language, 105*, 50 - 58.
Davis, C.J. (2005). N-Watch: A program for deriving neighborhood size and other psycholinguistic statistics. *Behaviour Research Methods, 37*(1), 65 - 70.
De Roo, E., Kolk, H., & Hofstede, B. (2003). Structural properties of syntactically reduced speech: A comparison of normal speakers and Broca's aphasics. *Brain and Language, 86*, 99 - 115.
de Ruiter, J. (2000). The production of gesture and speech. In D. McNeill (Ed.), *Language and Gesture* (pp. 284 – 311). Cambridge, UK: Cambridge University Press.
del Toro, C.M., Altmann, L.J.P., Raymer, A.M., Leon, S., Blonder, L.X., & Gonzalez Rothi, L.J. (2008). Changes in aphasic discourse after contrasting treatments for anomia. *Aphasiology, 22*(7), 881 - 892.
Douglas, J.M., O'Flaherty, C.A., & Snow, P.C. (2000). Measuring perception of communicative ability: The development and evaluation of the La Trobe communication questionnaire. *Aphasiology, 14*(3), 251 – 268.
Drew, P. (1997). 'Open' class repair initiators in response to sequential sources of troubles in conversation. *Journal of Pragmatics, 28*, 69 - 101.
Dronkers, N.F., Shapiro, J.K., Redfern, B., & Knight, R.T. (1992). The role of Broca area in Broca aphasia. *Journal of Clinical Experimental Neuropsychology, 14*, 52 - 53.
Druks, J. (2002). Verbs and nouns—a review of the literature. *Journal of Neurolinguistics, 15*, 289 – 315.
Druks, J., & Masterson, J. (2000). *The Object Action Naming Battery.* . Hove, UK: Psychology Press.

Duff, M.C., Mutlu, B., Byom, L., & Turkstra, L.S. (2012). Beyond utterances: Distributed cognition as a framework for studying discourse in adults with acquired brain injury. *Seminars in Speech Language, 33*, 44 – 54.

Edmonds, L.A., Nadeau, S.E., & Kiran, S. (2009). Effect of Verb Network Strengthening Treatment (VNeST) on lexical retrieval of content words in sentences in persons with aphasia. *Aphasiology, 23*(3), 402 - 424.

Edwards, S., Tucker, K., & McCann, C. (2004). The contribution of verb retrieval to sentence construction: A clinical study. *Brain and Language, 91*, 78 – 79.

Engelter, S.T., Gostynski, M., Papa, S., Frie, M., Born, C., Adhacic-Gross, V., . . . Lyrer, P.A. (2006). Epidemiology of aphasia attributable to first ischemic stroke: Incidence, severity, fluency, etiology and thrombolysis. *Stroke, 37*, 1379 - 1384.

Erber, N.P. (1994). Conversation as therapy for older adults in residential care: the case for intervention. *European Journal of Disorders of Communication, 29*(165 - 182).

Falconer, C., & Antonucci, S.M. (2012). Use of semantic feature analysis in group discourse treatment for aphasia: Extension and expansion. *Aphasiology, 26*(1), 64 - 82.

Faroqi-Shah, Y. (2008). A comparison of two theoretically driven treatments for verb inflection deficits in aphasia. *Neuropsychologia, 46*, 3088 – 3100.

Faroqi-Shah, Y., & Virion, C. (2009). Constraint-induced language therapy for agrammatism: role of grammaticality constraints. *Aphasiology, 23*, 977 - 988.

Ferretti, T.R., McRae, K., & Hatherell, A. (2001). Integrating verbs, situation schemas, and thematic role concepts. *Journal of Memory and Language, 44*, 516 – 547.

Feyereisen, P. (1997). The Competition between Gesture and Speech Production in Dual-Task Paradigms. *Journal of Memory and Language 36*, 13 – 33

Fillingham, J.K., Sage, K., & Lambon Ralph, M.A. (2005a). Further explorations and an overview of errorless and errorful therapy for aphasic word-finding difficulties: The number of naming attempts during therapy affects outcome. *Aphasiology, 19*, 597 – 614.

Fillingham, J.K., Sage, K., & Lambon Ralph, M.A. (2005b). Treatment of anomia using errorless versus errorful learning: are frontal executive skills and feedback important? *International Journal of Language & Communication Disorders, 40*(4), 505 - 523.

Fillingham, J.K., Sage, K., & Lambon Ralph, M.A. (2006). The treatment of anomia using errorless learning. *Neuropsychological Rehabilitation, 16*, 129 – 154.

Fink, R.B., Martin, N., Schwartz, M., Saffran, E., & Myers, J.L. (1991). Facilitation of verb retrieval skills in aphasia: A comparison of two approaches. *Clinical Aphasiology, 21*, 263 – 275.

Fink, R.B., Schwartz, M.F., & Myers, J.L. (1998). Investigations of the sentence-query approach to mapping therapy. *Brain and Language, 65*, 203 – 207.

Fisher, J.P., & Glenister, J.M. (1992). *The Hundred Pictures Naming Test* Victoria: Australian Council for Educational Research.

Fox, S., Armstrong, E., & Boles, L. (2009). Conversational treatment in mild aphasia: A case study. *Aphasiology, 23*(7 – 8), 951 – 964.

Garrett, M.F. (1988). Processes in language production. In F.J. Newmeyer (Ed.), *Linguistics: The Cambridge Survey: III Language: Psychological and Biological Aspects* (pp. 69 – 96). Cambridge: Cambridge University Press.

Goffman, E. (1955). On face work. *Psychiatry, 18*, 213 - 231.

Goodglass, H. (1976). Agrammatism. In H. Whitaker & H.A. Whitaker (Eds.), *Studies in neurolinguistics* (pp. 237 – 260). New York: Academic Press.

Goodglass, H., Kaplan, E., & Barresi, B. (2001). *The Boston Diagnostic Aphasia Examination (BDAE)* Baltimore: Lippincott.

Goodwin, C. (1995). Co-constructing meaning in conversations with an aphasic man. *Research on Language and Social Interactions, 28*, 233 – 260.

Gordon, J.K. (2008). Measuring the lexical semantics of picture description in aphasia. *Aphasiology, 22*(7), 839 – 852.

Gordon, J.K., & Dell, G.S. (2003). Learning to divide the labor: an account of deficits in light and heavy verb production. *Cognitive Science, 27*, 1 - 40.

Grant, D.A., & Berg, E.A. (1993). *Wisconsin Card Sorting Test*. New York: Psychological Assessment Resources Inc.

Greenwood, A., Grassly, J., Hickin, J., & Best, W. (2010). Phonological and orthographic cueing therapy: A case of generalised improvement *Aphasiology, 24*(9), 991 - 1016.

Hadar, U., & Butterworth, B. (1997). Iconic gestures, imagery, and word retrieval in speech. *Semiotica, 115*, 147 – 172.

Hadar, U., & Krauss, R. (1999). Iconic gestures: The grammatical categories of lexical affiliates. *Journal of Neurolinguistics, 12*, 1 - 12.

Hahimoto, N., & Frome, A. (2011). The use of a modified semantic features analysis approach in aphasia. *Journal of Communication Disorders, 44*, 459 – 469.

Heeschen, C., & Schegloff, E.A. (1999). Agrammatism, adaptation theory, conversation analysis : on the role of so-called telegraphic style in talk-ininteraction. *Aphasiology, 13*(4/5), 365 - 405.

Hengst, J.A., Frame, S.R., Neuman-Stritzel, T., & Gannaway, R. (2005). Using others' words: conversational use of reported speech by individuals with aphasia and their communication partners. *Journal of Speech, Language and Hearing Research, 48*(1), 137 - 156.

Herbert, R., Best, W., Hickin, J., Howard, D., & Osborne, F. (2003). Combining lexical and interactional approaches to therapy for word finding deficits in aphasia. *Aphasiology, 17*(12), 1163 – 1186.

Herbert, R., Hickin, J., Howard, D., Osborne, F., & Best, W. (2008). Do picture-naming tests provide a valid assessment of lexical retrieval in conversation in aphasia? . *Aphasiology, 22*(2), 184 - 203.

Hernández-Sacristán, C., & Rosell-Clari, V. (2009). Syntax and conversation in aphasia. A strategic restrictive use of Spanish and Catalan connector QUE by aphasic speakers. *Clinical Linguistics & Phonetics, 23*(10), 717 - 741.

Hickin, J., Best, W., Herbert, R., Howard, D., & Osborne, F. (2002). Phonological therapy for word-finding difficulties: A re-evaluation. *Aphasiology, 16*(10/11), 981 - 999.

Hickin, J., Herbert, R., Best, W., Howard, D., & Osborne, F. (2006). Efficacy of treatment: Effects on word retrieval and conversation. In C.P.J.M. S. Byng (Ed.), *Second aphasia therapy file* (2nd edition ed.). Hove, UK: Psychology Press.

Hillis, A.E., & Caramazza, A. (1994). Theories of lexical processing and rehabilitation of lexical deficits. In M.J. Riddoch & G.W. Humphreys (Eds.), *Cognitive neuropsychology and cognitive rehabilitation*. Hove, UK: Lawrence Erlbaum Associates Ltd.

Hinckley, J.J., & Carr, T.H. (2001). Differential contributions of cognitive abilities to success in skill-based versus context-based aphasia treatment. *Brain and Language, 79*, 3 - 6.

Holland, A.L. (1980). *Communicative Abilities in Daily Living*. Baltimore: University Park Press.

Hopper, T., Holland, A., & Rewega, M. (2002). Conversational coaching: Treatment outcomes and future directions. *Aphasiology, 16*(7), 745 – 761.

Horton, S. (2007). Topic generation in aphasia language therapy sessions: Issues of identity. *Aphasiology, 21*, 283 - 298.

Howard, D. (2000). Cognitive neuropsychology and aphasia therapy: the case of word retrieval. In I. Papathanasiou (Ed.), *Acquired Neurogenic Communication Disorders: A Clinical Perspective* (pp. 76 - 99). London: Whurr.

Howard, D., & Patterson, K. (1992). *The Pyramids and Palm Trees Test: A test of semantic access from words and pictures*. Bury St. Edmunds, UK: Thames Valley Test Company.

Huber, W., Poeck, K., & Willmes, K. (1985). The Aachen Aphasia Test. In F.C. Rose (Ed.), *Progress in aphasiology* (pp. 291 – 303). New York: Raven.

Hussman, K., Grande, M., Meffert, E., Chistoph, S., Piefke, M., Willmes, K., & Huber, W. (2012). Computer-assisted analysis of spontaneous speech: quantification of basic parameters in aphasic and unimpiared language. *Clinical Linguistics & Phonetics, 26*(8), 661 - 680.

Hutchby, I., & Wooffitt, R. (2008). *Conversation Analysis: Principles, Practices and Applications.* . Cambridge: Polity Press.
Indefrey, P., Brown, C.M., Hellwig, F., Amunts, K., Herzog, H., & Seitz, R. (2001). *A neural correlate of syntactic encoding during speech production.* Paper presented at the Proceedings of the National Academy of Sciences of the United States of America.
Jones, E.V. (1986). Building the foundations for sentence production in a non-fluent aphasic. *British Journal of Disorders of Communication, 21*, 63 – 82.
Jordan, F., Ward, K., & Cremona-meteyard, S. (1997). Word-finding in the conversational discourse of children with closed head injury. *Aphasiology, 11*(9), 877 - 888.
Kay, J., Lesser, R., & Coltheart, M. (1992). *Psycholinguistic Assessments of Language Processing in Aphasia (PALPA)*. Hove, UK: Lawrence Erlbaum Associates Ltd.
Kegl, J. (1995). Levels of representation and units of access relevant to agrammatism. *Brain and Language, 50*, 151 - 200.
Kellas, J.K., & Trees, A.R. (2006). Finding meaning in difficult family experiences: Sense-making and interaction processes during joint family storytelling. *Journal of Family Communication, 6*(1), 49 - 76.
Kendon, A. (1994). Do gestures communicate? A review. *Research on Language and Social Interaction, 27*, 175 – 200.
Kirmess, M., & Lind, M. (2011). Spoken language production as outcome measurement following constraint induced language therapy. *Aphasiology, 25*(10), 1207 - 1238.
Kirmess, M., & Maher, L.M. (2010). Constraint induced language therapy in early aphasia rehabilitation. *Aphasiology, 24*(6 - 8), 725 - 736.
Kolk, H. (1995). A time-based approach to agrammatic production. *Brain and Language, 50*, 282 – 303.
Kolk, H.H.J., & van Grunsven, M.M.F. (1985). Agrammatism as a variable phenomenon. *Cognitive Neuropsychology, 2*, 347 – 384.
Labov, W. (1972). The transformation of experience in narrative syntax. In W. Labov (Ed.), *Language and the inner city*. Philadelphia: University of Pennsylvania.
Lambon Ralph, M.A., Snell, C., Fillingham, J.K., Conroy, P., & Sage, K. (2010). Predicting the outcome of anomia therapy for people with aphasia post CVA: Both language and cognitive status are key predictors *Neuropsychological Rehabilitation, 20*, 289 - 305.
Larfeuil, C., & Le Dorze, G. (1997). An analysis of the word-finding difficulties and of the content of the content of the discourse of recent and chronic aphasic speakers. *Aphasiology, 11*(8), 783 - 811.
Lasker, J., & Beukelman, D.R. (1999). Peers' perceptions of storytelling by an adult with aphasia. *Aphasiology, 13*, 857 - 869.
Lee, M., & Thompson, C.K. (2004). Agrammatic aphasic production and comprehension of unaccusative verbs in sentence contexts. *Journal of Neurolinguistics, 17*(4), 315 - 330.
Lehnen, J., Anderson, S., Raymer, A.M., Blonder, L.X., & Rothi, L.J.G. (2006). *Conversational outcomes of word retrieval training in aphasia: Nouns and verbs.* Paper presented at the The annual convention of the American Speech-Language-Hearing Association, Miami, Florida.
Lindsay, J., & Wilkinson, R. (1999). Repair sequences in aphasic talk: a comparison of aphasic-speech and language therapist and aphasic-spouse conversations. *Aphasiology, 13*, 305 - 325.
Linebarger, M.C., Romania, J.F., Fink, R.B., Bartlett, M.R., & Schwartz, M.F. (2008). Building on residual speech: A portable processing prosthesis for aphasia. *Journal of Rehabilitation Research & Development, 45*(9), 1401 – 1414.
Linebarger, M.C., Romania, J.R., Kohn, S.E., Schwartz, M.F., & Locatelli, D. (1998). *Competence versus performance in agrammatic production: Evidence from an augmentative communication system*. Paper presented at the The annual meeting of the Academy of Aphasia, Santa Fe, NM.
Lomas, J., Pickard, L., Bester, S., Elbard, H., Finlayson, A., & Zoghaib, C. (1989). The Communication Effectiveness Index: Development and psychometric evaluation of a

functional communication measure for adults. *Journal of Speech and Hearing Disorders, 54*, 113 - 124.
Lubinski, R. (1978-1979). Why so little interest in whether or not old people talk? A review of recent research on verbal communication among the elderly. *International Journal of Aging and Human Development, 9*, 237 - 245.
Manning, L., & Warrington, E.K. (1996). Two routes to naming: A case study. *Neuropsychologia, 34*(8), 809 – 817.
Maouene, J., Laakso, A., & Smith, L.B. (2011). Object associations of early-learned light and heavy English verbs. *First Language, 31*, 109 - 132.
Marangolo, P., Bonifazi, S., Tomaiuolo, F., Craighero, L., Coccia, M., Altoè, G., . . . Cantagallo, A. (2010). Improving language without words: First evidence from aphasia. *Neuropsychologia 48* 3824 – 3833.
Marcotte, K., Adrover-Roig, D., Damien, B., de Préaumont, M., Généreux, S., Hubert, M., . . . Ansaldo, A.I. (2010). Functional integration of Semantic Feature Analysis therapy in chronic aphasia. *Procedia Social and Behavioural Sciences, 6*, 39 - 40.
Marshall, J. (1995). The mapping hypothesis and aphasia therapy. *Aphasiology, 9*(6), 517 - 539.
Marshall, J. (2002). The assessment and treatment of sentence processing disorders: A review of the literature. . In A. Hillis (Ed.), *Handbook on adult language disorders: Integrating cognitive neuropsychology, neurology and rehabilitation*. New York: Psychology Press.
Marshall, J. (2009). Framing ideas in aphasia: the need for thinking therapy. *International Journal of Language & Communication Disorders, 44*(1), 1 - 14.
Marshall, J., & Cairns, D. (2005). Therapy for sentence processing problems in aphasia: Working on thinking for speaking. *Aphasiology, 19*(10), 1009 - 1020.
Marshall, J., Pring, T., & Chiat, S. (1998). Verb retrieval and sentence production in aphasia. *Brain and Language, 63*, 159 – 183.
Mason, C., Nickels, L., McDonald, B., Moses, M., Makin, K., & Taylor, C. (2011). Treatment of word retrieval impairments in aphasia: Evaluation of a self-administered home programme using personally chosen words. *Aphasiology, 25*(2), 245 - 268.
Massaro, M.E., & Tompkins, C.A. (1992). Feature analysis for treatment of communication disorders in traumatically brain injured patients: an efficacy study. *Clinical Aphasiology, 22*, 245 - 256.
Mayer, J., & Murray, L. (2003). Functional measures of naming in aphasia: Word retrieval in confrontation naming versus connected speech. *Aphasiology, 17*(5), 481 - 497.
McAdams, D.P. (2001). The psyhology of life stories. *Review of General Psychology, 5*(2), 100 - 122.
McCann, C., & Doleman, J. (2011). Verb retrieval in nonfluent aphasia: A replication of Edwards & Tucker, 2006 *Journal of Neurolinguistics 24* 237 – 248.
McCarthy, R., & Warrington, E. (1985). Category specificity in an agrammatic patient: The relative impairment of verb retrieval and comprehension. *Neuropsychologia, 23*, 709 – 727.
McNeil, M.R., Robin, D.A., & Schmidt, R.A. (2008). Apraxia of speech: Definition and differential diagnosis. In M.R. McNeil (Ed.), *Clinical Management of Sensorimotor Speech Disorders* (2nd Edition ed.). New York: Thieme Medical Publishers.
McNeill, D. (1985). So you think gestures are nonverbal? . *Psychological Review, 92*, 350 – 371.
McRae, K., Hare, M., Elman, J.L., & Ferretti, T.R. (2005). A basis for generating expectancies for verbs from nouns. *Memory and Cognition, 33*(7), 1174 – 1184.
Meyers, J.E., & Meyers, K.R. (1995). *Rey Complex Figure Test and Recognition Trial*. New York: Psychological Assessment Resources Inc.
Miceli, G., Amitrano, A., Capasso, R., & Caramazza, A. (1996). The treatment of anomia resulting from output lexical damage: Analysis of two cases. *Brain & Language, 52*, 150 – 174.

Miller, J., & Chapman, R. (2000). *Systematic Analysis of Language Transcripts (SALT) [Computer software, SALT for Windows, Research Version 6.1]*. Madison: University of Wisconsin, Language Analysis Lab.

Miller, J.F., & Chapman, R.S. (1991). *SALT: A computer program for the systematic analysis of language transcripts*. Madison, WI: University of Wisconsin.

Mitchum, C.C., & Berndt, R.S. (1992). Verb retrieval and sentence construction: Effects of targeted intervention. In G. Humphreys & J. Riddoch (Eds.), *Cognitive neuropsychology and cognitive rehabilitation*. Hove, UK: Lawrence Erlbaum Associates Ltd.

Mitchum, C.C., & Berndt, R.S. (1994). Verb retrieval and sentence construction: Effects of targeted intervention. In M.J. Riddoch & G.W. Humphrey (Eds.), *Cognitive neuropsycholoy and cognitive rehabilitation*. Hover: Lawrence Erlbaum Associates.

Mitchum, C.C., & Berndt, R.S. (2001). Cognitive neuropsychological approaches to diagnosing and treating language disorders: Production and comprehension of sentences. In R. Chapey (Ed.), *Language intervention strategies in aphasia and related neurogenic communication disorders* (pp. 551 – 571). Baltimore, MD: Williams & Wilkins.

Mitchum, C.C., & Berndt, R.S. (2008). Testing the interplay of structure and meaning in aphasic sentence production. *Aphasiology, 22*(7), 853 - 865.

Mitchum, C.C., Greenwald, M.L., & Berndt, R.S. (2000). Cognitive treatments of sentence processing disorders: What have we learned? *Neuropsychological Rehabilitation, 10*(3), 311 - 336.

Mitchum, C.C., Haendiges, A.N., & Berndt, R.S. (1993). Model-guided treatment to improve written sentence production: A case study. *Aphasiology 7*, 71 – 109.

Morris, J., Franklin, S., Menger, F., & GD. (2011). Returning to work with aphasia, A case study. *Aphasiology, 25*(8), 890 - 907.

Morsella, E., & Krauss, R. (2004). The role of gestures in spatial working memory and speech. *American Journal of Psychology, 117*, 411 – 424.

Nicholas, L.E., & Brookshire, R.H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech and Hearing Research, 36*, 338 – 350.

Nickels, L. (2002a). Improving word finding: Practice makes (closer to) perfect? . *Aphasiology, 16*(10), 1047 - 1060.

Nickels, L. (2002b). Theoretical and methodological issues in the cognitive neuropsychology of spoken word production. *Aphasiology, 16*(1 - 2), 3 - 19.

Nickels, L. (2002c). Therapy for naming disorders: Revisiting, revising, and reviewing. *Aphasiology, 16*(10-11), 935 - 979.

Nickels, L., & Best, W. (1996). Therapy for naming disorders (Part I): Principles, puzzles and progress. *Aphasiology, 10*(1), 21 - 47.

Nickels, L., Byng, S., & Black, M. (1991). Sentence processing deficits: A replication of therapy. *British Journal of Disorders of Communication, 26*, 175 – 199.

Ninio, A. (1999). Pathbreaking verbs in syntactic development and the question of prototypical transitivity. *Journal of Child Language, 26*, 619 – 653.

Norrick, N.R. (2000). *Conversational narrative: Storytelling in everyday talk*. Amsterdam, Philadelphia: John Benjamins Pub.

Ochfeld, E., Newhart, M., Molitoris, J., Leigh, R., Cloutman, L., Davis, C., . . . Hillis, A.E. (2010). Ischemia in Broca area is associated with Broca aphasia more reliably in acute than in chronic stroke. *Stroke, 41*, 325 - 330.

Oelschlaeger, M.L., & Thorne, J.C. (1999). Application of the correct information unit analysis to the naturally occurring conversation of a person with aphasia. *Journal of Speech, Language, and Hearing Research, 42*(3), 636 - 648.

Olness, G. (2007). *Narrative Structure in Aphasia: Impact of Task and Aphasia Severity*. Paper presented at the 37th Clinical Aphasiology Conference, Scottsdale, AZ.

Page, S.J., & Harnish, S. (2012). Thinking about better speech: Mental practice for stroke-induced motor speech impairments. *Aphasiology, 26*(2), 127 – 142.

Pashek, G.V., & Tompkins, C.A. (2002). Context and word class influences on lexical retrieval in aphasia. *Aphasiology, 16*(3), 261 - 286.
Peach, R.K., & Reuter, K.A. (2010). A discourse-based approach to semantic feature analysis for the treatment of aphasic word retrieval failures *Aphasiology 24*(9), 971 - 990.
Penn, C. (2000). Paying attention to conversation. *Brain and Language, 71*, 185 - 189.
Perkins, L., Crisp, J., & Walshaw, D. (1999). Exploring conversation analysis as an assessment tool for aphasia: the issue of reliability. *Aphasiology, 13*, 259 - 281.
Pinker, S. (1989). *Learnability and cognition: The acquisition of argument structure*. Cambridge, MA: MIT Press.
Prins, R., & Bastiaanse, R. (2004). Analysing the spontaneous speech of aphasic speakers. *Aphasiology, 18*(12), 1075 - 1091.
Pulvermuller, F., & Berthier, M. (2008). Aphasia therapy on a neuroscience basis. *Aphasiology, 22*(6), 563 - 599.
Ramsberger, G., & Menn, M. (2003). Co-Constructing Lucy: Adding a Social Perspective to the Assessment of Communicative Success in Aphasia. In G. Goodwin (Ed.), *Conversation and Brain Damage*. New York: Oxford University Press.
Ramsberger, G., & Rende, B. (2002). Measuring transactional success in the conversation of people with aphasia. *Aphasiology, 16*(3), 337 - 353.
Randall, W. (2001). Acquiring a narrative perspective on aging, identity and everyday life. In G. Kenyon, P. Clark & B. de Vries (Eds.), *Narrative gerontology: Theory, research and practice* (pp. 31 - 62). New York: Springer.
Raven, J., Raven, J.C., & Court, J.H. (1998). *Raven manual: Section 1 general overview*. Oxford, UK: Oxford Pyschologists Press Ltd.
Raymer, A.M., & Ellsworth, T.A. (2002). Response to contrasting verb retrieval treatments: A case study. *Aphasiology, 16*(10/11), 1031 – 1045.
Raymer, A.M., Kohen, F., Blonder, L.X., Douglas, E., Sembrat, J.L., & Rothi, L.J.G. (2007). Effects of gesture and semantic-phonologic treatments for noun retrieval in aphasia. *Brain and Language 103* 8 – 249.
Raymer, A.M., Singletary, F., Rodriguez, A., Ciampitti, M., Heilman, K.M., & Gonzalez Rothi, L.J. (2006). Effects of gesture+verbal treatment for noun and verb retrieval in aphasia. *Journal of the International Neuropsychological Society, 12*(867 – 882).
Reichman-Novak, S., & Rochon, E. (1997). Treatment to improve sentence production: A case study. *Brain and Language, 60*, 102 – 105.
Rider, J.D., Harris-Wright, H., Marshall, R.C., & Page, J.L. (2008). Using semantic feature analysis to improve contextual discourse in adults with aphasia. *American Journal of Speech-Language Pathology, 17*, 161–172.
Riessman, C.K. (1993). *Narrative analysis*. Thousand Oaks, CA: Sage.
Robertson, I.H., Ward, T., Ridgeway, V., & Nimmo-Smith, I. (1994). *The Test of Everyday Attention (TEA)*. Bury St. Edmunds, UK: Thames Valley Test Company.
Rochon, E., Laird, L., Bose, A., & Scofield, J. (2005). Mapping therapy for sentence production impairments in nonfluent aphasia. *Neuropsychological Rehabilitation, 15*(1), 1 - 36.
Rose, M., & Douglas, J. (2001). The differential facilitatory effect of gesture and visualization processes on object naming in aphasia. *Aphasiology, 15*, 977 – 990.
Rose, M., & Douglas, J. (2008). Treating a semantic word production deficit in aphasia with verbal and gesture methods. *Aphasiology, 22*(1), 20 - 41.
Rose, M., Douglas, J., & Matyas, T. (2002). The comparative effectiveness of gesture and verbal treatments for a specific phonologic naming impairment. *Aphasiology, 16*(10 - 11), 1001 - 1030.
Rose, M., & Sussmilch, G. (2008). The effects of semantic and gesture treatments on verb retrieval and verb use in aphasia. *Aphasiology, 22*(7), 691 - 706.
Rose, M.L. (2006). The utility of arm and hand gestures in the treatment of aphasia. *Advances in Speech–Language Pathology, 8*(2), 92 – 109.

Ruiter, M.B., Kolk, H.H.J., & Rietveld, T.C.M. (2010). Speaking in ellipses: The effect of a compensatory style of speech on functional communication in chronic agrammatism. *Neuropsychological Rehabilitation, 20*(3), 423 - 458.
Rumelhart, D.E. (1975). Notes on a schema for stories. In D.G. Bobrow & A. Collins (Eds.), *Representation and Understanding: Studies in Cognitive Science* (pp. 211 – 236). New York, NY: Academic Press.
Ryan, E.B., Giles, H., Bartolucci, G., & Henwood, K. (1986). Psycholinguistic and social psychological components of communication by and with the elderly. *Language and Communication 6*, l - 24.
Sacks, H., Schegloff, E.A., & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking in conversation. *Language, 50*(4), 696 - 735.
Saffran, E., & Schwartz, M. (1988a). 'Agrammatic' comprehension it is not: alternatives and implications. *Aphasiology, 2*, 389 - 394.
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.
Saffran, E.M., & Schwartz, M.F. (1988b). Agrammatic comprehension it's not: Alternatives and implications. *Aphasiology, 2*, 389 – 394.
Saffran, E.M., Schwartz, M.F., & Marin, O. (1980). The word order problem in agrammatism: Production. *Brain and Language, 10*, 263 – 280.
Salis, C., & Edwards, S. (2004). Adaptation theory and non-fluent aphasia in English. *Aphasiology, 18*(12), 1103 - 1120.
Sarno, M.T. (1993). Aphasia rehabilitation: Psychosocial and ethical considerations. *Aphasiology, 7*(4), 321 - 334.
Schegloff, E.A., Jefferson, G., & Sacks, H. (1977). The preference for self-correction in the organization of repair in conversation. *Language, 53*, 361 - 382.
Schlenck, K.J., Schlenck, C., & Springer, L. (1995). *Die Behandlung des schweren Agrammatismus - Reduzierte-Syntax-Therapie (REST)*. Stuttgart: Thieme.
Schwartz, M.F., Linebarger, M.C., Saffran, E.M., & Pate, D.S. (1987). Syntactic transparency and sentence interpretation in aphasia. *Language and Cognitive Processes, 2*, 85 - 113.
Schwartz, M.F., Saffran, E.M., Fink, R.B., Myers, J.L., & Martin, N. (1994). Mapping therapy: A treatment programme for agrammatism. *Aphasiology, 8*(1), 19 - 54.
Sherratt, S. (2007). Multi-level discourse analysis: A feasible approach. *Aphasiology, 21*(3), 375 - 393.
Silveri, M.C., Salvigni, B.L., 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.
Simmons-Mackie, N., Kearns, K., & Potechin, G. (2005). Treatment of aphasia through family member training. *Aphasiology, 19*(6), 583 - 593.
Springer, L., Huber, W., Schlenck, K.J., & Schlenck, C. (2000). Agrammatism: Deficit or compensation? Consequences for aphasia therapy. *Neuropsychological Rehabilitation 10*(3), 279 - 309.
Strauss, E., Sherman, E.M.S., & Spreen, O. (2006). *A Compendium of neuropsychological tests: Administration, norms, and commentary* (3rd ed.). NY: Oxford University Press.
Swinburn, K., & Byng, S. (2006). *The Communication Disability Profile*. London: Connect.
Swinburn, K., Porter, G., & Howard, D. (2004). *Comprehensive Aphasia Test (CAT)*: Routledge, Psychology Press.
Thompson, C.K. (1989). Generalization research in aphasia: A review of the literature. In T.E. Prescott (Ed.), *Clinical aphasiology* (Vol. 18, pp. 195 – 222). Boston: College-Hill Publication, Little, Brown and Company.
Thompson, C.K. (2008). Treatment of syntactic and morphological deficits in agrammatic aphasia: Treatment of underlying forms. In R. Chapey (Ed.), *Language intervention strategies in aphasia and related neurogenic communication disorders* (5th ed ed., pp. 735 - 753). Baltimore, MD: Williams & Wilkins.

Thompson, C.K., Shapiro, L.P., Li, L., & Schendel, L. (1995). Analysis of verbs and verb-argument structure. A method for quantification of aphasic language production. *Clinical Aphasiology 23*, 121 – 140.

Thompson, C.K., Shapiro, L.P., & Roberts, M.M. (1993). Treatment of sentence production deficits in aphasia: A linguistic-specific approach to wh-interrogative training and generalization *Aphasiology, 7*(1), 111 - 133.

Tu, L.V., Togher, L., & Power, E. (2011). The impact of communication partner and discourse task on a person with traumatic brain in jury: the use of multiple perspectives *Brain Injury, 25*(6), 560 - 580.

Turner, S., & Whitworth, A. (2006). Conversational partner training programmes in aphasia: A review of key themes and participants' roles. *Aphasiology, 20*(6), 483 – 510.

van de Sandt-Koenderman, M.E., van der Meulen, I., & Ribbers, G.M. (2012). Aphasia Rehabiltiation, More than treating the language disorder. *Archives of Physical Medicine and Rehabilitation, 93*(Suppl), S1 - 3.

Van De Sandt-Koenderman, W.M.E., Bonta, E., Wielaert, S.M., & Visch-brink, E.G. (1997). Stimulating sentence production in agrammatic patients: The effect of the Visual Cue Programme on spontaneous speech. *Aphasiology, 11*(8), 735 - 759.

Vermeulen, J., Bastiaanse, R., & Van Wageningen, B. (1989). Spontaneous speech in aphasia: A correlational study. *Brain and Language, 36*, 252 - 274.

Wambaugh, J.L., Doyle, P.J., Martinez, A.L., & Kalinyak-Fliszar, M. (2002). Effects of two lexical retrieval cueing treatments on action naming in aphasia. *Journal of Rehabilitation Research and Development, 39*(4), 455 - 466.

Wambaugh, J.L., & Ferguson, M. (2007). Application of semantic feature analysis to retrieval of action names in aphasia. *Journal of Rehabilitation Research & Development, 44*, 381 – 394.

Webster, J., & Gordon, B. (2008). Contrasting therapy effects for verb and sentence processing difficulties: A discussion of what worked and why. *Aphasiology, 23*(10), 1231 - 1251.

Webster, J., Morris, J., & Franklin, S. (2005). Effects of therapy targeted at verb retrieval and the realisation of the predicate argument structure: A case study. *Aphasiology, 19*(8), 748 – 764.

Webster, J., & Whitworth, A. (2012). Treating verbs in aphasia, exploring the impact of therapy at the single word and sentence levels. *International Journal of Language and Communication Disorders, 47*(6), 619 - 636.

Weinrich, M., McCall, D., Boser, K.I., & Virata, T. (2002). Narrative and Procedural Discourse Production by Severely Aphasic Patients. *Neurorehabilitation and Neural Repair, 16*(3), 249 - 274.

Weinrich, M., Shelton, J.R., McCall, D., & Cox, D.M. (1997). Generalization from single sentence to multisentence production in severely aphasic patients. *Brain and Language, 58*, 327 – 352.

Whitworth, A. (2010). Using narrative as a bridge: Linking language processing models with real-life communciation. *Seminars in speech and language, 31*(1), 64 - 75.

Wierenga, C.E., Maher, L.M., Moore, A.B., White, K.D., McGregor, K., Soltysik, D.A., . . . Crosson, B. (2006). Neural substrates of syntactic mapping treatment: an fMRI study of two cases. . *Journal of the International Neuropsychological Society, 12*, 132 – 146.

Wilkinson, R., Bryan, K., Lock, S., & Sage, K. (2010). Implementing and evaluating aphasia therapy targeted at couples' conversations: A single case study. *Aphasiology, 24*(6 - 8), 869 - 886.

Wilkinson, R., Lock, S., Bryan, K., & Sage, K. (2011). Interaction-focused intervention for acquired language disorders: Facilitating mutual adaptation in couples where one partner has aphasia. *International Journal of Speech and Language Pathology, 13*(1), 74 - 87.

Wilshire, C.E., & McCarthy, R.A. (2002). Evidence for a context-sensitive word retrieval disorder in a case of non-fluent aphasia. *Cognitive Neuropsychology, 19*(2), 165 – 186.

World Health Organization: International Classification of Functioning, Disability and Health (ICF). (2001).

http://www.makaton.org.

http://www.youtube.com.

Zingeser, L.B., & Berndt, R.S. (1990). Retrieval of nouns and verbs in agrammatism and anomia. *Brain and Language, 39*, 14–32.

Appendix 1: Summary of the methods throughout the three therapy studies (Chapters 4 – 6)

Study	Verb retrieval therapy (N = 9)		Syntactic construction therapy (N = 9)		Interactive storytelling therapy (N = 4)	
	Pre-therapy	**Post-therapy**	**Pre-therapy**	**Post-therapy**	**Pre-therapy**	**Post-therapy**
Assessments	• Background assessments • Assessment using the OANB, IPNP, LVET and PR verbs • Conversation	• LVET • Conversation	• Syntactic construction in response to stimuli from the OANB and IPNP • Sentence comp. and production (VAST subtests) • Conversation	• Sentence comp. and production (VAST subtests) • Conversation	Conversation	Conversation
Stimuli for outcome measures	Eighty verbs which had been failed twice on baseline assessment were spilt between treatment (N = 40) and control sets (N = 40). In each set, stimuli was sourced from the OANB/IPNP (N = 30), light verbs (N = 5) and PR verbs (N = 5)		Forty items were split between treatment (N = 20) and control sets (N = 20). These items spanned a range of accuracy scores on baseline assessment (typically ranging from 30% - 50% of the maximum score)		1 x simple video narrative 1 x complex video narrative	
Timeframe	Within a month before therapy started	1-week and 1-month post-therapy	Within a month before therapy started	1-week and 1-month post-therapy	Within a month before therapy started	1-week post-therapy conversation data sampled over 4 weeks
Measures	• Retrieval of treated verbs • Retrieval of control verbs • Syntactic construction (VAST subtest) • Verbs as a proportion of total words produced in conversation		• Syntactic construction for treated items, • Syntactic construction for control items • Verb phrases as a proportion of all utterances in connected speech tasks and conversation • Verbs in isolation as a proportion of total content words produced in isolation in connected speech tasks and conversation		• Group: number of main ideas reported by each communication partner in their retelling of the story (based on control participants' salient content words) • Case study: i) analysis of the specific behaviours that contributed to changes in transactional success; ii) qualitative investigation of everyday conversation	

Appendix 2: Baseline picture description of the Cookie Jar Theft (Goodglass et al., 2001) by nine participants

Participant	Picture description
KK	Ehm… chairs… boy… gi- girls… eh… eh… no [you're pointing to this yeah] yeah… [bɒl]… ehm… don't know… [so can you tell me about what's happening here?]… dunno [ok]… [is there anything else in the picture that you can tell me about?] this one… dunno… drip ehm [partner: I think he said drip] drip… right that's it
GL	… k- ehm… two… ehm… [can you start by telling me who is in the picture?] very hard… it… it's not no… ehm…
BL	Chocolate… stool… eh… oh… oh… shoes… foot [æðə] funnel… ehm… garden… oh… eh… yes oh… oh eh oh… oh bloody hell grrr… ehm… saucer [ælə]… saucer eh… table no… oh… cake! [ah good]… phew! [good well done] yes [yeah]… kitchen… cuppa tea… saucer… [mhmm and what's happening in this picture? What's going on?] ehmm… oh [so let's look at here… what's happening here?] sugar… no biscuits [mhmm]… k- eh… oh… chocolate… [yeah and what are they doing?]… ehmm… no… [ok]… nothing [that's alright, ok. What about here? What's she doing?]… [ælə] no ((gestures)) [what was that? Drinking? Is she having something to drink?] no eh… ehm… oh… [something with the… with the plate] cup a t- no… what? [with the plate?] plate [yeah] eh house no… head head [yeah yeah]… [what's happening here?] yes [what's happening?]… [æðə] tap… sssssssssh sssssssssh [yeah]… puddle
DC	Water… water and ehm… the girl and boys and… cookie jar… but in the… chair… gonna go whoop whoops… that's it really… (what's happening here?) the eh… hold ah hot going sssh… she want turn it off… (what's she doing?) woman is eh drying and that's it
JH	Ehm cookie jar… ehm ehm… ehm… stool… ehm… ehm… ehm… ehm… eh rush rush I don't know and ehm… eh I don't know ehm… brrrr ehm… eh… oh dear… ehm… water water… and… ehm plates… ehm… curtains… ehm… I don't know ehm ehm… ehm… boy… ehm girl… ehm… ehm… I don't know… [can you tell me anything about what's happening?]… cookie jar ehm… ehm… reach… reach ehm… eh ehm… stool… rush… ha! ((laughs))… and then… I don't know…
AT	Right… ehm… a boy… cooking jars… and it's ehm… not not cooking… ehm… eh… washing… a man is… outspilling… [mhmm] outspilling and… I don't know… oh I don't know ((sits back)) [What's she doing?]… ehm… no gone… [ok what's] it's gone… [ok what do you think will happen here?] no it's cooking [yeah]… cookie jar [yeah and what do you think it about to happen?] well it's over… over… spilling the the cookie jar [good anything else?]… dunno… washing that's it… washing dishes… no
PM	Oh eh woman is washing… eh cups and that and ehm… eh ehm… eh… no… children are ehm… is ehm… is lad and eh cooking jar… is ehm br- eh sister

	and… eh tap a taps running over…no
PG	Cookie jar… ehm… boy and a girl… eh stepping off… a mother a fa- eh… eh… never mind eh a mother… washing up… down the… drain… eh along the… overflow… overflowing ehm… washing up the dishes… two… piece of… pl- eh the piece of pla… the… sandw- eh… sandwich?… ehm… [you were saying sandwich there, is that not the word you were looking for?]… not not the right word… cup cup cup yes cup cup … eh plate… garden… flower? no flowers… not flowers ehm… window… window... garden… [good and can you tell me anything else about what's happening?]… ah!… eh pl- eh fell over… falling over… and… c-… cookie jar falling over too… ehm… [anything else about the mum? about the mother?] plate… dish wa- eh dish… dish eh… dish [and what's she doing?]… drying the dishes drying the dishes… drying the dishes…
DM	stool or… off the eh… children… cupboard… reach ehm… kitchen… man… no… woman… washing… flood… tap… thee ehm… window… thee… pots… cleaning… cookie jar… [and what's happening here?] [æsɪdənt]… [an accident?] yeah well… just! yeah… stool… climb… [and what about over here? What's she doing?] washing and… flood… tap…

Appendix 3: Description of background assessments

Lexical retrieval (single word level)

1. The Boston Naming Test (Goodglass, et al., 2001) consists of 60 line drawings of objects, arranged in decreasing familiarity. Only those items named correctly within 10 seconds of presenting the stimulus were scored as correct. Outside of this window, a semantic cue was offered followed by a phonemic cue, but the response was scored as incorrect.

2. The OANB (Druks & Masterson, 2000) verb subset consists of 100 line drawings of actions. Participants were required to provide one word to describe each stimulus picture.
3. The VAST (Bastiaanse, et al., 2002) includes a range of subtests on verb production, i.e., single word production and filling in finite/infinite verbs in sentence context.

Phonological output (single word level)

1. PALPA 9 (Kay, et al., 1992): repetition of 80 words and 80 non-words. Target words are presented orally while the examiner covers his/her lips to prevent lip-reading. The words for repetition are counterbalanced for imageability and frequency.
2. PALPA 31 (Kay, et al., 1992): reading aloud 80 words which are counterbalanced for frequency and imageability. The items tested on PALPA 9 (repetition) and PALPA 31 (reading) are the same, allowing for comparison of phonological skills across modalities.

Semantic skills (single word level)

1. Pyramids and Palm Trees (Howard & Patterson, 1992) three-picture version consists of 52 sets of objects. Participants match one picture to a choice from two based on semantic relatedness; for example, the participant is presented with a picture of '*pyramid'* with a choice of selecting the closest semantic item from a (pictorial) choice of '*palm tree'* and '*fir tree'*.
2. The Kissing and Dancing Test (Bak & Hodges, 2003) uses the same format outlined above to examine understanding of verb meaning. This assessment consists of 52 picture sets of verbs to match one picture from a choice of two; for example, the

participant is presented with a picture of '*kissing'* with a choice of selecting the closest semantic item from a (pictorial) choice of '*dancing'* and '*running'*.

Auditory comprehension (single verbs and sentences)

1. Subtests from the VAST (Bastiaanse, et al., 2002) include single word verb comprehension, sentence comprehension and judgement of the semantic plausibility of sentences.

Executive and attention skills

1. The Wisconsin Card Sorting Test (Grant & Berg, 1993) is designed to investigate problem solving and cognitive flexibility. Participants are presented with a succession of cards and are asked to sort each card into one of four groups. After every response, participants receive feedback on the accuracy of their sorting. Throughout the assessment, the criterion for sorting the cards shifts from one of three parameters – colour, number and shape. Thus, participants are required to continually shift sets based on environmental feedback; thus, this test is sensitive to the presence of cognitive perseveration.
2. Two subtests from the Test of Everyday Attention (TEA, Robertson, et al., 1994) were selected to measure participants' sustained and divided attention. In the 'elevator counting' subtest, participants are asked to listen to a series of tones which are presented at irregular intervals, and count how many tones they hear. In the second subtest, a distraction element is introduction: participants are asked to listen to a series of tones which consist of high-pitch and low-pitch tones, and to count only the low-pitch tones. In order to eliminate the potential interference of any spoken production problems, a list of numbers is presented in written format for each subtest.
3. The Brixton Spatial Anticipation Test (Burgess & Shallice, 1997) is an assessment of rule attainment. Thus, it is similar to the WCST (Grant & Berg, 1993), with the exception that the rules do not relate to a perceptual aspect of the stimuli. The participant is presented with a 56-page booklet with each page displaying a series of 10 circles arranged over two rows and numbered 1-10. In each series of circles, one circle is coloured blue; as the location of the blue circle changes from page to page, the participant is required to infer which rule is governing the choice of next placement for the blue circle. Participants are advised that the rule can change at any given time without warning.

4. Raven's Coloured Progressive Matrices (CPM, Raven, et al., 1998) investigates reasoning in the visual modality and was designed to be used with children, older people and clinical populations. The test consists of three sets (A, Ab, B) which contain 12 items each. In Set A, participants are required to select a patterned tile (from a choice of six) that is continuous with a larger pattern; items are arranged hierarchically in increasing perceptual difficulty (Strauss, Sherman, & Spreen, 2006). In sets Ab and B, each series consists of four parts, in which one part has been omitted; participants are required to complete the series from a choice of six potential responses. As participants progress through the Ab and B sets, the problems presented gradually shift from forming a coherent whole (or gestalt) to symbols in an analogies test (Strauss, et al., 2006).

Memory skills were assessed using the following:

1. The Rey Complex Figure Test (Meyers & Meyers, 1995) consists of subtests of copying, immediate recall and delayed recall of the stimulus figure. The examiner scores each component part of the reproduced figures on the accuracy of the drawing as well as the placement of the component part in relation to the overall figure.

Appendix 4: Light Verb Elicitation Test (Conroy, unpublished)

Instructions: The tester reads aloud each sentence/excerpt from the accompanying stimuli document, using an obvious pause to indicate the gap. Then, ask the person being tested to read the sentence/excerpt silently and suggest a word to go into the gap so that the sentence will make sense. Correct response scores 1.

Stimuli:

1. When Sam heard the tickets were half-priced, he decided he would _____ to the concert after all.
2. Aisling just didn't know what to _____about her problem.
3. You don't always _____ what you want in life.
4. Rachel was horrified when the cash-point told her she did not _____ enough money in her account.
5. Let's not _____ hasty. We need to think this through.
6. Will you _____ and see me when I move to London?
7. I wouldn't _____ it a second thought.
8. Karen couldn't cope with the new litter of puppies. So she asked Tony to _____ them off her hands.
9. His Dad told Freddy that he should only _____ a promise if he knew he could keep it.
10. I didn't get the job. They don't think I _____ what it takes.
11. The neighbour was so annoyed about the ball going into his garden, that he refused to _____ it back to Jack.
12. I must try to _____ kinder to my sister.
13. Raymond is a very neat and tidy child. He will always _____ his bed before he comes down for breakfast.
14. Sheila was desperate for a cup of tea so went straight into the kitchen to _____ the kettle on.
15. I must _____ you out for Sunday Lunch sometime.
16. You need to be more independent. I can't _____ everything for you.
17. We are all off on holiday. Why don't you _____ with us.

18. It was a cold day. Dave reminded his son Michael to _____ some gloves on for the walk to school.

19. Next year, I will _____ on holiday, no matter what.

20. There are easier ways to _____ money, but Frank loves his job.

21. The teachers need to keep an eye on Tom as he can often ____ advantage of younger children.

22. He doesn't seem to _____ a damn about it anymore.

23. Naz remembered she had no food at home and she needed to _____ to the supermarket.

24. The best advice in a fire is to _____ everyone out and then call the fire brigade.

25. I would love to _____ a fly on the wall when they discuss that.

26. Sophie didn't want to _____ children before her thirties.

27. Why don't we stay here and they can _____ to us

28. The best way to cope with exam pressure is to tell yourself that all you can

    _____ is your best.

29. Pat saw Jackie buying a drink but told her to _____ her money away, as this round was on him.

30. He'll _____ what's coming to him in the long run

Score sheet:

NAME: Date:	TARGET:	RESPONSE:	SCORE:
1. When Sam heard the tickets were half-priced, he decided he would _____ to the concert after all.	Go		
2. Aisling just didn't know what to _____ about her problem.	Do		
3. You don't always _____ what you want in life.	Get		
4. Rachel was horrified when the cash-point told her she did not _____ enough money in her account.	Have		
5. Let's not _____ hasty. We need to think this through.	Be		
6. Will you _____ and see me when I move to London?	Come		
7. I wouldn't _____ it a second thought.	Give		
8. Karen couldn't cope with the new litter of puppies. So she asked Tony to _____ them off her hands.	Take		
9. His Dad told Freddy that he should only _____ a promise if he knew he could keep it.	Make		
10. I didn't get the job. They don't think I _____ what it takes.	Have		
11. The neighbour was so annoyed about the ball going into his garden, that he refused to _____ it back to Jack.	Give		
12. I must try to _____ kinder to my sister.	Be		
13. Raymond is a very neat and tidy child. He will always _____ his bed before he comes down for breakfast.	Make		
14. Sheila was desperate for a cup of tea so went straight into the kitchen to _____ the kettle on.	Put		
15. I must _____ you out for Sunday Lunch sometime.	Take		
16. You need to be more independent. I can't _____ everything for you.	Do		
17. We are all off on holiday. Why don't you _____ with us.	Come		

18. It was a cold day. Dave reminded his son Michael to _____ some gloves on for the walk to school.	Put		
19. Next year, I will _____ on holiday no matter what.	Go		
20. There are easier ways to _____ money, but Frank loves his job.	Make		
21. The teachers need to keep an eye on Tom as he can often ____ advantage of younger children.	Take		
22. He doesn't seem to _____ a damn about it anymore.	Give		
23. Naz remembered she had no food at home and she needed to _____ to the supermarket.	Go		
24. The best advice in a fire is to _____ everyone out and then call the fire brigade.	Get		
25. I would love to _____ a fly on the wall when they discuss that.	Be		
26. Sophie didn't want to _____ children before her thirties.	Have		
27. Why don't we stay here and they can _____ to us	Come		
28. The best way to cope with exam pressure is to tell yourself that all you can _____ is your best.	Do		
29. Pat saw Jackie buying a drink but told her to _____ her money away, as this round was on him.	Put		
30. He'll _____ what's coming to him in the long run	Get		
	TOTAL SCORE:		/30
Comparison with control participants (n=25) Email comments on the use of this test to Paul.Conroy@manchester.ac.uk	MEAN SCORE: St.Dev.: Cut-off:	29 (28.76) 2 (2.1) 27	

PERFORMANCE SUMMARY FOR SPECIFIC VERBS: TARGET:	EXEMPLARS (items):	SUB-SCORE: (/3)
Go	1, 19, 23	
Do	2, 16, 28	
Get	3, 24, 30	
Have	4, 10, 26	
Be	5, 12, 25	
Come	6, 17, 27	
Give	7, 11, 22	
Take	8, 15, 21	
Make	9, 13, 20	
Put	14, 18, 29	

Appendix 5: Participants' treatment and control sets (Chapter 4)

KK

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	wave	1	OANB	crawl
2	OANB	roar	2	OANB	fold
3	OANB	rain	3	OANB	drive
4	OANB	swim	4	OANB	weigh
5	OANB	stir	5	OANB	drink
6	OANB	kiss	6	OANB	push
7	OANB	fish	7	OANB	climb
8	OANB	type	8	OANB	snow
9	OANB	knit	9	OANB	dive
10	OANB	water	10	OANB	eat
11	OANB	cut	11	OANB	stop
12	OANB	pour	12	OANB	float
13	OANB	plant	13	OANB	dream
14	OANB	shave	14	OANB	rake
15	OANB	drop	15	OANB	juggle
16	OANB	wash	16	OANB	skate
17	OANB	swing	17	OANB	play
18	OANB	bend	18	OANB	kick
19	OANB	pull	19	OANB	slide
20	OANB	peel	20	OANB	light
21	OANB	cross	21	OANB	tickle
22	OANB	bleed	22	OANB	lean
23	OANB	sneeze	23	OANB	watch
24	OANB	jump	24	OANB	paint
25	OANB	drip	25	OANB	sink
26	OANB	bounce	26	OANB	tie
27	OANB	sit	27	OANB	walk
28	OANB	open	28	OANB	kneel
29	OANB	draw	29	OANB	blow
30	OANB	weave	30	OANB	skip
31	LVET	go	31	LVET	come
32	LVET	do	32	LVET	give
33	LVET	get	33	LVET	take
34	LVET	have	34	LVET	make
35	LVET	put	35	LVET	be
36	PR	bowl	36	PR	score
37	PR	empty	37	PR	throw
38	PR	boil	38	PR	save
39	PR	fry	39	PR	pass
40	PR	weed	40	PR	win

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.93	0.63	0.75	0.47	0.67

GL

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	rock	1	OANB	crawl
2	OANB	type	2	OANB	fold
3	OANB	water	3	OANB	drive
4	OANB	cut	4	OANB	weigh
5	OANB	pour	5	OANB	bite
6	OANB	plant	6	OANB	stop
7	OANB	wash	7	OANB	float
8	OANB	swing	8	OANB	dream
9	OANB	bend	9	OANB	juggle
10	OANB	pull	10	OANB	play
11	OANB	peel	11	OANB	light
12	OANB	cross	12	OANB	lean
13	OANB	sneeze	13	OANB	watch
14	OANB	jump	14	OANB	beg
15	OANB	bark	15	OANB	paint
16	OANB	drip	16	OANB	sink
17	OANB	bounce	17	OANB	walk
18	OANB	sit	18	OANB	blow
19	OANB	sleep	19	OANB	pray
20	OANB	fly	20	OANB	catch
21	OANB	open	21	OANB	build
22	OANB	weave	22	OANB	melt
23	OANB	write	23	OANB	ride
24	OANB	march	24	OANB	post
25	OANB	stroke	25	OANB	wave
26	OANB	ski	26	OANB	push
27	OANB	smile	27	OANB	read
28	OANB	carry	28	OANB	climb
29	OANB	dig	29	OANB	lick
30	OANB	touch	30	OANB	ring
31	OANB	drill	31	OANB	stir
32	LVET	make	32	LVET	be
33	LVET	get	33	LVET	take
34	LVET	have	34	LVET	go
35	LVET	give	35	LVET	come
36	PR	boil	36	PR	click
37	PR	fry	37	PR	chase
38	PR	mow	38	PR	dress
39	PR	prune	39	PR	clear
40	PR	feed	40	PR	dust

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.83	0.61	0.56	0.32	0.51

BL

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	crawl	1	OANB	ride
2	OANB	fold	2	OANB	post
3	OANB	drive	3	OANB	wave
4	OANB	stroke	4	OANB	push
5	OANB	drink	5	OANB	laugh
6	OANB	roar	6	OANB	climb
7	OANB	bite	7	OANB	stir
8	OANB	eat	8	OANB	kiss
9	OANB	stop	9	OANB	rock
10	OANB	float	10	OANB	point
11	OANB	yawn	11	OANB	tie
12	OANB	dream	12	OANB	cut
13	OANB	rake	13	OANB	pour
14	OANB	juggle	14	OANB	plant
15	OANB	play	15	OANB	drop
16	OANB	kick	16	OANB	pull
17	OANB	slide	17	OANB	peel
18	OANB	light	18	OANB	cross
19	OANB	lean	19	OANB	sneeze
20	OANB	watch	20	OANB	jump
21	OANB	beg	21	OANB	sit
22	OANB	paint	22	OANB	fly
23	OANB	sink	23	OANB	weave
24	OANB	water	24	OANB	march
25	OANB	walk	25	OANB	weigh
26	OANB	pray	26	OANB	smile
27	OANB	sew	27	OANB	carry
28	OANB	catch	28	OANB	cook
29	OANB	build	29	OANB	dig
30	OANB	melt	30	OANB	touch
31	LVET	go	31	LVET	come
32	LVET	do	32	LVET	be
33	LVET	get	33	LVET	take
34	LVET	have	34	LVET	make
35	LVET	give	35	LVET	put
36	PR	listen	36	PR	head
37	PR	score	37	PR	dribble
38	PR	save	38	PR	tackle
39	PR	win	39	PR	dress
40	PR	throw	40	PR	click

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.99	0.76	0.68	0.54	0.51

DC

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	roar	1	OANB	weave
2	OANB	dive	2	OANB	fold
3	OANB	lean	3	OANB	drive
4	OANB	rock	4	OANB	weigh
5	OANB	type	5	OANB	climb
6	OANB	point	6	OANB	lick
7	OANB	cut	7	OANB	float
8	OANB	pour	8	OANB	dream
9	OANB	plant	9	OANB	rake
10	OANB	shave	10	OANB	juggle
11	OANB	drop	11	OANB	skate
12	OANB	wash	12	OANB	play
13	OANB	bend	13	OANB	kick
14	OANB	pull	14	OANB	slide
15	OANB	peel	15	OANB	light
16	OANB	bleed	16	OANB	knock
17	OANB	sneeze	17	OANB	stir
18	OANB	jump	18	OANB	beg
19	OANB	fly	19	OANB	sink
20	OANB	draw	20	OANB	tie
21	OANB	crawl	21	OANB	pray
22	OANB	stroke	22	OANB	sew
23	OANB	ski	23	OANB	dance
24	OANB	smile	24	OANB	catch
25	OANB	carry	25	OANB	build
26	OANB	cook	26	OANB	melt
27	OANB	dig	27	OANB	shoot
28	OANB	touch	28	OANB	wave
29	OANB	sail	29	OANB	push
30	IPNP	spill	30	IPNP	Spread
31	LVET	go	31	LVET	come
32	LVET	do	32	LVET	be
33	LVET	get	33	LVET	take
34	LVET	have	34	LVET	make
35	LVET	give	35	LVET	put
36	PR	score	36	PR	win
37	PR	hit	37	PR	lose
38	PR	throw	38	PR	dribble
39	PR	save	39	PR	tackle
40	PR	pass	40	PR	collect

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.94	0.56	0.32	0.68	0.67

JH

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	drive	1	OANB	fish
2	OANB	drink	2	OANB	water
3	OANB	dive	3	OANB	pour
4	OANB	ski	4	OANB	shave
5	OANB	float	5	OANB	bend
6	OANB	dream	6	OANB	pull
7	OANB	play	7	OANB	bleed
8	OANB	slide	8	OANB	sneeze
9	OANB	tickle	9	OANB	jump
10	OANB	lean	10	OANB	bounce
11	OANB	watch	11	OANB	sleep
12	OANB	sink	12	OANB	fly
13	OANB	walk	13	OANB	draw
14	OANB	kneel	14	OANB	weave
15	OANB	dance	15	OANB	stroke
16	OANB	catch	16	OANB	eat
17	OANB	build	17	OANB	sing
18	OANB	melt	18	OANB	dig
19	OANB	wave	19	OANB	touch
20	OANB	climb	20	OANB	sail
21	IPNP	spill	21	IPNP	smell
22	IPNP	hitchhike	22	IPNP	slip
23	IPNP	sort	23	IPNP	serve
24	IPNP	unlock	24	IPNP	spray
25	IPNP	listen	25	IPNP	stretch
26	IPNP	camp	26	IPNP	spread
27	IPNP	squeeze	27	IPNP	magnify
28	IPNP	hide	28	IPNP	stack
29	IPNP	lift	29	IPNP	wake up
30	IPNP	knight	30	IPNP	pay
31	IPNP	splash	31	IPNP	shake
32	LVET	go	32	LVET	come
33	LVET	get	33	LVET	be
34	LVET	have	34	LVET	take
35	LVET	give	35	LVET	make
36	PR	teething	36	PR	feed
37	PR	dress	37	PR	telephone
38	PR	weed	38	PR	scold
39	PR	wallpaper	39	PR	hammer
40	PR	sweep	40	PR	sand

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.86	1.00	0.54	0.49	0.52

AT

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	comb	1	OANB	water
2	OANB	push	2	OANB	drive
3	OANB	climb	3	OANB	weigh
4	OANB	point	4	OANB	bite
5	OANB	fold	5	OANB	float
6	OANB	plant	6	OANB	dream
7	OANB	drop	7	OANB	juggle
8	OANB	wash	8	OANB	skate
9	OANB	pull	9	OANB	play
10	OANB	peel	10	OANB	kick
11	OANB	bleed	11	OANB	slide
12	OANB	sneeze	12	OANB	watch
13	OANB	bounce	13	OANB	beg
14	OANB	sit	14	OANB	sink
15	OANB	fly	15	OANB	tie
16	OANB	draw	16	OANB	run
17	OANB	weave	17	OANB	pray
18	OANB	march	18	OANB	dance
19	OANB	stroke	19	OANB	catch
20	OANB	sing	20	OANB	build
21	OANB	cook	21	OANB	melt
22	OANB	dig	22	OANB	ride
23	OANB	touch	23	OANB	sail
24	IPNP	hug	24	IPNP	operate
25	IPNP	cough	25	IPNP	shine
26	IPNP	hitchhike	26	IPNP	shoot
27	IPNP	sort	27	IPNP	plug
28	IPNP	unlock	28	IPNP	fight
29	IPNP	magnify	29	IPNP	sting
30	IPNP	hunt	30	IPNP	tow
31	IPNP	hide	31	IPNP	measure
32	LVET	go	32	LVET	be
33	LVET	come	33	LVET	give
34	LVET	get	34	LVET	take
35	LVET	have	35	LVET	make
36	LVET	do	36	LVET	put
37	PR	sweep	37	PR	mark
38	PR	lamb	38	PR	feed
39	PR	milk	39	PR	plough
40	PR	carry	40	PR	herd

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.91	0.57	0.14	0.20	1.00

PM

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	Weigh	1	OANB	Melt
2	OANB	Drink	2	OANB	Ride
3	OANB	Roar	3	OANB	Climb
4	OANB	Stop	4	OANB	Ring
5	OANB	Float	5	OANB	Rock
6	OANB	Dream	6	OANB	Pour
7	OANB	Play	7	OANB	Bend
8	OANB	Watch	8	OANB	Pull
9	OANB	Beg	9	OANB	Bleed
10	OANB	Sink	10	OANB	Bounce
11	OANB	Tie	11	OANB	Draw
12	IPNP	Arrest	12	OANB	Smile
13	OANB	Sew	13	OANB	Touch
14	IPNP	Hug	14	IPNP	Shine
15	IPNP	Spill	15	IPNP	Shoot
16	IPNP	Cough	16	IPNP	Sting
17	IPNP	Whisper	17	IPNP	Tow
18	IPNP	Pray	18	IPNP	Marry
19	IPNP	Hunt	19	IPNP	Measure
20	IPNP	Squeeze	20	IPNP	Burn
21	IPNP	Hide	21	IPNP	Bury
22	IPNP	Lift	22	IPNP	Bake
23	IPNP	Smell	23	IPNP	Cheer
24	IPNP	Spray	24	IPNP	Load
25	IPNP	Count	25	IPNP	Balance
26	IPNP	Spread	26	IPNP	Grind
27	IPNP	Camp	27	IPNP	Strain
28	IPNP	Stack	28	IPNP	Hatch
29	IPNP	Pay	29	IPNP	Shake
30	IPNP	Scoop	30	IPNP	Conduct
31	IPNP	Dip	31	IPNP	Tear
32	IPNP	Break	32	IPNP	Teach
33	IPNP	Feed	33	IPNP	Stand
34	IPNP	Save	34	IPNP	Steal
35	LVET	Go	35	LVET	Come
36	LVET	Do	36	LVET	Have
37	LVET	Get	37	LVET	Take
38	LVET	Give	38	LVET	Make
39	PR	Weed	39	PR	Score
40	PR	Lose	40	PR	Win

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.73	0.49	0.51	0.60	0.82

PG

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	Snow	1	OANB	Water
2	OANB	Float	2	OANB	Bend
3	OANB	Melt	3	OANB	Play
4	OANB	Weigh	4	OANB	Light
5	OANB	Eat	5	OANB	Build
6	OANB	Bounce	6	OANB	Climb
7	OANB	Draw	7	OANB	Cut
8	OANB	March	8	OANB	Pour
9	OANB	Cook	9	OANB	Wash
10	OANB	Touch	10	OANB	Pull
11	IPNP	Hug	11	IPNP	Grind
12	IPNP	Sort	12	IPNP	Sunbathe
13	IPNP	Unlock	13	IPNP	Pay
14	IPNP	Magnify	14	IPNP	Operate
15	IPNP	Lift	15	IPNP	Strain
16	IPNP	Serve	16	IPNP	Carve
17	IPNP	Spray	17	IPNP	Look
18	IPNP	Spread	18	IPNP	Save
19	IPNP	Camp	19	IPNP	Teach
20	IPNP	Stack	20	IPNP	Steal
21	IPNP	Meditate	21	IPNP	Scoop
22	IPNP	Shoot	22	IPNP	Row
23	IPNP	Plug	23	IPNP	Fix
24	IPNP	Sting	24	IPNP	Mop
25	IPNP	Marry	25	IPNP	Pray
26	IPNP	Buckle	26	IPNP	Pet
27	IPNP	Balance	27	IPNP	Arrest
28	IPNP	Chew	28	IPNP	Drown
29	IPNP	Boil	29	IPNP	Break
30	IPNP	Stand	30	IPNP	Twist
31	IPNP	Deliver	31	IPNP	Shake
32	IPNP	Drag	32	IPNP	Stretch
33	LVET	Get	33	LVET	Be
34	LVET	Have	34	LVET	Come
35	LVET	Give	35	LVET	Take
36	LVET	Make	36	LVET	Put
37	PR	Plan	37	PR	Inspect
38	PR	Weed	38	PR	Dress
39	PR	Tighten	39	PR	Loosen
40	IPNP	Sharpen	40	PR	Clean

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.75	0.71	0.67	0.97	0.30

DM

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	Plant	1	OANB	Fold
2	OANB	Cross	2	OANB	Roar
3	OANB	Stroke	3	OANB	Float
4	OANB	Sing	4	OANB	Lean
5	OANB	Carry	5	OANB	Build
6	IPNP	Hitchhike	6	IPNP	Swat
7	IPNP	Sort	7	IPNP	Look
8	IPNP	Unlock	8	IPNP	Save
9	IPNP	Listen	9	IPNP	Tear
10	IPNP	Magnify	10	IPNP	Teach
11	IPNP	Hunt	11	IPNP	Vacuum
12	IPNP	Serve	12	IPNP	Itch
13	IPNP	Spray	13	IPNP	Salute
14	IPNP	Stack	14	IPNP	Fix
15	IPNP	Pay	15	IPNP	Propose
16	IPNP	Operate	16	IPNP	Pet
17	IPNP	Shine	17	IPNP	Arrest
18	IPNP	Shoot	18	IPNP	Deliver
19	IPNP	Slide	19	IPNP	Count
20	IPNP	Marry	20	IPNP	Dry
21	IPNP	Burn	21	IPNP	Break
22	IPNP	Bury	22	IPNP	Twist
23	IPNP	Bake	23	IPNP	Drag
24	IPNP	Cheer	24	IPNP	Scare
25	IPNP	Load	25	IPNP	Follow
26	IPNP	Balance	26	IPNP	Explode
27	IPNP	Grind	27	IPNP	Erase
28	IPNP	Sunbathe	28	IPNP	Fill
29	IPNP	Strain	29	IPNP	Look
30	IPNP	Lasso	30	IPNP	Break
31	LVET	Go	31	LVET	Come
32	LVET	Do	32	LVET	Be
33	LVET	Get	33	LVET	Take
34	LVET	Have	34	LVET	Make
35	LVET	Give	35	LVET	Put
36	PR	Print	36	PR	Unload
37	PR	Download	37	PR	Load
38	PR	Set	38	PR	Wipe
39	PR	Clear	39	PR	Order
40	PR	Email	40	PR	Change

Comparison of the treatment and control sets using N-Watch (Davis, 2005):

	Frequency	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.95	0.89	0.43	0.33	0.49

Appendix 6: Therapy protocol to facilitate verb retrieval (Chapter 4)

1. Before targeting verb retrieval, ask the participant to generate relevant semantic features relating to the target verb (see Figure 2). The aim here is to facilitate *conceptualisation* of each relevant feature, rather than explicit *production*, in order to build up a complete semantic representation for the target verb. Therefore, accept nonverbal means such as pointing, gesture/mime, drawing.
2. If the participant fails to generate a specific semantic feature, offer a forced alternative. For example, for the target verb 'sliding', the forced choice for the feature of 'Who' might be 'a child' vs 'a man'.
3. Omit any semantic feature that would elicit production of the target verb as a noun. For example, target verb 'sliding', omit the feature of associations which would elicit 'slide' as a noun.
4. Once all of the semantic features have been explored, recap on the features and accompanying gesture in order to ease the load on the participant's working memory.
5. Ask the participant to retrieve the target verb.
6. If the participant retrieves the target verb successfully, ask him/her to produce the verb three times in total with the accompanying verb.
7. If the participant fails to retrieve the target verb, offer increasing phonemic cues to facilitate accurate retrieval. Once the participant produces the target verb, ask him/her to produce the verb three times in total with the accompanying verb.

Appendix 7: Conversation data used for outcome measurement following verb retrieval therapy (Chapter 4)

Pre-verb retrieval therapy sampled across four conversations. Raw data shown with proportional data in brackets

	conversation 1		conversation 2		conversation 3		conversation 4	
	total words	**lexical verbs**	**total words**	**lexical verbs**	**total words**	**lexical verbs**	**total words**	**lexical verbs**
KK	144	14 (.097)	136	17 (0.125)	99	12 (0.121)	109	16 (0.147)
GL	130	7 (.054)	66	3 (0.045)	49	3 (0.061)	107	7 (0.065)
BL	58	4 (.069)	48	4 (0.083)	26	4 (0.154)	24	2 (0.083)
DC	122	16 (0.131)	138	27 (0.196)	257	42 (0.163)	219	37 (0.17)
JH	111	10 (0.09)	148	17 (0.115)	96	16 (0.167)	55	7 (0.127)
AT	44	3 (0.068)	199	16 (0.08)	128	17 (0.133)	76	8 (0.105)
PM	42	3 (0.071)	67	9 (0.134)	59	6 (0.102)	121	14 (0.116)
PG	161	15 (0.093)	172	21 (0.122)	172	11 (0.064)	133	10 (0.075)
DM	170	14 (0.082)	187	15 (0.08)	102	6 (0.059)	145	18 (0.124)

Post-verb retrieval therapy sampled across four conversations. Raw data shown with proportional data in brackets

	conversation 1		conversation 2		conversation 3		conversation 4	
	total words	**lexical verbs**	**total words**	**lexical verbs**	**total words**	**lexical verbs**	**total words**	**lexical verbs**
KK	85	23 (.271)	90	15 (.167)	65	11 (.169)	25	7 (.28)
GL	70	5 (.071)	65	11 (.169)	82	9 (.11)	129	13 (.101)
BL	54	7 (.13)	64	3 (.047)	19	0 (0)	133	9 (.068)
DC	156	26 (.167)	145	33 (.228)	118	20 (.17)	84	9 (.107)
JH	105	22 (.209)	122	10 (.082)	142	8 (.056)	83	6 (.072)
AT	186	19 (.102)	111	7 (.063)	99	8 (.081)	92	8 (.087)
PM	89	12 (.135)	105	16 (.152)	113	3 (.027)	83	11 (.133)
PG	104	9 (.087)	124	12 (.097)	172	11 (.064)	55	10 (.182)
DM	212	30 (.142)	158	24 (.152)	113	17 (.15)	94	15 (.16)

Appendix 8: Criteria for scoring sentence production at baseline and post-treatment assessment (Chapter 5)

- Retrieval of an appropriate content or light verb = 1 point
- Retrieval of an appropriate agent, including pronouns = 1 point
- For transitive verbs, retrieval of any appropriate patient/theme = 1 point
- Grammatically acceptable word order (not necessarily morphologically correct) = 1 point

Appendix 9: Participants' treatment and control sets (Chapter 5)

KK

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	stop	1	OANB	crawl
2	OANB	float	2	OANB	fold
3	OANB	dream	3	OANB	juggle
4	OANB	rake	4	OANB	weigh
5	OANB	drive	5	OANB	drink
6	OANB	skate	6	OANB	roar
7	OANB	play	7	OANB	swim
8	OANB	kick	8	OANB	snow
9	OANB	slide	9	OANB	dive
10	OANB	tickle	10	OANB	rain
11	OANB	wave	11	OANB	light
12	OANB	push	12	OANB	lean
13	OANB	eat	13	OANB	watch
14	OANB	climb	14	OANB	paint
15	OANB	stir	15	OANB	sink
16	OANB	kiss	16	OANB	tie
17	OANB	fish	17	OANB	walk
18	OANB	type	18	OANB	kneel
19	OANB	knit	19	OANB	blow
20	OANB	cross	20	OANB	skip

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.43	0.52	0.64	0.54	0.81	0.12

GL

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	lean	1	OANB	crawl
2	OANB	watch	2	OANB	fold
3	OANB	type	3	OANB	blow
4	OANB	water	4	OANB	weigh
5	OANB	pour	5	OANB	bite
6	OANB	read	6	OANB	stop
7	OANB	drive	7	OANB	float
8	OANB	pray	8	OANB	juggle
9	OANB	catch	9	OANB	light
10	OANB	build	10	OANB	melt
11	OANB	peel	11	OANB	ride
12	OANB	cross	12	OANB	post
13	OANB	sneeze	13	OANB	wave
14	OANB	jump	14	OANB	push
15	OANB	bark	15	OANB	beg
16	OANB	drip	16	OANB	lick
17	OANB	bounce	17	OANB	rock
18	OANB	sit	18	OANB	paint
19	OANB	sleep	19	OANB	sink

20	OANB	fly	20	OANB	walk

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	Frequency	Length	AOA	Imageability	Argument structure
t-test	**0.17**	**0.31**	**0.60**	**0.67**	**0.97**	**0.76**

BL

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	melt	1	OANB	crawl
2	OANB	ride	2	OANB	fold
3	OANB	post	3	OANB	drive
4	OANB	wave	4	OANB	weigh
5	OANB	laugh	5	OANB	bite
6	OANB	point	6	OANB	eat
7	OANB	water	7	OANB	stop
8	OANB	paint	8	OANB	float
9	OANB	pour	9	OANB	yawn
10	OANB	juggle	10	OANB	rake
11	OANB	drop	11	OANB	sneeze
12	OANB	pull	12	OANB	play
13	OANB	peel	13	OANB	jump
14	OANB	cross	14	OANB	sit
15	OANB	sew	15	OANB	beg
16	OANB	slide	16	OANB	cut
17	OANB	light	17	OANB	sink
18	OANB	fly	18	OANB	tie
19	OANB	weave	19	OANB	walk
20	OANB	stir	20	OANB	plant

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	Frequency	Length	AOA	Imageability	Argument structure
t-test	0.582	0.587	0.53	0.43	0.49	0.35

DC

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	float	1	OANB	fold
2	OANB	push	2	OANB	drive
3	OANB	carry	3	OANB	roar
4	OANB	stir	4	OANB	dive
5	OANB	rock	5	OANB	dream
6	OANB	type	6	OANB	climb
7	OANB	sail	7	OANB	bleed
8	OANB	cut	8	OANB	juggle
9	OANB	pour	9	OANB	skate
10	OANB	plant	10	OANB	kick
11	OANB	shave	11	OANB	slide
12	OANB	drop	12	OANB	light
13	OANB	wash	13	OANB	pull
14	OANB	bend	14	OANB	peel
15	OANB	sink	15	OANB	beg

16	OANB	lean	16	OANB	knock
17	OANB	rake	17	OANB	tie
18	OANB	sneeze	18	OANB	weave
19	OANB	jump	19	OANB	sew
20	OANB	fly	20	OANB	dance

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	**0.75**	**0.65**	**0.46**	**0.21**	**0.69**	**0.76**

JH

Treatment set			**Control set**		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	dive	1	OANB	drive
2	OANB	eat	2	OANB	drink
3	OANB	slide	3	OANB	float
4	OANB	watch	4	OANB	dream
5	OANB	dance	5	OANB	sink
6	OANB	catch	6	OANB	walk
7	OANB	build	7	OANB	kneel
8	OANB	water	8	OANB	melt
9	OANB	pour	9	OANB	wave
10	OANB	shave	10	OANB	climb
11	OANB	bleed	11	OANB	fish
12	IPNP	unlock	12	IPNP	spill
13	IPNP	listen	13	IPNP	hitchhike
14	IPNP	magnify	14	IPNP	sort
15	IPNP	squeeze	15	IPNP	lift
16	IPNP	hide	16	IPNP	smell
17	OANB	sneeze	17	OANB	bounce
18	OANB	jump	18	OANB	sleep
19	IPNP	stack	19	IPNP	splash
20	IPNP	wake up	20	IPNP	spread

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.72	0.64	1.00	0.92	0.84	0.76

AT

Treatment set			**Control set**		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	drive	1	OANB	beg
2	OANB	weigh	2	OANB	build
3	OANB	bite	3	OANB	play
4	OANB	juggle	4	OANB	slide
5	OANB	watch	5	OANB	sink
6	OANB	dream	6	OANB	tie
7	OANB	skate	7	OANB	catch
8	OANB	push	8	OANB	comb
9	OANB	climb	9	OANB	point

10	OANB	water	10	OANB	wash
11	OANB	plant	11	OANB	sneeze
12	OANB	drop	12	OANB	draw
13	OANB	pull	13	OANB	stroke
14	OANB	sit	14	OANB	cook
15	OANB	fly	15	IPNP	hitchhike
16	OANB	weave	16	IPNP	shine
17	OANB	march	17	IPNP	shoot
18	IPNP	hunt	18	IPNP	fight
19	IPNP	hide	19	IPNP	sting
20	IPNP	operate	20	IPNP	measure

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.12	0.92	0.53	0.20	0.78	0.75

PM

Treatment set			**Control set**		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	OANB	ride	1	OANB	weigh
2	IPNP	shoot	2	OANB	drink
3	OANB	ring	3	OANB	dream
4	OANB	rock	4	OANB	play
5	OANB	pour	5	OANB	watch
6	OANB	bend	6	OANB	beg
7	OANB	bounce	7	OANB	tie
8	OANB	draw	8	OANB	sew
9	IPNP	balance	9	IPNP	spill
10	IPNP	hatch	10	IPNP	cough
11	IPNP	shake	11	IPNP	hunt
12	IPNP	conduct	12	IPNP	squeeze
13	IPNP	teach	13	IPNP	hide
14	IPNP	stand	14	IPNP	lift
15	IPNP	steal	15	IPNP	smell
16	IPNP	scoop	16	OANB	climb
17	IPNP	break	17	IPNP	measure
18	IPNP	feed	18	IPNP	bury
19	IPNP	sting	19	IPNP	bake
20	IPNP	tow	20	IPNP	load

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.65	0.74	0.56	1.00	0.64	0.44

PG

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	IPNP	mop	1	OANB	wash
2	OANB	pour	2	OANB	float
3	IPNP	meditate	3	IPNP	steal
4	OANB	pull	4	IPNP	sting
5	OANB	bounce	5	OANB	build
6	OANB	draw	6	OANB	melt
7	OANB	march	7	OANB	climb
8	OANB	cook	8	OANB	cut
9	OANB	play	9	IPNP	sort
10	IPNP	row	10	IPNP	lift
11	IPNP	fix	11	IPNP	spray
12	OANB	light	12	IPNP	stack
13	IPNP	pray	13	IPNP	Ppay
14	IPNP	drown	14	OANB	eat
15	IPNP	break	15	IPNP	shoot
16	IPNP	twist	16	IPNP	balance
17	IPNP	shake	17	IPNP	sunbathe
18	IPNP	drag	18	IPNP	teach
19	IPNP	stretch	19	OANB	water
20	IPNP	camp	20	IPNP	buckle

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	**Frequency**	**Length**	**AOA**	**Imageability**	**Argument structure**
t-test	0.21	0.45	0.66	0.88	0.44	0.15

DM

Treatment set			Control set		
No	**Source**	**Target**	**No**	**Source**	**Target**
1	IPNP	operate	1	OANB	fold
2	OANB	cross	2	OANB	float
3	OANB	carry	3	IPNP	explode
4	IPNP	swat	4	OANB	build
5	IPNP	tear	5	IPNP	hitchhike
6	IPNP	teach	6	IPNP	sort
7	IPNP	vacuum	7	IPNP	unlock
8	IPNP	fix	8	IPNP	magnify
9	IPNP	deliver	9	IPNP	hunt
10	IPNP	dry	10	IPNP	serve
11	IPNP	break	11	IPNP	spray
12	IPNP	twist	12	IPNP	stack
13	IPNP	drag	13	IPNP	pay
14	IPNP	scare	14	IPNP	save
15	IPNP	follow	15	IPNP	shoot
16	OANB	lean	16	OANB	plant
17	IPNP	erase	17	IPNP	load
18	IPNP	fill	18	IPNP	balance
19	IPNP	bake	19	IPNP	grind
20	IPNP	arrest	20	IPNP	sunbathe

Comparison of verbs used within the treatment and control sets using N-Watch (Davis, 2005):

	Mean accuracy	Frequency	Length	AOA	Imageability	Argument structure
t-test	0.21	0.45	0.69	0.16	0.69	0.69

Appendix 10: Cueing protocol within syntactic construction therapy (Chapter 5)

The following steps were implemented in order to shape and facilitate participants' production of accurate simplified syntactic structures:

- if the participant produced an accurate construction, he/she was asked to repeat this three times in total
- if the participant produced a list of features instead of a thematically linked construction, these features were written down and the participant was facilitated to place each word into the appropriate 'slot' using a written sentence frame
- if the participant failed to retrieve an appropriate verb, he/she was encouraged to produce a corresponding gesture. Subsequently increasing phonemic cueing was provided to aid retrieval of the target word
- if the participant struggled to retrieve a personally relevant agent, he/she was presented with a written list of agents from which to choose

Appendix 11: Criteria for coding connected speech and conversation data (Chapter 5)

Criteria specific to connected speech data

- Output that was excluded from analysis
    - meta-cognitive comments (e.g., “I don’t know” / “Yes that’s it” / “Not sure”)
    - output which was incorrect (e.g., semantic paraphasias)
    - output which was irrelevant (e.g., in the Cookie Jar Theft, “the gardener is doing his work”)
- Output that was included in analysis:
    - repetitions which formed part of a self-rehearsal sequence were coded as one utterance, e.g., “prince’s ball… prince’s ball… prince’s ball” = 1 non-verb utterance

Criteria specific to conversation data:

- Output that was excluded from analysis:
    - words repeated between speakers in a training sequence, i.e., when the PWA repeats a word or utterance without adding new content
- Output that was included in analysis:
    - repetitions within speakers and between speakers that did not part of a training/coaching sequence, e.g., repetitions as a question-answer sequence (e.g., “All of them?” “All of them”)

Appendix 12: Example of video stimuli used during therapy (Chapter 6)

Geri's game (Pixar short film) is a 3:41 minute video clip (http://www.youtube.com/watch?v=1m7dcbIKvlw)

Summary: It's autumn and an elderly man is in the park alone setting up a game of chess. He proceeds to play against himself; as he moves to each side of the chessboard, he plays as a different 'character' – on one side of the board he wears his glasses and is a timid character; on the other side of the board he takes off his glasses and is a competitive and somewhat aggressive character. As the game progresses, the competitive character (without the glasses) is winning. The timid character (with glasses) pretends to have a heart attack and, while his "opponent" is distracted, switches the chessboard so that he is winning. Once the game resumes, the competitive character realises he is no longer winning the game and he resigns. As a prize, he hands over a set of false teeth. As the camera zooms away from the park, the man is seen sitting alone at the chessboard.

Other examples of video stimuli used in Chapter 6:

Pixar short film: For the Birds http://www.youtube.com/watch?v=omk6TAxJYOg

Pixar short film: Pigeons http://www.youtube.com/watch?v=oIlIVFBBbNw&playnext=1&list=PLAD230308F8954A13&feature=results_main

French phone advert http://www.youtube.com/watch?v=b5YEYL0z1xs

Seaplane and fishing boat http://www.youtube.com/watch?v=x5qQgQoH8iY

Fenton http://www.youtube.com/watch?v=3GRSbr0EYYU

Appendix 13: Individual goals for PWA and their conversation partners (Chapter 6)

Initials	PWA	Partner	Goals for therapy
AT	✓		**Chunk it up**: think about the story in smaller, more manageable chunks **Set the scene**: detail the initial contextual information about the story or give a general impression of the tone of the story **Drip drip**: tell the story bit by bit, leaving time for partner to ask questions
Peter		✓	**Stop and check**: check your understanding as you go along by asking questions and summarising what you've understood **Move along**: during an unproductive lexical search for PWA, keep the conversation moving by briefly summarising the story so far and prompting PWA to tell you the next part **Who does what**: establish how many people are involved in the story and their role within the story **Pinpoint**: be specific about what you understand and what you don't understand
PM	✓		**Set the scene**: detail the initial contextual information about the story or give a general impression of the tone of the story **Drip drip**: tell the story bit by bit, leaving time for partner to ask questions **Show and tell**: use gesture or acting in combination with speech to convey parts of the story
Eve		✓	**Move on**: if you know the word the PWA is trying to say, keep the conversation going. If you don't know the word, ask questions such as "Do you mean…?" **Who does what**: establish how many people are involved in the story and their role within the story **Pinpoint**: be specific about what you understand and what you don't understand
BL	✓		**Set the scene**: detail the initial contextual information about the story or give a general impression of the tone of the story **Chunk it up**: think about the story in smaller, more manageable

			chunks **Drip drip**: tell the story bit by bit, leaving time for partner to ask questions **Show and tell**: use gesture or acting in combination with speech to convey parts of the story
Paula		✓	**Stop and check**: check your understanding as you go along by asking questions and summarising what you've understood **Who does what**: establish how many people are involved in the story and their role within the story **Pinpoint**: be specific about what you understand and what you don't understand
JH	✓		**Stop and listen**: use conversation partner's questions to clarify details of the story with yes/no responses **Set the scene**: detail the initial contextual information about the story or give a general impression of the tone of the story **Chunk it up**: think about the story in smaller, more manageable chunks **Drip drip**: tell the story bit by bit, leaving time for partner to ask questions
Noel		✓	**Go for the jugular**: establish the basic details/events first and then enquire specifically about background information or more fine-grained detail

Appendix 14: Conversation partner's retelling of stories, scored in comparison to the most frequently occurring content words produced by control participant (Chapter 6)

Pre-therapy simple narrative target	Peter	Eve	Paula	Noel
Mr Bean drives into a car park in a mini Mr Bean (1) drives (1) car park/parking lot (1) mini (1)	Well Mr Bean (1)… with Rowan Atkinson in it was a TV programme… and I assuming that this… this part of a TV programme… which shows Atkinson as Mr Bean… driving (1) into a car park (1) with his usual incompetence…	He saw a car (1) going into a car park (1)… the bloke who turned out to be Rowan Atkinson (1)	Rowan Atkinson (1) driving (1) a car (1)…	Right I think Ron Atkinson was driving (1) a mini (1) into a car park (1)…
He parks too far from the ticket machine and can't reach his ticket parks/pulls up (1) too far/not close enough (1) ticket machine (1)	not being able to reach (1) the ticket machine (1)	couldn't reach (1) the ticket (1) the ticket machine (1)	I don't know… was he going somewhere to pay for something and using his plastic card…	but it didn't show him going into the car park it showed him reaching (1) for a ticket (1) to press the button and he couldn't press it

can't reach (1) ticket (1)				
He uses a grabber to get the ticket grabber/stick/litter picker (1) get/grab/pull out (1) ticket (1)	so he has some sort of extended arm (1)… and then gets (1) the ticket (1)… out of the machine…	so he got something I presume out of the car… like a grabber thing a pick-me-up thing (1) to pull out (1) the ticket (1)	and he used his stick (1) to either push the plastic card in or… type out something or other I don't know I don't really know	so then he went inside the car and he found a litter-picking stick (1), reached out of the car to press the ticket, got (1) his ticket (1)
He drives recklessly into the car park drives (1) recklessly/quickly (1) car park (1)	and drives off (1) I don't know whether he's coming in or going out…	and then he went to park (1) the car somewhere… and it's was a black and… yellow and black car		and then drove (1) … into the car park (1) and then it ended… and the car was either yellow or cream
Total: 15	**9**	**10**	**4**	**10**

Post-therapy simple narrative target	Peter	Eve	Paula	Noel
Mr Bean is in the pool,	Mr Bean (1) eh Mr Bean… the scene appears to be Mr	Right so back to the swimming pool (1)… Mr	Right what I got… Rowan Atkinson (1)… and he said	Right… Mr Bean (1) again he's still in the swimming

looking around Mr Bean/he (1) arrives (1) pool (1) looking/had a look around (1)	Bean walks into a swimming pool (1)	Bean (1) again… so I assume from that it was going to be funny… he's standing on the side of the pool wearing his trunks…	slide at first… well he said there were two slides at first didn't he… but I- I never carried on with two slides… and then I found out it were in swimming baths and the slides were in the swimming baths (1)	pool (1) but he's sort of on the side… looking round (1) at the excitement
He spots an elephant slide in the children's pool and decides to go on it spots/sees (1) elephant (1) slide (1) go on it/have a go/drawn to (1)	and sees (1) a couple of kids with toy elephants (1) or real elephants I suppose toy elephants playing about… and he wants to get involved (1)…	and there were two lads… coming from down the slide (1)… I presume young lads… and he thought he'd go up (1) Mr Bean thought he'd go up,	(see reference to 'slides' above) (1)	and he spots (1)… that there's two elephant (1) slides (1) with trunk- there's trunks with slides and he sees… them and he thinks I'll go on there (1)
As he's about to slide into the water, the lifeguard blows the whistle sat on/got on/go on/have a play/slide down (1)	so in his clumsy way he clambers (1) onto the slide and then…. where they're all possibly jumbled together he's about to join into this and the attendant (1) comes along and says "oi we're not having this (1)… you're…	started going up (1) but he got stopped (1) by the instructor (1) who said he couldn't… and for children only…	anyway… it sounded like he were coming down (1) and he shouldn't have been… he were doing something wrong… and lifeguard (1) or something like life guard whatever… at swimming baths… were complaining to	so he goes over there and he's like going up (1) the steps and then he gets to the top sort of thing… and the life guard (1) whistles (1) and says you're not allowed on there (1) it's only for… young children or

lifeguard (1) blows whistle/whistles/stop/get off (1)	it's dangerous or whatever it is"		him… telling him he hadn't to do it (1) no no no…	whatever…
Mr Bean climbs back up the slide climbs back/gets off/pulls himself up (1) slide (1)	and that's it and he doesn't (1)… that's it	and that was the end of it	and then he got sent off (1) did he	and then he's sort of a bit stunned… and sort of starts to get back down but he's losing his footing in sort of stumbling… and then but then he just gets down (1)… while the life guard watching and doesn't go on the slide
Total: 13	**9**	**7**	**7**	**12**

Pre-therapy complex narrative target	Peter	Eve	Paula	Noel
Mr Bean notices the diving board and climbs to the highest level Mr Bean (1) notices/sees (1)	Another Mr Bean (1) story… he's at the swimming pool… decided to show off… finds himself on the top deck (1)….	Rowan Atkinson's (1) gone to a swimming pool… he's runs up to the either diving board (1) or the view I didn't get that out of it properly… he went up some steps…	I haven't a clue something about Rowan Atkinson (1) on a diving board (1)	Right I think Ron Atkinson's (1) in the swimming baths and he's… he goes up some steps to get up to the high diving board (1) which is there's two diving boards and he goes on the highest one (1)…

diving board (1) climbs/heads (1) top/highest level (1)				
He peers over the edge and becomes afraid as he realises the height and holds on to the rail peers over/looks down (1) edge (1) afraid/panicked/frightened (1) holds on (1) rail (1)	too high (1) for him…	and he got to the I presume the edge (1) of the diving board… didn't like it (1), flapped his arms… then he turned round as if he was going to perhaps dive backwards…		and then he's there trying to he looks over the edge (1) and he's too scared (1) so he yelps out and jumps back… and sort of holds onto (1) the handle rail (1) he's quivering and he's all scared…
Two boys appear on the diving board two (1) boys (1) appear/come up (1)	and I imagine the lads (1) are showing off and…. Winding him up and diving off the board I'm not quite sure if they were spring board or at the top	and then two (1) lads (1) two children appeared (1)… not quite sure where they came from…	and he had mates… that's it I don't know what he were doing with his hand up there like that ((mimics BL's raised hand))	and then there's two (1) lads (1) who come up (1)… oh and he's wearing trunks that have got blue and orange and maybe some other colours on… but then he…

The boys look impatient so Mr Bean pretends not to be afraid and has to dive in impatient/check watches (1) pretends (1) dive in/jump off (1)			he were he said he were frightened or nervous or…	because he's so scared they're sort of… sort of… taking the mick out of him a bit and saying you know… tapping their arms as if they're waiting for him(1) to get off and he's sort of… he's really scared so
Mr Bean eases down onto his front and hangs off the board by his hands eases down/lowers/climbs down (1) hangs off/holds (1) onto/dangles/clings (1) diving board (1) hand (1)		and he bent down (1) to put his hands down		eventually he ends up… hanging (1) off the edge of the diving board (1)
One of the boys stamps on Mr Bean's hand and he falls into the pool		and one (1) of the children (1) stamped (1) on his hands (1) but he still went in the water (1) in a fashion…	and he were on about his feet I don't know what he was talking about with his feet… can't think of owt else… he didn't tell me much did he	and then they stand on (1)… one one of his hands (1) on his fingers and then he drops (1) into the water (1) and… sort of dives

one (1) boys/lads (1) stamps (1) hand/finger (1) falls (1) pool (1)				
Total: 27	**4**	**13**	**2**	**17**

Post-therapy complex narrative target	Peter	Eve	Paula	Noel
Mr Bean is in the pool and realises his trunks have come off and are floating in the water Mr Bean (1) realises/notices (1) trunks (1) come off/lost (1)	Mr Bean's (1) in the pool… swimming or trying to swim in his usual probably incompetent way… til he discovers a pair of trunks (1) floating (1) about… and he thought well I'm struggling now cos I'm in the altogether… (1)	Back at the pool again… Mr Bean's (1) in the water… without any trunks (1) on… they've fallen off (1) … not quite sure why they would have… but he wouldn't have probably know that…	Well Rowan Atkinson (1) jumped in pool, lost (1) his trunks (1)…	It was Mr Bean (1) or Rowan Atkinson… not Ron Atkinson… and he was… it was like a like a follow-on of the diving into the pool one which we did ages ago… so he's in the pool and his trunk- and he realises (1) he's swimming about and he realises that he hasn't got his trunks (1) on and they're on the side…

floating (1)				
He swims over to get his trunks but a little girl picks them out of the water swims (1) get (1) trunks (1) little/little/young (1) girl/child (1) picks out/grabs (1)	before he could do anything a little (1) girl (1) who he was probably swimming next to picks up (1) the trunks (1) so he's left then without… the…	without his trunks (1), a little (1) girl (1) who had got (1) them was walking off with them…	a child (1) picked (1) them (1) up… run off (1) with them	and then… there's a couple with a young (1) child (1) who pick (1) up his trunks (1) and take them away so he's obviously panicking a bit…
The lifeguard blows the whistle to tell everyone to get out of the pool so Mr Bean hides underwater lifeguard (1) blows whistle (1) everybody out/get out (1) pool (1)	by this time… for some reason and I should have asked because that's my fault the pool cleared… and Mr Bean was left in there… whether it's closing time or whatever I'm not sure… and the only people there are two pool attendants (1)… so he's… and one of them is a female…. so Mr Bean is struggling to… keep out of sight if you will… he's swimming about in the	the instructor (1) and an assistant were on the pool side… the pool- they got more people in and they called time (1) it must have been time to go… or whatever to get out… so they get called out… Mr Bean didn't want to get out he was embarrassed cos he hadn't got his trunks on… he looked very sheepish…		but he just stays in the water and then but then it's the end of the… day so the whistle gets blown (1) to… get out of the pool (1)… so… he doesn't, he tries to hide (1) under the water (1) about three times and they keep blowing the whistle (1) and nobody knows he's hid

hides/ducks down (1) underwater (1)	altogether because he… keeping under the water (1) presumably to keep out of sight (1) but having to surface keeps surfacing…			
When everyone has left the pool, Mr Bean tries to sneak out of the pool tries (1) sneak out (1) pool (1)	and for some reason I should have asked again the two pool attendants left… but one of them so he tries (1) to get out (1)	eventually everybody had got out of the pool… he got out (1)…		and then everyone seems to have gone away so he sort of… comes out (1) of the pool and then tries (1) to make his way to the changing rooms
He hides from the female lifeguard who has come back into the pool hides (1) female (1) lifeguard (1) comes back (1) pool (1)	and one of them's a woman (1)… so… that's my fault I should have asked for more detail shouldn't I… the I can't… I cannot rem- Mr Bean then… gets out of the pool… thinking he's safe but by this time… well he'll have got out of the pool won't he but then the woman that's right the woman would see him and he he starts running around trying to escape her…	the instructor walked away but the assistant (1) was still around… but hadn't noticed that he hadn't got any trunks on…		
A group of girls come out of	and by this time there are	Mr Bean walked towards the	and then… then Atkinson got	but then there's a big group

the changing room, see Mr Bean and scream so he runs off group (1) girls/schoolgirls (1) come out/come in (1) see (1) scream (1) runs off/runs away (1)	more kids (1) have appeared (1) into the pool area so he then he dives back in again so he's back in the same position he was in before… and that appears to be the story [great, anything else?]… well I can't remember I think it's cos I didn't ask properly what actually happened between Mr Bean, the girl picking Mr Bean's trunks up and… these two attendants appearing and disappearing… whether Mr Bean was out of the pool by that stage… and when the kids arrive it's all a bit of a bit of a sort of intermix if you will	changing room as some girls-young girls (1) came out (1)… and he got all embarrassed and they laughed a bit… and that was the end of it	out naked… and he were in front of all people (1) that were watching or on side of baths… and they were in costumes they were all people… waiting to go into baths or been in baths… and that's it [asked to explain BL's drawing] well that was Rowan Atkinson but he scrubbed him out… and that was little boy on side and they were trunks there… little boy got his trunks out of baths run off and then he went up here… this is supposed to be Rowan Atkinson and I presume this is audience and they were all in swimming gear… so I presume they were waiting to go in or they had just got out or something [and what happened at the end?] I don't know	(1) of school girls (1) outside who see (1) him… naked and start screaming (1) and he's about a bit ((gestures startled)) and then that's it
Total: 31	**16**	**13**	**8**	**18**

Appendix 15: Operational definitions of categories (n = 4) and behaviours (n = 17) arising from analysis of single case narrative data (Chapter 6)

	Behaviour	**Definition/examples**	**Broader category**
B	Other-initiated repair	Turn initiating repair, relatively local to the trouble source	1. Utterances where the conversation partner displays a lack of knowledge/understanding of the PWA is talking about
C	Open-class repair	Non-indicative of specific trouble source, e.g., "sorry?", "what?"	
H	"Do you mean" construction	Offering an interpretation of prior turn(s) with a question intonation	
K	Explicit display of understanding difficulty	Such as, "I'm lost now", "I'm confused"	
M	Complaint as a form of other-initiated repair	A form of words prosodically marked to convey annoyance, e.g., "you've lost it now"	
O	Checking question or checking for more information	Checking question: turn which is downstream from a trouble source or not apparently connected to a specific trouble source. Turn may be designed to elicit more information	

A	Reformulation	Partially repeating or rewording a prior turn or putting words to A's enacted turn to produce a well-formed version of the prior turn or to add information, e.g., PWA: "coughing", conversation partner: "He's coughing and spluttering"	2. Explicit display of understanding by conversation partner (if there is any ambiguity between whether he is displaying what he understands or is displaying a lack of knowledge/understanding, code as 1)
E	Inference	Turn which draws on world knowledge or shared knowledge to elaborate on A's prior turn, e.g., PWA: "Mr Bean", conversation partner: "Mr Bean was on TV wasn't he"	
F	Summary	Summarising of the story so far; may be marked explicitly as a summary (e.g., "ok so what we've got is…") or not (e.g., "Mr Bean.. He's in the car… etc")	
G	Displays of understanding the humour of the story	Laughter particles or smile voice displaying shared humour	
Q	Explicit display of understanding	Demonstrating (as opposed to claiming) understanding; this may encompass a full or partial repetition of the PWA's prior turn, e.g., "oh his swimming trunk I see"	
D	"What happened next" and similar constructions	Turns that explicitly link to structural aspects of the story being constructed, e.g., "what happened next/first/after that" or "go back". If the turn contains content (e.g., "what did he see?"), code as 1	3. The conversation partner's utterance concerns meta-interactional/structural issues, e.g., 'what happened next?' (moving her on to the next bit of the story) or 'hang on/slow down' (discussing her current manner of telling the story/dealing with a problem, etc) or any reference by conversation partner that shows he's thinking about the story structure
P	Controlling the pace of storytelling	Turns that explicitly seek to make space within the interaction to clarify something or initiate repair, e.g., "woah woah", "hang	

		on", "slow down"	
I	Passing turns (note environment)	Minimal turns that signal to the PWA to continue with the story, e.g., "mhmm", "yes", "right", "go on"; often marked with continuing intonation	4. Other
J	Acknowledgement of A's difficulties by displaying empathy or advice	Turns which highlight the PWA's aphasic impairments, e.g., "take your time", "there's no rush"	
L	Test question	Asking a question when the answer is known in order to elicit a specific word/phrase	
N	Claim of understanding	Claiming (but not demonstrating) understanding, e.g., "oh I see", "oh right"	

Appendix 16: Data used to populate the treatment and control sets for verb retrieval therapy (Chapter 4): participants' responses to assessment of verb retrieval at two time points using the OANB and IPNP picture stimuli

Participants:		A		B		C		D		E		F		G		H		I	
Assessment at 2 time points:		Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
Source	**Target**																		
OANB	crawling	1	1	0	0	1	0	0	0	1	1	0	0	1	1	0	0	1	1
OANB	folding	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
OANB	driving	0	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1
OANB	weighing	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
OANB	drinking	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
OANB	roaring	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1
OANB	swimming	0	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	1	1
OANB	snowing	1	1	1	0	1	1	0	0	0	0	1	1	1	1	1	0	1	1
OANB	biting	1	1	0	0	1	1	0	1	1	0	0	1	1	1	0	0	0	0
OANB	diving	1	1	1	1	0	0	0	0	1	1	0	0	1	1	1	0	1	1
OANB	eating	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0
OANB	stopping	0	0	0	0	1	1	0	0	1	1	0	1	1	1	0	0	1	1
OANB	floating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OANB	yawning	0	1	0	0	1	0	1	1	1	1	0	1	1	1	0	1	1	1
OANB	dreaming	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0
OANB	raking	1	0	0	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1
OANB	juggling	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0

OANB	skating	0	1	1	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1
OANB	playing	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
OANB	kicking	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	0	0
OANB	sliding	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0
OANB	lighting	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1
OANB	knocking	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
OANB	tickling	0	1	0	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1
OANB	leaning	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
OANB	watching	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0
OANB	begging	0	0	0	0	0	1	0	1	0	1	0	0	1	1	0	0	0	0
OANB	crying	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1
OANB	pinching	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1
OANB	painting	1	1	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	0
OANB	sinking	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
OANB	tying	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	0	0	0
OANB	walking	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1
OANB	kneeling	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	1
OANB	blowing	1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	0	1	1
OANB	running	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	0	0	1
OANB	skipping	1	1	1	1	1	1	0	0	1	1	0	1	1	1	1	0	1	1
OANB	smoking	1	0	1	0	0	1	0	1	0	1	1	1	1	1	0	1	1	1
OANB	praying	1	1	0	0	1	0	1	1	1	1	0	0	1	1	0	0	0	0
OANB	sewing	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	1	1	0
OANB	dancing	1	1	1	1	0	0	0	0	1	1	0	0	1	1	1	1	0	0
OANB	catching	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
OANB	building	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

OANB	melting	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
OANB	riding	0	0	0	0	0	1	0	1	1	1	0	1	1	1	0	0	0	1
OANB	combing	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0
OANB	shooting	1	1	0	1	1	1	0	0	1	1	0	0	1	1	0	1	1	1
OANB	posting	1	1	0	0	1	1	0	1	1	1	1	0	1	0	0	0	1	0
OANB	waving	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1
OANB	pushing	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0
OANB	raining	0	1	0	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0
OANB	laughing	1	0	0	0	1	0	1	1	1	1	0	1	1	1	0	1	1	1
OANB	reading	1	1	1	0	0	1	1	0	1	0	0	1	1	1	0	0	1	0
OANB	ironing	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1
OANB	climbing	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
OANB	licking	0	1	0	1	1	1	0	1	1	1	0	0	1	1	0	0	1	1
OANB	ringing	0	0	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0
OANB	stirring	1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
OANB	kissing	0	1	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1
OANB	rocking	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0	0	1	0
OANB	fishing	1	1	0	1	0	0	0	0	1	1	0	1	1	1	1	0	0	1
OANB	typing	1	1	0	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1
OANB	knitting	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	1	1
OANB	pointing	1	1	0	0	0	1	1	1	1	1	0	0	1	1	0	1	0	0
OANB	watering	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0
OANB	cutting	1	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	1
OANB	pouring	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
OANB	planting	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
OANB	shaving	1	1	1	1	0	0	0	0	1	1	0	0	1	1	0	1	1	1

OANB	dropping	1	1	0	0	1	0	0	0	1	1	0	0	1	1	0	1	0	1
OANB	washing	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0
OANB	swinging	1	0	0	1	1	1	0	0	1	1	1	0	1	1	0	0	1	0
OANB	bending	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
OANB	pulling	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
OANB	peeling	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0
OANB	crossing	1	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0
OANB	bleeding	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0
OANB	sneezing	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
OANB	jumping	1	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0
OANB	barking	1	1	0	1	1	0	1	0	1	0	1	1	1	1	0	0	1	0
OANB	dripping	1	1	0	1	1	1	0	0	1	1	1	0	1	0	0	0	0	0
OANB	bouncing	0	0	1	1	0	0	0	0	1	0	1	1	1	1	0	0	1	0
OANB	sitting	1	1	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0
OANB	sleeping	1	1	1	1	0	0	1	0	1	1	1	1	1	1	0	0	1	1
OANB	flying	1	1	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	0
OANB	opening	0	1	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	0
OANB	drawing	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0
OANB	weaving	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
OANB	writing	0	1	1	0	0	1	1	1	1	1	0	1	1	1	0	0	1	1
OANB	marching	1	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
OANB	stroking	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
OANB	skiing	1	1	0	1	0	0	0	0	1	1	0	0	1	1	0	0	1	1
OANB	singing	1	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
OANB	smiling	0	0	0	0	1	1	1	0	1	1	0	0	1	1	0	0	1	1
OANB	carrying	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1

OANB	cooking	1	1	0	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0
OANB	digging	1	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0
OANB	touching	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
OANB	drilling	1	1	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1
OANB	sailing	1	1	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0
IPNP	hugging	0	0	0	0	1	0	N/A	N/A	0	0	0	0	0	1	0	0	0	0
IPNP	spilling	0	0	0	0	0	0	N/A	N/A	1	1	0	0	1	1	0	1	1	0
IPNP	coughing	0	0	1	1	1	1	N/A	N/A	1	0	0	0	1	1	0	1	0	0
IPNP	hitch-hiking	1	0	0	0	0	0	N/A	N/A	0	1	0	0	0	0	0	0	0	0
IPNP	sorting	0	0	0	0	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	unlocking	0	0	0	0	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	listening	0	0	0	0	0	0	N/A	N/A	1	1	0	0	0	0	0	0	1	1
IPNP	magnifying	0	0	0	0	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	hunting	0	0	0	0	0	1	N/A	N/A	0	1	0	0	0	0	0	0	0	0
IPNP	squeezing	0	0	0	0	0	0	N/A	N/A	1	1	0	0	1	1	0	0	0	0
IPNP	hiding	0	0	0	0	0	0	N/A	N/A	1	0	1	1	1	1	0	0	0	0
IPNP	lifting	0	0	0	0	0	0	N/A	N/A	0	0	0	0	0	1	0	0	0	0
IPNP	knighting	1	0	0	0	0	0	N/A	N/A	0	1	0	0	1	1	0	0	0	1
IPNP	smelling	0	0	0	0	0	0	N/A	N/A	1	0	0	0	1	1	0	0	1	1
IPNP	slipping	0	0	1	0	0	0	N/A	N/A	1	0	0	0	1	1	0	0	0	0
IPNP	serving	0	0	0	0	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	spraying	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	popping	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	0	1	0	0	0	0
IPNP	spreading	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	1	1	0	0	0	0
IPNP	camping	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	0	1	0	0	0	0
IPNP	stacking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0

IPNP	waking up	1	0	N/A	N/A	0	0	N/A	N/A	1	0	0	0	0	1	0	0	0	0
IPNP	paying	0	0	N/A	N/A	0	0	N/A	N/A	0	0	1	0	0	0	0	0	0	0
IPNP	meditating	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	1	1	0	0	1	1
IPNP	arguing	1	0	N/A	N/A	0	0	N/A	N/A	1	1	0	0	1	1	0	0	0	0
IPNP	operating	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	shining	0	0	N/A	N/A	0	0	N/A	N/A	1	1	0	0	0	0	0	0	0	0
IPNP	showering	1	1	N/A	N/A	1	1	N/A	N/A	0	1	1	1	1	1	1	1	1	1
IPNP	shooting	0	0	N/A	N/A	1	0	N/A	N/A	0	0	0	0	0	0	0	0	0	0
IPNP	pluging	1	0	N/A	N/A	1	1	N/A	N/A	0	0	0	0	1	1	0	0	0	0
IPNP	fighting	1	1	N/A	N/A	1	1	N/A	N/A	1	0	0	1	1	1	0	0	0	0
IPNP	sliding	1	1	N/A	N/A	0	0	N/A	N/A	1	1	0	0	0	0	0	1	0	1
IPNP	boxing	0	1	N/A	N/A	0	0	N/A	N/A	1	1	0	0	1	0	1	1	1	1
IPNP	stinging	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	1	1	0	0	0	0
IPNP	towing	0	0	N/A	N/A	0	0	N/A	N/A	0	1	0	0	1	1	0	0	0	0
IPNP	swinging	1	1	N/A	N/A	1	1	N/A	N/A	1	1	0	0	1	1	0	0	1	1
IPNP	making	0	1	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	marrying	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0
IPNP	measuring	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	buckling	1	1	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	burning	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	1
IPNP	zipping	1	0	N/A	N/A	0	1	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	burying	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0
IPNP	baking	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	chasing	1	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	cheering	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	loading	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0

IPNP	balancing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	grinding	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	bowling	1	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	sunbathing	1	1	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	straining	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	splashing	0	1	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	0	1
IPNP	blowing	1	1	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	0	1	N/A	N/A	1	1
IPNP	lassoing	1	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	hatching	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	sharpening	0	1	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	shaving	1	1	N/A	N/A	1	0	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	shaking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	conducting	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	chewing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	drying	1	1	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	1	1
IPNP	breaking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	1
IPNP	twisting	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	glueing	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	shaking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	oiling	1	1	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	dragging	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	scaring	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	giving	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	following	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	fencing	1	1	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	bowing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0

IPNP	typing	0	1	N/A	N/A	1	1	N/A	N/A	0	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	winning	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	exploding	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	dipping	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	1	N/A	N/A	0	1
IPNP	clapping	1	1	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	erasing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	filling	0	1	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	looking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	breaking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	1
IPNP	curling	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	crashing	0	0	N/A	N/A	1	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	coughing	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	stretching	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	erupting	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	dusting	1	1	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	feeding	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	decorating	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	boiling	1	1	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	triping	1	1	N/A	N/A	0	1	N/A	N/A	0	1	N/A	N/A	1	1	N/A	N/A	1	0
IPNP	selling	0	1	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	carving	1	1	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	winking	0	0	N/A	N/A	1	0	N/A	N/A	0	1	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	reaching	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	swatting	1	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	looking	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	saving	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0

IPNP	tearing	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	teaching	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0
IPNP	sucking	1	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	sweeping	1	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	0	N/A	N/A	1	0
IPNP	vacuuming	1	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	standing	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	whistling	1	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	surfing	1	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	0
IPNP	stealing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	scooping	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	itching	0	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	saluting	1	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0	N/A	N/A	1	0
IPNP	rowing	1	1	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	0	0
IPNP	fixing	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	mopping	1	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0
IPNP	golf	1	1	N/A	N/A	0	1	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	whipsering	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A	1	1	N/A	N/A	1	1
IPNP	proposing	1	1	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	praying	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	1	1
IPNP	petting	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	arresting	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	delivering	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	0
IPNP	drowning	0	0	N/A	N/A	0	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	0	0
IPNP	counting	0	0	N/A	N/A	0	0	N/A	N/A	1	0	N/A	N/A	0	0	N/A	N/A	0	0